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Bedside Clinical Guidelines Partnership Paediatric Guidelines 2018-20

These guidelines have been agreed for use within the Paediatrics Directorate at Pennine Acute Hospitals NHS Trust from 01/03/2019 and should be used until withdrawn or superseded.

Staff encountering any difficulties in implementation should contact Paddy McMaster (Paediatric Guidelines Lead) or the Bedside Clinical Guidelines Partnership directly.

Ratified for use by:

Job title	Name	Date
Medical Director, North Manchester Care Organisation	Matt Makin	02/03/2019
Medical Director, Oldham Care Organisation	Jawad Husain	04/03/2019
Divisional Director Women and Children's Division Chair Divisional Assurance Board, Oldham care organisation	Penny Martin	07/03/2019

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Paediatric Guidelines

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Walsall Healthcare NHS Trust
Wye Valley NHS Trust

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PREFACE

This book has been compiled as an aide-memoire for all staff concerned with the management of general medical paediatric patients, especially those who present as emergencies.

Guidelines on the management of common medical conditions
No guideline will apply to every patient, even where the diagnosis is clear-cut; there will always be exceptions. These guidelines are not intended as a substitute for logical thought and must be tempered by clinical judgement in the individual patient.

The guidelines are advisory, NOT mandatory

Prescribing regimens and nomograms
The administration of certain drugs, especially those given intravenously, requires great care if hazardous errors are to be avoided. These guidelines do not include all guidance on the indications, contraindications, dosage and administration for all drugs. Please refer to the British National Formulary for Children (BNFc).

Antibiotics
Recommendations are based on national guidance reflecting a balance between common antibiotic sensitivities and the narrowest appropriate spectrum to avoid resistance but local policies may reflect frequently encountered sensitivity patterns in individual local patient groups.

Antimicrobials
Recommendations are generic. Please check your local microbiology advice.

Practical procedures
DO NOT attempt to carry out any of these practical procedures unless you have been trained to do so and have demonstrated your competence.

National guidelines
Where there are different recommendations the following order of prioritisation is followed: NICE > NPSA > SIGN > RCPCH > National specialist society > BNFc > Cochrane > Meta-analysis > systematic review > RCT > other peer review research > review > local practice.

Evidence base
These have been written with reference to published medical literature and amended after extensive consultation. Wherever possible, the recommendations made are evidence based. Where no clear evidence has been identified from published literature the advice given represents a consensus of the expert authors and their peers and is based on their practical experience.

Supporting information
Where supporting evidence has been identified it is graded 1 to 5 according to standard criteria of validity and methodological quality as detailed in the table below. A summary of the evidence supporting each statement is available, with the original sources referenced. The evidence summaries are being developed on a rolling programme which will be updated as each guideline is reviewed.

Level	Treatment benefits	Treatment harms	Prognosis	Diagnosis
1	Systematic review of randomized trials or n-of-1 trials	Systematic review of randomized trials, systematic review of nested case-control studies, n-of-1 trial with the patient you are raising the question about, or observational study with dramatic effect	Systematic review of inception cohort studies	Systematic review of cross sectional studies with consistently applied reference standard and blinding
2	Randomized trial or observational study with dramatic effect	Individual randomized trial or (exceptionally) observational study with dramatic effect	Inception cohort studies	Individual cross sectional studies with consistently applied reference standard and blinding
3	Non-randomized controlled cohort/follow-up study	Non-randomized controlled cohort/follow-up study provided there are sufficient numbers to rule out a common harm	Cohort study or control arm of randomized trial	Non-consecutive studies, or studies without consistently applied reference standards
4	Case-series, case-control studies, or historically controlled studies	Case-series, case-control, or historically controlled studies	Case-series or case-control studies, or poor quality prognostic cohort study	Case-control studies, or poor or non-independent reference standard
5	Mechanism-based reasoning	Mechanism-based reasoning	n/a Me	chanism-based reasoning

Excerpt from: OCEBM Levels of Evidence Working Group. The Oxford Levels of Evidence 2. Oxford Centre for Evidence-Based Medicine. 2011. http://www.cebm.net/index.aspx?o=5653

Feedback

Evaluating the evidence-base of these guidelines involves continuous review of both new and existing literature. The editors encourage you to challenge the evidence provided in this document. If you know of evidence that contradicts, or additional evidence in support of the advice given in these guidelines please contact us.

The accuracy of the detailed advice given has been subject to exhaustive checks. However, if any errors or omissions become apparent contact us so these can be amended in the next review, or, if necessary, be brought to the urgent attention of users. Constructive comments or suggestions would also be welcome.

Contact

Partners in Paediatrics, via http://www.partnersinpaediatrics.org/, or Bedside Clinical Guidelines Partnership via e-mail: bedsideclinicalguidelines@uhnm.nhs.uk

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Contributors

Mona Abdel-Hady (BWC)
John Alexander (UHNM)
Sarah Band (PAT)
Tim Barratt (BWC)
Sue Bell (UHNM)
Robert Block (CMFT)
Nuala Bywater (WVT)
Sadie Clayton (UHNM)
William Coles (BCH)
Richard Crombie (HeFT)
Karen Davies (Royal Wolverhampton)
Nonhlanhla Dlamini (PAT)
Shireen Edmends (UHNM)
Claire Forrester (UHNM)
Natalie Francis (CMFT)
Isobel Fullwood (BWC)
Francis Gilchrist (UHNM)
Chhavi Goel (UHDB)
Helen Haley (UHNM)
Yvonne Humphreys (UHNM)
Rachel Isba (PAT)
Vijay Iyer (UHNM)
Aswath Kumar (UHNM)
Uma Kumbattae (UHNM)
Ignatius Losa (East Cheshire)
Jia Yi Leow (UHNM)
Paddy McMaster (PAT)
Rusia Manuel (UHNM)
David Milford (BWC)
Simon Mills (UHNM)
Tina Newton (BCH)
Louise Phillips (Betsi Cadwaladr UHB)
Anna Pigott (UHNM)
Sue Protheroe (BWC)
Parakkal Raffeeq (UHNM)
Panvanasam Ramesh (UHNM)
George Raptis (North Cumbria)
John Roche (BCPFT)
Martin Samuels (UHNM/GOSH)
Ravi Singh (UHNM)
Suzanne Smith (PAT)
Rebecca Sutton (CMFT)
Julie Taylor (DGp)
Sarah Thompson (UHNM)

Pharmacist

Helen Haley (UHNM)

Biochemistry reviewers

Ceri Parfitt (UHNM)

Microbiology reviewers

Seema Desai (UHNM)
Jeorge Orendi (UHNM)

Paediatric Editors

Surendran Chandrasekaran (East Cheshire)
Kate Palmer (UHNM)

Bedside Clinical Guidelines Partnership

Mark Brown (UHNM)
Kathryn McCarron (UHNM)
Naveed Mustfa (UHNM)

Clinical Evidence Librarian

Mathew Stone (UHNM)

Partners in Paediatrics

Surendran Chandrasekaran (East Cheshire)
Lesley Hines (PiP)
Mary Passant (PiP)

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Members of the West Midlands Paediatric Anaesthetic Network
(Co-chaired by Nuala Bywater, Wye Valley and Simon Crighton, South Warwickshire)
Paediatric Senior Nurses Forum

Other contributors

The Midlands Clinical Network for paediatric gastroenterology, hepatology and nutrition – known as the "Gut Club"
Network Lead: Sue Protheroe

TOP TIPS – FOR WORKING WITH CHILDREN AND YOUNG PEOPLE

A group of Young Health Champions, working in Shropshire, have developed these 'Top Tips'. They would like to share them with clinicians who work with children and young people.

1. Always introduce yourself and say what your role is: 'hashtag hello my name is' *(Dr Kate Granger's campaign)*
2. Explain what you are doing to a young person and why
3. Don't talk down to a young person/don't patronise them
4. DUA! Don't use acronyms
5. If you need to use specialist language please explain it
6. Don't treat us as if we are a rag doll - we have feelings and value our personal space
7. Don't make us feel small - believe what we are saying
8. Don't make us feel guilty about how we are feeling!
9. Talk to us as well as our parent or carer and make our parent or carer feel valued. They're frightened too and we worry about them
10. Make us feel safe
11. Listen. Don't keep making us repeat ourselves
12. Try not to give us conflicting advice
13. Be aware of our feelings
14. It's OK to say you don't know something or to apologise
15. Don't be the bad apple; be the good example and be proud!

How did the Young Health Champions come up with their 'Top Tips'?

- The Young Health Champions wrote up their own experience of hospital as a film review, this meant a summary of the plot, a category (e.g. comedy, horror, feel good) and finally a star rating
- This enabled them to discuss their experience in a way that was comfortable and slightly detached
- They then considered what made a good experience and what actions could improve their experience in the future…… the **'Top Tips!'**

About the Young Health Champions project

- If you would like to give feedback about these 'Top Tips', please contact Lynne or Amanda at Shropshire Young Health Champions: Lynne@sya.org.uk or Amanda@sya.org.uk

Video for training healthcare professionals

The 'Fixers UK' organisation have worked with one of the health champions to develop a video - designed to help all healthcare professionals improve their communications skills and better understand the health needs of young people. It is based on one young person's true story.

To access the video – www.youtube.com/watch?v=vnUmpFP9XsU or www.fixers.org.uk

ABDOMINAL PAIN ● 1/4

RECOGNITION AND ASSESSMENT

Symptoms and signs

- Pain may be localised or generalised
- Vomiting
- Anorexia
- Weight loss
- Fever
- Crying and irritability
- Character of the pain:
  - colicky (spasmodic/comes in waves) or
  - constant, sharp

Typical features of some important causes of acute abdominal pain in children

Appendicitis

- History of localised pain with increased severity
- On examination:
  - low grade fever
  - mid-abdominal pain migrating to RIF
  - guarding and rebound tenderness
  - pain on percussion
- Young children
  - may not have typical features e.g. irritability, grunting, diarrhoea, vomiting, limp, right hip pain

Intussusception

- Typical age at presentation: 2 months–2 yr
- History of intermittent colicky abdominal pain 2–3 times/hr initially with increasing frequency
- Looks pale with pain
- Lethargic between episodes of pain
- Vomiting prominent feature
- Diarrhoea common
- Passage of blood and/or mucus per rectum (redcurrant jelly stools) late sign
- Follows respiratory or diarrhoeal illness
- Clinical features of intestinal obstruction
- On examination:
  - a sausage-shaped mass crossing midline in the right upper quadrant, epigastrium or behind umbilicus may be palpable
  - may be associated with Henoch-Schönlein purpura (children can be aged >2 yr)
  - abdominal distension and hypovolaemic shock are late signs

Pneumonia and empyema

- History of fever and cough
- On examination:
  - tachypnoea
  - recession +/- focal signs at one base
  - decreased breath sounds and dullness to percussion

Other differential diagnoses

Surgical problems

- Intestinal obstruction
- Torsion of ovary or testis
- Meckel's diverticulitis
- Renal pelvis-ureteric junction obstruction
- Renal or biliary calculus
- Enterocolitis secondary to Hirschprung's disease

Medical problems – relatively common

- Mesenteric adenitis (history of sore throat)
- Constipation
- Gastroenteritis
- Inflammatory bowel disease

- Lower lobe pneumonia
- Acute pyelonephritis
- Henoch-Schönlein purpura
- Hepatitis
- Acute cholecystitis
- Gastritis/peptic ulcer
- Coeliac disease (chronic history)
- Recurrent functional abdominal pain (affects 10–20%)
- Irritable bowel syndrome

Medical problems – rare but important

- Lead poisoning
- Diabetes
- Sickle cell crisis
- Acute porphyria
- Pancreatitis
- Primary peritonitis
- Non-accidental injury

Gynaecological problems

- Ectopic pregnancy
- Torsion of ovarian cyst
- Miscarriage
- Pelvic inflammatory disease (PID)
- Mittelschmerz pain (mid menstrual cycle)
- Imperforate hymen

Chronic abdominal pain red flag symptoms (consider referral to paediatric gastroenterologist)

- Persistent vomiting
- Family history of:
  - inflammatory bowel disease
  - coeliac disease
  - peptic ulcer disease
- Dysphagia
- Pain on swallowing
- GI blood loss
- Nocturnal diarrhoea
- Arthritis
- Perianal disease
- Weight loss or reduced linear growth velocity
- Fever

INVESTIGATIONS

- Only urinalysis is essential, other tests as appropriate for differentials above:
- Urine testing and analysis
- FBC, ESR
- Blood and stool culture
- CRP, U&E, amylase, glucose, LFT
- tTG and IgA if chronic history
- Consider group and save if at high risk of blood loss
- Consider pregnancy test in adolescent females (inform patient)
- Normal WBC and CRP do not rule out appendicitis

Imaging

- Abdominal X-ray
  - only if bowel obstruction or perforation suspected
- Abdominal ultrasound scan
  - if child stable and appendicitis is suspected
  - intussusception
  - torsion of ovary or testis

- renal problems
- pancreatitis
- cholecystitis
- MRI abdomen and pelvis or CT
- If ultrasound normal and there is persisting pain discuss MRI with paediatric radiologist during working hours only. Out-of-hours, if skilled operator not available, CT abdomen can be useful for some conditions, but involves radiation
- useful to rule out appendicitis and avoid hospital admission
- imaging should be considered with the surgical team and in light of other investigations
- If respiratory symptoms, **CXR**
- Do not delay surgical review whilst awaiting scans if acute surgical problem suspected (e.g. torsion of testis, intussusception)

MANAGEMENT

- Treat hypotension and shock if present
- If surgical problem suspected stop feeding
- If appendicitis suspected, clear fluids whilst awaiting surgical review
- If clinically peritonitic: keep nil-by-mouth
- IV access if surgical cause likely
- Nasogastric tube free drainage if bowel obstruction
- If suspected bowel perforation, IV antibiotics (e.g. cefuroxime and metronidazole)

Indications for surgical review

- Localised RIF pain
- Rebound tenderness/pain on percussion
- Migration of pain
- Redcurrant jelly stools and bleeding per rectum (in the absence of constipation)
- Bile-stained vomiting
- Marked abdominal distension
- Inguino-scrotal pain or swelling
- Increasing abdominal pain with progressive signs of deterioration
- If in doubt, discuss with senior colleague

Recurrent abdominal pain

- If due to constipation prescribe laxatives/increased fibre in diet
- Probiotics may be of benefit (parents can purchase)
- Little evidence for benefit of any medications
- Hypnotherapy and psychological therapies are interventions most likely to provide benefit
- Little evidence dietary modification is helpful

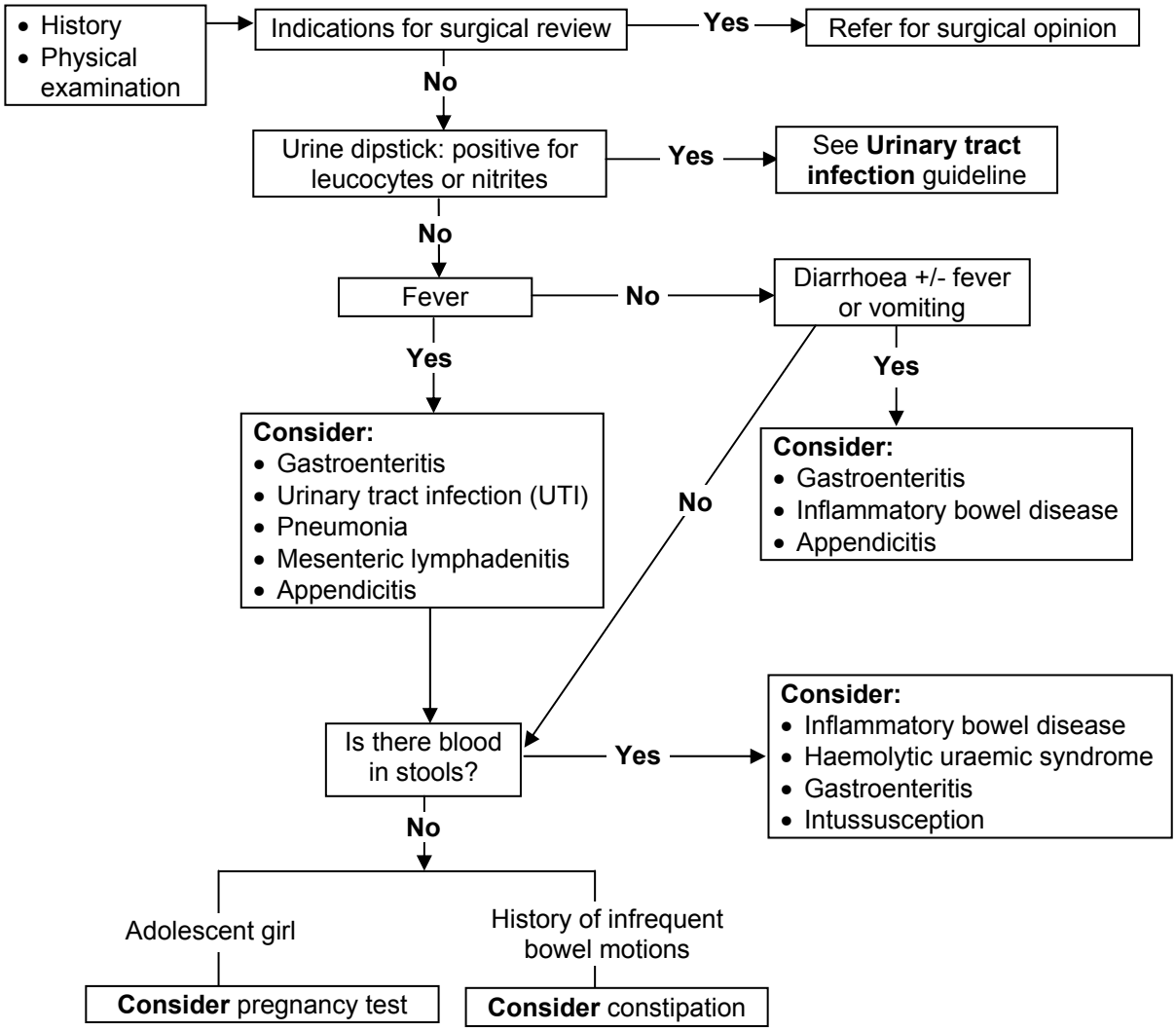
Observation

- If stable, period of observation may be useful to make diagnosis

Analgesia

- Do not withhold analgesia pending surgical review: opioids may be necessary (see Analgesia guideline)

Management of acute abdominal pain



DISCHARGE AND FOLLOW-UP

- Discharge usually within 24 hr of symptoms improving (e.g. fever, abdominal pain)
- Follow-up usually appropriate in primary care/GP

ACUTE KIDNEY INJURY ● 1/3

RECOGNITION AND ASSESSMENT

Definition

- Sudden deterioration in renal function associated with retention of nitrogenous waste and acute disturbance of water and electrolyte balance

Presentation

- Poor/absent urine output (oliguria) with puffiness/oedema:
  - <0.5 mL/kg/hr

Differential diagnosis

Pre-renal

- Secondary to hypotension (e.g. hypovolaemia from gastroenteritis or septicaemia)
- Urine osmolality >300 mOsm/kg
- Urine:plasma urea ratio >5
- Urine sodium <20 mmol/L

Renal

- Haemolytic uraemic syndrome (see **Haemolytic uraemic syndrome** guideline)
- Acute nephritis – see **Glomerulonephritis** guideline
- Acute tubular necrosis or renal vein thrombosis
- Unrecognised chronic renal failure (oliguria usually not a feature)
- Acute-on-chronic renal failure (e.g. dehydration or infection in a child with chronic kidney disease)

Post-renal

- Urinary tract obstruction (rare)

Assessment

- Hydration (under/over)
- Weight (compare with previous if available)
- Skin (turgor/oedema)
- Ascites
- BP/capillary refill
- Jugular venous pressure (JVP), heart sounds
- Urine output

Immediate investigations

- See separate guidelines for specific causes
- Blood
  - U&E, creatinine, calcium, phosphate, LDH (if considering haemolytic uraemic syndrome)
  - FBC and film if considering haemolytic uraemic syndrome
  - venous blood gas
- Urine
  - urinalysis for blood, protein, nitrites and leucocytes
- Renal ultrasound scan
  - size and appearance of kidneys, perfusion
  - swelling
  - evidence of obstruction

IMMEDIATE TREATMENT

- Correct volume status and maintain fluid and electrolyte balance
- Prevent hyperkalaemia
- Treat underlying cause where appropriate
- Maintain adequate nutrition
- Review prescription to exclude nephrotoxic drugs/modify dose

Fluid and sodium balance

Initial correction

- Dehydration
  - for shock, give sodium chloride 0.9% 20 mL/kg immediately
  - for correction of dehydration (see Diarrhoea and vomiting guideline)

- Volume overload/hypertension
- low plasma sodium usually indicates fluid overload
- furosemide 2–4 mg/kg (commence at 2 mg/kg and adjust to response) IV over 1 hr (maximum rate 4 mg/min), repeated 6-hrly if response obtained
- if furosemide ineffective, discuss dialysis with regional paediatric renal centre

Metabolic acidosis

- Sodium bicarbonate may be required – discuss with on-call consultant

Potassium

- Hyperkalaemia can lead to cardiac arrest or serious arrhythmias
- severely restrict potassium intake by introducing low potassium diet and avoiding potassium in IV fluids unless plasma potassium <3.5 mmol/L or there are ongoing losses
- If potassium >6.0 mmol/L, ECG monitoring essential, discuss with on-call consultant
- watch for development of prolonged P-R interval and/or peaked T wave
- as toxicity worsens, P wave is lost, QRS widens and S-T depression develops
- Once toxicity develops, the following (see **Table 1**) are holding measures whilst dialysis is set up
- give salbutamol IV or by nebuliser if no IV access as first-line emergency treatment, followed by oral/rectal calcium polystyrene sulphonate (even if salbutamol effective) to start to reduce potassium load
- if ECG still unstable, give calcium gluconate by slow IV injection
- if patient acidotic pH <7.30, give sodium bicarbonate
- if further reduction required after other measures implemented, use insulin and glucose
- After starting treatment discuss with on-call consultant

Table 1: Emergency treatment of hyperkalaemia

Treatment	Dose	Onset	Mode of action
Salbutamol nebuliser	2.5–5 mg	5 min. Lasts up to 2 hr; repeat as necessary	Shifts potassium into cells
Salbutamol IV	4 microgram/kg over 5 min repeat as necessary. Limited by tachycardia	Immediate. Effect maximal at 60 min	Shifts potassium into cells
Calcium gluconate 10%	0.11 mmol/kg (0.5 mL/kg) IV [max 4.5 mmol (20 mL)] over 5–10 min. Monitor ECG Do NOT administer through same line as bicarbonate	1 min Repeat after 5 min if ECG changes persist	Antagonises effect of high potassium
Sodium bicarbonate 4.2% infusion (only if patient acidotic)	1 mmol/kg IV over 15 min (2 mL/kg of 4.2% diluted 1 in 5 with sodium chloride 0.9%) Do NOT administer through same line as calcium	1 hr Effect may last 2 hr	Shifts potassium into cells
Glucose/insulin infusion	Glucose 10% 0.5 g/kg/hr (5 mL/kg/hr) and when blood glucose >10 mmol/L infuse insulin 0.1 unit/kg/hr (50 units insulin in 50 mL sodium chloride 0.9%). Stop glucose and insulin when potassium falls by 0.5 mmol/L	15 min. Effect may last several hours Frequent glucose stick checks	Shifts potassium into cells
Furosemide	1 mg/kg IV over 5 min	May not be effective in chronic renal failure	Potassium excreted in urine
Polystyrene sulphonate resins	Calcium polystyrene sulphonate Oral 250 mg/kg 6-hrly (max 15 g/dose) Rectal 1 g/kg (max 30 g); can be repeated if potassium level life threatening, and while awaiting dialysis	Oral 2 hr Rectal 30 min (irrigate to remove residue before next dose and after 8–12 hr to remove resin)	Removes potassium from body

- Hypokalaemia is also dangerous
  - if patient becomes potassium depleted from heavy ongoing losses (fistula or diuretic phase), it is most important that replacement is given
  - amount and rate of replacement depend on estimation of losses and response to initial supplementation. If in doubt, discuss with on-call consultant

SUBSEQUENT MANAGEMENT

Fluid and sodium balance

- Once normal hydration restored, aim to replace insensible loss (300 mL/m^2/day) + urine output + other losses
- In anuric patients (as opposed to oliguric), give fluids that are free of electrolytes to compensate for insensible loss; in patients having IV fluids, glucose 5%/sodium chloride 0.45%
- Replace sodium losses in urine and in other fluids (diarrhoea, gastric aspirate, fistula)
  - in most patients dietary sodium will suffice
  - in those with large fluid losses, consider IV sodium to match losses

Nutrition

- Involve paediatric dietitian
- A low-protein high-energy diet is ideal. Optimise nutritional intake in accordance with blood results and renal function
- Avoid foods high potassium and phosphate
- Be realistic about what a child will take

Indications for discussion with renal unit

- Anuric patient
- Fluid overload unresponsive to diuretics
- Fluid overload with uncontrolled hypertension (for height-related 97th centiles – see **Hypertension** guideline)
- Potassium toxicity (as indicated by features listed previously)
- Metabolic acidosis (pH <7.2) unresponsive to base supplementation
- Seizures (secondary to hypertension or hyponatraemia)
- Loss of general well being +/- alteration in conscious level (see **Glasgow coma score** guideline)
- Blood product requirement
- AKI + multisystem disease
- Spontaneous resumption of renal function likely to be delayed
  - acute-on-chronic renal failure
  - haemolytic uraemic syndrome

MONITORING TREATMENT

- Accurate fluid balance – maintain strict input-output chart
- Re-assess fluid intake at least 12-hrly
- Record weight twice daily
- Check potassium hourly if >6 or <3 mmol/L
- Check U&E 12-hrly if potassium 3–6 mmol/L in renal failure
- Respond promptly to increase in urine volume, fall in serum creatinine and increase in urine osmolality by increasing fluid intake
- Once diuresis begins, increase electrolyte replacement, including potassium
  - once stable, reduce fluid intake gradually to avoid prolonged diuretic phase

USEFUL INFORMATION

www.thinkkidneys.nhs.uk/aki/guidance-clinicians-managing-children-risk-acute-kidney-injury/

ANALGESIA ● 1/4

- For combination of analgesics to use, see **Analgesic ladder** in **Pain assessment** guideline

TOPICAL

Age group	Preparation		Time to onset	Comments
<1 month	Sucrose 24% solution on dummy		During procedure	For venepuncture or cannulation
>1 month	Local anaesthetic cream	Lidocaine 4% LMX4®	30–60 min	Wait 5 min after removing cream before cannulation
		Lidocaine 2.5% with prilocaine 2.5% EMLA® Denela®	30–60 min • 1–3 months: max 1 g in 24 hr • >3 months: max 2 g, 2 doses in 24 hr ◦ tube = 5 g	Remove after 1 hr • <3 months: apply no later than 1 hr before procedure • 3 months–1 yr: max 2 doses in 24 hr, 4 hr before procedure • >1–18 yr: 1–5 hr before procedure, max 2 doses in 24 hr
>5 yr	Ethyl chloride		Immediately	If cannot wait for cream

MILD PAIN – not impacting on activities (pain score 1–3)

Drug and preparation	Dose	Maximum dose	Comments
Paracetamol [oral/nasogastric(NG)] • Suspensions: ◦ 120 mg/5 mL ◦ 250 mg/5 mL • Tablets/soluble 500 mg	• Aged 1 month–children ≤50 kg: 15 mg/kg 4–6 hrly max QDS • Aged 12–18 yr and >50 kg: 500 mg–1 g 4–6 hrly max QDS • For TTO see **BNFc** banded doses	Max total dose in 24 hr • Aged <1 month (>32 weeks corrected gestational age): 60 mg/kg/day • Aged ≥1 month–18 yr: 75 mg/kg/day (max 4 g)	• For mild pain • Increase dose interval in renal impairment • Avoid large doses in dehydration, malnutrition, hepatic impairment • Review need for paracetamol at day 3
Paracetamol (rectal) • Suppositories: ◦ 60 mg ◦ 125 mg ◦ 250 mg ◦ 500 mg ◦ 1 g	• Aged 1–3 months: 30–60 mg 8-hrly • Aged 3–12 months: 60–125 mg 4–6 hrly as necessary • Aged 1–5 yr: 125–250 mg 4–6 hrly as necessary • Aged 5–12 yr: 250–500 mg 4–6 hrly as necessary • Aged 12–18 yr: 500 mg–1 g 4–6 hrly	• **Max total dose in 24 hr:** ◦ aged 1–3 months: 60 mg/kg daily in divided doses ◦ aged 3–12 months: 4 doses ◦ aged 1–5 yr: 4 doses ◦ aged 5–12 yr: 4 doses ◦ aged >12 yr: 6 doses	• As for oral paracetamol • For mild pain when oral/NG route not possible • Suspension can be given rectally
Paracetamol (IV) 10 mg/mL (<33 kg use 50 mL vial via burette or in syringe) Prescribe in mg (not mL)	• <10 kg: 7.5 mg/kg 6-hrly • 10–50 kg: 15 mg/kg 6-hrly • >50 kg: 1 g 6-hrly	• <10 kg: max 30 mg/kg/day • 10–50 kg: max 60 mg/kg/day • >50 kg: max 4 g/day	• As for oral paracetamol • For mild pain when oral/NG/PR route not possible • Give over 15 min

MODERATE PAIN – some interference with activities (pain score 4–7)

Drug and preparation	Dose	Maximum dose	Comments
Ibuprofen • Liquid 100 mg/5 mL • Tablets 200 mg and 400 mg	• Aged 3 months–12 yr: 5 mg/kg 6–8 hrly • Aged ≥12 yr: 200–600 mg 6–8 hrly • See **BNFc** for banded doses for TTO	• Aged <12 yr: max 30 mg/kg/day • Aged ≥12 yr: max 2.4 g/day	• If aged <3 months or <5 kg use only if recommended by consultant • Avoid in renal dysfunction • Contraindications: ◦ shock ◦ bleeding disorders ◦ hypersensitive to aspirin or other NSAID • Can be given to asthmatics if no history of NSAID-induced wheeze and chest clear on auscultation • Caution in hypertension, heart failure
Diclofenac sodium • Tablets: ◦ enteric coated 25 mg and 50 mg • Suppositories 12.5 mg, 25 mg, 50 mg and 100 mg	• Aged >6 months: 300 microgram–1 mg/kg 8-hrly	• Max 1 mg/kg up to 50 mg 8-hrly	• As ibuprofen • Second line NSAID – consultant led use only • If liquid dose form required for chronic pain aged >6 yr, consider piroxicam
Codeine • Liquid 25 mg/5 mL • Tablets 15 mg, 30 mg and 60 mg	• Do not use aged <12 yr or for adenotonsillectomy aged <18 yr • Aged 12–18 yr: 30–60 mg 6-hrly (1 mg/kg)	• Max 240 mg/day	• For moderate pain • Caution in hepatic impairment • Repeated doses increase risk of respiratory depression • Caution if renal impairment, obstructive or inflammatory bowel disease, raised ICP, convulsive disorders • Contraindications: ◦ acute respiratory depression ◦ paralytic ileus • Not to be given with other opioids • Prescribe laxatives if given for >24 hr
Morphine • Low dose as alternative to codeine	• 50 microgram/kg 4–6 hrly		• Respiratory rate, maintain: ◦ aged 1–2 yr: >16 breaths/min ◦ aged 2–9 yr: >14 breaths/min ◦ aged 10–16 yr: >12 breaths/min • If rate reduced, contact medical staff

SEVERE PAIN IN CHILDREN AGED >1 YR – unable to perform activities (pain score 8–10)

In head injuries/respiratory difficulties/upper airway obstruction, use opioids only with consultant advice. Monitor children needing oxygen and parenteral opioids with SpO_2 +/- $TcCO_2$ in an HDU setting

Analgesic method and technique	Dose	Monitoring
Oral morphine • Single dose before painful procedure may be useful • Use if no IV access or for weaning from IV opioid • If to be taken regularly consider use of prophylactic laxative	• Aged >1–12 yr: ◦ 200–300 microgram/kg 4-hrly • Aged >12 yr: ◦ 5–10 mg 4-hrly (max 10 mg)	• Respiratory rate, maintain: ◦ aged 1–2 yr: >16 breaths/min ◦ aged 2–9 yr: >14 breaths/min ◦ aged 10–16 yr: >12 breaths/min ◦ if rate reduced, contact medical staff
Morphine patient/nurse-controlled analgesia (PCA/NCA) • PCA suitable for children aged >5 yr (understand and will press button); NCA otherwise • Nurses must be certified competent in use of PCA/NCA • Use anti-reflux valve unless dedicated cannula • Use morphine 1 mg/kg made up to 50 mL with sodium chloride 0.9% ◦ max of 50 mg/50 mL	• If loading dose required: ◦ **experienced staff only** ◦ 50–100 microgram/kg over 5 min (max 5 mg) • Background infusion if used: ◦ 4–10 microgram/kg/hr • Bolus dose: ◦ 10–20 microgram/kg ◦ Lockout time: ◦ 5–30 min	Hourly observations • Pain score • Sedation score • Pump displays • Syringe movement • Respiratory rate • SpO_2 if needed • $TcCO_2$ if needed 4-hrly observations • Vomiting/itching • Urinary retention • Inspection of IV site
Morphine infusion • Use for severe pain when unable to use PCA/NCA • Use anti-reflux valve unless dedicated cannula • Use anti-siphon valve on line • Use morphine 1 mg/kg made up to 50 mL with sodium chloride 0.9% ◦ max of 50 mg/50 mL	• Loading dose of 100 microgram/kg given over 5 min (max 5 mg) • Continuous infusion of 10–30 microgram/kg/hr • Start at 20 microgram/kg/hr except after major surgery when start at 30 microgram/kg/hr and adjust according to pain and sedation scores	Hourly observations • Pain score • Sedation score • Respiratory rate (as above) • SpO_2 monitoring • Syringe movement • IV site for infection • Urinary retention
IV intermittent morphine • Infusion preferable	• Give slowly over 5 min • Aged 1–12 yr: ◦ 100 microgram/kg 4-hrly • Aged >12 yr: ◦ 2.5–5 mg 4-hrly	Hourly observations • Pain score • Sedation score • Respiratory rate (as above) • SpO_2 monitoring
SC intermittent opioid • IV preferable • Site 22/24 G SC cannula at time of surgery or using local anaesthetic cream ◦ suitable sites: uppermost arm, abdominal skin	• Flush with sodium chloride 0.9% 0.3 mL • Prime cannula with morphine solution • Morphine: ◦ 100–200 microgram/kg 4-hrly ◦ max 6 times in 24 hr	• Pain score • Sedation score • Respiratory rate (as above)

SEVERE PAIN IN CHILDREN AGED <1 YR (pain score 8–10)

In head injuries/respiratory difficulties/upper airway obstruction/ex-premature infant, only use opioids with consultant advice. Monitor children requiring oxygen and parenteral opioids with SpO_2 +/- $TcCO_2$ in an HDU setting

Analgesic method and technique	Dose	Monitoring
Oral morphine • Use if no IV access or for weaning from IV opiate	• Aged 1–6 months: 50–100 microgram/kg 6-hrly • Aged 6–12 months: 100–200 microgram/kg 4-hrly	• Pain score • Sedation score • **Respiratory rate**, maintain: ◦ if aged <6 months, >20 breaths/min ◦ if aged ≥6 months, >16 breaths/min ◦ if rate reduced, contact medical staff • SpO_2
Morphine infusion • Use anti-reflux valve unless dedicated cannula • Use anti-siphon valve on line • Use morphine 1 mg/kg made up to 50 mL with sodium chloride 0.9% ◦ thus 1 mL/hr = 20 microgram/kg/hr	• Aged <1 month: 50 microgram/kg over 5 min then 5–20 microgram/kg/hr • Aged 1–12 months: ◦ 100 microgram/kg over 5 min then 10–30 microgram/kg/hr • Adjust in increments of 5 microgram/kg/hr according to response	Hourly observations • Pain score • Sedation score • Respiratory rate (as above) • SpO_2 monitoring • Syringe movement • Site for infection • Urinary retention
IV intermittent morphine • Infusion preferable	• Aged <1 month: 50 microgram/kg 6-hrly • Aged 1–6 months: 100 microgram/kg 6-hrly • Aged 6–12 months: 100 microgram/kg 4-hrly	• Hourly observations for 24 hr then 4-hrly if stable • Pain score • Sedation score • Respiratory rate (as above) • SpO_2 monitoring
SC intermittent opiate • IV preferable • Site 24 G SC cannula at time of surgery or using local anaesthetic cream ◦ suitable sites: uppermost arm, abdominal skin	• Flush with sodium chloride 0.9% 0.3 mL • Morphine: ◦ aged <1 month: 100 microgram/kg 6-hrly ◦ aged 1–6 months: 100–200 microgram/kg 6-hrly (aged ≥6 months 4–6 hrly)	• Pain score • Sedation score • Respiratory rate (as above) • SpO_2

ANAPHYLAXIS ● 1/2

DEFINITION

Sudden onset systemic life-threatening allergic reaction to food, medication, contrast material, anaesthetic agents, insect sting or latex, involving either:

- Circulatory failure (shock) **and/or**
- Difficulty breathing from ≥1 of the following:
  - stridor
  - bronchospasm
  - rapid swelling of tongue, causing difficulty swallowing or speaking (hoarse cry)

Document

- Acute clinical features
- Time of onset of reaction
- Circumstances immediately before onset of symptoms

IMMEDIATE TREATMENT

Widespread facial or peripheral oedema with a rash in absence of above symptoms does not justify adrenaline or hydrocortisone. Give chlorphenamine orally

- See **Management of anaphylaxis** algorithm
- Remove allergen if possible
- Call for help
- Adrenaline **IM**: dose by age (see **Algorithm**) or 10 microgram/kg:
  - 0.1 mL/kg of 1:10,000 in infants (up to 10 kg = 1 mL)
  - 0.01 mL/kg of 1:1000 (maximum 0.5 mL = 0.5 mg)
  - give in anterolateral thigh
- ABC approach: provide BLS as needed
  - if airway oedema, call anaesthetist for potential difficult airway intubation
  - if not responding to adrenaline IM, give nebulised adrenaline 1:1000 (1 mg/mL) 400 microgram/kg (maximum 5 mg)
  - treat shock with sodium chloride 0.9% 20 mL/kg bolus
  - monitor SpO2, non-invasive blood pressure and ECG (see Algorithm)
- Repeat adrenaline IM after 5 min if no response, give IV infusion 1 microgram/kg = 0.01 mL/kg of 1:10,000 (maximum 50 microgram) in sodium chloride 0.9% 10–20 mL, infuse slowly over 1 min

Do not give adrenaline intravenously except in cardiorespiratory arrest or in resistant shock (no response to 2 IM doses)

SUBSEQUENT MANAGEMENT

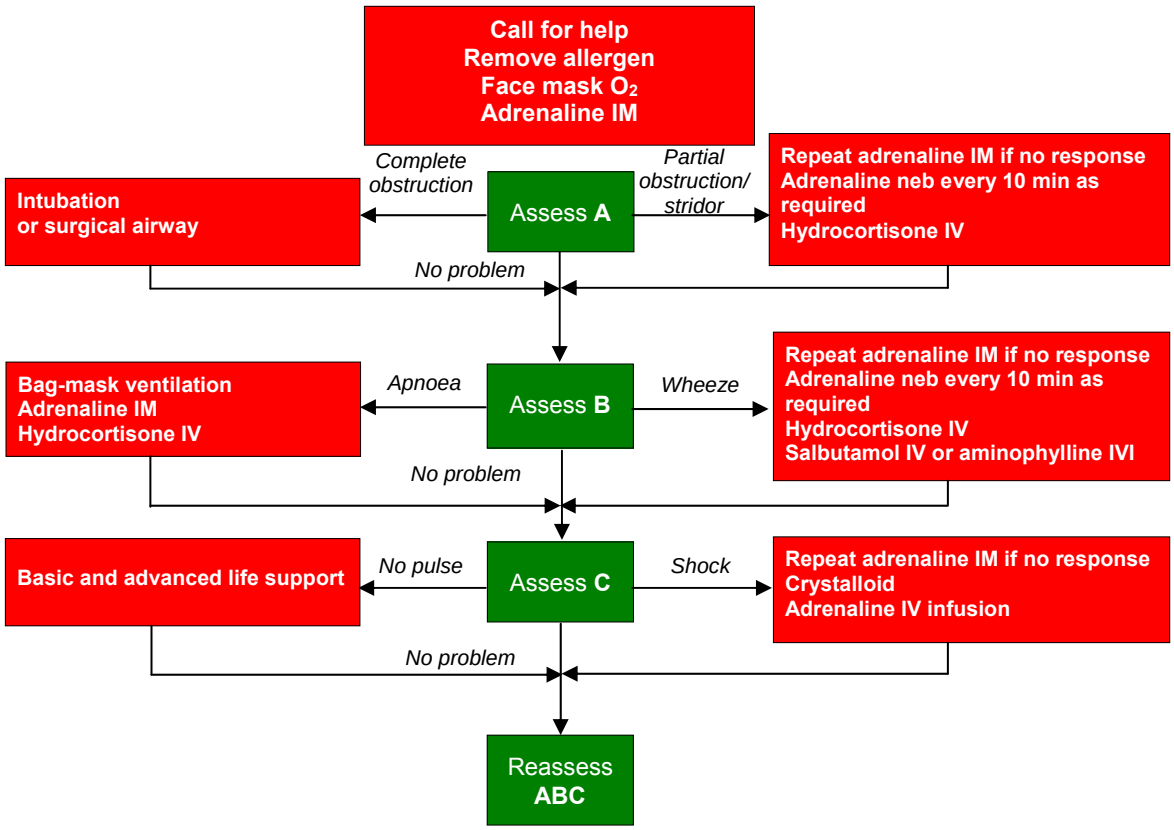
- Admit for a minimum of 6 hr to detect potential biphasic reactions and usually for 24 hr, especially in the following situations:
  - severe reactions with slow onset caused by idiopathic anaphylaxis
  - reactions in individuals with severe asthma or with a severe asthmatic component
  - reactions with possibility of continuing absorption of allergen
  - patients with previous history of biphasic reactions
  - patients presenting in evening or at night, or those who may not be able to respond to any deterioration
  - patients in areas where access to emergency care is difficult
- Monitor SpO_2, ECG and non-invasive BP, as a minimum
- Sample serum (clotted blood – must get to immunology immediately) for mast cell tryptase at the following times if clinical diagnosis of anaphylaxis uncertain and reaction thought to be secondary to venom, drug or idiopathic :
  - immediately after reaction
  - 1–2 hr after symptoms started when levels peak
  - >24 hr after exposure or in convalescence for baseline
- If patient presenting late, take as many of these samples as time since presentation allows

DISCHARGE AND FOLLOW-UP

- Discuss all children with anaphylaxis with consultant paediatrician before discharge
- Give following to patient, or as appropriate their parent and/or carer:
  - information about anaphylaxis, including signs and symptoms of anaphylactic reaction

- information about risk of biphasic reaction
- information on what to do if anaphylactic reaction occurs (use adrenaline injector and call emergency services)
- demonstration of correct use of the adrenaline injector and when to use it
- advice about how to avoid suspected trigger (if known)
- information about need for referral to a specialist allergy service and the referral process
- information about patient support groups
- Discharge with an emergency plan, including 2 adrenaline pen auto-injectors after appropriate training
- If still symptomatic give oral antihistamines and steroids for up to 3 days
- Refer as outpatient to consultant paediatrician with an interest in allergy

Management of anaphylaxis



DRUGS IN ANAPHYLAXIS	DOSAGE BY AGE			
	<6 months	6 months–5 yr	6–12 yr	>12 yr
Adrenaline IM: pre-hospital practitioners	150 microgram (0.15 mL of 1:1000)		300 microgram (0.3 mL of 1:1000)	500 microgram (0.5 mL of 1:1000)
Adrenaline IM: in-hospital practitioners	10 microgram/kg 0.1 mL/kg of 1:10,000 (infants and young children) **OR** 0.01 mL/kg of 1:1000 (older children)[1]			
Adrenaline IV	1 microgram/kg = 0.01 mL/kg of 1:10,000 over 1 min, max 50 microgram			
Crystalloid	20 mL/kg			
Hydrocortisone (IM or slow IV)	25 mg	50 mg	100 mg	200 mg

[1] Strength of IM adrenaline not intended to be prescriptive, 1:1000 or 1:10,000 is used depending on what is practicable: e.g. use of 1:1000 involves drawing up too small volumes when used in infants

ALSG: APLS Anaphylaxis Algorithm: Updated January 2016 reproduced with permission

EMPIRICAL ANTIBIOTICS

- See full guideline for each condition for indications, investigations and other management
- Once organism identified, change antibiotic to narrowest spectrum appropriate for site of infection
- **Oral** unless unavailable or IV stipulated; if not tolerating oral fluids use same antibiotic IV

Sepsis

Age	Antibiotic	Penicillin allergy
<3 month	Cefotaxime **or** ceftriaxone + amoxicillin IV	Ciprofloxacin IV + vancomycin IV
≥3 month	Ceftriaxone	

Suspected central line associated bloodstream infection

Infection	Antibiotic	Penicillin allergy
Empiric	• Glycopeptide (e.g. teicoplanin) **and** ceftriaxone	• Glycopeptide (e.g. teicoplanin) + gentamicin
Coagulase negative *staphylococcus*	• Glycopeptide (e.g. teicoplanin)	
Staphylococcus aureus	• Flucloxacillin	• Glycopeptide (e.g. teicoplanin)
MRSA	• Glycopeptide (e.g. teicoplanin)	
Enterococcus	• If sensitive: amoxicillin • If amoxicillin resistant: glycopeptide (e.g. teicoplanin)	• Glycopeptide (e.g. teicoplanin)
Candida spp.	• Liposomal amphotericin	

Haematology/oncology and other immunocompromised sepsis

Infection	Antibiotic
Neutropenic sepsis 1st line	• Piperacillin with tazobactam
Neutropenic sepsis 2nd line (already on piperacillin/tazobactam) **or** non-anaphylactic allergy to penicillin	• Meropenem
Non-neutropenic oncology	• Piperacillin with tazobactam
Non-neutropenic oncology 2nd line **or** on methotrexate	• Meropenem

Respiratory tract infection

Infection	Mild/moderate	Severe	Penicillin allergy
Community acquired pneumonia	• Amoxicillin 5 days	• Co-amoxiclav 7 days + macrolide (e.g. azithromycin) 3 days	• Macrolide (e.g. azithromycin)
Aspiration pneumonia	• Co-amoxiclav 7 days		• Ciprofloxacin + clindamycin

Hospital acquired pneumonia and complex cases

Previous antibiotic	Antibiotic	Penicillin allergy	Duration
None	Co-amoxiclav	Ciprofloxacin	7 days
Recent	Piperacillin/tazobactam Switch to co-amoxiclav when afebrile	Ciprofloxacin + clindamycin	7 days

Empyema

Antibiotic	Oral continuation	Penicillin allergy	Duration
Cefuroxime IV + clindamycin IV/PO	Co-amoxiclav	Ciprofloxacin + clindamycin	IV until chest drains removed and afebrile; minimum 2 weeks, 4 weeks if loculated

Bronchiestasis

Infection	Antibiotic	Penicillin allergy	Duration
Empiric 1st line	Amoxicillin	Macrolide (e.g. azithromycin)	7 days
Haemophillus influenzae	Co-amoxiclav		7 days
Severely unwell	Ceftriaxone		7–14 days

Pseudomonas (1st episode)	Ciprofloxacin		7 days
Pseudomonas (Chronic)	Ceftazidime + tobramycin	Ciprofloxacin + tobramycin	14 days

Infection	Antimicrobial	Duration
Influenza	Osteltamivir	5 days
Pertussis	Macrolide (e.g. azithromycin)	10 days

ENT infection
(NICE recommend not to give antibiotics for acute otitis media or tonsillitis)

Infection	Antibiotic	Penicillin allergy
Severe otitis media	• Amoxicillin ◦ <2 yr: 7–10 days ◦ ≥2 yr: 5 days	• Macrolide (e.g. azithromycin) 3 days • If PO administration difficult ceftriaxone 1–3 days
Chronic otitis media	• Co-amoxiclav (10 days)	• Macrolide (e.g. azithromycin) 3 days
Otitis externa	• Acetic acid 2% 10 days • If extensive: flucloxacillin 7 days ◦ if unable to take tablets co-amoxiclav	• Macrolide (e.g. azithromycin) 3 days
Malignant otitis externa	• Ceftazidime IV + ciprofloxacin eye drops topically in ear (7 days)	
Tonsillitis	NICE recommend no antibiotics for *Group A streptococcus*	
Severe tonsillitis	• Penicillin V 10 days • Amoxicillin 5 days	Macrolide (e.g. azithromycin) 3 days
Peri-tonsillar/retro-pharyngeal abscess	• Co-amoxiclav IV then oral step down 7 days	Clindamycin (7 days)
Epiglottitis	• Cefotaxime **or** ceftriaxone, then • Co-amoxiclav oral step-down (total 5 days)	• Ciprofloxacin IV oral step down (total 5 days)
Lymphadenitis	• Co-amoxiclav 7 days	• Clindamycin 7 days
Acute mastoiditis	• Ceftriaxone + clindamycin (2 weeks), co-amoxiclav once improving	• Clindamycin 2 weeks
Sinusitis (acute)	• Penicillin V 7 days • Amoxicillin (if unable to take tablets)	• Macrolide (e.g. azithromycin) 3 days
Sinusitis (chronic)	• Co-amoxiclav 10 days	• Clindamycin 10 days
Dental infection	• Co-amoxiclav 4 days	• Macrolide (e.g. azithromycin) and metronidazole 3 days

Ophthalmology

Infection	Antibiotic	Penicillin allergy
Acute bacterial conjunctivitis	• No antimicrobial treatment required	
Purulent conjunctivitis	• Azithromycin eye drops (3 days) **or** • Chloramphenicol eye ointment (3 days)	
Herpes simplex	• Aged <1 month: aciclovir IV • Aged ≥1 month: aciclovir topical • Refer to ophthalmologist	
Ophthalmia neonatorum	• Ceftriaxone single dose + azithromycin topical 3 days	
Chlamydia	• Erythromycin PO 14 days	
Peri-orbital cellulitis • Pre-septal: mild • Pre-septal: severe	 • Co-amoxiclav **or** clindamycin (5 days) • Co-amoxiclav IV **or** cefuroxime IV for 24–48 hr, then co-amoxiclav PO 7 days	 • Clindamycin • Clindamycin and ciprofloxacin
Orbital cellulitis	• Ceftriaxone **and** metronidazole (minimum 14 days)	• Clindamycin and ciprofloxacin
Orbital cellulitis	• Add liposomal amphotericin	

immunocompromised not responding to antibiotics		

Central nervous system

Infection	Antibiotic	Penicillin allergy
Meningitis <3 month ≥3 month	• Cefotaxime **or** ceftriaxone (high dose) **and** amoxicillin IV (min 10 days) • Ceftriaxone (high dose) IV (min 10 days)	• If history of anaphylaxis to penicillin or cephalosporin ciprofloxacin IV + vancomycin

Age	Organism	Antibiotic	Duration
<3 months	*Group B streptococcus*	Cefotaxime or ceftriaxone	Minimum 14 days
	Listeria monocytogenes	Amoxicillin (high dose) IV + gentamicin (once daily)	Amoxicillin 21 days + gentamicin 7 days
	Gram negative bacilli	Cefotaxime or ceftriaxone	Minimum 21 days
≥3 months	*Haemophillus influenzae type B*	Ceftriaxone	Total 10 days
	Streptococcus pneumoniae	Ceftriaxone	Total 14 days
All	*Neisseria meningitidis*	Ceftriaxone	Total 7 days
All	*Mycobacterium tuberculosis*	Discuss with paediatric TB specialist	
All	Fungal meningitis	Discuss with infection specialist	
Encephalitis	• Aciclovir IV 21 days		

Infection	Antibiotic	Penicillin allergy
Ventricular shunt infection	• Cefotaxime **or** ceftriaxone **and** vancomycin 10 days	• Meropenem (if history of anaphylaxis to penicillin or cephalosporin give ciprofloxacin **and** vancomycin)
Penetrating craniocerebral injury (including depressed skull fracture)	• If no meningitis cefuroxime IV **and** metronidazole 5 days	
Brain abscess/subdural empyema	• Ceftriaxone **and** metronidazole **and** flucloxacilllin IV 6 weeks	
Post-operative meningitis	• Meropenem **and** vancomycin 2–3 weeks	

Intra-abdominal infections

Indication (all ages)	1st line antibiotic	Penicillin allergy
Peritonitis and abscess (including appendicitis)	• Cefotaxime/ceftriaxone + metronidazole **or** co-amoxiclav IV if not septic • Co-amoxiclav PO step down • 7 days (longer if non-drainable abscess)	• Metronidazole, gentamicin and glycopeptide (e.g. teicoplanin)
Pelvic inflammatory disease	• Ceftriaxone (for 24 hr after clinical improvement) + doxycycline (aged >12 yr) or macrolide e.g. azithromycin (aged <12 yr) and metronidazole PO (14 days)	• Clindamycin + doxycycline (aged >12 yr) or macrolide e.g. azithromycin (aged <12 yr) and metronidazole PO 14 days
Sexual assault (if indicated)	• Ceftriaxone (single dose) + macrolide (e.g. azithromycin) PO (single dose) + metronidazole PO (single dose)	• Macrolide (e.g. azithromycin) PO (single dose) + metronidazole PO (single dose)
Necrotising enterocolitis	Ceftriaxone + metronidazole 5 days	
Campylobacter	• Macrolide (e.g. azithromycin) 5 days (only if severe infection/immunocompromised)	
Clostridium difficile	• Metronidazole PO 10–14 days (not for colonisation)	
Salmonella (non-typhoidal) (check sensitivities)	• Macrolide (e.g. azithromycin) 5 days (only if chronic GI tract disease, haemoglobinopathy, malignancies or immunocompromised) • If aged <3 months: ampicillin 5 days • If septicaemic: ceftriaxone 5 days	

Shigella	• Macrolide (e.g. azithromycin) 5 days • If severe, ceftriaxone 5 days

UTI

Age	Cystitis/lower UTI	Acute pyelonephritis/upper UTI
<3 months	• As per sepsis guideline for antibiotic choice **and** duration	
≥3 months	• Nitrofurantoin (tablets only), **or** co-amoxiclav, **or** cefalexin for 3 days	• If outpatient: co-amoxiclav (if penicillin allergy ciprofloxacin) • If septic: gentamicin stat dose, **then** ceftriaxone, **then** ciprofloxacin (if no organism identified)

Osteomyelitis and septic arthritis

Age	Antibiotic (use high doses)	PO switch in simple disease when organism unknown (use high doses)
<3 months	• Cefotaxime	• After 14–21 days if afebrile and pain free minimum 24 hr, **and** CRP <20, **or** decreased by ≥two-thirds highest value: co-amoxiclav **or** cefalexin
≥3 months–≤5 yr	• Cefuroxime IV	• After 72 hr, if afebrile and pain free minimum 24 hr, **and** CRP <20, **or** decreased by ≥two-thirds highest value: ◦ **3 months–5 yr:** co-amoxiclav **or** cefalexin ◦ **6–7 yr:** flucloxacillin (if flucloxacillin not tolerated, co-amoxiclav only) ◦ **8–19 yr**: flucloxacillin **or** clindamycin
≥6 yr	• Flucloxacillin IV **or** • Clindamycin IV	
Penicillin allergy: clindamycin		

Skin and soft tissue infection

Infection	1st line antibiotic	Penicillin allergy	MRSA
Impetigo	Localised: hydrogen peroxide 1% topically Widespread: flucloxacillin	Widespread: macrolide (e.g. azithromycin)	
Cellutitis			
• Mild	• Flucloxacillin (capsules only) **or** cefalexin (suspension)	• Clindamycin (capsules) or macrolide (e.g. azithromycin) (suspension)	• Clindamycin
• Severe/systemically unwell	• Flucloxacillin IV (severe sepsis add gentamicin)	• Clindamycin (capsules) **or** clarithromycin IV	• Glycopeptide (e.g. teicoplanin)
Necrotising fasciitis	• Piperacillin/tazobactam **or** ceftriaxone + clindamycin IV	• Glycopeptide (e.g. teicoplanin) + clindamycin IV + gentamicin IV	
Bites			
• Prophylaxis	• Co-amoxiclav (7 days)	• Ciprofloxacin	
• Infected bites	• If severely infected, co-amoxiclav IV	• Ciprofloxacin + clindamycin	

APLS – CARDIORESPIRATORY ARREST ● 1/3

MANAGEMENT

- Stimulate patient to assess for signs of life and call for help
- Establish basic life support: Airway – Breathing – Circulation
- Connect ECG monitor: identify rhythm and follow **Algorithm**
- Control airway and ventilation: preferably intubate
- Obtain vascular access, peripheral or intraosseous (IO)
- Change person performing chest compressions every few minutes

Airway (A)

- Inspect mouth: apply suction if necessary
- Use either head tilt and chin lift or jaw thrust
- Oro- or nasopharyngeal airway
- Intubation [see **Aide memoire** (**APLS Recognition and assessment of the sick child** guideline)]
- If airway cannot be achieved, consider laryngeal mask or, failing that, cricothyrotomy

Breathing (B)

- Self-inflating bag and mask with 100% oxygen
- Ventilation rate
- unintubated: 2 inflations for every 15 compressions
- intubated: 10–12/min, with continuous compressions
- Consider foreign body or pneumothorax

Circulation (C)

- Cardiac compression rate: 100–120/min depressing lower half of sternum by at least one third (4 cm infant, 5 cm child, 6 cm adult): push hard, push fast
- Peripheral venous access: 1–2 attempts (<30 sec)
- IO access: 2–3 cm below tibial tuberosity (see **Intraosseous infusion** guideline)
- Use ECG monitor to decide between:
- a non-shockable rhythm: asystole or pulseless electrical activity (PEA) OR
- a shockable rhythm: ventricular fibrillation or pulseless ventricular tachycardia

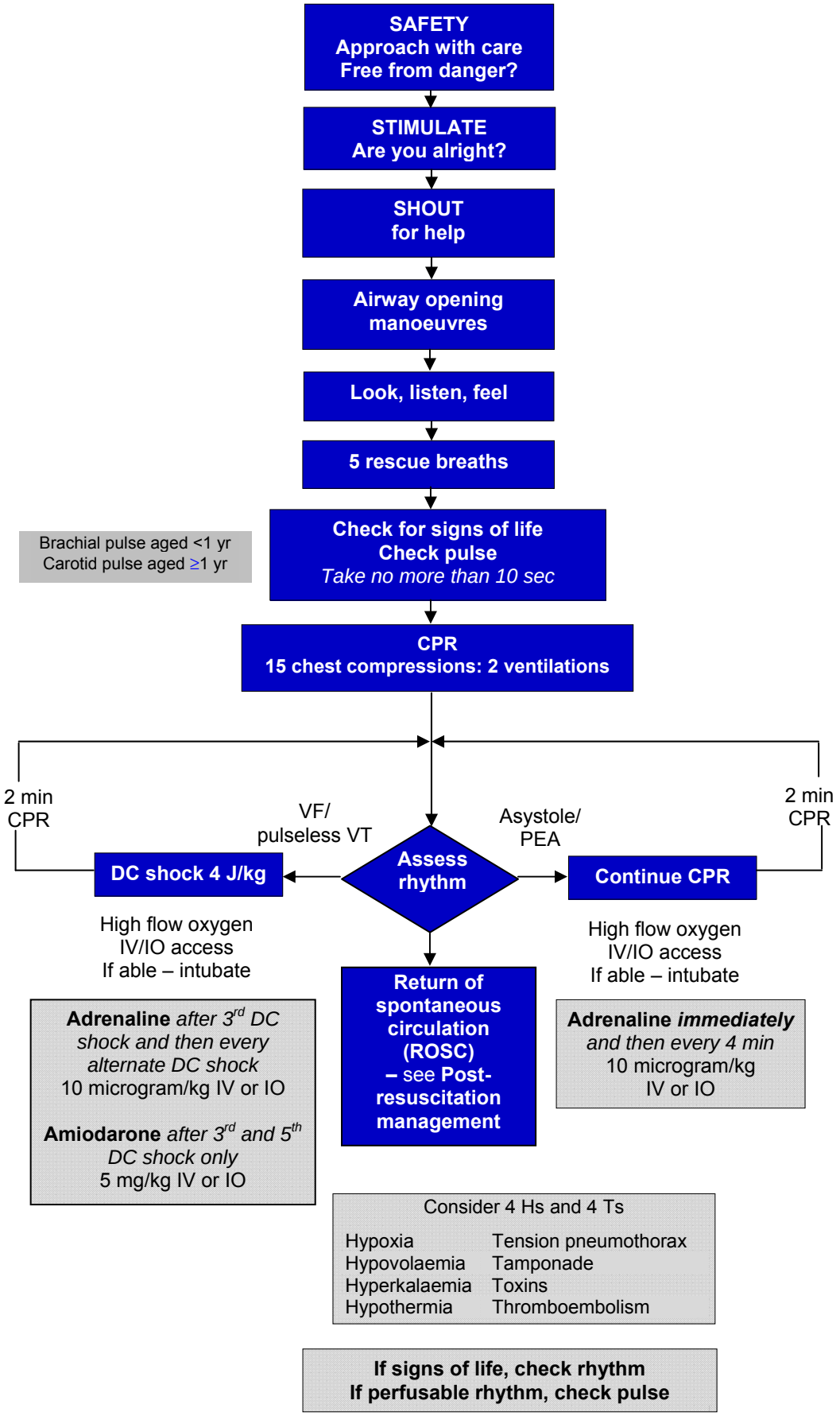
Algorithm for managing these rhythms follows:

- If arrest rhythm changes, restart **Algorithm**
- If organised electrical activity seen, check pulse and for signs of circulation

Adrenaline doses for asystole

Route	Aged <12 yr	Aged 12 yr–adult	Notes	
IV rapid bolus/ IO	10 microgram/kg (0.1 mL/kg of 1:10,000)	1 mg (10 mL of 1:10,000 **OR** 1 mL of 1:1,000)	Initial and usual subsequent dose	If given by IO route flush with sodium chloride 0.9%

APLS – CARDIORESPIRATORY ARREST ● 2/3



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Defibrillation
- Use hands-free paediatric pads in children, may be used anteriorly and posteriorly
- Resume 2 min of cardiac compressions immediately after giving DC shock, without checking monitor or feeling for pulse
- Briefly check monitor for rhythm before next shock: if rhythm changed, check pulse
- Adrenaline and amiodarone are given after the 3rd and 5th DC shock, and then adrenaline only every other DC shock
- Automatic external defibrillators (AEDs) do not easily detect tachyarrythmias in infants but may be used at all ages, ideally with paediatric pads, which attenuate the dose to 50–80 J

PARENTAL PRESENCE
- Evidence suggests that presence at their child's side during resuscitation enables parents to gain a realistic understanding of efforts made to save their child. They may subsequently show less anxiety and depression
- Designate 1 staff member to support parents and explain all actions
- Team leader, not parents, must decide when it is appropriate to stop resuscitation

WHEN TO STOP RESUSCITATION
- No time limit is given to duration of CPR
- no predictors sufficiently robust to indicate when attempts no longer appropriate
- cases should be managed on individual basis dependent on circumstances
- Prolonged resuscitation has been successful in:
- hypothermia (<32°C)
- overdoses of cerebral depressant drugs (e.g. intact neurology after 24 hr CPR)
- Discuss difficult cases with consultant before abandoning resuscitation

POST-RESUSCITATION MANAGEMENT
Identify and treat underlying cause

Monitor
- Heart rate and rhythm
- Oxygen saturation
- CO_2 monitoring
- Core and skin temperatures
- BP
- Urine output
- Arterial blood gases and lactate
- Central venous pressure

Request
- CXR
- Arterial and central venous gases
- Haemoglobin and platelets
- Group and save serum for crossmatch
- Sodium, potassium, U&E
- Clotting screen
- Blood glucose
- LFTs
- 12-lead ECG

- Transfer to PICU
- Hold team debriefing session to reflect on practice

APLS – RECOGNITION AND ASSESSMENT OF THE SICK CHILD ● 1/5

RAPID CLINICAL ASSESSMENT

Airway (A) and Breathing (B)

- Effort of breathing
  - respiratory rate
  - recession
  - use of accessory muscles
  - additional sounds: stridor, wheeze, grunting
  - flaring of nostrils
- Efficacy of breathing
  - chest movement and symmetry
  - breath sounds
  - SpO_2 in air

Circulation (C)

- Heart rate
- Pulse volume
  - peripheral
  - central (carotid/femoral)
- Blood pressure
- Capillary refill time
- Skin colour and temperature

Disability (D)

- Conscious level
- Posture
- Pupils

Exposure (E)

- Fever
- Skin rashes, bruising

Don't Ever Forget Glucose (DEFG)

- BM sticks

Actions

- Complete assessment should take <1 min
- Treat as problems are found
- Once airway (A), breathing (B) and circulation (C) are clearly recognised as being stable or have been stabilised, definitive management of underlying condition can proceed
- Reassessment of ABCDE at frequent intervals necessary to assess progress and detect deterioration
- Hypoglycaemia: glucose 10% 2 mL/kg followed by IV glucose infusion

CHILD AND PARENTS

- Give clear explanations to parents and child
- Allow and encourage parents to remain with child at all times

STRUCTURED APPROACH TO THE SERIOUSLY ILL CHILD

Airway

Primary assessment of airway

- Vocalisations (e.g. crying or talking) indicate ventilation and some degree of airway patency
- Assess patency by:
  - **looking** for chest and/or abdominal movement
  - **listening** for breath sounds
  - **feeling** for expired air

Re-assess after any airway opening manoeuvres

- Infants: a neutral head position; other children: 'sniffing the morning air'
- Other signs that may suggest upper airway obstruction:
  - stridor
  - intercostal/subcostal/sternal recession

Breathing

Primary assessment of breathing

- Assess
- effort of breathing
- efficacy of breathing
- effects of respiratory failure

Effort of breathing

- Respiratory rates 'at rest' at different ages (see **Aide memoire: boys/girls)**
- Respiratory rate:
- tachypnoea: from either lung or airway disease or metabolic acidosis
- bradypnoea: due to fatigue, raised intracranial pressure, or pre-terminal
- Recession:
- intercostal, subcostal or sternal recession shows increased effort of breathing
- degree of recession indicates severity of respiratory difficulty
- in child with exhaustion, chest movement and recession will decrease
- Inspiratory or expiratory noises:
- stridor, usually inspiratory, indicates laryngeal or tracheal obstruction
- wheeze, predominantly expiratory, indicates lower airway obstruction
- volume of noise is not an indicator of severity
- Grunting:
- a sign of severe respiratory distress
- can also occur in intracranial and intra-abdominal emergencies
- Accessory muscle use
- Gasping (a sign of severe hypoxaemia and can be pre-terminal)
- Flaring of nostrils

Exceptions

- **Increased effort of breathing DOES NOT occur in 3 circumstances:**
- **exhaustion**
- **central respiratory depression** (e.g. from raised intracranial depression, poisoning or encephalopathy)
- **neuromuscular disease** (e.g. spinal muscular atrophy, muscular dystrophy or poliomyelitis)

Efficacy of breathing

- Breath sounds on auscultation:
- reduced or absent
- bronchial
- symmetrical or asymmetric
- Chest expansion
- Pulse oximetry

Effects of respiratory failure on other physiology

- Heart rate:
- increased by hypoxia, fever or stress
- bradycardia is a pre-terminal sign
- Skin colour:
- hypoxia first causes vasoconstriction and pallor (via catecholamine release)
- cyanosis is a late and pre-terminal sign
- some children with congenital heart disease may be permanently cyanosed and oxygen may have little effect
- Mental status:
- hypoxic child will be agitated first, then drowsy and unconscious
- pulse oximetry can be difficult to achieve in agitated child owing to movement artefact

Circulation

- Heart rates 'at rest' at different ages (see **Aide memoire: boys/girls**)

Pulse volume

- Absent peripheral pulses or reduced central pulses indicate shock

Capillary refill

- Pressure on centre of sternum or a digit for 5 sec should be followed by return of circulation in skin within 2–3 sec
- can be prolonged by shock or cold environmental temperatures
- not a specific or sensitive sign of shock
- should not be used alone as a guide to response to treatment

BP

- See **Aide memoire: boys/girls** below
- Cuff should cover >80% of length of upper arm
- Hypotension is a late and pre-terminal sign of circulatory failure

Effects of circulatory inadequacy on other organs/physiology

- Respiratory system:
- tachypnoea and hyperventilation occur with acidosis
- Skin:
- pale or mottled skin colour indicates poor perfusion
- Mental status:
- agitation, then drowsiness leading to unconsciousness
- Urinary output:
- <1 mL/kg/hr (<2 mL/kg/hr in infants) indicates inadequate renal perfusion

Features suggesting cardiac cause of respiratory inadequacy

- Cyanosis, not relieved by oxygen therapy
- Tachycardia out of proportion to respiratory difficulty
- Raised JVP
- Gallop rhythm/murmur
- Enlarged liver
- Absent femoral pulses

Disability

Primary assessment of disability

- Always assess and treat airway, breathing and circulatory problems before undertaking neurological assessment:
- respiratory and circulatory failure have central neurological effects
- central neurological conditions (e.g. meningitis, raised intracranial pressure, status epilepticus) have both respiratory and circulatory consequences

Neurological function

- Conscious level: **AVPU**; a painful central stimulus may be applied by sternal pressure, squeezing trapezius muscle or Achilles tendon, or supra-orbital ridge pressure
- **A**lert
- **V**oice
- **P**ain (equivalent to GCS <8)
- **U**nresponsive
- Posture:
- hypotonia
- decorticate or decerebrate postures may only be elicited by a painful stimulus
- Pupils, look for:
- pupil size, reactivity and symmetry
- dilated, unreactive or unequal pupils indicate serious brain disorders

Signs of raised intracranial pressure (Cushing's Triad)

- Respiratory:
- hyperventilation
- Cheyne-Stokes breathing
- slow, sighing respiration
- apnoea
- Systemic hypertension
- Sinus bradycardia

APLS aide-memoire: boys

Age	Guide Weight (kg)	A ET tube		C Joules 4 J/kg	C Fluids 20 mL/kg (mL)	C Adrenaline 0.1 mL/kg of 1:10,000 (mL)	D Lorazepam 0.1 mg/kg Max 4 mg (mg)	D Glucose 2 mL/kg of 10% glucose (mL)	RR At rest Breaths/ min 5^{th}–95^{th} centile	HR Beats/min 5^{th}–95^{th} centile	BP Systolic		
		Int diameter mm	Length cm								5^{th} centile	50^{th} centile	95^{th} centile
Birth	3.5	3.0/3.5	9	20	70	0.4	0.4	7	25–50	120–170	65–75	80–90	105
1 month	4.5	3.5	9	20	90	0.5	0.5	9	25–50	120–170	65–75	80–90	105
3 months	6.5	3.5	10	30	130	0.7	0.7	13	25–45	115–160	65–75	80–90	105
6 months	8	4	12	30	160	0.8	0.8	16	20–40	110–160	65–75	80–90	105
12 months	9.5	4.5	13	40	200	1.0	1.0	19	20–40	110–160	70–75	85–95	105
18 months	11	4.5	13	40	220	1.1	1.1	22	20–35	100–155	70–75	85–95	105
2 yr	12	4.5	13	50	240	1.2	1.2	24	20–30	100–150	70–80	85–100	110
3 yr	14	5	14	60	280	1.4	1.4	28	20–30	90–140	70–80	85–100	110
4 yr	16	5	14	60	320	1.6	1.6	32	20–30	80–135	70–80	85–100	110
5 yr	18	5.5	14	80	360	1.8	1.8	36	20–30	80–135	80–90	90–110	110–120
6 yr	21	5.5	15	80	420	2.1	2.1	42	20–30	80–130	80–90	90–110	110–120
7 yr	23	6	15	100	460	2.3	2.3	46	20–30	80–130	80–90	90–110	110–120
8 yr	25	6	16	100	500	2.5	2.5	50	15–25	70–120	80–90	90–110	110–120
9 yr	28	6.5	16	120	500	2.8	2.8	56	15–25	70–120	80-90	90–110	110–120
10 yr	31	6.5	17	130	500	3.1	3.1	62	15–25	70–120	80–90	90–110	110–120
11 yr	35	6.5	17	140	500	3.5	3.5	70	15–25	70–120	80–90	90–110	110–120
12 yr	43	7.5	18	150	500	4.3	4.0	86	12–24	65–115	90–105	100–120	125–140
14 yr	50	8	21	150	500	5.0	4.0	100	12–24	60–110	90–105	100–120	125–140
Adult	70	8	24	120–150 Joules biphasic	500	10 mL (i.e. 1 mg)	4 mg	100 mL	12–24	60–110	90–105	100–120	125–140

TIP: if a child is particularly big go up 1 or 2 yr; particularly small go down 1 or 2 yr

The final responsibility for delivery of the correct dose remains that of the physician prescribing and administering the drug

APLS aide-memoire: girls

Age	Guide Weight (kg)	A ET tube		C Joules 4 J/kg	C Fluids 20 mL/kg (mL)	C Adrenaline 0.1 mL/kg of 1:10,000 (mL)	D Lorazepam 0.1 mg/kg Max 4 mg (mg)	D Glucose 2 mL/kg of 10% glucose (mL)	RR At rest Breaths/min 5^{th}–95^{th} centile	HR Beat/min 5^{th}–95^{th} centile	BP Systolic		
		Int diameter mm	Length cm								5^{th} centile	50^{th} centile	95^{th} centile
Birth	3.5	3.0/3.5	9	20	70	0.4	0.4	7	25–50	120–170	65–75	80–90	105
1 month	4.5	3.5	9	20	90	0.5	0.5	9	25–50	120–170	65–75	80–90	105
3 months	6	3.5	10	30	120	0.6	0.6	12	25–45	115–160	65–75	80–90	105
6 months	7	4	12	30	140	0.7	0.7	14	20–40	110–160	65–75	80–90	105
12 months	9	4.5	13	40	180	0.9	0.9	18	20–40	110–160	70–75	85–95	105
18 months	10	4.5	13	40	200	1.0	1.0	20	20–35	100–155	70–75	85–95	105
2 yr	12	4.5	13	50	240	1.2	1.2	24	20–30	100–150	70–80	85–100	110
3 yr	14	5	14	60	280	1.4	1.4	28	20–30	90–140	70–80	85–100	110
4 yr	16	5	14	60	320	1.6	1.6	32	20–30	80–135	70–80	85–100	鞅 鞴
5 yr	18	5.5	14	80	360	1.8	1.8	36	20–30	80–135	80–90	90–110	110–120
6 yr	20	5.5	15	80	400	2.0	2.0	40	20–30	80–130	80–90	90–110	110–120
7 yr	22	6	15	90	440	2.2	2.2	44	20–30	80–130	80–90	90–110	110–120
8 yr	25	6	16	100	500	2.5	2.5	50	15–25	70–120	80–90	90–110	110–120
9 yr	28	6.5	16	120	500	2.8	2.8	56	15–25	70–120	80-90	90–110	110–120
10 yr	32	6.5	17	130	500	3.2	3.2	64	15–25	70–120	80–90	90–110	110–120
11 yr	35	6.5	17	140	500	3.5	3.5	70	15–25	70–120	80–90	90–110	110–120
12 yr	43	7.5	18	150	500	4.3	4.0	86	12–24	65–115	90–105	100–120	125–140
14 yr	50	8	21	150	500	5.0	4.0	100	12–24	60–110	90–105	100–120	125–140
Adult	70	8	24	120–150 Joules biphasic	500	10 mL (i.e. 1 mg)	4 mg	100 mL	12–24	60–110	90–105	100–120	125–140

TIP: if a child is particularly big go up 1 or 2 yr; particularly small go down 1 or 2 yr

The final responsibility for delivery of the correct dose remains that of the physician prescribing and administering the drug

APPARENT LIFE THREATENING EVENT (ALTE) ● 1/2

DEFINITION

A sudden, unexpected change in an infant's behaviour that is frightening to the observer and includes changes in ≥2 of the following:

- Breathing: noisy, apnoea
- Colour: blue, pale
- Consciousness, responsiveness
- Movement, including eyes
- Muscle tone: stiff, floppy
- Event has a clear beginning and end so has resolved before presentation [brief resolved unexplained episode (BRUE)]

INVESTIGATION OF FIRST ALTE

Clinical history

- Feeding
- Sleeping
- Infant and family illness and medicines
- Gestation at delivery

Examination

- Full examination including signs of non-accidental injury

Assessment

- SpO_2
- Fundoscopy by paediatric ophthalmologist if:
- recurrent
- severe events (e.g. received CPR)
- history or examination raises child safeguarding concerns (e.g. inconsistent history, blood in nose/mouth, bruising or petechiae, history of possible trauma)
- anaemic

Investigations

Indicated if any of the following present:

- Aged <1 month
- <32 weeks' gestation
- Previous illness/ALTE
- Examination abnormal
- Severe ALTE

Immediate

- FBC
- U&E, blood glucose
- Plasma lactate
- Blood gases
- Blood culture

Urgent

- Nasopharyngeal aspirate for virology
- Per-nasal swab for pertussis
- Urine microscopy and culture (microbiology)
- Urine biochemistry: store for possible further tests (see below)
- CXR
- ECG

MANAGEMENT

- If event has resolved, admit for observation
- SpO_2, ECG monitoring
- Liaise with health visitor (direct or via liaison health visitor on wards)
- Check if child known to local authority children's social care or is the subject of a child protection plan
- If events recur during admission, discuss with senior role of further investigations (see below)

APPARENT LIFE THREATENING EVENT (ALTE) ● 2/2

After 24 hr observation

- If event brief and child completely well:
- reassure parents and offer resuscitation training
- discharge (no follow-up appointment)
- All patients in following categories to have consultant review and be offered Care of Next Infant (CONI) Plus programme and/or home SpO_2 monitoring:
- parents remain concerned despite reassurance
- recurrent ALTE
- severe ALTE (e.g. needing CPR/PICU)
- <32 weeks' gestation at birth
- a sibling was either a sudden unexplained death (SUD) or had ALTEs
- family history of sudden death

If events severe (e.g. CPR given) or repeated events

- Multi-channel physiological recording

Further investigations

Exclude following disorders:	
Gastro-oesophageal reflux	pH/impedance study +/- contrast swallow
Seizures	EEG
Intracranial abnormalities	CT or MRI brain
Cardiac arrhythmias	ECG and 24 hr ECG
Upper airway disorder	ENT review +/- sleep study
Hypocalcaemia	Ca and bone screen
Metabolic assessment	Urinary amino and organic acids Plasma amino acids and acylcarnitine
Abuse	Skeletal survey (including CT brain) Blood and urine toxicology (from admission) Continuous physiological or video recordings

ARTHRITIS ● 1/2

RECOGNITION AND ASSESSMENT

Definition

- Acute, chronic (≥6 weeks) or recurrent inflammation of ≥1 joint(s)

Acute arthritis associated with fever requires urgent assessment to rule out septic arthritis/osteomyelitis (see* Osteomyelitis and septic arthritis *guideline)

Symptoms and signs

- ≥1 swollen joint(s), which may be:
- warm
- stiff +/- painful
- tender
- reduced in range of movement

Differential diagnosis

Acute septic arthritis

- See **Osteomyelitis and septic arthritis** guideline

Malignancy

- Malignancy, particularly leukaemia and neuroblastoma, can present with joint pain +/- swelling
- Cytopaenia and hepatosplenomegaly may be absent at presentation

Non-accidental injury (NAI)

- See **Child protection** guideline

Reactive arthritis

- 7–14 days following acute infection
- Self-limiting
- Human leukocyte antigen (HLA)-B27 associated pathogens:
- campylobacter, shigella, salmonella, chlamydia, *Clostridium difficile*
- classic Reiter's triad of arthritis, conjunctivitis and sterile urethritis rare in children
- Non HLA-B27 associated pathogens:
- *H. influenzae*, mycobacteria, *N. gonorrhoeae*, *N. meningitidis*, *Staph. aureus*, streptococci
- some viral, fungal and parasitic infections

Inflammatory bowel disease associated arthritis

- Monoarthritis in a large joint or peripheral arthritis associated with disease activity

Juvenile idiopathic arthritis (JIA)

- Arthritis of unknown aetiology before aged 16 yr (peak aged 1–5 yr)
- Persisting for ≥6 weeks
- Stiffness especially after rest (e.g. mornings), gradual refusal to participate in usual activities
- Reported pain can be surprisingly minimal (but not always)
- Any or multiple joints

Systemic rheumatic diseases

- Juvenile systemic lupus erythematosus (SLE), juvenile dermatomyositis
- Vasculitis, including Henoch-Schönlein purpura and Kawasaki disease (see **Henoch-Schönlein** guideline and **Kawasaki disease** guideline)

Rarer causes

- Infectious causes – tuberculosis, Lyme disease
- Rheumatic fever – migratory arthritis, erythema marginatum, chorea, history of tonsillitis
- Inherited metabolic disorders e.g. mucopolysaccharidoses
- Haemophilia
- Chronic recurrent multifocal osteomyelitis
- Chronic infantile neurological, cutaneous, and articular (CINCA) syndrome

INVESTIGATIONS

- If monoarthritis and NAI/osteomyelitis/malignancy suspected, X-ray
- Bloods including:
- FBC and film, ESR, CRP, ASOT

- if prolonged bleeding, coagulation studies
- if SLE suspected, ANA
- if septic arthritis suspected (monoarthritis and fever), synovial aspiration with microscopy and culture +/- joint washout **before** antimicrobial treatment are mandatory (refer to orthopaedics)
- Further imaging e.g. US/MRI may be indicated (seek advice from paediatric rheumatology/orthopaedics)
- ultrasound can be carried out to look for hip joint effusion – cannot differentiate between transient synovitis and septic arthritis

MANAGEMENT

Primary care

Acute

- Contact local paediatric team for advice on assessment and management of acute musculoskeletal symptoms and pyrexia of unknown origin
- Provide adequate analgesia/anti-inflammatory medications
- anti-inflammatories contraindicated in gastrointestinal (GI) ulceration/bleeding
  - use with caution in asthma, angioedema, urticaria, coagulation defects, cardiac, hepatic or renal impairment
  - if taking other medicines that increase risk of upper GI side effects, or with serious co-morbidity – give ranitidine or proton pump inhibitor as gastro protection

Chronic

- **Refer all** children with suspected JIA, autoimmune connective tissue diseases (e.g. juvenile SLE, juvenile dermatomyositis, scleroderma and sarcoidosis) to nearest paediatric rheumatology service without delay

If JIA suspected, arrange early referral to local ophthalmologist to commence screening programme for uveitis
Chronic anterior uveitis can be asymptomatic initially, and can progress to irreversible loss of vision if referral delayed

Secondary care

- Explore possible differential diagnoses and manage/refer as appropriate
- If septic arthritis suspected discuss urgently with local orthopaedic team
- requires urgent joint aspiration, microscopy and culture, followed by IV antibiotics
- Suspected JIA requires prompt onward referral to paediatric rheumatology
- If systemic JIA or autoimmune connective tissue disease suspected, discuss with paediatric rheumatology without delay

Tertiary care

- Management includes:
- exploring differential diagnoses
- optimising medical treatment including:
  - corticosteroid injections
  - disease modifying agents e.g. oral steroids, methotrexate, etanercept and other biological therapies
- disease education
- physiotherapy, occupational therapy and rehabilitation
- involvement of other paediatric/surgical specialties as indicated

ASTHMA – ACUTE MANAGEMENT ● 1/5

RECOGNITION AND ASSESSMENT

Definition

- A chronic inflammatory disorder of the airways with reversible obstruction

In children aged <2 yr who have an initial poor response to β_2 agonists administered with adequate technique, continue treatment if severe (see definition below), but consider alternative diagnosis and other treatment options

Symptoms and signs

- Breathlessness
- Wheeze
- Cough
- Nocturnal cough
- Tight chest

- Symptoms and signs tend to be:
- variable
- intermittent
- worse at night
- provoked by triggers, including exercise

Mild/moderate

- Normal vital signs
- Mild wheeze
- Speaks in complete sentences or feeding
- SpO_2 >92% in air
- PEF >50% in patient aged ≥5 yr

Severe

- Too breathless to talk/feed
- Tachypnoea
- aged <5 yr: >40 breaths/min
- aged 5–12 yr: >30 breaths/min
- aged 12–18 yr: >25 breaths/min
- Tachycardia
- aged <5 yr: >140 beats/min
- aged 5–12 yr: >125 beats/min
- aged 12–18 yr: >110 beats/min
- Use of accessory muscles, recession subcostal and intercostal, flaring of alae nasi
- SpO_2 <92% in air
- Peak expiratory flow (PEF) ≤50% predicted/best

Life-threatening

- Cyanosis/pallor
- Decreased air entry/silent chest
- Poor respiratory effort
- Altered conscious level
- Irritable/exhausted
- SpO_2 <92% in air
- PEF ≤33% in those aged ≥5 yr

Patients with severe or life-threatening attacks may not be distressed and may not have all these abnormalities. Presence of any one of these should alert doctor

Differential diagnosis

- Inhaled foreign body
- Pneumonia
- Pneumothorax
- Aspiration
- Cystic fibrosis

- Tracheobronchomalacia
- Gastro-oesophageal reflux
- Hyperventilation

Assessment
- Record:
- respiratory rate and effort
- recession
- heart rate
- air entry
- oxygen saturation in air
- if ≥5 yr, PEF
- conscious level
- CXR if severe and life threatening sign/symptoms do not improve with medical management

Do not take any samples for routine blood tests or routine blood gases.
Routine CXR is unnecessary in a child with asthma

IMMEDIATE TREATMENT

- Follow algorithm **Management of acute wheezing in children**
- Prescribe oxygen on drug chart if required

Senior assessment
- If you are worried about child's conscious level or there is no response to nebulised salbutamol or poor respiratory effort:
- Call senior doctor for further assessment
- Site an IV line
- Initial bolus dose of salbutamol IV over 5 min
- aged <2 yr: 5 microgram/kg (maximum 250 microgram)
- aged >2 yr: 15 microgram/kg (maximum 250 microgram)
- Using 500 microgram/mL injection preparation dilute to a concentrate of 50 microgram/mL with sodium chloride 0.9%
- e.g. withdraw 250 microgram = 0.5 mL and make up to a total volume of 5 mL using sodium chloride 0.9% = 250 microgram in 5 mL

Not responding within 15 min
- Magnesium sulfate IV injection over 20 min (aged 2–17 yr): 40 mg/kg single dose (maximum 2 g)
- use 50% injection and dilute to a 10% concentration by diluting required volume with 4x volume of sodium chloride 0.9%

Not responding within 15 min of completion of magnesium sulfate
- Discuss with on-call paediatric consultant
- Salbutamol 1–2 microgram/kg/min continuous infusion (use 50 kg as maximum weight)
- use 1 mg/mL solution for IV infusion, take 10 mg (10 mL) and make up to 50 mL with sodium chloride 0.9% giving a concentration of 200 microgram/mL
- If not responding increase up to 5 microgram/kg/min for 1 hr then reduce back to 2 microgram/kg/min
- If requiring >2 microgram/kg/min admit to HDU or PICU depending on severity of illness
- Use $TcCO_2$ monitor
- Continue with oxygen and continuous salbutamol nebuliser whilst waiting for infusion to be made up

Drug doses
- Salbutamol nebulised, driven by 6–8 L/min oxygen:
- aged <5 yr: 2.5 mg
- aged >5–12 yr: 2.5–5 mg
- aged >12 yr: 5 mg

- Ipratropium bromide (Atrovent®) nebulised:
- aged <12 yr: 250 microgram
- aged >12 yr: 500 microgram

- Prednisolone 0.5 mg/kg oral (round up to nearest 5 mg):
- aged <2 yr: maximum 10 mg once daily
- aged 2–5 yr: maximum 20 mg once daily
- aged >5 yr: maximum 30 mg once daily
- if already on maintenance oral corticosteroids prednisolone 1–2 mg/kg (maximum 60 mg) and discuss weaning plan with respiratory consultant

- Hydrocortisone slow IV injection:
- aged <2 yr: 4 mg/kg (maximum 25 mg) 6-hrly
- aged 2–5 yr: 50 mg 6-hrly
- aged 5–18 yr: 100 mg 6-hrly

- Do not give antibiotics routinely
- If high prevalence of influenza with fever, coryza, generalised symptoms (headache, malaise, myalgia, arthralgia) give oseltamivir

Monitoring

If treated with nebulised or IV salbutamol:

- Record heart rate and respiratory rate every 10 min
- Continuous SpO_2
- Cardiac monitoring
- Baseline U&E
- Capillary blood gas and lactate
- 12-hrly potassium for hypokalaemia

If treated with IV magnesium sulfate:

- Record heart rate, respiratory rate and blood pressure every 5 min
- Continuous SpO_2
- Cardiac monitoring
- Baseline U&E
- Capillary blood gas and lactate

SUBSEQUENT MANAGEMENT

Follow algorithm **Management of acute wheezing in children**

Previous history

- When recovering, ask about:
- previous episodes of wheeze, similar episodes
- triggering factors, seasonal variation
- nocturnal cough
- family history of asthma, hay fever, eczema, other atopy
- smokers in the family (including child)
- days off school because of asthma
- number of courses of prednisolone used in last year
- pets
- drug history (device and dose) especially any bronchodilators/inhaled corticosteroids and their effect, particularly need to use beta-agonists

DISCHARGE AND FOLLOW-UP

Discharge criteria

- SpO_2 in air >94%
- Respiratory rate:
- aged <5 yr: <40 breaths/min
- aged 5–12 yr: <30 breaths/min
- aged 12–18 yr: <25 breaths/min
- Heart rate:
- aged <5 yr: <140 beats/min
- aged 5–12 yr: <125 beats/min
- aged 12–18 yr: <110 beats/min
- Peak flow: ≥75% predicted/best (aged >5 yr)
- Stable on 4-hrly treatment

Discharge home same day if:

- Child has made a significant improvement and has remained stable for 4 hr
- Parents:
  - understand use of inhalers
  - have a written personal asthma action plan (PAAP)
  - have a written discharge/weaning salbutamol information leaflet
  - know how to recognise signs of deterioration and the actions to take

Discharge treatment

- Prescribe beta-agonist with spacer with mask for aged <3 yr
  - aged >3 yr without mask (e.g. Volumatic or aerochamber)
- Give prednisolone daily for 3–5 days (if already on oral prednisolone maintenance therapy speak to respiratory consultant/nurse)
- Educate on use of PEF meter if aged ≥5 yr
- Prescribe preventer as appropriate – see **Chronic management**
- Inhaled corticosteroids generally not required for recurrent viral induced wheeze
- Discuss follow-up in either nurse-led asthma clinic or consultant clinic
- If there have been life-threatening features refer to paediatric respiratory specialist
- Advise follow-up with GP within 2 working days
- Refer smokers to smoking cessation services
- Identify trigger of acute attack and discuss future management plan for exposure

Chronic management

- Commence inhaled corticosteroid or escalate preventer treatment if any of following:
  - frequent episodes
  - bronchodilators used most days (>3 days/week)
  - nocturnal and/or exercise-induced symptoms
  - other atopic symptoms and strong family history of atopy
- If recurrent upper respiratory tract problems or allergic rhinitis triggering attacks, give oral antihistamines +/- steroid nasal spray

Algorithm: Management of acute wheezing in children

Assessment

MILD/MODERATE

Normal vital signs
Mild wheeze
Speaking in complete sentences or feeding
SpO_2 >92% in air
PEF >50% in those aged ≥5 yr

Salbutamol MDI 2–10 puffs (200–1000 microgram) via large volume spacer (LVS) +/- face mask
Oxygen if SpO_2 <94% in air
Once daily oral prednisolone, if on maintenance therapy, discuss with respiratory consultant/nurse
- Aged <2 yr = max 10 mg once daily
- Aged 2–5 yr = max 20 mg once daily
- Aged >5 yr = max 30 mg once daily

RE-ASSESS EVERY 15–30 MIN

DISCHARGE CRITERIA MET

SpO_2 >94% in air

Age	Respiratory rate	Heart rate
<5 yr:	<40 breaths/min	<140 beats/min
5–12 yr:	<30 breaths/min	<125 beats/min
12–18 yr:	<25 breaths/min	<110 beats/min

Peak flow ≥75% predicted/best
Stable on 4-hrly inhaled treatment

NO → ADMIT

YES

DISCHARGE HOME

Continue once daily oral prednisolone, complete a 3 day course
Review long-term asthma control + treatment
- Check inhaler technique
- Provide PAAP
- Agree follow-up plan
- Complete respiratory discharge letter

DISCHARGE

SEVERE

Too breathless to talk/feed
SpO_2 <92% in air
Use of accessory muscles

Age	Respiratory rate	Heart rate
<5 yr:	>40 breaths/min	>140 beats/min
5–12 yr:	>30 breaths/min	>125 beats/min
12–18 yr:	>25 breaths/min	>110 beats/min

Peak flow ≤50% predicted/best

Oxygen via mask or nasal cannula
Salbutamol MDI 10 puffs (1000 microgram) via large volume spacer +/- face mask, or:
Salbutamol nebulised, driven by 6–8 L/min oxygen:
- aged <5 yr: 2.5 mg
- aged >5–12 yr: 2.5–5 mg
- aged >12 yr: 5 mg

If poor response, give ipratropium bromide nebulised:
- Aged <12 yr = 250 microgram
- Aged >12 yr = 500 microgram

Once daily oral prednisolone, if on maintenance therapy, discuss with respiratory consultant/nurse
- Aged <2 yr: max 10 mg once daily
- Aged 2–5 yr: max 20 mg once daily
- Aged >5 yr: max 30 mg once daily

If oral steroids not tolerated give hydrocortisone by slow IV injection
- Aged <2 yr: 4 mg/kg (max 25 mg) 6-hrly
- Aged 2–5 yr: 50 mg 6-hrly
- Aged 5–18 yr: 100 mg 6-hrly

YES → **DISCHARGE CRITERIA MET**

NO → **ADMIT**

Continue oxygen via mask/nasal cannula
Nebulised salbutamol ¼–4 hrly
Repeat ipratropium bromide. If poor response, give every 20–30 min for first 2 hr

REASSESS FREQUENCY OF BRONCHODILATOR THERAPY

YES → **SYMPTOMS IMPROVING**

LIFE-THREATENING

Assess ABC
Cyanosis/pallor
Silent chest
Poor respiratory effort
Altered consciousness
SpO_2 <92% in air
Irritable/exhausted
PEF ≤33% in those aged ≥5 yr

Inform on-call consultant and PICU
Oxygen via mask/nasal cannula
Continuous salbutamol nebulised, driven by 6–8 L/min oxygen

Ipratropium bromide nebulised:
- Aged <12 yr = 250 microgram
- Aged >12 yr = 500 microgram

Hydrocortisone by slow IV injection
- Aged <2 yr: 4 mg/kg (max 25 mg) 6-hrly
- Aged 2–5 yr: 50 mg 6-hrly
- Aged 5–18 yr: 100 mg 6-hrly

If signs of shock, sodium chloride 0.9% 20 mL/kg IV bolus

Consider anaphylaxis as an alternative diagnosis

REASSESS

SYMPTOMS IMPROVING

NO CHANGE WORSENING

NO IMPROVEMENT

Continuous nebulised salbutamol
Repeat ipratropium bromide. If poor response, give every 20–30 min for first 2 hr
- Salbutamol IV (see **Salbutamol infusion**)
- Consider magnesium sulphate IV
- Blood gas
- CXR

SYMPTOMS IMPROVING

Check

Has patient received:
- Continuous salbutamol nebulised?
- Ipratropium bromide nebulised?
- Hydrocortisone IV?

Is patient still not improving/worsening and meets severe/life-threatening criteria?

YES

SALBUTAMOL BOLUS
- Aged 1 month–2 yr: 5 microgram/kg
- Aged 2–18 yr: 15 microgram/kg (max 250 microgram)

Using 500 microgram/mL injection preparation, dilute to a concentration of 50 microgram/mL with sodium chloride 0.9% (e.g. withdraw 250 microgram = 0.5 mL and make up to a total volume of 5 mL using sodium chloride 0.9% = 250 microgram in 5 mL). Calculate dose per kg as above and administer as a slow bolus over 5 min

MONITORING
- Record heart rate and respiratory rate every 10 min
- Continuous SpO_2 and CO_2 monitoring
- ECG monitoring
- Baseline U&E (capillary blood gas for potassium)

RESPONSE

YES

NO

MAGNESIUM SULFATE IV BOLUS (aged 2–17 yr)
- Magnesium sulfate IV injection over 20 min : 40 mg/kg single dose (max 2 g)

Use 50% injection and dilute to a 10% concentration by diluting required volume with 4x volume of sodium chloride 0.9%

MONITORING
- Record heart rate and respiratory rate every 5 min
- Record blood pressure every 5 min
- Continuous SpO_2 and CO_2 monitoring

RESPONSE

YES

NO

SALBUTAMOL INFUSION

Using 1 mg/mL solution for IV infusion dilute to a concentration of 200 microgram/mL with sodium chloride 0.9% [e.g. take 10 mg (10 mL) of 1 mg/mL solution for IV infusion and make up to 50 mL with sodium chloride 0.9% = 200 microgram/mL solution]
Infuse at 60–300 microgram/kg/hr (use 50 kg as max weight) = 0.3–1.5 mL/kg/hr when using 200 microgram/mL solution (maximum 75 mL/hr)
- If >2 microgram/kg/min in PICU

MONITORING
- Continuous SpO_2 and CO_2 monitoring
- ECG monitoring
- Repeat bloods at 2 hr, 4 hr, then 4-hrly

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BLEEDING DISORDERS IN CHILDREN● 1/3

INTRODUCTION

- All patients with a bleeding disorder must have open access and possess a medical card identifying their condition. Conditions include:
- haemophilia A (factor VIII deficiency)
- haemophilia B (factor IX deficiency)
- von Willebrand's (vW) disease
- platelet defects
- deficiency of other coagulation factors (rare)
- Normal levels of factor VIII and IX = 50–150%
- Mild haemophilia >5% – muscle and joint bleeds, usually following trauma
- Moderate haemophilia 1–5% – muscle and joint bleeds, usually following trauma
- Severe haemophilia <1% – spontaneous joint and muscle bleeds
- Unless major trauma or major head injury (which should attend A&E), patient to attend children's assessment unit (CAU) and be treated within 30 min of arrival – open access folder in CAU available with patient details of condition and treatment
- Minor bleeds usually present with pain and slight restriction of movement, with minimal or no joint swelling
- Major bleeds present with severe pain/tenderness with marked swelling and restricted movement of joint
- Do not request inappropriate blood tests, venepuncture can cause bleeding. FBC only if large bleed, coagulation screen not required on a known patient. Discuss with consultant whether pre and post treatment factor levels required
- Patients presenting will be registered with the local designated haemophilia unit
- If condition severe, patient may be registered locally and also with comprehensive care centre

INDICATIONS FOR ADMISSION

- Bleeding in mouth, neck, respiratory passages or gastro-intestinal tract
- Suspected internal bleeding (intracranial, intra-thoracic or intra-abdominal)
- Haemorrhage endangering a nerve (e.g. carpal tunnel – median nerve, iliopsoas – femoral nerve) or other vital structure
- Requiring surgical treatment, including dental surgery
- Haemarthrosis, especially weight-bearing joints (e.g. hips and knees)
- Any lesion requiring 12-hrly or more frequent replacement therapy

MANAGEMENT OF ACUTE BLEEDING

- Patients present for treatment, particularly when developing a haemarthrosis before any physical signs are present
- If suspected intracranial bleed: arrange scans **but treat IMMEDIATELY – do not wait for results**
- Give **IMMEDIATE** replacement therapy for joint bleeds as haemarthroses are very painful and any delay may increase severity of bleed and risk of joint damage**– do not wait for results**
- When requesting any factor inform blood bank that it is required immediately; (use same brand factor named in each child's open access information)
- Prescribe analgesia (do not use ibuprofen or other NSAID – risk of bleeding), do not administer IM medications
- Contact haemophilia nurse (Mon–Fri) or out-of-hours on-call paediatric consultant requesting they liaise with haematologist

Replacement therapy dosage

- When deciding dose, consider:
- type of bleed
- time of onset of symptoms
- factor level required to sustain haemostasis
- half-life of therapy (varies with each concentrate)

Type of bleed	Level of factor desired
• Uncomplicated bleeding into joints and muscles	• Non weight bearing joint 30% • Weight bearing joint 50% (may need twice daily infusion)
• Haematoma in potentially serious situations: • bleeding in mouth • neck • respiratory passages	• 30–50%

• endangering nerves	
• Pre-dental extraction	• 50%
• Major surgery • Serious accident • Head injury	• 80–100%

Calculation of replacement factor

- Give patient same brand of concentrate each time treatment is required

Step 1 Calculate factor (%)

Increase required = desired factor percentage – baseline factor percentage of patient

Step 2 Calculate dose of specific factor required

a) For factor VIII concentrate (Advate®, ReFacto AF®): dose required (units) = body weight (kg) × factor (%) increase required divided by 2

b) For factor IX concentrate (BeneFix): dose required (units) = body weight (kg) × factor (%) increase required × 1.2

c) For vW factor concentrate (Haemate® P): dose required (units) = weight (kg) × Ricof /vW factor(%) increase required divided by 3

- For any other Factor concentrate, contact on-call haematologist to discuss treatment and ascertain correct recovery constant

Other treatment

- On advice of consultant haematologist for those with inhibitors to factors VIII or IX
- Factor VIIa (recombinant: Novoseven) or FEIBA (factor VIII inhibitor bypass agent)

Administration of factor concentrate

- **Always wear gloves**
- Most factor concentrates are provided in packs with concentrate, diluent in syringe, vial adapter for transfer, infusion set
- Read instructions carefully (picture guides included in each pack) before reconstituting factor-incorrect reconstitution may result in wastage of expensive concentrate. If in doubt seek advice from haemophilia nurse or haematology consultant on-call
- Transfer the diluent into the dried concentrate vial via a needleless adapter
- Give intravenously, via butterfly if 1 dose required, use cannula if admitting for several doses. Rate to be given by slow bolus at no more than 3 mL per min – or as specified
- Factor IX infusion may cause reaction, observe patient carefully post infusion
- Vials available in 250–3000 units for factor VIII and IX
- adverse reactions rare but include anaphylactic shock
- During prolonged treatment screen for inhibitors every 5 doses
- Half-life of factor VIII is 8–12 hr, half-life of factor IX is 18 hr (maybe shorter in young children). Initial levels can be assessed 15 min post infusion, blood tests to assess factor level are advisable post infusion under guidance of haematologist

Duration of treatment

- Decided by local on-call haematologist or designated tertiary haemophilia unit (on-call haematologist). **If in doubt, ask**

DESMOPRESSIN IN MILD HAEMOPHILIA A AND VON WILLEBRAND'S DISEASE

- SC or IV
- may be used to raise Factor VIII and vW factor levels
- response usually fourfold rise (IV/SC) or 2-fold rise (intranasal) in Factor VIII and vW antigen concentration – peak response is seen approximately 60 min after administration SC/IV

Patient selection

- Consider **only** in mild (**NOT** severe) haemophilia A
- **Not** appropriate in Factor IX deficiency (haemophilia B)
- Check notes for outcome of previous desmopressin challenge

- Do not use in:
- aged <2 yr
- cardiac conditions
- epilepsy
- renal impairment
- diabetes insipidus

Administration of desmopressin

- Desmopressin SC/IV, **be vigilant with dose prescribing and preparation choice**
- **SC**: 0.3 microgram/kg (vials of 1 mL = 15 microgram/mL) or, less preferably
- **IV**: 0.3 microgram/kg IV in sodium chloride 0.9% 30–50 mL over 20 min. 4 microgram vials for IV only)
- May be repeated after 12 hr
- **Side effects** include hypertension, headache, flushed face, nausea
- measure pulse and BP every 5 min during IV infusion. If either rises unacceptably, reduce rate of infusion
- Blood samples may be taken before and after infusion to measure Factor VIII/vW level and ensure therapeutic level reached if requested by consultant
- tachyphylaxis can occur with depletion of stored Factor VIII with consecutive days. After 3 days there may be an inadequate rise of Factor VIII
- Monitor patient's fluid intake over the following 24 hr

VON WILLEBRAND'S DISEASE

- More common than haemophilia
- caused by deficiency (qualitative or quantitative) of vWF protein, which binds to Factor VIII (prolonging half-life) and platelets
- Can present with acute episodes of mucosal bleeding, helping to form initial clot
- Before treatment, consider:
- von Willebrand's disease (vWD) subtype
- bleeding history, including previous response to any treatment
- nature of haemostatic challenge
- Treatment is often a combination of tranexamic acid and desmopressin or Haemate® P

Tranexamic acid

- Anti-fibrinolytic agent
- Contraindicated in presence of frank haematuria (>2+blood)
- Decrease dose in mild renal impairment
- Oral tranexamic acid alone can be used to treat minor problems such as recurrent epistaxis, but main use is in combination with desmopressin if appropriate
- oral dose 15–25 mg/kg 8-hrly (maximum dose 1.5 g 8-hrly) for maximum 5 days (oral suspension available but pharmacy may need to order in or manufacture on site)
- IV tranexamic acid 10 mg/kg (maximum 1g) 8-hrly over 10 min

Desmopressin

- Treatment of choice in responsive patients for spontaneous bleeding, trauma and minor surgery
- For administration, see **Administration of desmopressin**

vWD Type	Advice
Type 1	• Most patients responsive
Type 2A	• Some patients responsive • ask about previous challenge
Type 2B	• DO NOT GIVE desmopressin • it causes platelet agglutination and thrombocytopenia
Type 3	• Not all responsive and some can be severe • ask about previous challenge

Haemate® P (blood product)

- Avoid if at all possible
- Use in patients not responsive to, or unsuitable for, desmopressin (e.g. aged <2 yr)

BLOOD AND PLATELET TRANSFUSIONS ● 1/2

Always check front sheet in oncology patient notes before prescribing any blood product

Before transfusion
- Explain indications for blood products to parents and, if appropriate, the child
- Document indications and verbal consent
- If previous reactions to blood products have occurred, pre-medicate with chlorphenamine (oral or IV), if severe with hydrocortisone 4 mg/kg IV

BLOOD TRANSFUSION

When to transfuse

Oncology children

If Hb ≤70 g/L or if >70 g/L and symptomatic or unstable, transfuse
- If having radiotherapy, transfuse if Hb <110 g/L
- If oncology patient has potential to require a bone marrow transplant give hepatitis E –ve leucodepleted blood, unless already identified as requiring irradiated products

PICU patients
- Hb transfusion trigger of ≤70 g/L in stable critically ill children
- If symptomatic anaemia or impaired cardiorespiratory function, transfuse at higher threshold

Non-oncology children
- If Hb <60 g/L or >60 g/L and symptomatic

Target Hb and volume to be transfused
- Aim for target Hb of 120 g/L or for 100 g/L if initial Hb <60 g/L
- In newly diagnosed patients with leukaemia/profound anaemia, aim for target Hb 80–90 g/L
- Calculate volume to be given as: (round to nearest unit)

  [Target Hb – actual Hb (g/L)] × weight (kg) × 0.4 mL
- **Total volume should not exceed 20 mL/kg**

Rate of infusion
- Give **total** over 3–4 hr. **Maximum rate 5 mL/kg/hr**
- If Hb <60 g/L, give blood over 4–8 hr (each unit must be used **within 4 hr** once removed from fridge)
- If concerns regarding fluid overload give furosemide 1 mg/kg oral if tolerated, or IV half-way through

Use irradiated blood if
- Allogenic bone marrow transplant (BMT) from start of conditioning regimen
- Allogenic BMT donors
- If <7 days pre-harvest for autologous BMT and stem cell transplant patients (e.g. stage IV neuroblastoma)
- Hodgkin's disease or if patient has received fludarabine
- Children with severe immunodeficiency (e.g. SCID)
- HLA-matched platelets
- For high risk neonates e.g. post intrauterine transfusion

Leucodepleted blood

All packed cells are leucodepleted

CMV negative blood
- All the packed cells are leucodepleted and therefore CMV negative
- For neonates aged <28 days post expected date of delivery and for intrauterine transfusions, CMV serology negative blood requested

PLATELET TRANSFUSION IN ONCOLOGY CHILDREN

Transfuse platelets if platelet level
- $<10 \times 10^9$/L oncology children except brain tumour
- $<20 \times 10^9$/L oncology children except brain tumour, and unwell
- $<30 \times 10^9$/L brain tumour
- $<50 \times 10^9$/L brain tumour and unwell
- $<50 \times 10^9$/L for lumbar puncture

Dosage and rate

- <15 kg: 15 mL/kg (round off the nearest unit)
- ≥15 kg: 1 pack
- Transfuse within 15–30 min

Immune thrombocytopenic purpura (ITP) – transfuse platelets only if bleeding and see* Immune thrombocytopenic purpura (ITP) *guideline

FRESH FROZEN PLASMA

- For bleeding in disseminated intravascular coagulopathy (DIC) when INR >1.7
- 12–15 mL/kg
- 10–20 mL/kg/hr

CRYOPRECIPITATE

- For bleeding with DIC with fibrinogen <1.5 g/L

BRONCHIOLITIS ● 1/3

RECOGNITION AND ASSESSMENT

Definition

- Acute viral inflammatory illness of small airways that occurs in winter epidemics and affects children aged <2 yr, with peak incidence at around 6 months

Symptoms and signs

- Coryzal symptoms for 2–5 days before presentation
- Cough (sometimes paroxysmal)
- Intermittent wheeze
- Irritability and poor feeding
- Mild pyrexia – rarely higher than 38.5°C
- Respiratory distress with progressive tachypnoea, flaring of alae nasi and intercostal recession
- Apnoea or hypoventilation
- Hyperinflated chest on examination
- Widespread fine crackles and wheeze over both lung fields

Differential diagnosis

- Recurrent viral-induced wheeze
- Early asthma
- Cystic fibrosis
- Pertussis
- Recurrent aspiration
- Foreign body in trachea
- Congenital lung anomaly

Investigations

- SpO_2 while breathing air
- Capillary blood gas if:
  - respiratory rate >80 breaths/min
  - transcutaneous PCO_2 >6 kPa
  - SpO_2 <92% in >50% inspired oxygen
  - severe respiratory distress
- Avoid tests that do not contribute to immediate management. Perform following only for specific indications:
  - viral nose swab for respiratory virus PCR
    - when flu prevalence high. Prescribe oseltamivir if admission required
    - in severely immunocompromised patient to plan antiviral treatment
- CXR if there are localising signs, cardiac murmur or atypical presentation (e.g. aged >18 months)
- U&E if there is a plan for IV fluids
- blood cultures if signs of sepsis or temperature >38.5°C

IMMEDIATE TREATMENT

- Nurse in cubicle, or in bay with children with same diagnosis
- Strict hand washing to support infection prevention and use apron for patient contact
- Nurse head up to reduce splinting of diaphragm
- Clear airway by careful suction of nares and mouth
- Use sodium chloride 0.9% nose drops before suction

Respiratory

- If oxygen saturation ≤92% in air, prescribe oxygen via face mask with a reservoir bag
  - if mask not tolerated, use nasal prongs for oxygen flow up to 1 L/min in children ≤5 kg body weight, or up to 2 L/min in children >5 kg
  - use heated humidified oxygen if available
- Patients with impending respiratory failure: [SpO_2 <90% in >50% oxygen or in 2 L/min oxygen via nasal prongs, or cyanotic episodes despite supplemental oxygen (except cyanotic congenital heart disease)]
  - review hourly
  - give additional respiratory support with humidified high flow nasal cannula oxygen (2 L/kg/min, maximum 20 L/min)
  - review <1 hr; treatment effective if heart and respiratory rate reduced
- Give additional respiratory support with CPAP if:
  - no response to humidified high flow oxygen

- respiratory rate >60 breaths/min or bradypnoea
- severe intercostal recession
- rise in $PaCO_2$ (>3 kPa from baseline)
- respiratory acidosis (pH <7.20)

Circulation and hydration
- Assess circulation and treat shock if present
- Correct dehydration if present
- Use IV fluids if oral fluids not tolerated or significantly increased work of breathing
- restrict intake to 80% of estimated maintenance requirements (see **Intravenous fluid therapy** guideline) using sodium chloride 0.9% in glucose 5% with 10 mmol potassium chloride per 500 mL
- check U&E at least once every 12 hr while giving IV fluids (more frequently if abnormal), and adjust volume and potassium content accordingly

Feeds
- Normal feeds (breast, bottle, solids) if tolerated
- NG tube feeds if:
- oral intake by normal route insufficient **and**
- airway protective reflexes test normal on suctioning **and**
- patient well enough to tolerate NG feeds
- IV fluids (as above) if:
- persistent respiratory rate >80 breaths/min
- persistent vomiting
- oxygen saturation <92% despite supplemental oxygen
- deterioration of respiratory status during NG feeding
- marked increase in work of breathing with poor coordination of sucking, swallowing and breathing

Drug treatment
- In immunocompetent patients, drug treatment and physiotherapy (in acute phase) are ineffective. **Do not routinely prescribe** salbutamol, ipratropium bromide (Atrovent®), adrenaline, antibiotics or corticosteroids
- For babies aged <6 weeks or patients with temperature >39°C, discuss antibiotics with consultant
- If symptoms <48 hr and influenza test positive (or high prevalence influenza) and risk factors (chronic respiratory, renal, liver, neurological or cardiovascular disease, diabetic or immunocompromised) prescribe oseltamivir

Criteria for admission
Absolute
- Apnoea
- Underlying cardiac defects, especially large left-to-right shunt
- SpO_2 <92% in air in a child in the early phase of the illness
- Inadequate feeding (<75% of normal)
- Dehydration
- Diagnostic uncertainty

Relative
- Re-attends A&E or CAU in <48 hr
- Aged <6 weeks (corrected gestational age)
- Difficult family circumstances and impaired ability to care for unwell child
- Younger children (i.e. aged <6 months), presenting earlier in illness (<3 days symptoms)
- Pre-existing lung disease, including chronic lung disease, ex-preterm, cystic fibrosis: inform speciality consultant
- Other pre-existing chronic disease (e.g. neurodegenerative)

MONITORING TREATMENT
- Standard nursing observations
- Continuous oxygen saturation monitoring if patient requires supplemental oxygen
- Transcutaneous CO_2 monitoring (if available) if SpO_2 <90% in nasal prongs oxygen at 2 L/kg/min (approximately ≥60% oxygen), or has history of apnoea or colour changes
- Continuous heart and respiratory rate monitoring if patient requires additional respiratory support

SUBSEQUENT MANAGEMENT

- Fluid balance
- Oxygen support:
- test need for support 6-hrly
- keep oxygen saturation ≥92% in recovery phase
- wean from nasal prongs to air as tolerated

DISCHARGE AND FOLLOW-UP

- Discharge home when:
- fully fed orally
- SpO_2 >92% in air
- Hospital follow-up if:
- ventilated on PICU
- consolidation on CXR (first reassess clinically, do not request ‘routine’ follow-up X-ray, but repeat if clinical examination at follow-up is abnormal)
- ex-preterm with chronic lung disease
- GP follow-up in all other cases

CERVICAL LYMPHADENOPATHY ● 1/3

Enlargement of cervical lymph nodes >2 cm

Acute lymphadenitis
- Short history (usually <2 weeks)
- Neck mass with features of acute inflammation

Subacute lymphadenopathy
- History variable
- Often non-tender but with overlying erythema

Chronic lymphadenopathy
- Longer history (usually >6 weeks)
- No feature of acute inflammation

HISTORY

Symptoms
- Duration
- Symptoms of URTI
- Fever
- Weight loss
- Night sweats
- Eczema/skin infection
- Bruising
- Pallor
- Bone pain
- Pruritis

Social
- Contact with TB or cats
- Travel or place of birth/parental origin

EXAMINATION
- Site of node(s)
- Size of node(s)
- ENT examination
- Skin – especially eczema
- Axillae, supraclavicular and groin for other nodes
- Abdomen for hepatosplenomegaly

DIFFERENTIAL DIAGNOSIS

Acute unilateral
- Reactive
  - URTI (*Strep. pneumoniae*)
  - skin infection (*Group A Strep.*, *Staph. aureus*)
  - dental infection (anaerobes)
- Kawasaki (see **Kawasaki disease** guideline)
- Cat scratch disease (Bartonella: tender, axillary lymphadenopathy)
- Kikuchi-Fujimoto disease (histiocytic necrotising lymphadenitis)

Acute bilateral
- Reactive
  - viral URTI
  - EBV, CMV (generalised lymphadenopathy, hepatosplenomegaly)

Subacute
- Non-tuberculous mycobacterial infection (aged <5 yr, unilateral, non-tender, purple, systemically well)
- *Mycobacterium tuberculosis* and *toxoplasmosis*
- *Toxoplasma gondii* (generalised lymphadenopathy, fatigue, myalgia)

Chronic
- Reactive
- Neoplasia
- lymphoma, leukaemia
- soft tissue tumours
- Juvenile chronic arthritis, SLE

URGENT INVESTIGATION
If any of the following are noted:

Nodes:
- Supraclavicular – diagnostic of significant pathology
- >2 cm at 4–6 weeks
- Growing in size for ≥2 weeks
- Not returned to base line (<1 cm) at 8–12 weeks

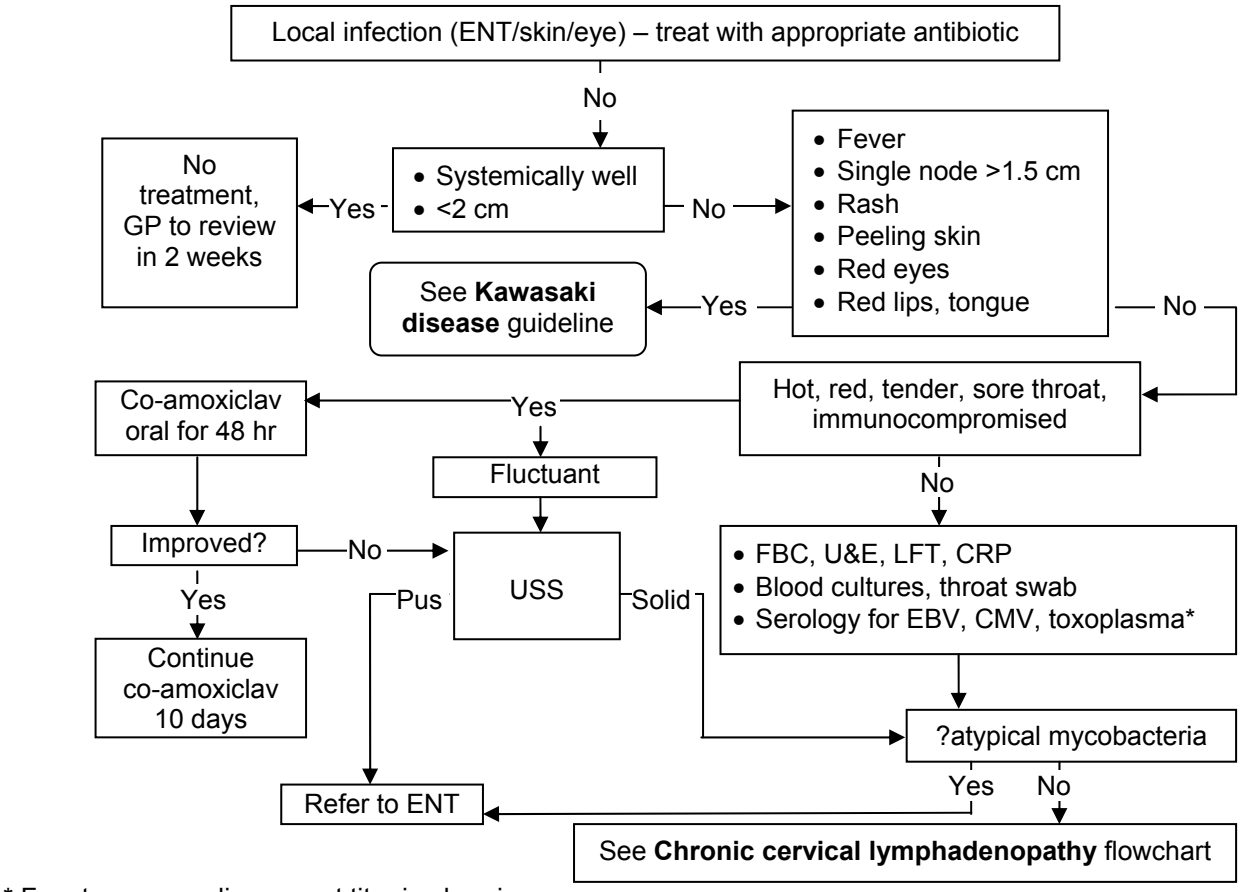
Signs and symptoms:
- Petechiae/purpura
- Respiratory compromise
- Dysphagia
- Hepatosplenomegaly – also need to exclude EBV
- Weight loss and night sweats – TB/malignancy, early investigation
- Persistent fever (>2 weeks)

INVESTIGATIONS
See **Flowchart**
- To be done urgently:
- FBC, film, ESR, CRP
- CXR
  - hilar lymphadenopathy on CXR – refer for biopsy of suitable node
  - hilar lymphadenopathy significantly increases likelihood of neoplastic disease
- ultrasound scan (USS)
  - high sensitivity and specificity for abscess formation in acute lymphadenitis
  - value in chronic lymphadenopathy for assessing size, architecture and vascularity
- LDH of limited diagnostic value: not to be done routinely
- LFTs: only if suspected viral infection
- Serology for toxoplasma, CMV and EBV
- CT only if suspected deep neck space infection
- Discuss with ENT for biopsy

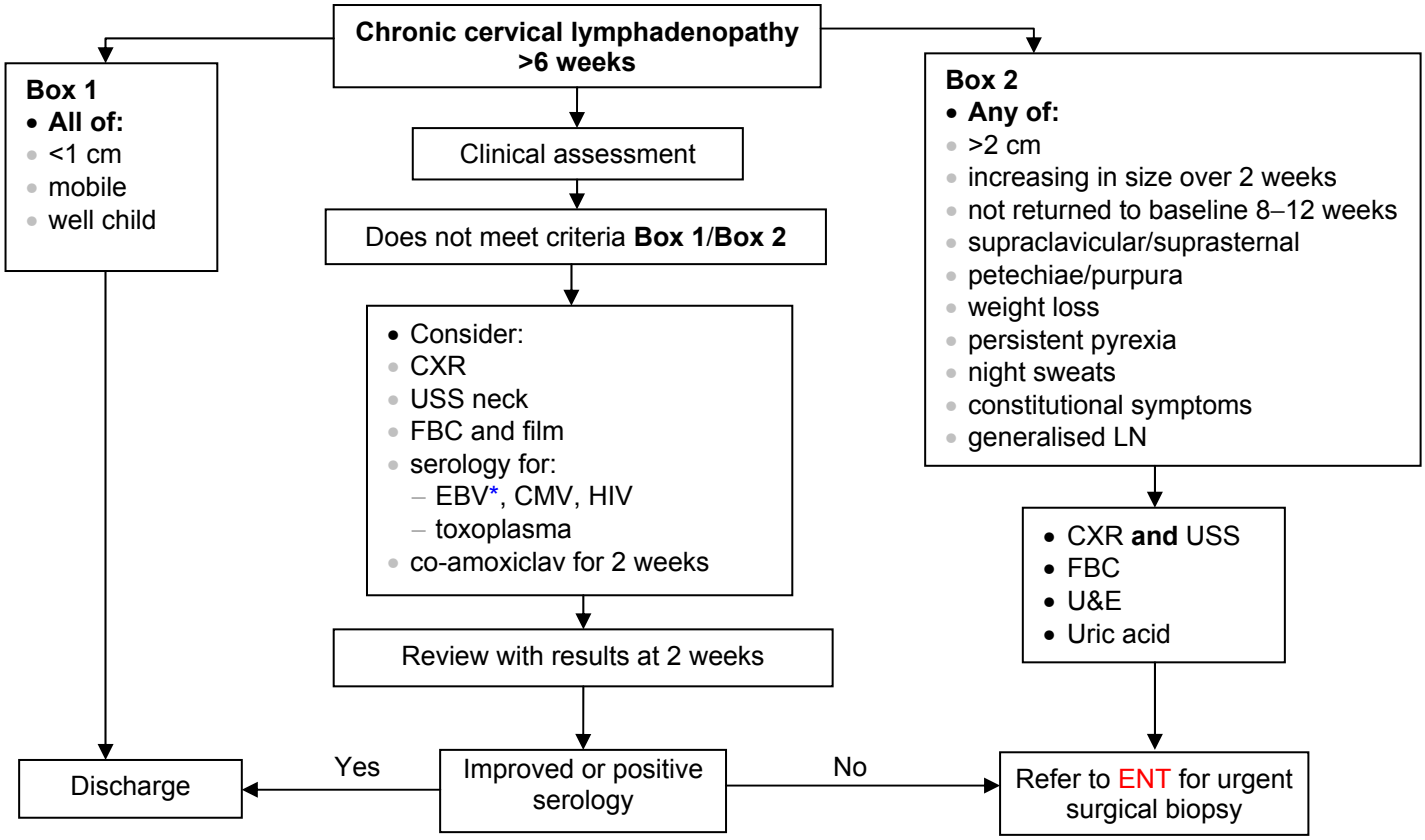
Surgical excision biopsy
- Atypical mycobacterial infection
- Features highly suggestive of neoplasia:
- lymph nodes >2 cm diameter
- all supraclavicular and suprasternal nodes
- constitutional symptoms
- hepatosplenomegaly
- generalised lymphadenopathy
- abnormal architecture on USS

Children undergoing surgical biopsy for suspected neoplastic disease
- FBC and film
- U&E, uric acid, LFTs
- CXR

CERVICAL LYMPHADENOPATHY ● 3/3



* For storage pending repeat titre in chronic course



*If EBV negative and history of clinical suspicion – retest after 2 weeks

CHILD PROTECTION ● 1/5

Always follow your local child safeguarding policies and procedures.
The safety of children is everyone's responsibility

More comprehensive guidance – the child protection companion can be found on the RCPCH website: http://www.rcpch.ac.uk/index.php?q=child-protection-companion

- 4 recognised categories of abuse (rarely seen in isolation)
- physical abuse (non-accidental injury)
- emotional abuse
- neglect
- sexual abuse

NON-ACCIDENTAL INJURY

Definition

Physical abuse may involve hitting, shaking, throwing, poisoning, burning or scalding, drowning, suffocating or otherwise causing physical harm to a child. Physical harm may also be caused when a parent fabricates the symptoms of, or deliberately induces, illness in a child

Recognition and assessment

Assessment of the child should be carried out by a paediatrician with Level 3 competences as per 'Safeguarding Children and Young people: roles and competences for health care staff'. Where a trainee carries out the assessment, they should be supervised by a consultant or senior paediatrician

There may be direct information from the child or carer. The following presentations need to be considered

- Delay in seeking medical attention following injury
- History incompatible with injury seen
- Numerous explanations suggested for injury
- Changes in the history
- Parents 'shopping around' for medical help (e.g. from GP, A&E, different hospitals)
- History of domestic violence
- Odd or aggressive parental behaviour
- Any fracture in an infant without a satisfactory explanation
- Any bruise on a child aged <6 months or pre-mobile
- Patterns of bruising, injury or explanation not compatible with child's development
- Recurrent injuries
- Evidence of other forms of abuse (e.g. failure to thrive, neglect)
- Previous evidence of injury or neglect (check if child known to local authority children's social care or is the subject of a child protection plan)

Referrals

- Most referrals for medical assessment will come through children's social care teams or the police
- Discuss referrals from GP with consultant before arranging medical assessment by on-call team
- consultant will review whether referral should be made to child protection agencies first/as well
- Referrals from A&E or surgical wards to be taken by registrar or above
- discuss with consultant first to determine who should carry out initial examination and whether social care or police should be present

Always discuss referrals with the on-call consultant for child protection duties

Immediate action

- If there is an urgent or life-threatening situation, start necessary emergency treatment
- Refer to your Trust on-call child protection arrangements
- if you suspect harm, refer to social care, and police if they are not already involved
- Keep any social worker or police officer involved informed
- Always consider potential risks to siblings or other children

History

- Where referral is made from social care and/or police, the child may have given a full history of events, often a visual recording
- ask for this information from social worker or police officer at beginning of examination. It may not be necessary to repeat this information unless further detail is required
- If child first presents in a health setting, registrar or consultant should take history and examine child before discussing with social care or police

How

- Record findings accurately during or immediately after examination, using a dedicated child protection proforma with body charts if available
- Complete and sign each page and include:
- full family history
- persons present at interview
- source of your information (including the child)
- person giving consent
- date and time of start and finish

Take care when talking to the child not to ask leading questions or make suggestions that could contaminate evidence in a subsequent trial, document clearly what is said in child's own words

Examination

- Ideally there should be only 1 examination. It can be useful to do further examinations as injuries such as bruises may evolve and the picture becomes clearer
- Keep your immediate senior informed
- All child protection examinations to be carried out within appropriate timescales, for physical abuse: within 24 hr

If this is a planned medical assessment at the request of child protection agencies, carers with parental responsibility and the child (depending on age and understanding) must give their consent (usually written) for examination to take place. If consent not forthcoming, social care may obtain a legal order giving permission for the child to be examined. This does not apply where a child needs urgent assessment and treatment

- Must include:
- state of child: cleanliness, appropriate clothing, etc.
- **all** body areas
- accurate description of all injuries (size, colour, position and pattern) on body charts
- mouth (torn frenulum of lip and tongue especially)
- fundi: look particularly for haemorrhages. With small children, especially where head injuries suspected, this is usually the role of the paediatric ophthalmologist
- note of any birth marks, scars etc.
- full paediatric systemic examination
- plotting height and weight and head circumference on growth charts – note centiles
- child's emotional state, demeanour and degree of co-operation
- a comment on the developmental state (or school progress)
- observations on relationships or behaviour between parents and child

Investigations

A selection of the following tests will usually be necessary; seek advice from consultant as to which are appropriate:

- If personal history of abnormal bleeding or concerning family history, discuss with paediatric haematologist first as other tests may be indicated
- Bone biochemistry [including vitamin D, PTH (EDTA specimen)] if there are unexplained fractures
- Investigations into other suspected abuse (e.g. failure to thrive)
- Skeletal survey in children aged <2 yr with unexplained injuries, repeat views after 11–14 days are required. Head CT scan in children aged <12 months and in older children if focal encephalopathic features, focal neurology or haemorrhagic retinopathy
- Further neuroimaging according to RCR/RCPCH guidelines
- Document in notes if decision made not to proceed with imaging
- Photographs (often a police photographer is used)

Haematological investigations
When a bleeding diathesis suspected or needs to be ruled out, perform following:
- Initial baseline investigations
- FBC and film (EDTA up to 1 mL)
- APTT and PT (not INR)
- thrombin time
- fibrinogen levels
- if thrombocytopenic, mean platelet volume
- von Willebrand Factor antigen and activity (ristocetin cofactor/ricoff)
- Factor 8 and 9 assay if male
- blood group
- send 2 or 3 sodium citrate bottles, filled to appropriate fill line level

Subsequent investigations
- Identify all requests as non-accidental injury investigations
- Interpret all test results with age appropriate reference values
- If significant bruises, before further investigations, discuss with paediatric haematologist:
- von Willebrand Factor antigen and activity
- Factor 8, 9 if not already done
- Factor 13 assay
- child aged <2 yr: platelet function assay

EMOTIONAL ABUSE

Recognition and assessment
Definition
- Habitual harassment of a child by disparagement, criticism, threat and ridicule
- Present in most cases of physical and sexual abuse, and neglect
- presents difficulties in definition, recognition and management
- long-term consequences upon social, emotional and cognitive development can be more harmful than other forms of abuse

Presentation
- Part of the differential diagnosis if a child presents with the following non-specific behaviours:
- unhappy
- disturbed
- poor concentration leading to learning difficulties/school failure
- poor social interactions
- unable to play
- problems with attachment to parents or caretakers
- behavioural difficulties
- over-friendly or craving affection from strangers

Assessment
- Assessment is complex and requires a multidisciplinary approach
- Social care take the investigative lead
- May need to rule out mental health difficulties
- if concerned seek advice from CAMHS

NEGLECT

Neglect may not always be intentional (e.g. parental mental health problems)

Recognition and assessment
Definition
- Neglect is persistent failure to meet a child's physical and/or psychological needs
- Lack of care of physical needs that can result in failure to thrive
- important to eliminate organic causes
- neglect of physical care most likely to come to Child Health attention along with developmental delay

Presentation
- Child's appearance
  - note condition of clothing, hair, skin
- Growth
  - height, weight, serial measurements to check growth rate
  - head circumference
  - mid-upper arm circumference
- Non attendance at (or repeat alterations of) appointments

Physical examination
- Signs of medical problem not appropriately treated
- Evidence of other forms of abuse
- Development
  - gross motor skills, fine motor skills, vision, hearing, language, behaviour, play

SEXUAL ABUSE

Recognition and assessment

Definition
- Forcing or enticing a child or young person to participate in sexual activities, whether or not the child is aware of what is happening
  - may involve physical contact, including penetrative (e.g. rape or buggery) or non-penetrative acts
  - may include non-contact activities (e.g. involving children in looking at, or in production of, pornographic material, watching sexual activities, or encouraging them to behave in sexually inappropriate ways)

Presentation
- Information given by child
- Symptoms resulting from local trauma or infection (e.g. bruises, bleeding, discharge)
- Symptoms resulting from emotional effects (e.g. behavioural changes, enuresis, encopresis, self-harming, eating disorders or psychosomatic symptoms)
- Sexualized behaviour or sexual knowledge inappropriate to age
- Under-age pregnancy
- Sexually transmitted infections

Referrals
- Referrals usually come from local authority children's social care or the police
  - refer to your departmental child protection rota

If a child presents in a medical setting and there are concerns about sexual abuse, call the on-call consultant for child protection immediately. Depending on any urgent medical needs e.g. bleeding; child protection agencies may need to be involved before medical assessment

IMMEDIATE ACTION – HISTORY AND EXAMINATION

Preparation
- Where sexual abuse suspected, whoever examines the child **MUST** have training and experience in this field and the examination must take place in an appropriate location e.g. sexual assault referral centre (SARC)
- In exceptional cases, particularly where there is acute trauma and bleeding that may require surgical management, it may be appropriate for the examination to be carried out under anaesthetic by a gynaecologist after discussion with the forensic medical examiner (FME)

Examination
- Purpose of medical examination is to:
  - detect traumatic or infective conditions that may require treatment
  - evaluate the nature of any abuse
  - secure forensic evidence
  - reassure the child
  - start process of recovery

Initial management
- If penetration and/or passage of bodily fluids are suspected consider sexually transmitted diseases and pregnancy
- pregnancy test
- if assault within 72 hr, offer post-coital contraception (ideally <12 hr) – usually levonorgestrel 1.5 mg stat dose
- Contact genito-urinary medicine department
- Post exposure prophylaxis should be started within 1 hr of assault if indicated (can be given up to 72 hr after assault). See **HIV and hepatitis B post-exposure prophylaxis PEP** guideline
- If ano-genital warts found, discuss with a senior/safeguarding lead (though usually spread non-sexually)

Investigations
- Mid-stream urine
- Forensic tests (FME to determine)
- Photos/video recordings obtained with a colposcope, stored in accordance with local policy

Always follow your local child safeguarding policy and procedures

SUBSEQUENT MANAGEMENT
- Majority of children seen will be allowed home if it is safe and after discussion with social care and police
- some children who have been abused will be admitted while problems are investigated
- Always keep parents and children informed of concerns and what next actions will be
- Be open and honest with parents where possible unless this could put child (or others) at risk of further harm

Keeping children safe
- If there is clear evidence of child abuse and parents attempt to remove child there are 2 courses of action:
- in an emergency, dial 999, the police can use police protection powers to keep child safe
- if there is time, a social worker can obtain an Emergency Protection Order from Court (Section 44, Children Act 1989)
- Put the child's safety first
- Communicate with other staff involved (e.g. nursing staff) so that situation can be supervised
- Consider the safety of siblings
- usual for siblings to be examined at same time as index child

DISCHARGE AND FOLLOW-UP

Only a consultant may allow child to go home

- Consultant should make decision regarding discharge, usually after discussion with the police and social care

Communication is vital

- Send written report to GP without delay, with a copy for social care and the police
- If child referred from A&E, send copy of report to them for feedback
- Ensure notes and dictation is available to secretary, marked 'for urgent attention'
- Ensure report is signed in a timely manner
- Complete ward discharge forms
- Check with consultant if follow-up is required

Child protection conference
- May be convened following a child protection investigation to consider whether child needs to be the subject of a child protection plan
- Medical and nursing staff will be invited if child has been admitted
- expected to contribute, usually in person, or via a written report
- ensure reports are available for future reference

CONGENITAL HYPOTHYROIDISM ● 1/2

RECOGNITION AND ASSESSMENT

- Most children with congenital hypothyroidism CHT are not symptomatic at birth but have an elevated TSH in the newborn blood screen (Guthrie test)
- Screening relies on measurement of raised blood spot TSH

SCREENING

- Normal TSH: <10 mU/L
- If TSH from newborn blood screen or venous blood (after day 4 of life) >20 mU/L, suspect CHT
- If TSH 10–20 mU/L (CHT borderline) repeat sample 7–10 days after initial test
- Babies born <32 weeks gestation require repeat testing at 28 days postnatal age or discharge home, whichever is sooner
- If baby moved to another hospital, responsibility for taking the CHT preterm repeat sample is transferred to the receiving hospital

SYMPTOMS AND SIGNS

- Asymptomatic
- Sleepiness
- Poor feeding
- Cold extremities
- Neonatal jaundice
- Lethargy
- Hypotonia
- Macroblasts
- Umbilical hernia
- Dry skin

IMMEDIATE MANAGEMENT

- Clinical nurse specialist from the screening laboratory or hospital to inform parents and request mother and child attend paediatric clinic/admission unit that day (or next day at the latest)
- Book urgent thyroid radioisotope scan with nuclear medicine (thyroid pertechnetate) and aim to arrange on same day, or within 5 days of starting treatment

ASSESSMENT

- Take detailed history including:
  - family history
  - pregnancy/maternal medication
  - maternal diet
- Examine for signs of CHT
  - look for associated anomalies (10% in CHT v 3% in baby without CHD), congenital heart disease (pulmonary stenosis, ASD and VSD) is commonest abnormality
- Obtain results of newborn hearing screen
- If radioisotope scan booked on same day, cannulate to inject tracer
- Take bloods from child and mother using 3 red-top bottles (serum) and request thyroid antibodies, TSH and FT4
- Provide CHT information leaflet to parents (see www.btf-thyroid.org/information/leaflets/42-congenital-hypothyroidism-guide)
- Arrange endocrinology clinic follow-up appointment with consultant paediatrician in 2 weeks

TREATMENT

- Levothyroxine 10–15 microgram/kg daily (maximum 50 microgram)
  - licensed liquid formulation available
  - tablets available in 25 microgram and 50 microgram sizes; tablet can be halved and dispersed in water (round up/down to nearest half tablet)
- In suspected severe CHT aim for higher dose [i.e. absent gland on scan or highly elevated TSH (>40 mU/L) on venous sample]
- Provide prescription. Give first dose same day and subsequent doses every morning
- Explain to crush tablets and dissolve in a few mL of water/milk
  - do not add to bottle of formula
  - suspensions not advised due to variable bioavailability
  - repeat dose if baby vomits or regurgitates immediately

CONGENITAL HYPOTHYROIDISM ● 2/2

- If diagnosed in first sample, treatment to be started within 14 days and within 21 days in those confirmed in second sample
- TSH must be normalised within 1 month of treatment

SUBSEQUENT MANAGEMENT

- Monitoring to be based on clinical assessment and biochemical testing (venous sample for TSH and T4) and repeat thyroid function test at 2, 4 and 8 weeks' post commencement of treatment
- Recommended serum levels:
- TSH: within age-specific reference range (avoid undetectable TSH levels)
- T4: in upper half of age-specific reference range
- Follow-up with clinical and biochemical evaluation:
- 1–2 weeks after initiation of treatment then at aged 2, 4, 6, 9 and 12 months beyond infancy, follow-up recommended every 4 months
- If dose adjustment of levothyroxine made, biochemical thyroid function tests to be performed 4–6 weeks later
- Physical and developmental checks should be performed at each clinic visit and adjust the dose of levothyroxine if required depending on the result

AFTERCARE

- Reassure parents that baby will grow into healthy adult with normal intelligence and stress the importance of regular treatment
- Objective of treatment is to normalise TSH within first month
- if TSH suppressed or if baby showing signs of overtreatment dose of levothyroxine may need to be reduced
- Monitor TSH and thyroid hormone concentration closely so that levels are maintained within accepted ranges to enable normal growth and intellectual function
- In cases where cause or persistence/permanence of hypothyroidism has not been confirmed, confirmatory testing should be undertaken by stopping treatment at aged 2–3 yr with subsequent monitoring of thyroid function
- Regular follow-up in paediatric endocrinology clinic

USEFUL LINKS

- BSPED website (British Society for Paediatric Endocrinology and Diabetes) www.bsped.org.uk/
- British Thyroid Foundation (BTF) website www.btf-thyroid.org

CONSTIPATION ● 1/5

RECOGNITION AND ASSESSMENT

Definition

- **Constipation:** infrequent bowel evacuation of hard faeces or difficult/painful defecation for ≥1 month
- **Faecal soiling** (overflow as a result of faecal impaction): passage of loose and offensive stools in child's underwear over which child has no control
- **Encopresis** (functional non-retentive soiling): inappropriate passage of normal stools in inappropriate places. Often associated with behavioural problems
- **Faecal incontinence**: soiling in the presence of an anatomical or organic lesion
- **Faecal impaction**: hard faecal mass in lower abdomen, a dilated rectum impacted with stool or excessive stool in the colon identified radiologically

KEY POINTS IN HISTORY

- Frequency, volume and type of stool using Bristol stool chart (see: commons.wikimedia.org/wiki/File:Bristol_stool_chart.svg)
- Overflow soiling in older children
- Distress and/or straining on opening bowels
- Holding behaviour (crossing legs, back arching or tiptoeing)
- Time of passing meconium after birth
- Bleeding *per rectum*
- Any trigger factors i.e. diet change, infection, potty training or starting nursery/school

KEY POINTS IN PHYSICAL EXAMINATION

- Weight and height
- Abdominal examination to look for abdominal distension, faecal loading
- Lower limb neuromuscular examination in long standing cases
- Spinal examination
- Inspection of perianal area for appearance, position of anus or evidence of streptococcal infections

Symptoms and signs suggestive of organic constipation (red flags)

- Early onset of constipation (first few weeks of life)
- Failure to thrive/growth failure
- Neuropathic bowel:
  - lack of lumbosacral curve
  - sacral agenesis
  - flat buttocks
  - patulous anus
  - absent cremasteric reflex/absent anal wink
  - decreased lower extremity tone and/or strength
  - absence or delay in relaxation phase of lower extremity deep tendon reflex
  - urinary symptoms
- Hirschsprung's disease
  - delayed passage of meconium for >24 hr after birth in a term baby
  - abdominal distension
  - tight empty rectum in presence of palpable faecal mass
  - gush of liquid stool and air from rectum on withdrawal of finger
  - rarely causes soiling
- Anteriorly displaced anus
- Anal stenosis:
  - tightness or stricture felt when *per rectum* digital examination done using lubricated 5th finger in newborn and infants up to 6 months
- Delayed cow's milk protein allergy in first 3 yr of life

DIFFERENTIAL DIAGNOSIS

- Idiopathic functional constipation (90–95%). Most common cause of constipation beyond neonatal period

Organic constipation (suspected in presence of red flags)

- Constipation secondary to anal anatomic malformation (anorectal examination required)
- Neurogenic constipation due to spinal cord anomalies or trauma, neurofibromatosis and tethered cord (lower limb neurological examination required)

- Constipation secondary to endocrine/metabolic disorders (hypothyroidism, hypercalcaemia, hypokalaemia, CF)
- Constipation induced by drugs (opioids)
- Coeliac disease

INVESTIGATIONS

- Most children with chronic constipation require minimal investigation:
- careful history and physical examination will help determine appropriate investigation
- In cases of refractory constipation (consider earlier if faltering growth/short stature):
- thyroid function tests
- coeliac panel
- If delayed passage of meconium:
- sweat test

Abdominal X-ray

- Has little or no value in the diagnosis of idiopathic constipation

When to consider referral for rectal biopsy

- History of delayed passage of meconium
- Constipation since neonatal period
- History of abdominal distension and vomiting
- Failure to thrive or faltering growth
- Family history of Hirschsprung's

MANAGEMENT OF FUNCTIONAL CONSTIPATION

- See **Constipation management flowchart**

Principles of treatment

- Education
- Diet and lifestyle
- Behavioural management
- Medication
- Supporting child and family

Education

- Give parents clear explanation of pathophysiology of constipation and soiling

Diet and lifestyle

- Use in combination with laxatives
- Ensure adequate fluid intake
- High fibre diet recommended
- Encourage physical activities

Behavioural management

- Use of behavioural management in combination with medications decreases time to remission
- regular toileting: unhurried time on toilet after meals
- correct toilet position
- maintain diaries of stool frequency combined with reward system
- regular review and positive reinforcement
- discourage negative responses to soiling from family
- encourage older children to take responsibility
- May need counselling or a psychology referral in case of motivational or behavioural problems

Medication

- Disimpaction in the presence of impacted stools

DISIMPACTION

1. A macrogol laxative [polyethylene glycol (e.g. Movicol® paediatric plain)]; faecal impaction dose, see below up to a maximum of 7 days

2. Use stimulant laxative, senna or sodium picosulphate (Picolax®) if no result with macrogol or if not tolerated
3. Review all children within/after 1 week of disimpaction (in hospital or by GP)

Disimpaction dosage

Age (yr)	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
	Number of macrogol 3350 paediatric plain sachets daily divided into 2–3 doses						
1–5	2	4	4	6	6	8	8
6–11	4	6	8	10	12	12	12
	Number of adult macrogol 3350 sachets for children aged >12 yr						
12–18	4	6	8	8	8	8	8

Rectal disimpaction (only if oral disimpaction fails)

- Sodium citrate micro-enemas
- Small volume sodium citrate enemas preferable to large volume phosphate enemas
- Phosphate enemas (only if oral medications and sodium citrate enemas failed). Use only under specialist supervision. Consider sedation if child is distressed

Manual evacuation

- If all above have failed, consider manual evacuation under general anaesthetic. Consult with paediatric gastroenterologist or paediatric surgeon

MAINTENANCE THERAPY

- After disimpaction, or if child had no impaction, focus treatment on prevention of recurrence and establishment of a regular bowel habit to allow bowel to regain normal tone and sensation
- Continue maintenance therapy for 4–6 months then reduce dosage gradually
- half the highest disimpaction dose of macrogol 3350 is a useful guide for initial maintenance dose

Laxatives

- Use macrogols as first line maintenance treatment (½–1 sachet daily in children aged <1 yr)
- If not improved within 1 month or to prevent recurrence of impaction, add a stimulant laxative such as senna, bisacodyl or sodium picosulphate syrup. Using stimulants is recommended only for short periods of time and intermittently. Use with faecal softener e.g. sodium docusate and/or fibre
- Aim for soft/loose stools initially daily
- High doses (up to 4–6 sachets daily of macrogols) may be required and doses may need frequent adjustment by child and parent to maintain a regular bowel action. Advise parents to reduce doses gradually and to increase again if no bowel action in 3 days
- If macrogols not tolerated, use sodium docusate or lactulose
- Aged <6 months:
- give infant glycerol suppository once/day
- change milk to hydrolysed formula if delayed cow's milk allergy suspected

Supporting child and family

- Organise review within 1 week then regular and frequent local contact and by telephone to prevent re-impaction
- Provide contact telephone number for parents if available
- Discuss timing of doses for convenience with bowel action
- Emphasise need for good compliance
- Use outreach nursing support if available
- Liaise with child's health visitor, community paediatric nurse and/or school nurse. Send copies of consultations with parental agreement to help provide a unified approach
- Child psychology support when available is invaluable

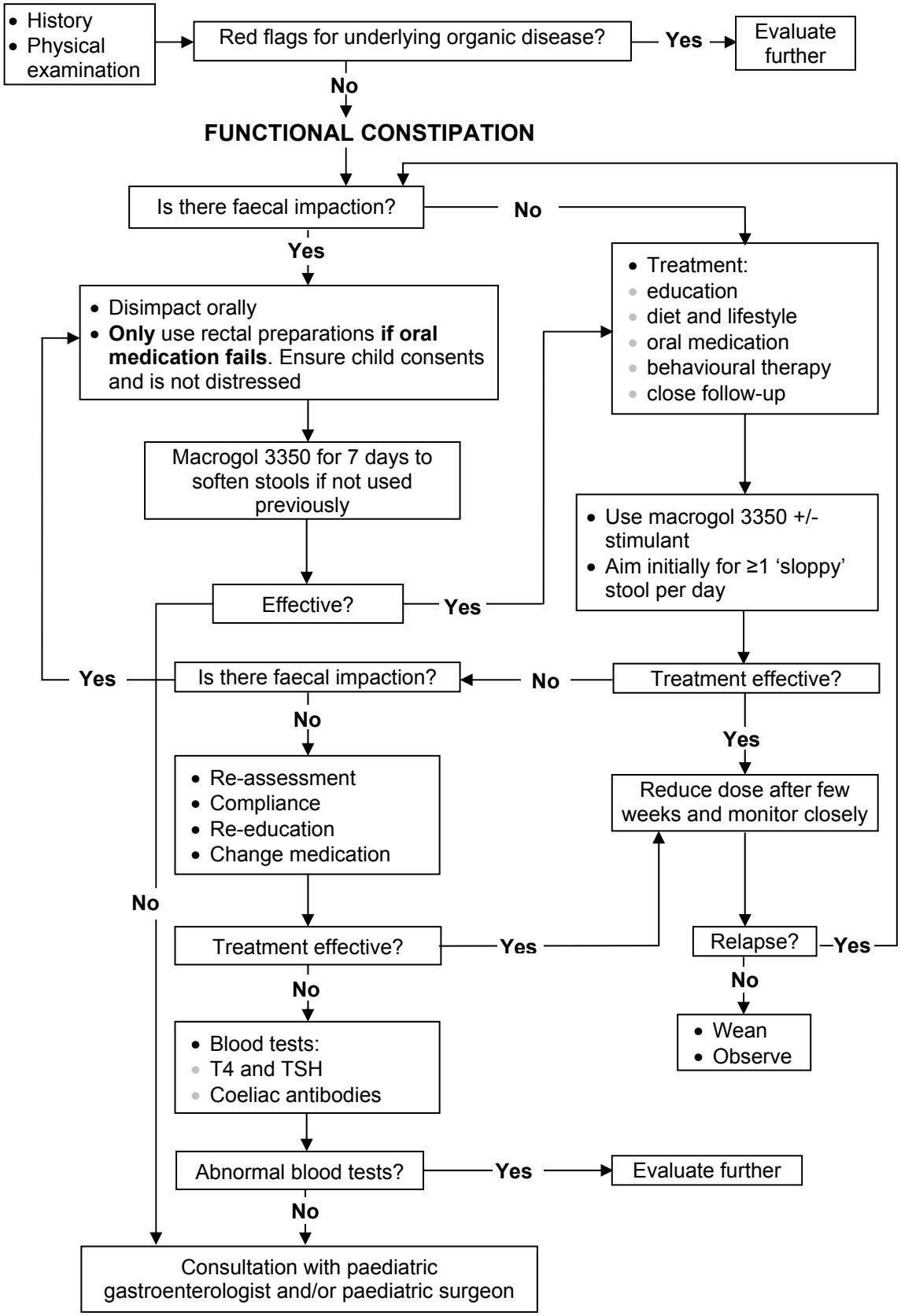
Withdrawal of laxatives

- Once regular bowel habit has been established for a few months, and child has good sensation of need to open bowels gradually withdraw laxatives over a period of months

INDICATIONS FOR SEEKING ADVICE OF PAEDIATRIC GASTROENTEROLOGIST

- Organic cause of constipation suspected
- Disimpaction orally/rectally unsuccessful
- Soiling/abdominal pain continues despite treatment
- Children aged <1 yr with faecal impaction or not responding to maintenance therapy

CONSTIPATION MANAGEMENT



CROUP ● 1/2

DEFINITION

- Acute viral inflammation of upper airway causing oedema of larynx and trachea and presenting with barking cough, stridor and respiratory distress
- Causative agent: parainfluenza virus (sometimes influenza, respiratory syncytial virus, rhinovirus)

Aetiology

- Aged 6 months–6 yr (peak aged 2 yr)
- Seasonal peak: Spring and Autumn
- Transmission: usually by droplet spread
- Incubation period: 2–6 days

Differential diagnosis of stridor

Acute

- Croup
- Epiglottitis (rare since immunisation against *Haemophilus influenzae* type B)
- Bacterial tracheitis
- Foreign body

Chronic

- Allergic airways disease
- Congenital abnormality e.g. laryngeal haemangioma
- Laryngomalacia
- Foreign body
- Laryngeal papilloma

CROUP

Symptoms and signs

- Preceding coryzal illness
- Fever
- Harsh bark/seal-like cough
- Hoarse voice
- Inspiratory stridor
- Symptoms worse at night
- Child does not look toxic

Assessment

- Record croup severity:
- C – Cyanosis
- R – Recession of chest
- O – Oxygen saturations (keep >92%)
- UP – Upper airway obstruction e.g. stridor
- Respiratory rate
- Heart rate
- Level of consciousness
- **Do not examine throat as it may cause acute severe/total obstruction**
- Do not distress child
- Any clinical concerns call consultant paediatrician immediately

Severity

Mild croup

- Barking cough
- Mild stridor
- No recession
- No cyanosis

Moderate croup

- Intermittent stridor at rest
- Mild recession
- Alert and responsive

Severe croup
- Stridor at rest
- Cyanosis
- Oxygen saturation <92% in air
- Moderate to severe recession
- Apathetic/restless

Investigations
- No investigations necessary, do not attempt to take blood or put in cannula
- If diagnosis unclear, or child severely unwell, call consultant as an emergency measure

IMMEDIATE MANAGEMENT

Mild to moderate croup
- Analgesia e.g. paracetamol or ibuprofen for discomfort
- Adequate fluid intake
- Leaflet on croup and reassurance
- Oral dexamethasone 150 microgram/kg
- Admit/observe moderate croup for 4 hr and reassess
- Dexamethasone dose can be repeated after 12 hr or if well, patient can be discharged with a single dose of prednisolone 1 mg/kg rounded up to nearest 5 mg to take 12–24 hr later

If parents do not clearly understand what to do, do not discharge

Severe croup
- Keep child and parents calm – do not upset child e.g. by forcing oxygen mask onto face or examining throat; nurse on parent's lap and in position they find comfortable
- High flow oxygen 15 L/min via mask with reservoir bag which must be prescribed
- Dexamethasone 150 microgram/kg oral (or if child refuses to swallow oral medication, nebulised budesonide 2 mg)
- Nebulised adrenaline 400 microgram/kg to maximum 5 mg (0.4 mL/kg to maximum 5 mL of 1:1000 injection) can be used to relieve symptoms whilst dexamethasone/budesonide starts to work
- short duration of action; can be repeated after 30 min
- if severe enough to require nebulised adrenaline likely to be admitted to ward; if considering discharge, ensure observed for ≥3 hr
- Contact on-call consultant paediatrician urgently to assess clinical situation
- discuss whether to involve on-call paediatric anaesthetist and ENT surgeon
- If no sustained improvement with adrenaline and dexamethasone:
- secure airway in theatre by experienced anaesthetist
- transfer to PICU

DISCHARGE AND FOLLOW-UP
- Leaflet on croup
- Antibiotics, antitussives and humidified air do not help
- Encourage oral fluid intake
- Advise parents to seek help urgently if any of the following are present:
- drooling
- laboured breathing
- persistent fever
- biphasic/worsening stridor
- cyanosis
- reduced level of consciousness/confusion
- No need for follow-up of croup

CUTS AND BITES ● 1/2

Prevention of infection after bites from humans and other animals

PROPHYLACTIC ANTIBIOTICS

Give to:

- All human bite wounds ≤72 hr old, even if no sign of infection
- Animal bite wounds if wound ≤48 hr old and risk of infection high as follows:
  - bites to hand, foot, and face; puncture wounds; wounds requiring surgical debridement; crush wounds with devitalised tissue; wounds in genital areas; wounds with associated oedema; wounds involving joints, tendons, ligaments, or suspected fractures
  - wounds that have undergone primary closure
  - patients at risk of serious wound infection (e.g. immunosuppressed)
  - asplenic patients, even after trivial animal bites
  - patients with prosthetic implants e.g. heart valve, VP shunt
  - antibiotics are not generally needed if wound ≥2 days old and no sign of local or systemic infection
- Advise patient and carers of signs of developing infection and to attend urgently for review should this happen. Do not give prophylactic antibiotics for insect bites
- Send swab for bacterial culture and blood culture if systemically unwell
- Co-amoxiclav (if penicillin allergy – clindamycin and cotrimoxazole) for 5 days

TETANUS-PRONE WOUND

- Wounds
  - that require surgical intervention that is delayed for >6 hr
  - that show a significant degree of devitalised tissue or a puncture-type injury particularly where there has been contact with soil or manure
  - containing foreign bodies
  - in patients who have systemic sepsis
- Compound fractures

Immunisation status	Clean wound	Tetanus-prone wound	
	Vaccine	Vaccine	Human tetanus immunoglobulin
Fully immunised, i.e. has received a total of 5 doses of vaccine at appropriate intervals	None required	None required	Only if high risk*
Primary immunisation complete, boosters incomplete but up to date	None required (unless next dose due soon and convenient to give now)	None required (unless next dose due soon and convenient to give now)	Only if high risk*
Primary immunisation incomplete or boosters not up to date	A reinforcing dose of vaccine and further doses as required to complete recommended schedule (to ensure future immunity)	A reinforcing dose of vaccine and further doses as required to complete recommended schedule (to ensure future immunity)	Yes: give 1 dose of human tetanus immunoglobulin in a different site
Not immunised or immunisation status not known or uncertain	An immediate dose of vaccine followed, if records confirm the need, by completion of a full 5 dose course to ensure future immunity	An immediate dose of vaccine followed, if records confirm the need, by completion of a full 5 dose course to ensure future immunity	Yes: give 1 dose of human tetanus immunoglobulin in a different site

* High risk: heavy contamination with material likely to contain tetanus spores and/or extensive devitalised tissue

Tetanus vaccine [e.g. combined diphtheria (low dose), tetanus, and poliomyelitis] and immunoglobulin if indicated – see **Department of Health, Immunisation against infectious diseases**: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/148506/Green-Book-Chapter-30-dh_103982.pdf

RABIES

- Bat bites in UK
- Any animal bite overseas

CUTS AND BITES ● 2/2

- Take history of:
- patient name, date of birth, age and address
- date of exposure
- species and current health status of animal involved
- country of exposure
- type of exposure
- site of exposure
- any previous rabies vaccinations
- For vaccine, immunoglobulin and advice contact your local health protection team (https://www.gov.uk/health-protection-team)

CYANOTIC CONGENITAL HEART DISEASE ● 1/3

RECOGNITION AND ASSESSMENT

Symptoms and signs

- Central cyanosis may be respiratory or cardiac in origin
- Respiratory illness producing cyanosis will usually have signs of respiratory distress (e.g. cough, tachypnoea, recession and added respiratory sounds)
- Cardiac decompensation may occur with a respiratory infection; they may co-exist
- Cyanosis more likely due to cardiac disease if:
- SpO_2 responds poorly to high flow oxygen (15 L/min) via face mask with reservoir bag
- marked tachycardia
- enlarged heart (clinically or on CXR)
- gallop rhythm/murmur
- enlarged liver/raised JVP
- basal crackles
- absent femoral pulses
- finger clubbing occurs after a few months (also consider endocarditis)

Causes of cardiac cyanosis

Significant right-to-left shunt

- Transposition with inadequate mixing, pulmonary or tricuspid atresia
- Fallot's tetralogy: hypercyanotic episodes follow emotional or painful upset

Duct-dependent pulmonary circulation

- Commonly presents in first 10–14 days of life
- severely blue, breathless or shocked
- pulmonary atresia
- critical pulmonary valve stenosis
- tricuspid atresia
- severe Fallot's tetralogy
- transposition of the great arteries without septal defect
- single ventricle anatomy

Acute pulmonary outflow obstruction (cyanotic episodes)

- Fallot's tetralogy or other complex congenital cyanotic heart disease
- severe pallor
- loss of consciousness
- convulsions

Physical examination

- Remember to check femoral pulses
- If coarctation of the aorta suspected: check BP in upper and lower limbs – normal difference <15 mmHg

Investigations

If infant cyanosed or in heart failure, discuss urgency of investigations with consultant

SpO_2

- Check pre (right arm) and postductal (lower limbs)
- when breathing air before oxygen given
- after giving 15 L/min oxygen by mask with a reservoir bag for 10 min

Chest X-ray

- For cardiac conditions, specifically record:
- cardiac situs (normal or right side of chest)
- aortic arch left or right-sided
- bronchial situs (is right main bronchus on the right?)
- cardiac size and configuration
- size of pulmonary vessels and pulmonary vascular markings
- when breathing air before oxygen given
- after giving 15 L/min oxygen by mask with a reservoir bag for 10 min

Electrocardiogram
See **ECG interpretation** guideline

Nitrogen washout in cyanosed babies
- Monitor SpO_2 in air then in headbox after breathing 100% oxygen for 10 min
- in cyanotic congenital heart disease, PaO_2 will remain below 20 kPa with SpO_2 unchanged
- not as reliable as echocardiogram

Echocardiogram
- Locally, if available, or refer to regional paediatric cardiac centre

IMMEDIATE TREATMENT

If infant cyanosed or in heart failure, discuss urgency of referral to local paediatric cardiac surgical centre with consultant

Duct-dependent congenital heart disease
- Immediate treatment before transfer to paediatric cardiac centre:
- open duct with alprostadil (prostaglandin E_1) or dinoprostone (E_2): see **Prostaglandin infusion**

Acute pulmonary outflow obstruction (cyanotic episodes)
- Immediate treatment before transfer to paediatric cardiac centre:
- do not upset child
- give morphine 50–100 microgram/kg IV over 5 min or IM
- provide high concentration face mask oxygen (15 L/min with reservoir bag)
- if Fallot's tetralogy has been diagnosed by echocardiography, discuss use of IV beta-blocker with cardiologist

SUBSEQUENT MANAGEMENT
- On advice of consultant and paediatric cardiac centre

PROSTAGLANDIN INFUSION
Dosage
- Ranges from 5–50 nanogram/kg/min (higher doses may be advised by cardiologist)
- Antenatal diagnosis of duct dependent lesion:
- start at 5 nanogram/kg/min
- Cyanotic baby or with poorly palpable pulses who is otherwise well and non-acidotic:
- start at 5–15 nanogram/kg/min
- Acidotic or unwell baby with suspected duct dependent lesion:
- start at 10–20 nanogram/kg/min. If no response within first hour, consider an increase of up to 50 nanogram/kg/min

Desired response
- Suspected left-sided obstruction:
- aim for palpable pulses, normal pH and normal lactate
- Suspected right-sided obstruction:
- aim for SpO_2 75–85% and normal lactate
- Suspected or known transposition of the great arteries (TGA) or hypoplastic left or right heart syndrome with SpO_2 <70% or worsening lactate
- liaise urgently with cardiology and/or intensive care/retrieval team as rapid assessment and atrial septostomy may be necessary

Preparations
Dinoprostone (prostaglandin E_2) is the recommended prostaglandin*

Dinoprostone infusion	Other information
• Standard dinoprostone infusion • Make a solution of 500 microgram in 500 mL by adding 0.5 mL of dinoprostone 1 mg in 1 mL to a 500 mL bag of suitable diluent (glucose 5% or 10% or sodium chloride 0.45% and 0.9%) • Transfer 50 mL of this solution into a 50 mL Luer lock syringe and label • Discard the 500 mL bag immediately into clinical waste – single patient and single dose use only • Infusion rate: 0.3 mL/kg/hr = 5 nanogram/kg/min	• **Stability:** ◦ syringe stable for 24 hr • **Compatibility:** ◦ infuse dinoprostone via separate line **Flush:** ◦ sodium chloride 0.9% at same rate as infusion • **Administration:** ◦ continuously (short half-life). Ensure 2 working points of IV access at all times ◦ infusions can be given via long line, UVC or peripherally ◦ extravasation can cause necrosis – use central access if available

*If dinoprostone IV not available, use alprostadil (prostaglandin E_1) IV as alternative (see **BNFc**)

Oral dinoprostone (see BNFc)
- Used temporarily on very rare occasions when IV access is extremely difficult
- Discuss with cardiac centre before using
- Use dinoprostone injection orally
- May not be as effective as prostaglandin IV

Side effects
Common
- Apnoea – tends to occur in first hour after starting prostaglandin or when dose increased. Consider ventilation
- Hypotension – due to systemic vasodilatation. Consider sodium chloride 0.9% 10 mL/kg bolus
- Fever
- Tachycardia
- Hypoglycaemia

Uncommon
- Hypothermia
- Bradycardia
- Convulsions
- Cardiac arrest
- Diarrhoea
- Disseminated intravascular coagulation (DIC)
- Gastric outlet obstruction
- Cortical hyperostosis
- Gastric hyperplasia (prolonged use)

Monitor
- Heart rate
- Blood pressure
- Respiratory rate
- Temperature
- Oxygen saturations
- Blood gases
- Blood glucose and lactate

CYSTIC FIBROSIS – ADMISSION ● 1/2

ARRANGING ADMISSION

- Elective – via CF team and ward sister
- Refer to admission plan in notes or clinic letter
- Always admit to a cubicle

ADMISSION PROCEDURE

- Plot baseline weight, height
- Perform flow volume loop spirometry on admission day (aged ≥6 yr)
- Review drug history with patient/parent/carer and last clinic letter
- Prescribe all medication
- Check whether annual bloods could conveniently be taken now (see **Annual bloods**)
- Ask nursing staff to inform physiotherapist and dietitian on day of admission
- Check specific aspects of management or investigations, as described by CF team
- for IV antibiotics: see **Cystic fibrosis – Exacerbation** guideline
- for bowel obstruction: see **Cystic fibrosis – Distal intestinal obstructive syndrome (DIOS)** guideline

INVESTIGATIONS

Bloods

- If child admitted for IV antibiotics, send bloods when the cannula/long line is inserted or port-a-cath accessed
- Send: FBC, U&E, CRP, LFT and blood cultures
- If allergic to bronchopulmonary aspergillosis (ABPA) suspected, request total IgE, specific IgE to *aspergillus* and *aspergillus* precipitins

Microbiology

- On admission, request sputum/cough swab for MC&S
- If clinically indicated consider sending nose and throat viral swabs
- If non-tuberculous mycobacteria (NTM) infection suspected send sputum for NTM culture
- Repeat sputum/cough swabs for MC&S 1–2 x per week during admission (usually performed by physiotherapist but check this has been done)
- If new pathogen found, see **Cystic fibrosis – Microbiology** guideline

Chest X-ray

- If new clinical signs present when examining chest, order CXR
- Most children have CXR every 12 months, check when last one was performed; if in doubt, discuss with CF consultant
- If new CXR performed always compare with previous
- If recent CT performed review findings and discuss with CF consultant and radiologist

Lung function and oxygen saturation

- Perform spirometry on admission, then weekly on all children who blow reliably (usually aged ≥6 yr)
- undertaken by physiotherapist or trained nurse. If evidence of airway obstruction repeat spirometry 15 min after inhalation of salbutamol MDI 4 puffs via a spacer
- Monitor oxygen saturation overnight for first 2 nights after admission
- if saturations <91%, prescribe oxygen via nasal cannulae or face mask

Screening for hyperglycaemia

Approximately 8% of children with CF develop diabetes after aged 10 yr, usually manifests as weight loss; ketoacidosis is rare

- If taking regular oral corticosteroids, screen for glucose intolerance at admission:
- during first 24 hr after admission request fingerprick blood glucose before breakfast, 1–2 hr after every meal, and at 0200 hr if on overnight feeds
- If prednisolone started or dosage increased during admission, repeat fingerprick blood glucose
- If blood glucose elevated, discuss with CF team

Annual bloods

- All children attending CF clinics have annual blood screening
- Perform annual bloods if admission within a month of annual screening (usually at time of birthday) during insertion of a long line or port-a-cath needle, or when checking tobramycin level

CYSTIC FIBROSIS – ADMISSION ● 2/2

All ages
- FBC and film
- Vitamins A, D, E
- Parathyroid hormone
- U&E, CRP, LFTs, chloride, bone profile, magnesium, *Pseudomonas aeruginosa* antibodies
- Glucose
- Total IgE, specific IgE to *aspergillus* and *aspergillus* precipitins

If aged ≥10 yr
- Add glucose tolerance test (at 0, 60 and 120 min)

NUTRITION
- Always involve dietitians
- Weigh twice weekly, **in nightwear** and **before breakfast** (weigh babies naked if possible)
- Continue normal supplements

Pancreatic enzyme supplements
- Continue same type and dose of pancreatic supplement as already prescribed

Starting dosage for newly diagnosed child
- **Infants**
- Creon® Micro for children ½ scoop (2500 units lipase) to 1 scoop (5000 units lipase) per 120 mL milk or breast feed

OR
- Creon® 10,000 one-quarter (2500 units lipase) to one-half capsule (5000 units lipase) per 120 mL milk or breast feed

- **Children**
- starting dose Creon® 10,000 – 2 capsules per meal, 1 capsule per snack
- Dose titrated with fat content of meals and snacks to control symptoms of malabsorption
- maximum 10,000 units lipase/kg/day, higher doses can result in colonic strictures

Signs of malabsorption
- Fatty pale stools, frequent, smelly, orange oil, excess flatulence, abdominal pains
- discuss with CF team

H2-receptor antagonists
- If taking large doses of pancreatic enzymes (e.g. >10,000 units lipase), discuss with CF team need for concurrent ranitidine to reduce deactivation of pancreatin

Vitamins A, D and E
Starting dosage for newly-diagnosed
- **Infants**
- 0.6 mL Dalivit® and 0.5 mL (50 mg) alpha tocopheryl acetate (Vitamin E)
- **Children**
- 1 mL Dalivit® or 3 BPC multivitamin capsules and 100 mg alpha tocopheryl acetate (Vitamin E) (2 x 50 mg capsule)

OR
- continue dose as prescribed in CF clinic
- Vitamin levels are checked annually and dosage adjusted accordingly

Oral sodium chloride
- Only if prescribed by CF team
- Often needed in first year of life after diagnosis has been made

CYSTIC FIBROSIS – DISTAL INTESTINAL OBSTRUCTION SYNDROME (DIOS) ● 1/1

DEFINITION

- An acute complete or incomplete faecal obstruction in the ileocaecum
- in contrast, constipation is defined as gradual faecal impaction of the total colon

RECOGNITION AND ASSESSMENT

- Patients present with constipation, intermittent abdominal pain, abdominal distension and faecal masses
- Abdominal X-ray (AXR) may be performed to evaluate degree of bowel dilatation and obstruction
- If diagnostic doubt CT abdomen may be helpful – discuss with CF and radiology consultants

MANAGEMENT

- Manage medically with surgical intervention used only as a last resort. Discuss with CF team before making surgical referral
- If symptoms are mild, prescribe daily macrogol laxative (e.g. Movicol®) see **BNFc**, and encourage fluids
- Ensure adherence with pancreatic enzyme replacement therapy
- If unresponsive, or symptoms more severe:
- ensure adequate pre-hydration (low threshold for IV fluids and essential for all neonates and infants) and for ≥3 hr after administration of treatment. Monitor fluid balance and allow food
- Sodium amidotrizoate (Gastrografin®):
- aged 1 month–2 yr: 15–30 mL Gastrografin® diluted in 90 mL water/fruit juice
- 15–25 kg: 50 mL Gastrografin® diluted in 150 mL water/fruit juice
- >25 kg: 100 mL Gastrografin® diluted in 200 mL water/fruit juice
- Above can be given as single dose or 4 divided doses. If no effect after 24–48 hr or if patient deteriorates, bowel lavage with Klean-Prep® (usually requires NG tube)
- 1 sachet Klean-Prep® in 1 L water give (clear fruit cordials may be added):
- 10 mL/kg/hr for 30 min
- then 20 mL/kg/hr for 30 min
- then 25 mL/kg/hr up to maximum total dose of 100 mL/kg or 4 L
- Start early in the morning and continue until stools are yellow, watery and free of solid matter
- 2 L in first instance, increasing to 3 or 4 L depending on response, age and size of child (most children with DIOS will be teenagers)
- Withhold food but, if success not achieved after 12 hr, stop, give an evening meal and repeat following morning
- Monitor effectiveness with plain AXR before and after lavage
- If signs of complete intestinal obstruction, stop lavage, give IV fluids and discuss contrast enema with CF team

CYSTIC FIBROSIS – EXACERBATION ● 1/2

RESPIRATORY INFECTION/EXACERBATION

If unusual symptoms, e.g. haemoptysis, abdominal pain suggestive of distal intestinal obstruction syndrome, or bleeding varices, discuss urgently with CF team

Symptoms and signs

- Increasing cough and sputum production
- Increasing dyspnoea
- Weight loss with loss of appetite
- Thick, tenacious sputum
- Coarse crackles
- Haemoptysis

Investigations

- See investigations in **Cystic fibrosis – Admission** guideline

Differential diagnosis

- Non-CF bronchiectasis
- Chronic obliterative bronchiolitis

ADDITIONAL ADMISSION PROCEDURE

- All admissions must be discussed with CF team
- Trained nursing staff needed to needle port-a-cath
- CXR not performed routinely – request if pneumothorax or lobar collapse suspected

IMMEDIATE TREATMENT

- Use IV antibiotic regimen suggested following discussion with CF team
- If no discussion possible, stop oral antibiotics and start the same IV antibiotics used during the last exacerbation
- If patient has never had IV antibiotics give first-line regimen (see below)
- Take into account any past allergic reactions

First-line regimen

- Sputum culture
- *Pseudomonas aeruginosa*: ceftazidime 50 mg/kg 8-hrly (maximum 3 g/dose) and tobramycin 10 mg/kg once daily (maximum 660 mg) given over 30 min; use ideal body weight for height to avoid overdose
- no *Pseudomonas aeruginosa*: cefuroxime 50 mg/kg 8-hrly (maximum 1.5 g/dose)
- Courses usually last 2 weeks
- For cephalosporins (but not tobramycin), aim to use whole vials by rounding doses +/- 10% considering vial size

Nebulised antibiotics

- Prescribe the child's routine nebulised antibiotics and administer as normal. Do not start new nebulised treatment without discussion with CF team

Oral antibiotics

Children's routine prophylactic antibiotics should be prescribed and administered as normal during an admission, even when receiving IV antibiotics

Bronchodilators

- Salbutamol by MDI and spacer may be used before nebulised treatments or physiotherapy, discuss with CF team

Inhaled corticosteroids

- There is no evidence these are of benefit. Discuss stopping with CF team

TOBRAMYCIN MONITORING

Once daily regimen:

- Trough level immediately before 2nd and 8th doses

- Should be <1 mmol/L
- **High levels need to be discussed with CF team**
- No need to determine peak
- **Always discuss dose or interval changes with CF team beforehand and ensure level taken at correct time**
- Do not check tobramycin level via port-a-cath or long line

SUBSEQUENT MANAGEMENT

- Do not change antibiotics before discussing with CF team
- If no chest improvement has occurred after 7 day course of IV antibiotics – consider CXR

Oral corticosteroids

- If no chest improvement after a week of IV antibiotics, discuss with CF team about starting 7 day course of prednisolone 1 mg/kg/day rounded to nearest 5 mg
- If already taking alternate-day prednisolone at lower dosage, review dosage needed at discharge
- For children with allergic bronchopulmonary aspergillosis (ABPA), continue prednisolone for longer (e.g. at least 1 month then wean) and add an anti-fungal agent

Nebulised mucolytics [dornase alfa (DNAse)/hypertonic saline]

- During admission prescribe patient's routine nebulised mucolytics and administer as normal
- If thick secretions are a particular problem a new nebulised mucolytic may be started or frequency of existing treatments increased. Discuss with CF team
- discuss timing of these treatments in relation to chest physiotherapy with CF team and patient
- Patient should bring their own nebuliser into hospital

DISCHARGE AND FOLLOW-UP

- On advice of CF team

Self-administration of IV antibiotics – home IV therapy

- It is appropriate in some patients for the IV antibiotic course to be completed at home
- Patients/families must receive appropriate training and achieve the necessary competences whilst on the ward
- Service managed by CF team in conjunction with hospital pharmacy
- Discuss fully with CF team before making any changes or arrangements

Criteria for home administration of IV antibiotics

Ensure that:

- CF team and ward staff happy for patient to be discharged
- Patient and parents entirely happy, confident and competent to administer IV antibiotics at home
- Patient/parent has been assessed before discharge by CF team
- Parents have written guidelines and 24 hr contact numbers
- If patient considered responsible enough to self-administer IV antibiotics, important that parent/carer also has adequate instruction and guidance
- Anaphylaxis kit at home and family know how to use
- Notify CF team of any patient discharged on home antibiotic therapy so they can arrange support at home or at school if necessary
- CF team will visit patient at home during his/her course of IV therapy, to monitor progress
- Feedback any concerns to CF team

CYSTIC FIBROSIS – MICROBIOLOGY ● 1/2

In addition to standard precautions and hand hygiene, the following precautions are required for patients infected with potentially transmissible pathogens

- Do not share equipment between patients
- Nurse children with CF in a cubicle
- Prevent contact between CF patients

PATIENT NEWLY DIAGNOSED WITH CF

- Prophylaxis with flucloxacillin 125 mg oral 12-hrly until aged 2 yr
- If newly diagnosed CF patient has chest infection requiring IV antibiotics:
- commence cefuroxime IV for 2 weeks
- Subsequent treatment depends on antibiotic sensitivities

PSEUDOMONAS AERUGINOSA

First isolation in sputum/cough swab

- If asymptomatic with first isolation from sputum/cough swab:
- ciprofloxacin: aged 1 month–18 yr 20 mg/kg oral 12-hrly (maximum 750 mg) for 6 weeks and nebulised colistimethate sodium aged <2 yr 1 million units 12-hrly, aged ≥2 yr 2 million units 12-hrly via nebuliser for 3 months
- If symptomatic:
- tobramycin and ceftazidime IV for 2 weeks, followed by: nebulised colistimethate sodium at doses listed above. If organism is not successfully eradicated after 2 months of treatment consider 4 week course of nebulised tobramycin as directed by CF team

Chronic infection with *Pseudomonas aeruginosa*

- Defined as >50% of microbiology samples positive for *Pseudomonas aeruginosa* in previous 12 months (minimum of 4 samples)
- **Patients with chronic *Pseudomonas aeruginosa* to receive nebulised antibiotic prophylaxis; choice of agent (colistimethate sodium/tobramycin/aztreonam) will be decided by CF team according to clinical status and microbiology sensitivities**

BURKHOLDERIA CEPACIA COMPLEX (BCC)

First isolation in sputum/cough swab

- **Report new cases of BCC to CF team immediately**
- Eradication to be attempted using a regimen containing IV and nebulised antibiotics; choice of agent dependent on sensitivities

Chronic infection with BCC

- Defined as >50% of microbiology samples positive for BCC in previous 12 months (minimum of 4 samples)
- Children with chronic BCC to receive nebulised antibiotic prophylaxis; choice of agent (tobramycin/meropenem) will be decided by CF team according to clinical status, microbiology sensitivities and tolerability
- Children with transmissible strains of BCC need to be nursed in cubicle on a separate ward from other CF children

METHICILLIN RESISTENT STAPHYLOCOCCUS AUREUS (MRSA)

First isolation in sputum/cough swab

- **Report new cases to CF team immediately**
- If asymptomatic:
- attempt eradication using nebulised vancomycin for 5 days, followed by 2 or 3 oral antibiotics for 6 weeks (choice dependent on sensitivities)
- If symptomatic:
- eradication to also include 2 weeks IV antibiotics (choice dependent on sensitivities)

Chronic infection with MRSA

- Defined as >50% of microbiology samples positive for MRSA in previous 12 months (minimum of 4 samples)
- Use of nebulised or oral antibiotic prophylaxis to be discussed with CF Team

CHICKENPOX AND CF

- Varicella infection can have serious consequences in immunosuppressed children
- CF patients taking oral corticosteroids are at high risk

- If no history of chickenpox and no antibodies, vaccinate

Exposure

- Ask about exposure to a known case:
  - being in the same room (e.g. in the house, classroom or hall in school) for ≥15 min
  - face-to-face contact, e.g. whilst having a conversation
- If exposure significant, check notes to determine immune status (history of chickenpox or antibody status before corticosteroids)
- If non-immune and taking a high dose of oral corticosteroid (prednisolone 1 mg/kg/day for 1 month or 2 mg/kg/day for 1 week), and exposure occurred <96 hr earlier, request varicella-zoster immunoglobulin (VZIG) from microbiology
  - aged <6 yr: 250 mg
  - aged 6–10 yr: 500 mg
  - aged 11–14 yr: 750 mg
  - aged ≥15 yr: 1 g
- If non-immune and taking a modest dose of oral corticosteroid (prednisolone <1 mg/kg/day) or higher dose >96 hr since exposure, give aciclovir prophylaxis 6-hrly: 10 mg/kg oral 6-hrly from 7–21 days after exposure

Infected

- If chickenpox appears in a child not taking oral corticosteroid, give aciclovir 10 mg/kg oral 6-hrly for 7 days (IV if chickenpox severe) and a course of oral antibiotics (e.g. co-amoxiclav)

INFLUENZA AND PNEUMOCOCCAL VACCINE

- Influenza vaccine every October
- Conjugate pneumococcal vaccine (Prevenar13®)
- Usually prescribed by patient's own GP but obtainable from pharmacy

PORT-A-CATH

- Use in children requiring frequent IV antibiotics
- Manufacturer's instructions found on ward
- Observe sterile precautions whenever Vascuport® accessed
- Accessed only by trained nursing staff

Routine flushing of port-a-cath (usually by nursing staff)

- Every 4 weeks (coincide with clinic appointment where possible)
- Use a straight port-a-cath needle and 4 mL heparinised sodium chloride 0.9% 100 units/mL (e.g. Canusal®, not Hepsal®), withdrawing needle while injecting last mL

DIABETES NEW (NON-KETOTIC) ● 1/2

Any child or young person presenting to GP or A&E with symptoms suggestive of diabetes should be referred (by phone) immediately to paediatric diabetes team/paediatric assessment unit

RECOGNITION AND ASSESSMENT

Definition

Elevated blood glucose with no ketonuria/blood ketones

- Random plasma glucose ≥11 mmol/L or
- Symptoms + fasting plasma glucose ≥7 mmol/L

Symptoms and signs

- Change in school performance
- Thirst
- Weight loss
- Thrush
- Polyuria
- Nocturia
- Tiredness
- If obese, no ketonuria or evidence of insulin resistance (e.g. acanthosis nigricans), consider type 2 diabetes

Investigations

- Height and weight
- Blood:
- glucose
- electrolytes
- pH
- ketones
- HbA_{1c}
- FBC
- cholesterol and triglycerides
- TSH and FT4
- immunoglobulin A
- autoantibody screen for thyroid, coeliac, GAD and islet cell antibodies

Do not arrange a fasting blood glucose or glucose tolerance test

IMMEDIATE TREATMENT

- Admit under admitting consultant of day/week
- Inform diabetes team, consultant or diabetes nurse specialist
- Start on SC insulin, total daily dose of 0.5–0.75 unit/kg (higher in puberty)
- **If starting on multiple daily dose regimen:**
- give 40% as long-acting insulin at night
- 20% short-acting insulin with each of the 3 main meals
- Adjust ratio if necessary, depending on child's eating patterns

SUBSEQUENT MANAGEMENT

- If tolerating food, allow to eat according to appetite for first 24–48 hr
- Adjust insulin according to eating habits
- Refer to dietitians

MONITORING TREATMENT

- BM stick monitoring pre-meals and bedtime (minimum 5)

DISCHARGE AND FOLLOW-UP

- Outpatient appointment to see consultant 1–2 weeks after discharge
- Prescribe as TTO (dependent on local policy):
- brand and strength of regular (long-acting) insulin, specify if pre-filled pen or cartridges
- brand of soluble (short-acting) insulin, specify if pre-filled pen or cartridges

DIABETES NEW (NON-KETOTIC) ● 2/2

- needles 4 or 5 mm
- 1 pack glucogel triple pack
- 1 packet glucose tablets
- 1 box lancets (e.g. Microfine™ plus)
- GlucaGen hypoKit (glucagon) 1 kit:
  - <25 kg: 500 microgram
  - ≥25 kg: 1 mg
- 1 box BM sticks appropriate to blood glucose monitor
- 1 box blood ketone testing strips

DIABETES AND FASTING FOR SURGERY ● 1/5

INTRODUCTION
Children with diabetes mellitus undergoing surgery are at risk of hypoglycaemia and hyperglycaemia

DEFINITIONS
Peri-operative management
- Dependent upon insulin regimen

Minor surgery
- Short procedures (<30 min)
- With/without sedation or anaesthesia
- Rapid recovery anticipated
- Expected to be able to eat by next meal
- Examples include:
- endoscopic biopsies
- myringotomy
- incision and drainage

Major surgery
- General anaesthesia >30 min or procedure likely to cause:
- post-operative nausea
- vomiting
- inability to feed adequately
- If unsure of length of anaesthetic or risk of slow post-operative recovery from anaesthesia, discuss with anaesthetist

ELECTIVE SURGERY
Glycaemic targets
- If glycaemic control:
- very poor [HbA_{1c} >75 mmol/mol (9.0%)]: postpone elective surgery
- poor: consider admission to hospital before surgery for assessment and stabilisation
  - if control remains problematic, cancel surgery and re-schedule

Pre-operative assessment
- Surgeon to inform hospital, paediatric diabetes team and anaesthetist of:
- date and time of planned procedure (if possible first on morning list)
- type of procedure (major/minor)
- Before surgery paediatric diabetes team to:
- optimise glycaemic control
- ensure parents have clear written instructions regarding diabetes management (including medication adjustments)
- if surgery taking place in another hospital, local diabetes team must inform other hospital diabetes team

Pre-operative fasting
- Before surgery
- children: solid food >6 hr
- infants:
  - breast milk: >4 hr
  - other milks: >6 hr
- Encourage to drink clear fluids (including water, low-sugar squash) >2 hr before elective surgery
- if not possible, give IV fluid

Peri-operative blood glucose targets
- 5–11.1 mmol/L
- Check at least hourly before, during and after surgery

INSULIN TREATED
Minor elective morning surgery
Day before surgery
- Normal insulin and diet

DIABETES AND FASTING FOR SURGERY ● 2/5

Morning of procedure

- Admit
- If possible first on list
- Insert IV cannula
- Measure and record capillary blood glucose:
- hourly pre-operatively
- half-hourly during operation

Basal bolus regime using multiple daily injection (MDI) regimens with stable blood glucose (5–11.1 mmol/L)

- Omit rapid-acting insulin [e.g. insulin aspart, (NovoRapid®) insulin lispro (Humalog®), insulin glulisine (Apidra®)] in the morning until after procedure, give with late breakfast
- If basal insulin analogue [insulin glargine (Lantus®) or insulin detemir (Levemir®)] usually given in the morning, continue

Insulin pump

- Before surgery:
- run pump at usual basal rate
- check blood glucose hourly; ask parents to adjust basal rates to maintain blood glucose 5–11.1 mmol/L
- During surgery
- run pump on normal basal setting for duration of procedure
- once nil-by-mouth check blood glucose hourly, and half-hourly during operation
- basal rate can be suspended for 30 min to correct any episodes of mild hypoglycaemia
- if pump stopped for 30–60 min, start IV insulin and IV fluid (see **Maintenance fluid guide** and **Insulin infusion guide**)

Biphasic regimen (premixed insulin in the morning)

- Delay morning dose until after procedure, then give with late breakfast

All insulin regimens (peri-/post-operative)

- Blood glucose <5 mmol/L
- glucose 10% 2 mL/kg IV bolus; recheck blood glucose 15 min later
- Blood glucose >12 mmol/L
- start IV insulin infusion and IV fluids as per sliding scale (see **Maintenance fluid guide** and **Insulin infusion guide**)
- If procedure delayed for further 2 hr, or child has had repeated low blood glucose, start IV maintenance fluids (see **Maintenance fluid guide**)

Minor elective afternoon surgery

Day before surgery

- Advise usual doses of insulin before procedure

Morning of procedure

- Normal breakfast no later than 0730 hr
- breakfast insulin dose dependent on regimen
- **MDI regimen**
- FULL usual dose rapid-acting insulin according to carbohydrate content of breakfast; as well as usual correction dose, depending on pre-meal blood glucose level
- if insulin glargine (Lantus®) or insulin detemir (Levemir®) given in the morning: give dose in FULL
- **Twice daily insulin regimen**
- give half rapid-acting component of morning dose as rapid-acting insulin
  Example: if usual morning dose 10 units of NovoMix® 30 or Humulin M3®, then the usual fast-acting component is:
  3/10 x 10 = 3 units of rapid-acting insulin [e.g. insulin aspart (NovoRapid®), lispro (Humalog®), glulisine (Apidra®)] give half of this i.e. 1.5 units
- **Insulin pump**
- run pump on normal basal setting
- check blood glucose at least hourly
- child/carer to alter infusion rate accordingly

Peri-operatively
- Measure and record capillary blood glucose on arrival
- Insert IV cannula
- First on list
- Once nil-by-mouth measure and record capillary blood glucose hourly, and half-hourly during operation
- Blood glucose <5 mmol/L:
- give glucose 10% 2 mL/kg IV bolus
- recheck blood glucose after 15 min
- if procedure delayed for further 2 hr, or child is continuing to have low blood glucose, start IV maintenance fluids (see **Maintenance fluid guide**)
- Blood glucose ≥12 mmol/L:
- start IV insulin infusion and IV fluids as per sliding scale (see **Maintenance fluid guide** and **Insulin infusion guide**)
- Insulin pump: continue provided blood glucose remains 5–11.1 mmol/L
- blood glucose to be checked hourly pre-operatively, and half-hourly during surgery
- if blood glucose <5 mmol/L, suspend pump for 30 min and give glucose bolus (see above)
- if pump stopped for >1 hr start IV insulin and IV fluid (see **Maintenance fluid guide** and **Insulin infusion guide**)

After procedure
- Once eating, give usual dose rapid-acting insulin generally taken with that meal
- If IV fluids and insulin infusion required, see **How to restart SC insulin after being on IV insulin**
- Insulin pump regimen:
- allow parents to re-start pump at usual basal rate once child recovered
- discharge when eating and drinking, regardless of blood glucose level (in consultation with diabetes team), parent will control this better at home

Major elective morning surgery
Day before surgery
- Admit
- Measure and record: weight, U&E, FBC, true blood glucose, urine or blood for ketones, pre-meal and bedtime capillary blood glucose
- Give usual insulin evening and night before surgery
- if using insulin pump, continue as usual with parental management until surgery

Morning of surgery
- First on list
- Nil-by-mouth <6 hr before operation
- morning list patients to commence nil-by-mouth 0300 hr (can drink clear fluids >2 hr before operation)
- Omit morning dose of rapid-acting insulin
- If insulin glargine (Lantus®) or insulin detemir (Levemir®) given in the morning, give usual FULL dose
- At 0630 hr start:
- IV maintenance fluids at maintenance rate
- IV insulin according to sliding scale
- Maintain blood glucose 5–11.1 mmol/L (see **Maintenance fluid guide** and **Insulin infusion guide**)
- Measure and record capillary blood glucose pre-operatively, and half-hourly during surgery
- Insulin pump: continue pump as usual with parental management until operation, then stop pump and commence IV infusion

After surgery
- Measure and record capillary blood glucose and ketones hourly
- Continue IV fluids and IV insulin infusion until ready to start eating
- Give basal insulin analogue at usual time (including if still on IV fluids and sliding scale of insulin)
- See **How to restart SC insulin after being on IV insulin**

Major elective afternoon surgery
Day before surgery
- Admit
- Measure and record: weight, U&E, FBC, true blood glucose, urine or blood for ketones, pre-meal and bedtime capillary blood glucose
- Give usual insulin evening and night before surgery

- Insulin pump: continue pump as usual with parental management until operation

Morning of surgery
- Light breakfast at 0700 hr on morning of procedure, then nil-by-mouth (check with anaesthetist for exact timing)
- MDI: rapid-acting insulin – FULL usual dose according to carbohydrate content, as well as usual correction dose, depending on pre-meal blood glucose level
- if basal insulin analogue given in the morning, give FULL dose
- Biphasic insulin regimen: give half usual morning insulin dose
- IV fluid infusions from 1200 hr and IV insulin infusion (see **Maintenance fluid guide** and **Insulin infusion guide**)
- Measure capillary blood glucose pre-operatively and half-hourly during operation
- Insulin pump: continue pump as usual with parental management until time of operation

After surgery
- Measure and record capillary blood glucose and ketones hourly including theatre
- Continue IV fluids and IV insulin infusion until ready to start eating
- See **How to restart SC insulin after being on IV insulin**

Emergency surgery
Before surgery
- Measure and record weight, capillary and plasma blood glucose, venous blood gases, blood ketones, electrolyte, urea and creatinine
- Inform diabetes team of admission
- If ketoacidotic:
- see **Diabetic ketoacidosis** guideline
- operate when rehydrated, blood pressure stable, blood glucose normal, and sodium and potassium in normal range
  - blood glucose levels to be stable; ideally 5–11.1 mmol/L (may not be possible for some life-saving operations)
- If not ketoacidotic
- see **Major elective surgery**
- start fluid maintenance and IV insulin (see **Maintenance fluid guide** and **Insulin infusion guide**)
- if on insulin pump: stop pump once IV infusion commenced
- always give basal insulin analogue at usual time (including if still on IV fluids and sliding scale of insulin)

After surgery
- Measure capillary blood glucose hourly and check for blood ketones on every sample (including while in theatre)
- Continue IV fluids and insulin infusion until ready to eat
- See **How to restart SC insulin after being on IV insulin**

MAINTENANCE FLUID GUIDE
- Fluid of choice – sodium chloride 0.9% with glucose 5%

Glucose
- Use glucose 5%
- if concern about hypoglycaemia, use 10%
- If blood glucose >12 mmol/L, increase insulin supply (see **Insulin infusion guide**)

Potassium
- Monitor electrolytes
- IV fluid to include potassium chloride 20 mmol/L

Maintenance fluid calculation

	Body weight (kg)	Fluid requirement in 24 hr
For each kg between	3–<10 kg	100 mL/kg
For each kg between	10–20 kg	Add additional 50 mL/kg
For each kg over	>20 kg	Add additional 20 mL/kg

INSULIN INFUSION GUIDE

- Dilute 50 units soluble insulin (Actrapid®) in sodium chloride 0.9% 50 mL; 1 unit per mL

Start infusion rate

Blood glucose	Rate	Dose
7.9	0.025 mL/kg/hr	0.025 unit/kg/hr
8–11.9	0.05 mL/kg/hr	0.05 unit/kg/hr
12–15	0.075 mL/kg/hr	0.075 unit/kg/hr
>15	0.1 mL/kg/hr 0.1 ml/kg/hr	0.1 unit/kg/hr

- Monitor blood glucose hourly before surgery, half-hourly during operation, and until child recovers from anaesthesia. Adjust IV insulin accordingly
- If blood glucose <5 mmol/L:
- stop IV insulin infusion for 10–15 min
- give glucose 10% 2 mL/kg IV bolus
- recheck blood glucose after 15 min

HOW TO RESTART SC INSULIN AFTER BEING ON IV INSULIN

If ready to eat at lunch give following insulin:

- Biphasic injection regimen, NOT using long-acting basal insulin analogue, allow to eat but continue IV insulin sliding scale until evening meal
- If using long-acting basal insulin analogues give rapid-acting insulin with lunch
- Check long-acting insulin has been carried on throughout stay
- if missed dose, delay restarting SC insulin until had long-acting insulin
- If on insulin pump:
- parents to restart insulin pump at usual basal rate once child feeling better and blood glucose levels stable with no ketones
- allow parents to manage according to their usual practice

If ready to eat by evening meal give the following insulin:

- Biphasic injection regimen NOT using long-acting basal insulin analogue: give usual dose of insulin with evening meal
- MDI regimen with long-acting basal insulin analogue: give rapid-acting insulin with evening meal and long-acting insulin analogue at usual time
- Always give dose of long-acting basal insulin analogue at usual time, even if still on IV fluids and IV insulin overnight, to prevent rebound hyperglycaemia
- If child given premixed insulin or long-acting basal insulin analogue dose, stop IV insulin 60 min after SC insulin commenced
- If given a rapid-acting insulin dose, stop IV insulin 10 min after SC insulin has commenced
- Insulin pump: parents to restart pump at usual basal rate once child feeling better and capillary blood glucose levels stable with no ketones
- allow parents to manage according to their usual practice

ORAL MEDICATIONS

Metformin

- Discontinue ≥24 hr before procedure for elective surgery
- in emergency surgery and when stopped <24 hr, ensure optimal hydration to prevent risk of lactic acidosis

Other oral medications e.g. sulphonylureas/thiazolidinediones

- Stop on day of surgery

RECOGNITION AND ASSESSMENT

Symptoms and signs

- Thirst
- Weight loss
- Polyuria
- Abdominal pain/vomiting
- Tachypnoea
- Sighing respiration (Kussmaul breathing)
- Odour of ketones
- Dehydration
- Drowsiness
- Coma
- Biochemical signs:
- ketones in urine or blood
- elevated blood glucose (>11 mmol/L)
- acidaemia (pH <7.3)

Assessment

- Airway, breathing, circulation
- record respiratory rate, heart rate, BP, peripheral pulse volume
- Conscious level: look for signs of cerebral oedema (see **Glasgow coma score** guideline)
- Headache, confusion, irritability, abnormal movements, slow pulse, high BP, papilloedema, small and irregular pupils
- Infection
- Height, weight
- Estimate dehydration based on pH value

Investigations

- Insert IV cannula (as large as appropriate for child)

All cases

- Capillary blood glucose
- FBC
- Blood glucose
- Blood gas
- HbA_{1c}
- Blood osmolality, sodium, potassium, urea, bicarbonate, creatinine, pH
- Urine ketones on urinalysis
- Blood ketones
- Infection screen: blood and urine culture
- if meningism consider lumbar puncture

Severe cases

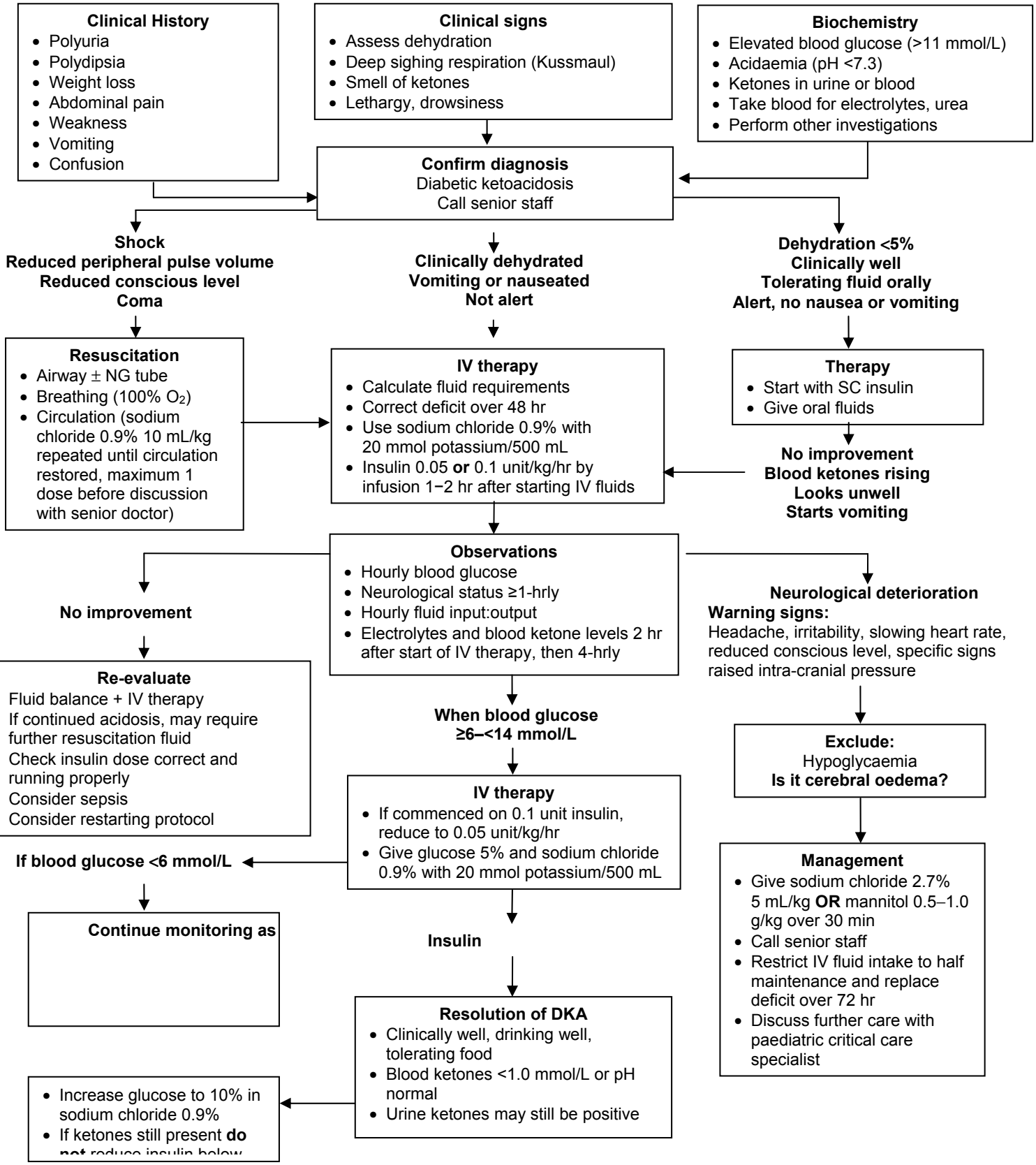
- Liver function tests and amylase
- Group and save

Newly diagnosed case

- Thyroid and coeliac disease antibody screen
- Islet cell antibodies
- GAD antibodies
- Thyroid function tests, TSH, FT4
- Immunoglobulin A

ALGORITHM (cross-referenced to text)

- Remember paediatric type 2 patients can present in DKA



IMMEDIATE TREATMENT

Inform senior staff

Admission
- If alert and not shocked, admit to ward/HDU
- If shock or GCS <8, admit to PICU
- Discuss with PICU if:
- pH <7.1 and marked hyperventilation
- aged <2 yr

General
- Nil-by-mouth for first 8–12 hr
- if vomiting, abdominal pain, no bowel sounds or decreased GCS, insert NG tube
- Place on weigh-bed (if available)
- Strict fluid balance and discuss catheterisation with consultant if requiring HDU or PICU
- Start flow-sheet to record biochemistry and blood gases
- Monitor ECG for T wave changes
- Initiate IV fluids and insulin (see below)

Shock and resuscitation
- Patient is shocked (very rare in DKA):
- poor peripheral pulses
- poor capillary refill
- tachycardia
- with/without hypotension
- Give sodium chloride 0.9% 10 mL/kg as bolus
- do not give >1 bolus IV without discussion with responsible consultant
- If child cannot protect airway: seek urgent anaesthetic review and discuss with paediatric critical care specialist
- If in hypotensive shock: discuss use of inotropes with paediatric critical care specialist
- When no longer shocked and circulated blood volume has been restored, calculate volume of fluid required (see below)

IV FLUIDS
- See https://www.bsped.org.uk/media/1434/dka-calc-disclaimer.pdf

Volume of fluid
- Total fluid requirement is the addition of 4 categories:
- fluid to re-expand circulating volume if shocked
- maintenance fluids
- deficit
- continuing losses, do not include continuing urinary losses at this stage

Maintenance fluids
- Child will be nil-by-mouth and will need normal fluid requirement IV

Weight (kg)	Rate
0–9	2 mL/kg/hr
10–39	1 mL/kg/hr
≥40	40 mL/hr

Fluid deficit
- Assume 5% fluid deficit in mild or moderate DKA (blood pH of ≥7.1)
- Assume 10% fluid deficit in severe DKA (blood pH <7.1)
- Deficit in mL = % dehydration × body weight (kg) × 10
  Example: for a 10 kg child with 5% dehydration, the deficit is 5×10×10 = 500 mL

Total amount
- Hourly rate of fluid replacement for first 48 hr = 48 hr maintenance requirements + deficit - resuscitation fluid already given (>20 mL/kg)/48 (see **Example** below)

- Weight should rise gradually with rehydration
- If available, use weigh-bed to record weight hourly to obtain accurate assessment

Example:

A 60 kg girl aged 16 yr with pH 6.9, who was given sodium chloride 0.9% 30 mL/kg for circulatory collapse will require:

maintenance fixed rate	= 40 mL/hr
deficit 10% (10 × 60 × 10 mL)	= 6000 mL
- 10 mL/kg (excess over 20 mL/kg) resuscitation fluid (-600)	= 5400 mL
hourly replacement (5400/48)	= 113 mL/hr
Total	**= 153 mL/hr**

Type of fluid

- Initially use sodium chloride 0.9% with potassium chloride dependent on serum potassium – see **Table 1**. Use **commercially premixed bag**
- Maximum rate of infusion of potassium on ward 0.2 mmol/kg/hr
- If femoral line used prescribe dalteparin 100 units/kg/day (maximum 5000 units) SC

Table 1

Potassium <3.5	Potassium 3.5–5.5	Potassium >5.5
500 mL sodium chloride 0.9% with potassium chloride (40 mmol/500 mL) via **central line** and seek senior advice	Sodium chloride 0.9% with potassium chloride 0.3% (20 mmol/500 mL)	Sodium chloride 0.9% and seek senior advice

If serum potassium <2.5 mmol/L, transfer to PICU. Discuss with consultant whether to give potassium chloride 0.2 mmol/kg in sodium chloride 0.9% by separate infusion over 1 hr. Before infusing bag containing potassium, connect patient to cardiac monitor.
If possible, use commercially premixed bag. Only in exceptional circumstances (with consultant agreement and 2 doctors checking procedure) should potassium chloride be added on the ward to a bag of sodium chloride 0.9% (MIX WELL)

- Further fluid and potassium as dictated by the child's condition and serum potassium (**Table 1**), repeated until glucose falls to 14 mmol/L, then move to **Subsequent management**

Fluid losses

- If a massive diuresis continues for several hours fluid input may need to be increased
- If large volumes of gastric aspirate continue, replace with sodium chloride 0.45% with potassium chloride (discuss with consultant)

Oral fluids

- If receiving IV fluids for DKA **do not** give oral fluids until ketosis is resolving and no nausea/vomiting
- In the case of gastric paresis a NG tube may be necessary
- If oral fluids given before 48 hr rehydration period completed, reduce IV infusion to take account of oral intake

Do not give IV sodium bicarbonate to children and young people with DKA

Insulin infusion

- **Start 1–2 hr after IV fluids**
- Soluble insulin (e.g. Actrapid®) infusion 1 unit/mL in sodium chloride 0.9% via IV syringe pump at 0.05–0.1 unit/kg/hr (according to local policy)
- If no fall in glucose after 2 hr (very unusual, check pump and patency of IV cannula), increase by 20%. If no fall after 4 hr, increase to 0.1 unit/kg/hr and re-evaluate (e.g. sepsis, insulin errors)
- If blood glucose falls exceed 5 mmol/L/hr, reduce insulin infusion rate to 0.05 unit/kg/hr initially, then adjust if necessary
- Do **not** stop insulin infusion. Check capillary glucose in 1 hr

Do not give insulin bolus. Do not add insulin directly to fluid bags

Other insulin management

Continuous subcutaneous insulin infusion (CSII) pump therapy

- Stop pump when commencing insulin IV

Long-acting insulin [insulin glargine (Lantus®)/insulin degludec (Tresiba®)]

- Usual dose/time may be continued throughout DKA treatment in addition to IV insulin infusion, in order to shorten length of stay after recovery from DKA

MONITORING TREATMENT

- Hourly capillary blood gas and glucose
- Check U&E, glucose, osmolality pH and capillary ketones 2-hrly until improving, then 4-hrly
- Neurological status, heart rate and blood pressure hourly (half-hourly if aged <2 yr)
- Complete DKA summary sheets
- If complaining of headache, for medical review

Medical reviews

- At 2 hr after starting treatment, and then at least 4-hrly, carry out and record results of:
- glucose (laboratory measurement)
- blood pH and pCO_2
- plasma sodium, potassium and urea
- blood ketones (beta-hydroxybutyrate)
- Doctor to carry out face-to-face review at start of treatment, and then 4-hrly, and more frequently if:
- aged <2 yr
- severe DKA (blood pH <7.1)
- any other reasons for special concern
- At each face-to-face review assess following:
- clinical status (including vital signs and neurological status)
- blood investigation results
- ECG trace
- cumulative fluid balance record

SUBSEQUENT MANAGEMENT

When blood glucose falls <14 mmol/L use a glucose containing fluid

- Maintenance fluid dependent on, glucose and potassium

Table 2: Glucose

Blood glucose	**Fluid:** sodium chloride 0.9% with potassium chloride (see **Table 1**) and:
0–6.0	Glucose 10%
6.1–14.0	Glucose 5%
>14.0	No glucose

- When pH >7.3 reduce insulin infusion rate to 0.05 unit/kg/hr (if on 0.1 unit/kg/hr)
- Blood glucose may rise as a result, **but do not revert to sodium chloride 0.9% unless plasma pH falls**
- if pH falls, reassess fluid deficit and regimen
- If glucose falls <4 mmol/L, give glucose 10% 2 mL/kg IV. Reduce insulin infusion rate by 20%. Check capillary glucose in 1 hr
- To make glucose 10% with sodium chloride 0.9% (with/without potassium): remove 50 mL from 500 mL bag of glucose 5%, sodium chloride 0.9% (with/without potassium) and add 50 mL of glucose 50%
- Continue with IV fluids and insulin infusion until blood ketones <0.5 and child tolerating oral fluids and food
- Start SC insulin ≥30 min before stopping IV insulin
- If using insulin pump therapy:
- restart pump ≥60 min before stopping IV insulin
- change insulin cartridge and infusions set
- insert cannula into new SC site

If acidosis not improving, exclude:
- Insufficient insulin to switch off ketones
- Inadequate resuscitation
- Sepsis
- Hyperchloraemic acidosis
- Salicylate or other prescription or recreational drugs

Cerebral oedema
- Observe for headache, any change in symptoms, pH <7.2, or persistently low serum sodium as glucose corrects
- Exclude hypoglycaemia
- If cerebral oedema suspected, inform consultant immediately
- Give sodium chloride 2.7% 5 mL/kg over 10–15 min
- if not available give mannitol 0.5 g/kg (2.5 mL/kg of 20%) over 15 min, repeat mannitol after 2 hr if required
- Restrict IV fluid intake to half maintenance and replace deficit over 72 hr
- If patient unconscious, insert urethral catheter
- Admit to PICU
- Consider CT scan/MR scan

Converting to SC insulin
- Inform diabetes team (consultant, diabetes nurse and dietitian)
- Children usually require insulin 0.5–1.0 unit/kg/day (pre-pubertal usually 0.5–0.6 unit/kg/day; higher in puberty and children with high level of ketosis)
- **If converting to multiple daily dose regimen:**
- give 40% as long-acting insulin at night
- 20% short-acting insulin with each of the 3 main meals
- Adjust ratio if necessary, depending on child's eating patterns
- Start SC insulin ≥30 min before stopping IV insulin
- If using insulin pump therapy:
- restart pump ≥60 min before stopping IV insulin
- change insulin cartridge and infusions set
- insert cannula into new SC site

DISCHARGE AND FOLLOW-UP
- Prescribe following as TTO for all new patients (according to local policy):
- brand and strength of regular long-acting insulin, specify if pre-filled pen or cartridges
- brand of soluble short-acting insulin, specify if pre-filled pen or cartridges
- needles 4 or 5 mm
- 1 pack hypostop triple pack
- 1 packet glucose tablets
- 1 box lancets (e.g. Micro-Fine™ plus)
- GlucaGen® HypoKit (glucagon) 1 kit
  - <25 kg: 500 microgram
  - ≥25 kg: 1 mg
- 1 box blood glucose strips appropriate to blood glucose monitor
- 1 box blood ketone testing strips
- Organise outpatient follow-up

RECOGNITION AND ASSESSMENT

Definition of diarrhoea

- Passage of loose watery stools ≥3 times in 24 hr
- Most common cause is acute infective gastroenteritis

Diarrhoea and vomiting in infants may be a sign of sepsis.
Treat sepsis using sepsis guidance including IV antibiotics

Symptoms and signs

- Sudden onset of diarrhoea (D) or vomiting (V), or both (D&V)
- Fever, malaise, lethargy
- Abdominal cramps
- Loss of appetite

Patient history

- Ask about:
- duration of illness
- frequency of stools and vomiting (>6 stools and/or 2 vomits means children are more likely to become dehydrated)
- colour of vomit (if green bilious vomit, consider obstruction)
- nature of stools, including presence of blood in stool
- feeds (fluid and food intake)
- urine output (number of wet nappies)
- contacts/exposure to infection
- recent travel abroad
- drug history: recent antibiotic use, immunosuppressants
- symptoms of other causes of D&V (e.g. high pyrexia, shortness of breath, severe/localised abdominal pain or tenderness, symptoms of meningitis/septicaemia)
- weight loss
- underlying problems e.g. low birth weight, malnutrition, immunodeficiency, neuro-disability

Inform Public Health if outbreak of gastroenteritis suspected or reportable pathogen

Assessment

Assessment should be repeated regularly

- Weight, including any previous recent weight
- Temperature, pulse, respiratory rate
- Degree of dehydration (see **Table 1**) and/or calculate from weight deficit
- Complete systemic examination to rule out other causes of D&V
- Children aged <1 yr are at increased risk of dehydration

Calculating fluid deficit over 24 hr

- Aged <4 yr:
- 10% dehydrated: 100 mL/kg
- 5% dehydrated: 50 mL/kg
- Older children: deficit in mL = % dehydration x weight (kg) x 10
- e.g. for a 10 kg child with 5% dehydration deficit is 5 x 10 x 10 = 500 mL

Calculating maintenance fluids

Weight (kg)	Fluid volume
<10	100 mL/kg/day
10–20	1000 mL + 50 mL/kg/day for each kg >10 kg
>20	1500 mL + 20 mL/kg/day for each kg >20 kg

Table 1: Assessment of degree of dehydration

	INCREASING SEVERITY OF DEHYDRATION		
	No clinically detectable dehydration (<5%)	**Clinical dehydration 5–10% dehydrated**	**Clinical shock >10% dehydration**
Symptoms (remote and face-to-face assessment)	Appears well	Appears to be unwell or deteriorating	–
	Alert and responsive	Altered responsiveness (e.g. irritable, lethargic)	Decreased level of consciousness
	Normal urine output	Decreased urine output	–
	Skin colour unchanged	Skin colour unchanged	Pale/mottled skin
	Warm extremities	Warm extremities	Cold extremities
Signs (face-to-face assessment)	Alert and responsive	Altered responsiveness (e.g. irritable, lethargic)	Decreased level of consciousness
	Skin colour unchanged	Skin colour unchanged	Pale/mottled skin
	Warm extremities	Warm extremities	Cold extremities
	Eyes not sunken	Sunken eyes	–
	Moist mucous membranes (except for 'mouth breather')	Dry mucous membranes (except after a drink)	–
	Normal heart rate	Tachycardia	Tachycardia
	Normal breathing pattern	Tachypnoea	Tachypnoea
	Normal peripheral pulses	Normal peripheral pulses	Weak peripheral pulses
	Normal capillary refill time	Normal capillary refill time	Prolonged capillary refill time
	Normal skin turgor	Reduced skin turgor	–
	Normal blood pressure	Normal blood pressure	Hypotension (decompensated shock)

Investigations

- If vomiting is a major feature or vomiting alone, or if baby aged <3 months: urine for dipstick and MC&S
- If septicaemia suspected, child immunocompromised, or if stools bloody, mucous or chronic diarrhoea present, send stools for MC&S and virology
- If recent antibiotics and aged >2 yr send stool for *Clostridium difficile* toxin
- If severe dehydration, possible hypernatraemic dehydration (see **Hypernatraemic dehydration** below) or diagnosis in doubt:
- FBC, U&E, chloride, glucose, blood and urine cultures. Blood gas or venous bicarbonate
- if decreased level of consciousness consider lumbar puncture, especially in babies

IMMEDIATE TREATMENT

See **flowchart – Management of acute gastroenteritis in young children (aged <4 yr)**

General advice to parents

- Adequate hydration important
- Encourage use of low osmolarity oral rehydration solution (ORS e.g.Diorolyte™)
- 'clear fluids' (water alone/homemade solutions of sugar and fruit) lack adequate sodium content and are inappropriate
- sugar, fruit juices and cola have a high osmolar load and little sodium, and can worsen diarrhoea
- Recommend early re-feeding with resumption of normal diet (without restriction of lactose intake) after 4 hr rehydration
- Do not use opioid anti-diarrhoeal agents. The enkephalinase inhibitor racecadotril can be used to reduce diarrhoeal stools
- Anti-emetics e.g. ondansetron can be given for vomiting

- ***Continue breastfeeding throughout episode of illness, ORS can be given in addition***

Treatment of dehydration

- Admit if:
- patient ≥10% dehydrated
- failure of treatment (e.g. worsening diarrhoea and/or dehydration)
- other concerns (e.g. diagnosis uncertain, child aged <3 months, irritable, drowsy, potential for surgical cause)

Mild dehydration (<5%)

- Can be managed at home
- Rehydrate orally using ORS (prescribe sachets and give clear instructions: if genuinely not tolerated, parents may substitute with diluted sugar containing juice)
- calculate fluid deficit and replace over 4 hr with frequent small volumes (e.g. 5 mL every 1–2 min)
- Do not withhold food unless vomiting

Moderate dehydration (6–10%)

- If improving after 4 hr observation, can be managed at home provided social circumstances are appropriate/parents are happy. Otherwise, admit
- Calculate deficit and aim to replace with ORS 50 mL/kg oral over 4 hr (aged <4 yr)
- Give small frequent volumes (e.g. 5 mL every 1–2 min)
- If not tolerating oral rehydration (refuses, vomits, takes insufficient volume), use NG tube (or try water, milk, dilute juice)
- Review after 4 hr
- if dehydration persists, continue the same regimen but replace fluid deficit with ORS over the next 4 hr
- if this fails, e.g. vomiting ORS, use IV rehydration if possible (see below). If venous access not possible discuss with senior to decide if intraosseous or NG tube is most appropriate
- If improving move to **Step 1**

***Severe dehydration (>10%) – see* flowchart – Management of severe dehydration**

Beware hypernatraemic dehydration. See* Hypernatraemic dehydration *section

- Obtain IV access
- If child in shock, first resuscitate with sodium chloride 0.9% (20 mL/kg) and reassess
- Calculate deficit using recent normal weight if available
- if not available calculate losses based 10% dehydration and reassess response frequently
- If alert, rehydrate orally with ORS, replacing deficit (+ maintenance requirement) over 4 hr
- Use NG tube if necessary
- If oral/NG rehydration not possible, replace deficit with isotonic fluid IV e.g. sodium chloride 0.9% or sodium chloride 0.9% with glucose 5%, add potassium when U&Es available, provided not hyperkalaemic (see **Intravenous fluid therapy** guideline)
- if hypoglycaemic or at risk of hypoglycaemia use sodium chloride 0.9% with glucose 5% and potassium chloride
- start normal diet as soon as tolerated
- continue to replace ongoing losses with ORS for each watery stool or vomit (5 mL/kg per watery stool)
- Reassess regularly, when improves move to **Moderate dehydration (6–10%)**

Hypernatraemic dehydration (Na >150 mmol/L)

- In hypernatraemic dehydration, there are fewer signs of dehydration
- skin feels warm and doughy, child lethargic and irritable/jittery with hypertonia and hyperreflexic. They may have seizures
- if in shock, resuscitate with sodium chloride 0.9% 20 mL/kg bolus
- if Na >170 mmol/L, contact PICU for advice
- if child has passed urine, give IV fluid bags containing potassium – initially at 10 mmol/500 mL, adjust according to blood results when available

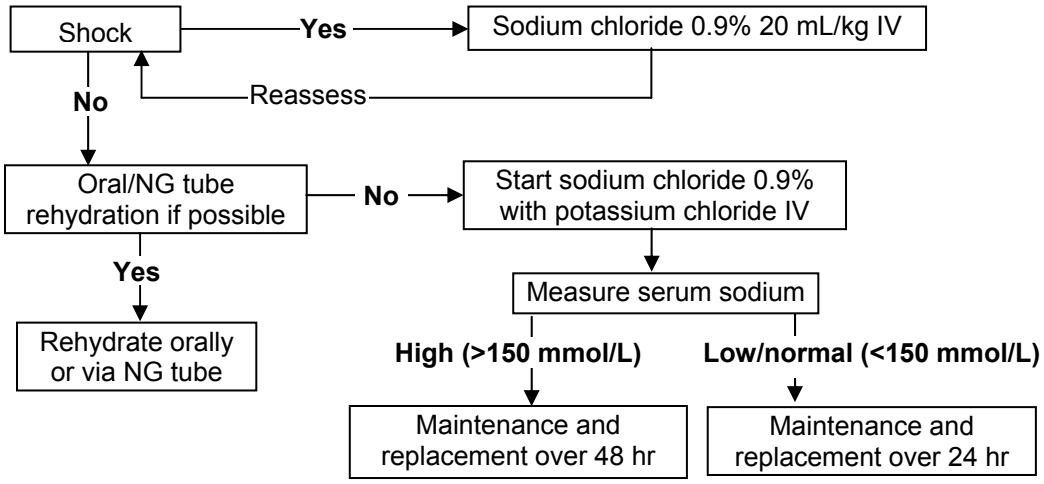
In hypernatraemic dehydration, aim to reduce sodium by no more than 10 mmol/L in 24 hr

- After initial resuscitation, give ORS: (maintenance) + replace deficit over 48 hr – via NG if necessary
- Check U&E after 1 hr
- If ORS not tolerated or sodium drops >0.5 mmol/L/hr, start IV rehydration with sodium chloride 0.9%, (maintenance) + replacing deficit over 48 hr

- Recheck U&E after 1–4 hr (depending on rate of drop of serum sodium and starting value)
- If sodium dropping by >0.5 mmol/L/hr, reduce rate by 20%
- Once rehydrated, start normal diet including maintenance fluids orally

Hyponatraemia (see **Intravenous fluid therapy** guideline)

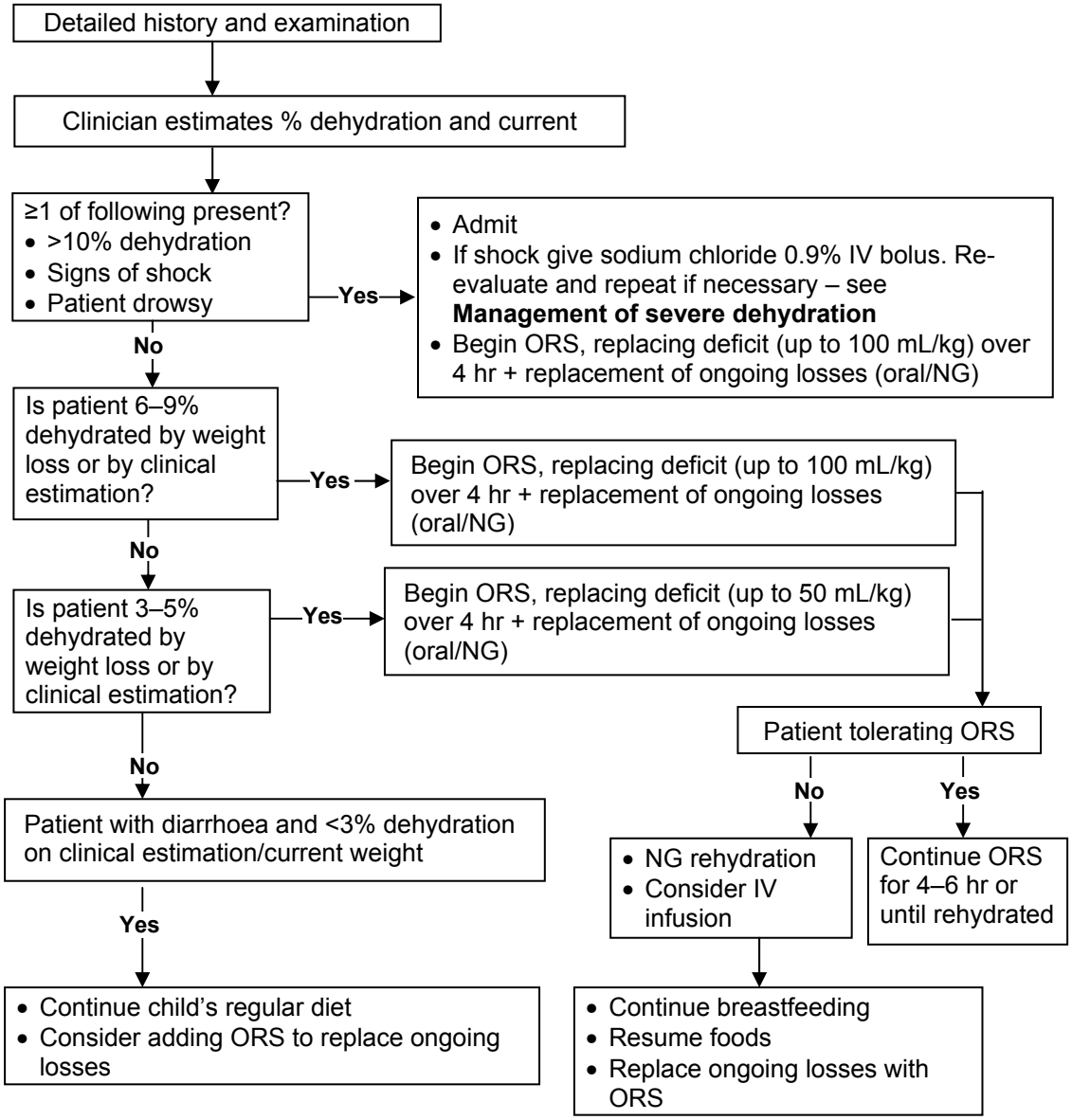
MANAGEMENT OF SEVERE DEHYDRATION



DISCHARGE AND FOLLOW-UP

- If dehydration was >5%, ensure child has taken and tolerated 2 breast or bottle feeds, or at least 1 beaker of fluid
- Check child has passed urine
- Tell parents diagnosis and advise on management and diet
- Explain nature of illness, signs of dehydration, and how to assess and deal with continuing D&V (explain flagged symptoms in **Table – Assessment of degree of dehydration**)
- Emphasise importance of adequate hydration. If dehydration recurs will need further rehydration
- If symptoms persisting, aged <1 yr or low birth weight, continue to supplement with ORS at 5 mL/kg per watery stool or vomit
- Do not withhold food, (especially breast milk), full feeding appropriate for age if well tolerated after initial rehydration
- Advise parents how to prevent transmission to other family members and contacts
- patient should not share towels with others
- hand-washing with soap and warm water after using toilet or changing nappy. Dry hands properly
- Exclude from school/nursery until 48 hr from last episode of diarrhoea or vomiting
- Exclude from swimming for 2 weeks following last episode of diarrhoea
- Give open access if appropriate, ensure parents aware of how to seek help if needed
- If diarrhoea persists for >10 days, advise to return for medical reassessment

MANAGEMENT OF ACUTE GASTROENTERITIS IN YOUNG CHILDREN (AGED <4 YR)



EATING DISORDERS ● 1/5

RECOGNITION AND ASSESSMENT

Symptoms and signs

Anorexia nervosa (AN)

- Restriction of energy intake relative to requirements leading to low body weight (typically <85% median BMI for age and gender)
- Fear of gaining weight or persistent behaviour that prevents weight restoration
- Disturbance in perception of body weight or shape
- Self-evaluation unduly influenced by weight and body shape
- Ambivalence about very low weight

Bulimia nervosa (BN)

- Episodes of binge eating unusually large amount of food with sense of loss of control, occurring at least weekly with compensatory behaviour e.g. vomiting, laxative use, exercise and/or fasting
- Self-evaluation unduly influenced by weight and body shape
- May be underweight, normal range or overweight

Binge eating disorder (BED)

- Episodes of binge eating with no compensatory behaviour
- Associated with weight gain

Eating disorder not otherwise specified (EDNOS)/other specified feeding or eating disorder (OSFED)

- Resembles AN, BN, BED but does not meet diagnostic threshold
  - atypical AN with weight in normal range
  - atypical BN/BED as infrequent bingeing
- Purging disorder (vomiting/laxatives after food without bingeing)

Avoidant/restrictive food intake disorder (ARFID)

- No body image disturbance
- Restricting food due to intolerance of textures, leading to weight loss which can be severe
- May be related to fear of eating/psychological disturbance impairing nutrition (e.g. autistic spectrum disorder)

Pica

- Persistent eating of non-nutritive substance

Rumination disorder

- Repeated regurgitation of food

DIFFERENTIAL DIAGNOSIS

- Consider physical causes of weight loss including:
  - coeliac disease
  - Addison's disease
  - inflammatory bowel disease
  - malignancy
  - diabetes
  - hyperthyroidism
  - nutritional deficiencies (zinc, selenium, vitamin D)

BODY MASS INDEX (BMI)

- See **Table 1**
- BMI = weight (kg) ÷ height^2 (m^2)
  - percentage median BMI (%mBMI) = 100 × BMI/mBMI for age/gender (see **Table 1**)
  - calculation tool available at www.marsipan.org.uk

Table 1: Approximate median BMI

Age (yrs)	Girls	Boys
9	16.1	16
9.5	16.4	16.2
10	16.6	16.5
10.5	16.9	16.7
11	17.2	17
11.5	17.6	17.2
12	18	17.5
12.5	18.4	17.9
13	18.8	18.1
13.5	19.1	18.3
14	19.5	18.8
14.5	19.7	19.2
15	20	19.5
15.5	20.25	19.7
16	20.5	20.0
16.5	20.7	20.3
17	20.9	20.6
17.5	21.1	21.0
18	21.2	21.1

REFEEDING

- A switch to carbohydrate metabolism after starvation can cause acute phosphate depletion with serious sequelae
- **After commencing feeding in high-risk patients monitor the following at least daily:**
- U&E, phosphate, calcium, magnesium, glucose
  - if phosphate level falls, give 2–3 mmol/kg/day in 2–4 divided doses
- Monitor children in red or amber categories (see **Table 2**) for refeeding – see http://www.gosh.nhs.uk/health-professionals/clinical-guidelines/re-feeding and **Nutritional first line advice** guideline
- Give Pabrinex® at appropriate dose for age or oral thiamine 100 mg 8-hrly, and vitamin B Co Strong, 2 tablets 8-hrly for ≥10 days (consult **BNFc** for age appropriate dosing)
- Avoid Hypostop® unless symptomatic non-ketotic hypoglycaemia
- Higher risk:
- %mBMI <70
- neutropenia
- minimal energy intake pre-admission
- previous history of refeeding syndrome
- If vomiting and/or laxative use lead to hypokalaemia, supplement with potassium 1–2 mmol/kg/day in divided doses [each tablet contains 12 mmol potassium (also available as a liquid formulation Kay-Cee-L®)

OTHER INVESTIGATIONS

- FBC, U&E, LFT, phosphate, magnesium, calcium, TFT, glucose
- If vomiting, amylase and bicarbonate may be raised
- B_{12}, folate, ferritin, coeliac screen, ESR, CRP, CPK
- Check zinc level, deficiency leads to altered appetite and may resemble AN
- Vitamin D:
- commonly deficient in eating disorders
- increases risk of osteoporosis

MANAGEMENT

- Be aware of refeeding syndrome
- Monitor for:
- over activity
- possible concealment of food
- interfering with nasogastric feeds
- vomiting and laxative use

- manipulating weight (e.g. drinking water, heavy clothes, concealing weights)
- Discuss with local specialist CAMHS eating disorder team
- aim to build a specialist Management of Really Sick Patients with Anorexia Nervosa (MARSIPAN) group; including psychiatrist, nurse, dietitian and paediatrician – see MARSIPAN guidance www.marsipan.org.uk
- Early recognition and treatment of AN improves outcomes

Table 2: Risk

	Red (high risk)	Amber (alert to high concern)	Green (moderate risk)	Blue (low risk)
BMI and weight	• %mBMI <70% (approx. <0.4th BMI centile) • Recent loss ≥1 kg/week for 2 consecutive weeks	• %mBMI 70–80% (approx. between 2nd–0.4th BMI centile) • Recent loss of weight of 500–999 g/week for 2 consecutive weeks	• %mBMI 80–85% (approx.9th–2nd BMI centile) • Recent weight loss <500 g/week for 2 consecutive weeks	• %mBMI >85% (approx. >9th BMI centile) • No weight loss over past 2 weeks
Cardiovascular health	• Heart rate (awake) <40 bpm • History of recurrent syncope: ◦ marked orthostatic changes (fall in systolic blood pressure of ≥20 mmHg or ◦ <0.4th–2nd centiles for age or ◦ increase in heart rate of >30 bpm • Irregular heart rhythm (does not include sinus arrhythmia)	• Heart rate (awake) 40–50 bpm • Sitting blood pressure (depending on age and gender) ◦ systolic: <0.4th centile (84–98 mmHg • diastolic: <0.4th centile (35–40 mmHg • Occasional syncope; moderate orthostatic cardiovascular changes ◦ systolic: fall ≥15 mmHg **or** ◦ diastolic fall: ≥ of 10 mmHg within 3 min standing **or** ◦ increase in heart rate of up to 30 bpm • Cool peripheries; prolonged peripheral capillary refill time (normal central capillary refill time)	• Heart rate (awake) 50–60 bpm • Sitting blood pressure (depending on age and gender: ◦ systolic: <2nd centile (98–105 mmHg) ◦ diastolic: <2nd centile (40–45 mmHg) • Pre-syncopal symptoms but normal orthostatic cardiovascular changes	• Heart rate (awake) >60 bpm • Normal sitting blood pressure for age and gender with reference to centile charts • Normal orthostatic cardiovascular changes • Normal heart rhythm
ECG abnormalities	• QTc: ◦ girls: >460 ms ◦ boys: >400 ms ◦ with evidence of bradyarrhythmia or tachyarrhythmia (excludes sinus bradycardia and sinus arrhythmia); ECG evidence of biochemical abnormality	• QTc: ◦ girls: >460 ms ◦ boys: >400 ms	• QTc: ◦ girls: <460 ms ◦ boys: <400 ms ◦ taking medication known to prolong QTc interval ◦ family history of prolonged QTc or sensorineural deafness	• QTc ◦ girls: <460 ms ◦ boys: <400 ms
Hydration status	• Fluid refusal • Severe dehydration (10%): ◦ reduced urine output ◦ dry mouth ◦ decreased skin turgor ◦ sunken eye ◦ tachypnoea ◦ tachycardiac	• Severe fluid restriction • Moderate dehydration (5–10%): ◦ reduced urine output ◦ dry mouth ◦ normal skin turgor ◦ some tachypnoea ◦ some tachycardia ◦ peripheral oedema	• Fluid restriction • Mild dehydration (<5%); may have dry mouth or not clinically dehydrated but with concerns about risk of dehydration with negative fluid balance	• Not clinically dehydrated
Temperature	• <35.5°C tympanic or 35.0°C axillary	• <36°C		

Biochemical abnormalities	• Hypophosphataemia • Hypokalaemia • Hypoalbuminaemia • Hypoglycaemia • Hyponatraemia • Hypocalcaemia	• Hypophosphataemia, • Hypokalaemia, • Hyponatraemia, • Hypocalcaemia		
Disordered eating behaviours	• Acute food refusal or estimated calorie intake 400–600 kcal/day	• Severe restriction (<50% of required intake) • Vomiting • Purging with laxatives	• Moderate restriction • Bingeing	
Engagement with management plan	• Violent when parents try to limit behaviour or encourage food/fluid intake • Parental violence in relation to feeding (hitting, force feeding)	• Poor insight into eating problems • Lacks motivation to tackle eating problems • Resistance to changes required to gain weight • Parents unable to implement meal plan advice given by healthcare providers	• Some insight into eating problems • Some motivation to tackle eating problems • Ambivalent towards changes required to gain weight but not actively resisting	• Some insight into eating problems • Motivated to tackle eating problems • Ambivalence towards changes required to gain weight not apparent in behaviour
Activity and exercise	• High levels of uncontrolled exercise in the context of malnutrition (>2 h/day)	• Moderate levels of uncontrolled exercise in the context of malnutrition (>1 hr/day)	• Mild levels of uncontrolled exercise in the context of malnutrition (<1 hr/day)	• No uncontrolled exercise
Self-harm and suicide	• Self-poisoning, suicidal ideas with moderate to high risk of completed suicide	• Cutting or similar behaviours • Suicidal ideas with low risk of completed suicide		
Other mental health diagnoses		• Other major psychiatric co-diagnosis, e.g. OCD, psychosis, depression		
Sit Up Squat Stand (SUSS) Test	• Unable to sit up at all from lying flat (score 0)	• Unable to sit up without using upper limbs (score 1)	• Unable to sit up without noticeable difficulty (score 2)	• Sits up from lying flat without any difficulty (score 3)
Stand up from squat	• Unable to get up at all from squatting (score 0)	• Unable to get up without using upper limbs (score 1)	• Unable to get up without noticeable difficulty (score 2)	• Stands up from squat without any difficulty (score 3)
Other	• Confusion and delirium • Acute pancreatitis • Gastric/oesophageal rupture	• Mallory–Weiss tear • Gastro-oesophageal reflux or gastritis • Pressure sores	• Poor attention and concentration	

ECG INTERPRETATION ● 1/4

- Examine all ECGs for:
- P wave size and axis
- axis of QRS complex
- R-S pattern in chest leads
- P-R, QRS and Q-T intervals
- P and T wave configuration
- size of QRS in chest leads

PAPER SPEED

- ECG normally recorded at 25 cm/sec
- 1 mm (1 small square) = 0.04 sec
- 5 mm (1 large square) = 0.2 sec

P WAVE

- Reflects atrial activity
- Duration shorter than in adults
- infants: 0.04–0.07 sec
- adolescents: 0.06–0.1 sec
- Height ≤2.5 mm
- Varying P wave morphology may indicate wandering atrial pacemaker

Right atrial hypertrophy (RAH)
Increased P wave amplitude in leads II, V1, and V4R

Causes

- Pulmonary hypertension
- Pulmonary stenosis
- Pulmonary atresia
- Tricuspid atresia

Left atrial hypertrophy (LAH)
Biphasic P wave (later depolarization of LA)

Causes

- Mitral valve disease
- LV obstruction and disease

P-R INTERVAL

Atrial depolarization varies with age and rate

Normal range of P-R interval (time in sec)

HEART RATE	P-R INTERVAL (SEC)			
	0–1 month	0–12 months	1–12 yr	12–16 yr
<60	-	-	-	0.1–0.19
60–99	-	-	0.1–0.16	0.1–0.17
100–139	0.08–0.11	0.08–0.12	0.1–0.14	-
140–180	0.08–0.11	0.08–0.12	0.1–0.14	-
>180	0.08–0.09	0.08–0.11	-	-

Prolonged interval

- Normal
- Myocarditis
- Ischaemia
- Drugs
- Hyperkalaemia

Short interval

- Wolff-Parkinson-White syndrome
- Lown-Ganong-Levine syndrome
- Glycogen storage disease

Variable interval
- Wandering atrial pacemaker
- Wenckebach phenomenon

QRS COMPLEX
Ventricular activity
Duration: 0.06–0.08 sec

Prolonged
- Ventricular hypertrophy
- Bundle branch block
- Electrolyte disturbance
- Metabolic disease
- Drugs (e.g. digoxin)

Normal range of R and S waves (height in mm)

Age	R and S waves (height in mm)					
	V4-R	V1-R	V1-S	V5-R	V6-R	V6-S
Birth	4–12	5–20	0–20	2–20	1–13	0–15
6–12 months	2–7	3–17	1–25	10–28	5–25	0–10
1–10 yr	0–7	2–16	1–12	5–30	5–25	0–7
>10 yr	0–6	1–12	1–25	5–40	5–30	0–5

Q WAVE
- Normal in II; III; aVF; V5-6
- Depth 2–3 mm
- pathological if >4 mm (i.e. septal hypertrophy)
- May be found in other leads in:
- anomalous coronary arteries
- hypertrophic obstructive cardiomyopathy
- transposition of great arteries (with opposite polarity)

Q-T INTERVAL
Inversely proportional to rate
- Calculate ratio of Q-T interval to R-R interval
- QTc = $\frac{\text{Q-T}}{\sqrt{\text{R-R}^{1}}}$
- QTc is usually less than 0.44 s
- prolonged QTc is associated with sudden death: alert consultant immediately

Prolonged interval
- Hypocalcaemia
- Myocarditis
- Jervell-Lange-Nielsen syndrome
- Romano-Ward syndrome
- Head injuries or cerebrovascular episodes
- Diffuse myocardial disease
- Antiarrhythmics

Short interval
- Hypercalcaemia
- Digitalis effect

T WAVE
Ventricular repolarization

Normal
- T inversion V4R/V1 (from 3rd day of life until 10 yr)
- Amplitude is 25–30% of R-wave
- Aged <1 yr: V5 ≤11 mm; V6 ≤7 mm
- Aged >1 yr: V5 ≤14 mm; V6 ≤9 mm
- Adolescence reduces amplitude

Peaked T wave
- Hyperkalaemia
- LVH
- Cerebrovascular episode
- Post-MI

Flat T wave
- Normal newborn
- Hypothyroidism
- Hypokalaemia
- Hyper/hypoglycaemia
- Hypocalcaemia
- Peri/myocarditis
- Ischaemia
- Digoxin effect

MEAN QRS AXIS

Vertical plane (limb leads)

Normal axis in vertical plane
- Birth +60° to +180° (av +135°)
- Aged 1 yr +10° to +100° (av +60°)
- Aged 10 yr +30° to +90° (av +65°)

Right axis deviation
- Right ventricular hypertrophy (RVH)
- Left posterior hemiblock
- Ostium secundum atrial septal defect (ASD)/right bundle branch block (RBBB)

Left axis deviation
- Left ventricular hypertrophy (LVH)
- Ostium primum ASD (+ RBBB)
- Often in conduction defects

Horizontal plane (anterior chest leads)

Normal
- Transition at around V3

Clockwise rotation
- S>R in V4 = RA/RV hypertrophy

Anticlockwise rotation
- R>S in V2 = cardiac shift (e.g. pneumothorax)

LEFT VENTRICULAR HYPERTROPHY

Diagnosis
- SV1 + RV5 ≥40 mm (30 mm aged <1 yr)
- +/- prolonged QRS
- Flat T wave
- T wave inversion V5-V6 (LV strain)
- Left bundle branch block

Causes include
- Aortic stenosis
- Aortic regurgitation
- Hypertension
- Moderate VSD
- Hypertrophic obstructive cardiomyopathy
- Patent ductus arteriosus
- Mitral regurgitation

RIGHT VENTRICULAR HYPERTROPHY

Diagnosis

- RAD and RV1 > SV1 (aged >1 yr)
- SV6 above maximum for age:
- 0–6 months 15 mm
- >6 months 10 mm
- >12 months 7 mm
- 10 yr 5 mm
- R waves in V4R/V1 >normal
- T wave changes
- upright in V1/V4R (aged from 3 days to 10 yr)

Causes include

- Pulmonary stenosis/atresia
- Transposition of great arteries
- Pulmonary regurgitation
- Total anomalous pulmonary drainage
- Tricuspid regurgitation
- Fallot's tetralogy
- Pulmonary hypertension

BIVENTRICULAR HYPERTROPHY

Diagnosis

- R + S >50 mm in V3-V4
- LVH + bifid R <8 mm in V1
- RVH + LV strain
- Q waves V3-V6 imply septal hypertrophy

TYPICAL ECG ABNORMALITIES

Heart lesion	ECG abnormalities
PDA	LVH > RVH; LAH
VSD	LVH > RVH; +/- RBBB; T inv LV leads
ASD	Secundum RAD; RBBB; +/- increased P-R; AF Primum LAD; RBBB; BVH; RAH
Eisenmenger's	RVH; P pulmonale
Aortic stenosis	LVH + strain
Aortic regurgitation	LVH
Coarctation	Newborn: RVH Older: Normal or LVH +/- strain; RBBB
Mitral regurgitation	LVH
Pulmonary stenosis	RVH; RAH
Ebstein's anomaly	Prolonged P-R interval; gross RAH; RBBB
Fallot's tetralogy	Newborn: Normal or T +ve V1 Older: RVH; RAH
Pulmonary atresia	RAH
Tricuspid atresia	LAD; RAH; LVH

ENCEPHALITIS ● 1/2

- History of:
- altered consciousness, personality **or**
- behaviour **or**
- focal neurology **or**
- focal seizures **and**
- fever

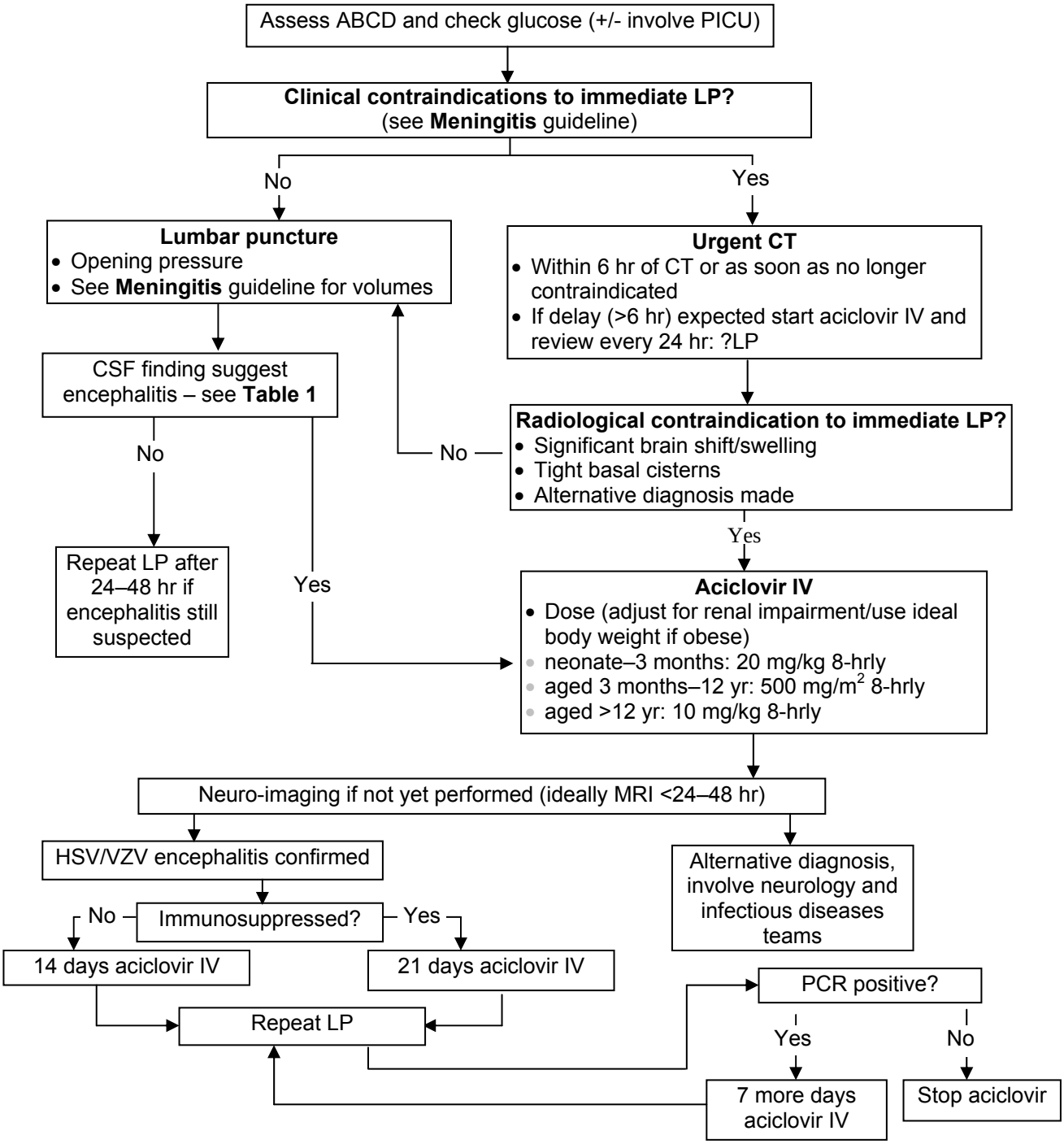


Table 1: CSF interpretation

Investigation	Normal	Bacterial meningitis	Viral encephalitis	Tuberculous meningitis	Fungal
Opening pressure	10–20 cm	High	Normal/high	High	High/very high
Colour	Clear	Cloudy	'Gin' clear	Cloudy/yellow	Clear/cloudy
Cells	<5	High/very high 100–50000	Slightly increased 5–1000	Slightly increased <500	Normal/high 0–1000
Differential	Lymphocytes	Neutrophils	Lymphocytes	Lymphocytes	Lymphocytes
CSF/plasma glucose	50–66%	<40%	Low	Low/very low <30%	Normal/low
Protein (g/L)	<0.45	High >1	Normal/high 0.5–1.0	High/very high 1.0–5.0	Normal/high 0.2–5.0

ADDITIONAL INVESTIGATIONS

- Swab in viral transport medium
  - throat
  - vesicle (if present)
- Sputum (if symptoms)
- Urine (if ? mumps for PCR)
- If travel consider
  - 3 x thick/thin malaria films OR
  - rapid malaria antigen test
  - CSF flavivirus IgM (Europe, Russia, eastern China)
- If HIV +ve, discuss with infectious diseases
- If psychiatric symptom presentation, anti-NMDA antibodies
- Whilst on aciclovir IV ensure adequate hydration and monitor fluid balance (risk of kidney injury)

EEG indications

- If subtle motor status epilepticus suspected
- If unclear if psychiatric cause of encephalopathy

Involve

- Microbiology
- Virology
- Infectious diseases
- Neurology

ENDOCARDITIS PROPHYLAXIS ● 1/1

PATIENTS AT RISK OF INFECTIVE ENDOCARDITIS

- Acquired valvular heart disease with stenosis or regurgitation
- Hypertrophic cardiomyopathy
- Previous infective endocarditis (IE)
- Structural congenital heart disease, including surgically corrected/palliated structural conditions, but excluding isolated atrial septal defect, fully repaired ventricular septal defect or fully repaired patent ductus arteriosus, and closure devices judged to be endothelialised
- Valve replacement

PATIENT ADVICE

- Provide explanation of:
- why antibiotic prophylaxis not routinely recommended
- importance of maintaining good oral health
- symptoms that may indicate IE, and when to seek expert advice
- risks of undergoing invasive procedures, including non-medical procedures e.g. body piercing or tattooing

PROPHYLAXIS AGAINST INFECTIVE ENDOCARDITIS

- Not recommended routinely for children undergoing:
- dental procedure
  - do not offer chlorhexidine mouthwash as prophylaxis
- non-dental procedure at following sites:
  - upper and lower gastrointestinal tract
  - genitourinary tract
  - upper and lower respiratory tract; includes ENT procedures and bronchoscopy

INFECTION

- To reduce risk investigate and treat promptly any episode of infection in a child at risk of IE
- If at risk of IE and receiving antibiotic for gastrointestinal/genitourinary procedure at a site with suspected infection, give antibiotic that covers organisms that cause IE

If uncertain, seek advice from cardiology team at regional paediatric cardiac centre

EPILEPSY ● 1/6

DEFINITIONS

- Seizures/convulsions: paroxysmal disturbance of consciousness, behaviour, motor function, sensation – singly or in combination
- Epilepsy:
  - ≥2 unprovoked (or reflex) seizures occurring >24 hr apart
  - 1 unprovoked (or reflex) seizure and probability of further seizure in ≥60%
  - diagnosis of Epilepsy syndrome
- Seizure type: (focal, generalised or any other type) based on history and EEG
- Try to categorise into one of epilepsy syndromes

RECOGNITION AND ASSESSMENT

- Detailed and accurate history from an eyewitness (beginning, middle and end of the episode)
- When history unclear, recording the episode with camcorder/mobile phone can be very useful
- Episodes occurring only in certain situations with certain provoking factors (e.g. fall, emotions, certain posture etc., except photosensitive stimuli) are likely to be non-epileptic
- Any underlying problem: learning difficulties, cerebral palsy, hypoxic ischaemic encephalopathy, head injury or other CNS insult
- Look for any co-morbidity
- Family history may be positive in certain idiopathic generalised epilepsies, some symptomatic epilepsies (tuberous sclerosis), autosomal dominant frontal epilepsies
- Genetic conditions (e.g. Angelman's syndrome)
- Neurocutaneous syndromes, café-au-lait spots/depigmented patches, use Woods Light
- Neurological examination
- If in doubt about diagnosis, do not label as epilepsy but watch and wait or refer to specialist

Diagnosis of epilepsy is clinical

Seizure types

Generalised

- Tonic-clonic/tonic
- Clonic
- Atonic
- Absence – typical absences, absences with special features such as myoclonic absences or eyelid myoclonia, atypical absences
- Myoclonic – myoclonic, myoclonic-atonic

Focal

- Characterised by ≥1 following features:
  - aura
  - motor
  - autonomic
  - awareness/responsiveness: altered (dyscognitive) or retained
- May evolve to bilateral convulsive seizures

Unknown

- Epileptic spasm

Cause

- Genetic
- Structural/metabolic
- Unknown

EPILEPSY SYNDROMES

Identification

- Based on:
  - seizure type
  - age of onset
  - neurodevelopmental status
  - appearance of EEG (ictal and interictal)
  - genetics

Electroclinical syndromes

Neonatal

- Familial neonatal epilepsy
- Otahara syndrome
- Early myoclonic encephalopathy

Infancy

- Febrile seizures/febrile seizures plus:
- West syndrome
- Dravet syndrome
- myoclonic epilepsy in infancy
- epilepsy of infancy with migrating focal seizures

Childhood

- Febrile seizures/febrile seizures plus:
- Panayiotopoulus syndrome
- epilepsy with myoclonic atonic (previously astatic) seizures
- childhood absence epilepsy
- epilepsy with centrotemporal spikes (Rolandic epilepsy)
- autosomal dominant frontal lobe epilepsy
- Lennox Gastaut syndrome
- epileptic encephalopathy with continuous spike and wave during sleep
- Landau-Kleffner syndrome

Adolescence

- Juvenile absence epilepsy
- Juvenile myoclonic epilepsy
- Epilepsy with generalised tonic clonic seizures alone
- Autosomal dominant epilepsy with auditory features
- Other familial temporal lobe epilepsies

Common childhood/adolescent epilepsy syndromes

Childhood absence epilepsy

- Usually presents aged 3–8 yr
- More common in girls
- Several (up to 100) brief episodes in a day
- Very quick recovery
- Typical EEG 3 per sec spike and wave
- 10–30% of children can have generalised seizures in teenage years

Juvenile absence epilepsy

- Usually presents after age 9–10 yr
- Absence frequency is less than in childhood absence epilepsy
- Cluster after awakening
- 90% of children have generalised seizures in the same period while they have absences
- EEG generalised spike and wave

Juvenile myoclonic epilepsy (JME)

- Usually presents aged 12–18 yr
- Myoclonic jerks are hallmark of this syndrome
- Jerks after awakening (myoclonic jerks), common and often go unrecognised
- 90% of children have generalised seizures at some stage
- 15–30% of children will have absences

Benign epilepsy of childhood with rolandic spike

- Usually nocturnal seizures
- Unilateral focal motor seizures of face, palate and arm with gurgling and salivation focal oromotor
- May become secondary generalised
- May present with nocturnal generalised seizures
- Spikes in one or the other centro temporal areas

- Awake interictal EEG could be normal and sleep EEG would usually show the abnormality

Panayiotopoulos syndrome
- Younger children (peak age 5 yr)
- usually nocturnal and happens in sleep
- Usually starts with vomiting and child initially conscious
- Child continues to vomit repeatedly and becomes unresponsive
- Subsequent deviation of eyes to one side or may end in hemiclonic seizure or (rarely) generalised seizure
- Other autonomic features very common (e.g. dilated pupils, pale skin or flushing, incontinence)
- Usually lasts for a few to 30 min, occasionally for several hours

Common focal epilepsies in children
Temporal lobe epilepsy (TLE)
- Focal seizures with impaired consciousness and complex automatism
- Aura common before seizure, which could be a sense of fear, abnormal abdominal sensation or any other
- Children are very tired and sleepy after episode
- Children with history of prolonged febrile seizure in the early years of life may have mesial temporal sclerosis as a cause of their seizures
- Other known causes: cortical dysplasia, gliomas, dysembryonic neuroectodermal tumour
- Some patients can be a candidate for epilepsy surgery

Frontal lobe epilepsy
- Usually focal motor seizures
- Either tonic or clonic seizures – may have speech arrest and head rotation or complex partial seizures or focal with secondary generalisation
- Multiple brief seizures in the night
- Repeated/multiple brief nocturnal seizures are a characteristic feature of frontal lobe epilepsy
- Ictal EEG can be normal
- Can mimic pseudo seizures

Epileptic encephalopathy
West syndrome

Early diagnosis is important: suspect infantile spasm in an infant presenting with any abnormal movements and request urgent opinion

- Typically present aged 3–7 months with:
- infantile spasms (flexor, extensor or mixed) occurring in clusters, usually on waking
- abnormal EEG (hypsarrhythmia)
- developmental regression/intellectual disability with visual inattention
- Arrange same/next day EEG
- Further investigations include cranial MR scan (preferably as inpatient)
- Treat with high dose of steroids and/or vigabatrin

INVESTIGATIONS

Indications for EEG
- Clinically diagnosed epilepsy
- After an episode of status epilepticus
- Unexplained coma or encephalopathy
- Suspicion of non-convulsive status in children with learning difficulties and epilepsy
- Acquired regression of speech or language function
- Developmental regression suspected to have neurodegenerative condition
- To monitor progress in West's syndrome and non-convulsive status

EEG not indicated
- Funny turns, apnoeic attacks, dizzy spells, strange behaviour
- Non-convulsive episodes [e.g. syncope, reflex anoxic seizures, breath-holding episodes (ECG more appropriate)]
- Febrile seizures

- Single uncomplicated generalised tonic-clonic seizures
- To monitor progress in well-controlled epilepsy
- Before stopping treatment

Indications for MRI of brain
- Focal epilepsy (including TLE) except rolandic seizures
- Epilepsy in children aged <2 yr
- Myoclonic epilepsy
- Intractable seizures
- Loss of previous good control
- Seizures continuing in spite of first line medication
- Associated neurological deficits or appearance of new neurological signs
- Developmental regression in children with epilepsy
- Infantile spasms (West's syndrome)

Other investigations
- Sleep or sleep-deprived EEG useful in all children in whom there is a high clinical suspicion but awake EEG normal
- sleep EEG useful to pick up some focal/generalised epilepsies and sleep-deprived EEG useful in generalised epilepsies in young adults including JME. Perform sleep EEG with melatonin
- Video telemetry useful if diagnostic dilemma, pseudo seizures or before surgery
- Drug levels: phenytoin, phenobarbitone (other anticonvulsants only if concerns about compliance and overdose)
- Biochemistry: glucose, calcium, LFT, lactate, ammonia; metabolic and genetic investigations where suspicion of metabolic disorder (e.g. progressive developmental delay)
- Epileptic encephalopathies, e.g. West's syndrome, need a series of investigations (discuss with paediatrician with special interest/paediatric neurologist)

TREATMENT

General guidelines
- Discuss treatment with consultant before starting
- Start/offer anti-epileptic only if diagnosis certain (≥2 unprovoked seizures)
- Preferably after initial EEG results obtained
- Start with small dose and build up to half maintenance. If seizures continue, increase to full maintenance
- Increase dose stepwise every 2–3 weeks

First line drugs
- See **Table** for choice of anti-epileptic drug
- Carbamazepine: start with 2.5–5 mg/kg/day in 2 divided doses gradually increasing to 20 mg/kg/day (maximum 1.8 g daily)

OR
- Sodium valproate: start with 5–10 mg/kg/day in 2 divided doses gradually increasing to 40 mg/kg/day (maximum 2.5 g daily)
- Avoid polypharmacy; do not add a second medication unless the full or maximum tolerated dose of the first medication has been reached (discuss with a paediatrician with special interest/paediatric neurologist before adding second drug)
- Aim to switch to monotherapy after a period of overlap
- Give liquids as sugar-free preparations
- Make sure you discuss potential adverse effects with parents and document these in notes
- In girls of present and future childbearing potential, discuss possible risk of malformation and neurodevelopmental impairments in an unborn child, particularly with high doses of this anti-epileptic drug (AED) or when using as part of polytherapy
- valporate not to be prescribed to female children/women of child-bearing potential/pregnant women unless alternative treatments not suitable and the terms of the pregnancy prevention programme are met
- discuss risk associated with taking valproate whilst pregnant and document in notes at each clinical review
- If child develops adverse effects, discuss and reduce dose
- Prescribe buccal midazolam or rectal diazepam for use in the community for children who have had a previous episode of prolonged or serial convulsive seizures

Discussion with child and parents

- Provide additional advice regarding safety (e.g. supervision when swimming) and document discussion in notes
- Discuss and prescribe rescue treatment, especially in generalised epilepsy, with training for parents
- Provide written information, including information about national or local epilepsy associations and website for Epilepsy Action (www.epilepsy.org.uk)
- Explain how to gain access to epilepsy specialist nurse
- Allow parents and children to ask questions, especially about sensitive issues such as sudden death
- Discuss possibility of suicidal thoughts associated with some anti-epileptic medication

Table: Drugs of first and adjunctive treatment of seizure types
(See https://www.nice.org.uk/guidance/cg137/chapter/appendix-e-pharmacological-treatment)

Seizure	First-line	Adjunctive
Generalised tonic–clonic	Carbamazepine‡ Lamotrigine Oxcarbazepine Sodium valproate*	Clobazam Lamotrigine Levetiracetam Sodium valproate* Topiramate
Tonic or atonic	Sodium valproate*	Lamotrigine
Absence	Ethosuximide Lamotrigine Sodium valproate*	Ethosuximide Lamotrigine Sodium valproate*
Myoclonic	Levetiracetam Sodium valproate* Topiramate	Levetiracetam Sodium valproate* Topiramate
Focal	Carbamazepine‡ Lamotrigine Levetiracetam Oxcarbazepine Sodium valproate*	Carbamazepine‡ Clobazam Gabapentin Lamotrigine Levetiracetam Oxcarbazepine Sodium valproate* Topiramate
Prolonged/repeated seizures and convulsive status epilepticus in community	Buccal midazolam Rectal diazepam Lorazepam IV	
Convulsive status epilepticus in hospital	Lorazepam IV Diazepam IV Midazolam buccal	Phenobarbital IV Phenytoin
Refractory convulsive status epilepticus	Midazolam† IV Propofol† (not in children) Thiopental sodium†	

* Valproate treatment must not be used in girls and women including in young girls below the age of puberty, unless alternative treatments are not suitable and unless the conditions of the pregnancy prevention programme are met. Valproate must not be used in pregnant women. See also MHRA toolkit to ensure female patients are better informed about the risks of taking valproate during pregnancy www.gov.uk/guidance/valproate-use-by-women-and-girls

† At the time of publication (January 2018), this drug did not have UK marketing authorisation for this indication and/or population (see table 3 for specific details about this drug for this indication and population). Informed consent should be obtained and documented in line with normal standards in emergency care

‡Carbamazepine should be prescribed by brand name to avoid differences in bioavailability between products

Epilepsy in adolescence – additional factors to be considered

- Compliance
- Career choices
- Driving
- Contraception and pregnancy, including pre-pregnancy counselling
- Alcohol and drugs

SUBSEQUENT MANAGEMENT

- Increase dose of anti-epileptic gradually towards full dose or maximum tolerated dose until control good

- If control suboptimal with one drug or unacceptable side effects, start second-line drug

OUTPATIENT MANAGEMENT

- Initial follow-up at 3 months
- Subsequent follow-up/structured review every 3–12 months based on clinical need

FURTHER OPINION/REFERRAL TO SPECIALIST SERVICE OR TERTIARY CENTRE

Refer immediately

- Behavioural or developmental regression
- Epilepsy syndrome cannot be identified

Refer soon

- When ≥1 of the following are present:
- child aged <2 yr
- seizures continuing despite being on AED for 2 yr
- 2 AEDs have been tried and are unsuccessful
- risk of unacceptable side effects of medication
- unilateral structural lesion
- psychological or psychiatric co-morbidity
- diagnostic doubt about seizure type and/or syndrome

Refer

- Refer specific syndromes such as:
- Sturge-Weber syndrome
- Rasmussen's encephalitis
- hypothalamic hamartoma

WITHDRAWAL OF ANTI-EPILEPTIC DRUGS

- Consider when child has been seizure free for 2 yrs
- Discuss risks of recurrence (25–30%), if this occurs, recommence treatment
- Recurrence is very high in some syndromes (e.g. juvenile myoclonic epilepsy, 70–80% usually requires lifelong treatment)
- Postpone withdrawing anti-epileptic medication if important events such as GCSEs are looming
- Gradual withdrawal over 2–3 months usual
- Some drugs (phenobarbital or benzodiazepines) need very slow withdrawal over 6–12 months

EXTRAVASATION INJURIES ● 1/3

BACKGROUND

- Extravasation may be due to:
  - cannula piercing vessel wall
  - distal venous occlusion causing backpressure and increased vascular permeability
    - asses ease of administration of sodium chloride flush and monitor pump infusion pressures regularly to identify problems early
- Centrally placed catheters also cause extravasation. Limiting the IV pump cycle to 1 hr **may** minimise the extent of tissue damage from extravasation providing entry site is observed concurrently
- Degree of tissue damage dependent on:
  - volume of infusate, its pH and osmolality
  - dissociation constant and pharmacological action of drug(s) being infused
- Extravasation of an IV infusion can cause skin necrosis

Wound dressings

- When choosing wound dressing, consider need to prevent:
  - further trauma
  - epidermal water loss
  - contractures by allowing a full range of limb movements
- Dressings must be:
  - easy to apply
  - sterile
  - translucent (to allow easy monitoring of access site)

Most commonly used dressings

- Hydrocolloid 9 (e.g. Duoderm®) or hydrogel (e.g. Intrasite gel, Intrasite conformable)
  - if in doubt, seek advice from tissue viability nurse

ASSESSMENT

Table 1: Grading of extravasation injuries

Grade 1	Grade 2	Grade 3	Grade 4
• IV device flushes with difficulty • Pain at infusion site • No swelling or redness	• Pain at infusion site • Mild swelling • Redness • No skin blanching • Normal distal capillary refill and pulsation	• Pain at infusion site • Marked swelling • Skin blanching • Cool blanched area • Normal distal capillary refill and pulsation	• Pain at infusion site • Very marked swelling • Skin blanching • Cool blanched area • Reduced capillary refill • +/- arterial occlusion • +/- blistering/skin breakdown/necrosis

Investigations

- No specific investigations required. However, if wound appears infected:
  - wound swab
  - FBC
  - CRP
  - blood culture
  - start appropriate antibiotics

EXTRAVASATION INJURIES ● 2/3

ACUTE MANAGEMENT

Table 2

Grade 1 and Grade 2	Grade 3	Grade 4
• Stop infusion immediately • Remove cannula and splints/tapes unless a vesicant/irritant drug being infused then follow advice for **Grade 4** • Elevate limb	• Stop infusion immediately • Remove constricting tapes • Leave cannula *in situ* until review by doctor/ANNP • Withdraw as much of the drug/fluid as possible via the cannula • Mark area with a pen • Consider irrigation of affected area • Elevate limb • Inform tissue viability nurse	• Stop infusion immediately • Remove constricting tapes • Leave cannula *in situ* until review by doctor/ANNP • Withdraw as much of the drug/fluid as possible via the cannula • Mark area with a pen • Photograph lesion – provided no delay in further treatment • Irrigate affected area • Elevate limb • Give analgesia if required • Inform tissue viability nurse/registrar/consultant +/- plastic surgery team • Use cold/hot compress if advised (dependent on drug)

- Most extravasation injuries are of Grades 1 and 2 and do not require extensive intervention (unless vesicant/irritant drug is being administered)
- Grade 3 and 4 injuries have a greater potential for skin necrosis, compartment syndrome and need for future plastic surgery, depending on type of solution extravasated

FURTHER ASSESSMENT

- Following irrigation treatment, review all injuries within 24 hr of extravasation occurring (consider using serial photography to document changes)
- Irrigation of major grades of extravasation has been used to prevent extensive skin loss and need for plastic surgery and skin grafting. However, the evidence for the use of irrigation in preventing long-term injury is limited

Documentation

- Document extent and management of the injury in medical record

FOLLOW-UP AND REVIEW

- Determined by grade of extravasation
- medical staff review minor grades after 24 hr
- plastic surgery staff/tissue viability nurse review Grades 3 and 4 within 24 hr to assess degree of tissue damage and outcome of irrigation procedure if performed

Other considerations

- **Family-centred care** – inform parents of extravasation injury and management plan

Special considerations

- Infection prevention– observe standard infection prevention procedures
- Complete an incident report for Grade 3 and 4 extravasations

IRRIGATION OF EXTRAVASATION INJURIES

Procedure

- Withdraw as much of the drug and or fluid as possible via cannula or catheter
- Infiltrate the site with lidocaine 1% 0.3 mL/kg (maximum 20 mL) before to reduce pain
- Using a scalpel, make 4 small incisions around periphery of extravasated site

- Insert blunt Veress needle, or pink cannula with needle removed, into each incision in turn, and irrigate damaged tissue with hyaluronidase* followed by sodium chloride 0.9%. It should flow freely out of other incisions
- Massage out any excess fluid using gentle manipulation
- Cover with paraffin gauze for 24–48 hr

***Preparation of hyaluronidase**

For infants:

- Reconstitute a 1500 unit vial of hyaluronidase with 3 mL of water for injection
- Use 1–2 mL shared between each incision then irrigate with sodium chloride 0.9%

For children:

- Reconstitute a 1500 unit vial of hyaluronidase with 3mL of water for injection
- Use 3 mL shared between each incision, then irrigate with sodium chloride 0.9%

When irrigating with sodium chloride 0.9%, use discretion depending on child's weight

Documentation

- Person performing procedure must document in child's medical record

FACIAL PALSY ● 1/1

RECOGNITION AND ASSESSMENT

Definition

- Bell's palsy: idiopathic lower motor neurone facial nerve palsy
- Exclude secondary causes of facial nerve palsy due to infection, inflammation, tumour, trauma, vascular event clinically and/or with appropriate investigations

Symptoms and signs

- Asymmetry of face or smile and loss of nasiolabial fold on same side
- demonstrable weakness in lower motor neurone distribution (includes loss of wrinkles on forehead)
- Increased or decreased lacrimation
- Hyperacusis
- Altered taste
- Facial pain
- Difficulty in closing eye

History

- History of prior viral infection may be present
- Abrupt onset with no progression
- No history of preceding seizure or head injury

Examination

- Full neurological examination, including other cranial nerves, and fundoscopy
- Ears, nose and throat to exclude cholesteatoma, mastoiditis or herpes infection
- Blood pressure to exclude hypertension
- Check for lymphadenopathy, hepatosplenomegaly, pallor or bruising to exclude malignancy

INVESTIGATIONS

- If all history/examination unremarkable and no other neurological signs/symptoms, no investigations needed
- If difficulty in closing eye, ophthalmology referral
- Bilateral facial palsy – consider Lyme disease, Guillain-Barré syndrome, brain stem pathology: discuss further investigations with consultant with special interest in neurology or tertiary paediatric neurologist
- Recurrent facial palsy: discuss with senior
- Recurrent infections: first line immune deficiency investigations (including HIV)
- Severe pain associated with varicella zoster

IMMEDIATE TREATMENT

- If difficulty in closing eye, provide eye patch and carbomer ointment
- If no other signs, no other treatment necessary
- If vesicles suggest HSV, prescribe aciclovir oral
- Within 72 hr prednisolone 1 mg/kg/day (maximum 60 mg) for 5–7 days. Can be given as per adult practice (discuss with senior)

DISHCHARGE AND FOLLOW-UP

- 4 weekly GP follow-up until symptoms and signs resolved (95% by 1 yr)
- If facial palsy does not improve considerably within 4 weeks arrange cranial imaging – MRI brain with request to focus on brain stem
- If any other neurological signs/symptoms consider early/immediate imaging

FALTERING GROWTH ● 1/3

Always follow your local safeguarding policies and procedures.
The safety of children is everyone's responsibility

RECOGNITION AND ASSESSMENT

- An infant or older child who fails to gain weight as expected without an apparent cause
- Growth below the 2nd percentile or a change in growth that has crossed downwards 2 major growth percentiles in a short time (approximately 4 months, or longer period in older child)
- Associated features include:
- developmental delay
- apathy
- misery

Symptoms and signs

- Gastrointestinal problems
- vomiting
- voracious appetite
- anorexia
- diarrhoea
- Full physical examination
- dysmorphic features
- heart murmurs
- abdominal distension
- wasting
- bruising
- examine mouth for cleft palate

Patient and family history

Child

- Take a full feeding history
- type of milk given (breast milk, formula milk, cow's milk)
- volume given at each feed
- frequency of feeding
- method of making up feeds (correct strength)
- introduction of solids: age and type of solid
- any difficulty with feeding process (e.g. breathless, uncomfortable)
- Perform direct observation of child at mealtimes:
- oral, motor, co-ordination, behaviour (e.g. crying, tantrums), appetite, family interaction

Family

- Family history of siblings/children with unexplained growth faltering or early onset diarrhoea
- Ask about socio-emotional factors
- family composition (other children, age?)
- ask parental ages, health, educational status
  - was either parent in care during childhood?
  - do parents have a history of psychiatric illness or depression (including post-natal depression) or have a learning disability?
  - parents with inadequate social or problem solving skills?
- has the family any support network (e.g. grandparents)?
- social isolation?
- is there a lack of money in the home or unemployment?
- other sources of stress (e.g. divorce)?
- substance abuse?
- domestic violence?

Measurements

- Measurements must be checked if there is doubt
- Record birth weight and gestation
- some 'light-for-dates' infants fail to catch up, and grow parallel but below the 2nd percentile
- Measure and plot
- weight (unclothed)

- head circumference
- length or height
- body mass index and plot on chart (useful if height or weight below 0.4th centile)
- Infant may be a small, normal child growing below but parallel to the 2nd percentile
- parents are often also small
- record height of parents and grandparents
- calculating midparental height, height velocity can be helpful – see **Fact sheet: UK 2–18 years Growth Chart** available at: www.rcpch.ac.uk/child-health/research-projects/uk-who-growth-charts/uk-growth-chart-resources-2-18-years/school-age%232-18
- review 'Red Book' growth charts for more information
- pubertal staging is helpful for teenagers

Single set of measurements of limited value and does not justify complex investigations. Serial measurements of more value and should be plotted on percentile charts

Investigations

First-line tests (as indicated) where cause of poor growth is not obvious

- Blood gas
- Faeces: culture and sensitivity, microscopy for ova, cysts and parasites (if diarrhoea)
- Urinalysis for protein, nitrites and blood
- Hb, blood film (for signs of iron deficiency), WBC and ESR
- Biochemical profile including U&E, liver and bone profile, CRP, B_{12}, folate, ferritin, thyroid function, creatinine, bicarbonate, calcium and albumin
- Coeliac screen (anti-tTG and IgA) – only useful if having gluten in diet, i.e. after weaning commenced

Further tests

- If underlying pathology indicated by history, clinical examination or results of routine investigations, request further tests, such as:
- CXR
- bone age (X-ray of non-dominant hand and wrist)
- if head size is increasing, ultrasound of head before aged 6 months
- Vitamin A, D, E, trace metals, faecal elastase
- sweat test/cystic fibrosis (CF) gene
- Further gastrointestinal investigation or management of malabsorption disorders should be undertaken by referral to specialist gastroenterology team as appropriate:
- endoscopy
- gastrointestinal imaging
- genetic testing appropriate to clinical features, e.g. Di George and Turners syndromes

Differential diagnosis

- Low genetic growth potential:
- familial
- 'light-for-dates' baby
- genetic syndrome
- Social factors:
- maternal depression
- poor parenting skills
- abuse
- Malabsorption:
- pancreatic insufficiency: CF, Swachman-Diamond syndrome
- enteropathy: coeliac, cow's milk protein allergy
- inflammatory bowel disease (IBD)
- infective: Giardia, bacterial overgrowth
- others (rarer): abetalipoproteinaemia, lymphangiectasia
- Vomiting/severe regurgitation
- Any chronic underlying disorder:
- renal failure
- liver disease
- congenital heart disease
- severe asthma

- immunodeficiency
- other rare conditions e.g. endocrine, chromosomal or metabolic conditions if dysmorphic features present

MANAGEMENT

- Most patients can be managed as an outpatient
- record height and weight at each visit
- seek dietitian opinion
- if treatable cause identified, treat
- If social problems responsible, consider:
- admission to ward to demonstrate good weight gain out of home environment
- significant weight gain after admission (>180 g/week in infant) supports parenting issues as cause
- health visitor support
- social work support
- child psychology consultation, referral and/or intervention (evaluation of: child's cognitive development, food refusal etc; parents' perception of the child; family/child disturbances of affect expression and family dynamics)
- day care and nursery provision
- case conference
- care proceedings

FEBRILE ILLNESS • 1/4

ASSESSMENT AND INITIAL MANAGEMENT

- Fever, in a child aged <5 yr, usually indicates underlying infection
  - infants aged <3 months, low temperature could indicate infection
  - consider vaccination induced fever in infants aged <3 months
- **Parental perceptions of fever are usually accurate and must be taken seriously**

IDENTIFYING RISK OF SERIOUS ILLNESS

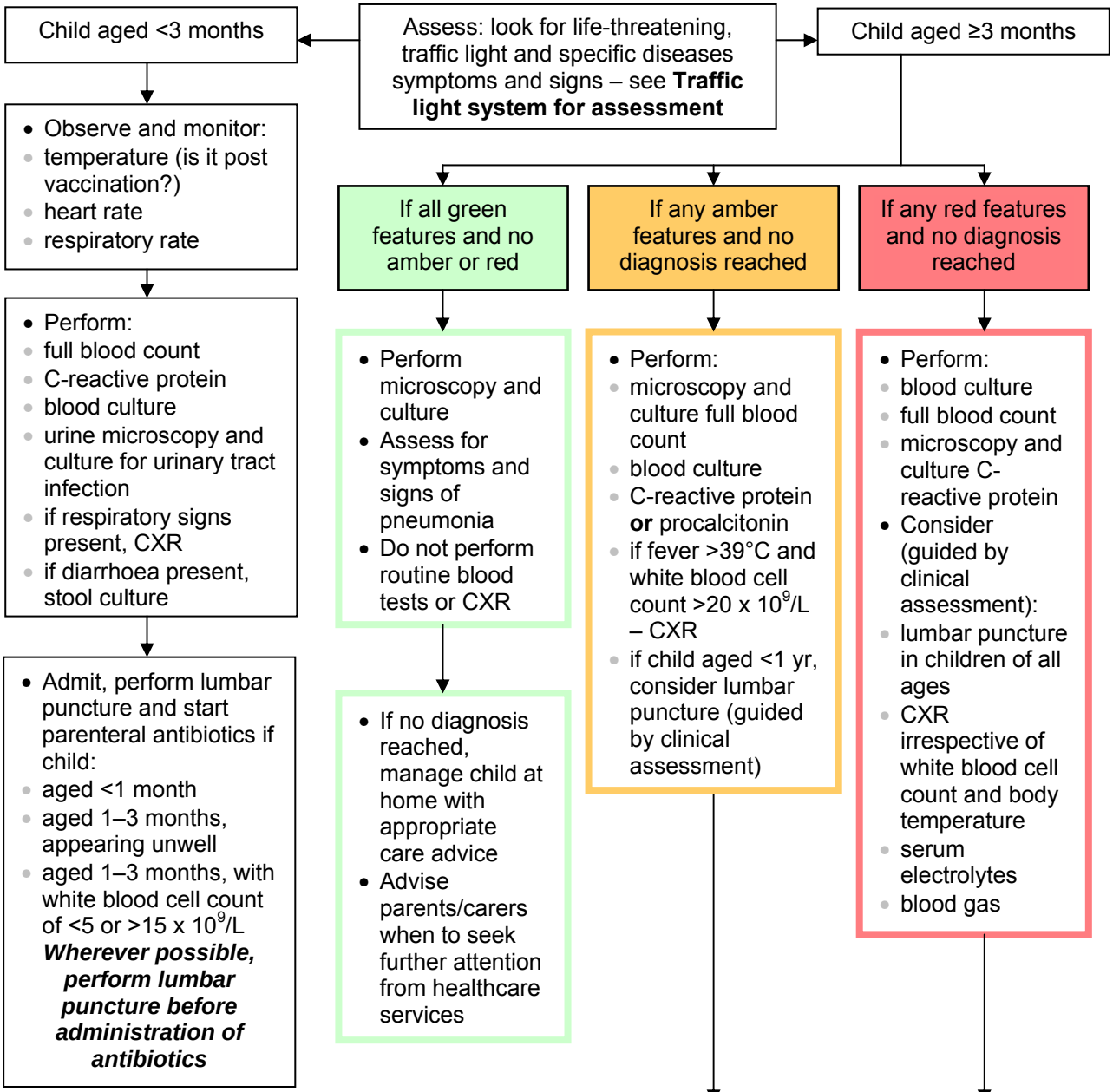
Three stages of clinical assessment

1. Identify life-threatening features [utilising Airway, Breathing, Circulation (hydration) and Disability assessment]
2. Assess risk of serious illness (see **Traffic light system for assessment**) – can be used with Paediatric Early Warning Score (PEWS)
3. Attempt to identify source of infection/features of specific serious conditions. If child has a learning disability, take this into account when interpreting the traffic light system

Traffic light system for assessment

<table>
<tr><th></th><th>Low risk</th><th>Intermediate risk</th><th>High risk</th></tr>
<tr><td>Colour</td><td>• Skin, lips and tongue normal</td><td>• Pallor reported by carer</td><td>• Pale, mottled, ashen or blue</td></tr>
<tr><td>Activity</td><td>• Responds to normal social cues
• Content/smiles
• Stays awake/ wakes quickly
• Strong normal cry/settled/smiles</td><td>• Not responding normally to social cues
• Wakes only with prolonged stimulation
• Decreased activity
• No smile</td><td>• No response to social cues
• Looks ill
• Unrousable/doesn’t stay awake after rousing
• Weak, high pitched or continuous cry</td></tr>
<tr><td>Breathing</td><td>• Normal</td><td>• Nasal flare
• Tachypnoea
  ◦ respiratory rate ≥50/min (aged <1 yr)
  ◦ respiratory rate ≥40/min (aged >1 yr)
• SpO_2 ≤95%
• Crackles on auscultation</td><td>• Grunting/nasal flare
• Tachypnoea
  ◦ respiratory rate >60/min (any age)
• Chest wall recession (moderate/severe)</td></tr>
<tr><td>Circulation and hydration</td><td>• Normal skin and eyes
• Moist mucous membranes</td><td>• Dry mucous membranes
• Poor feeding (infants)
<table><tr><th>Age</th><th>Heart rate (bpm)</th></tr><tr><td><1 yr</td><td>>160</td></tr><tr><td>1–2 yr</td><td>>150</td></tr><tr><td>2–5 yr</td><td>>140</td></tr></table>• CRT ≥3 sec
• Reduced urine output</td><td>• Reduced skin turgor</td></tr>
<tr><td>Other</td><td>• No amber/red features</td><td>• Temperature ≥39°C (aged 3–6 months)
• Rigors
• Fever ≥5 days
• New lump >2 cm diameter
• Swelling of joint/limb
• Not using a limb/weight bearing</td><td>• Temperature ≥38°C (aged <3 months)
• Non-blanching rash
• Bulging fontanelle
• Neck stiffness
• Status epilepticus
• Focal neurological signs
• Focal seizures
• Bilious vomiting</td></tr>
</table>

FEBRILE ILLNESS ● 2/4



Observations

- Measure and record in **all** febrile children:
  - temperature
    - aged <4 weeks: electronic thermometer in the axilla
    - aged >4 weeks: infrared tympanic or electronic thermometer in the axilla
  - respiratory rate, heart rate, capillary refill time
  - signs of dehydration: skin turgor, respiratory pattern, weak pulse, cool extremities
  - travel history
- Re-assess all children with amber or red features within 1–2 hr

IMMEDIATE TREATMENT

Antipyretic treatment

- Tepid sponging not recommended
- Dress child normally
- If child appears distressed or unwell, give **either** paracetamol or ibuprofen
- do not routinely administer both drugs at the same time with the sole aim of reducing fever or preventing febrile seizures
- Alternate if distress persists or recurs before next dose due

Antibiotics

- Do not prescribe oral antibiotics to children with fever without apparent source
- if aged >3 months consider admission and observation with/without investigations

Signs of shock

- Increased respiratory and heart rate, cold peripheries, prolonged CRT, pallor/mottled, drowsy/agitated/confused
- Give immediate IV fluid bolus of sodium chloride 0.9% 20 mL/kg. Give additional boluses as necessary
- If signs of shock, SpO_2 <92% or clinically indicated, prescribe oxygen
- Urgent senior support: discuss with PICU
- See **Sepsis (including meningococcal)** guideline

SUBSEQUENT MANAGEMENT

- Serious bacterial infection suspected:
- shock
- unrousable
- meningococcal disease
- aged <1 month
- aged 1–3 months with a white blood cell count <5 or >15 x 10^9/L
- aged 1–3 months appearing unwell
- Cefotaxime 50 mg/kg slow IV bolus 6-hrly (see **BNFc** for neonatal doses)
- When patient is stable change to once daily ceftriaxone:
- see contraindications (hyperbilirubinaemia etc.) in **BNFc**
- RSV/flu: assess for serious illness/UTI
- If rates of antibacterial resistance significant, refer to local policy
- See **Sepsis (including meningococcal)** and **Meningitis** guidelines

Symptoms and signs of specific diseases

Meningococcal disease

- Non-blanching rash with ≥1 of the following:
- ill-looking child
- lesions >2 mm in diameter (purpura)
- CRT ≥3 sec
- neck stiffness

Meningitis

- Neck stiffness
- Bulging fontanelle
- Decreased level of consciousness
- Convulsive status epilepticus

Herpes simplex encephalitis

- Focal neurological signs
- Focal seizures
- Decreased level of consciousness

Pneumonia

- Tachypnoea, measured as:
- aged <1 yr: respiratory rate ≥50 breaths/min
- aged >1 yr: respiratory rate >40 breaths/min
- Crackles in the chest

- Nasal flaring
- Chest indrawing
- Cyanosis
- SpO_2 ≤95%

Urinary tract infection

- Vomiting (in children aged >3 months)
- Poor feeding
- Lethargy
- Irritability
- Abdominal pain or tenderness
- Urinary frequency or dysuria
- Offensive urine or haematuria

Septic arthritis/osteomyelitis

- Swelling of a limb or joint
- Not using an extremity
- Non weight bearing

Kawasaki disease

- Fever lasting >5 days and ≥4 of the following:
- bilateral conjunctival injection
- change in upper respiratory tract mucous membranes (e.g. injected pharynx, dry cracked lips or strawberry tongue)
- change in peripheral extremities (e.g. oedema, erythema or desquamation)
- polymorphous rash
- cervical lymphadenopathy

FEBRILE NEUTROPENIA ● 1/3

Frequent clinical re-assessment of patients is a vital part of effective management of febrile neutropenia in children

RECOGNITION AND ASSESSMENT

Definition

- Temperature ≥38°C at any time
- Neutrophils ≤0.5 × 10^9 cells/L

IMMEDIATE TREATMENT

See **Figure 1** (see **BNFc** for dose reduction in renal impairment)

ALL PATIENTS – with central venous access

- Culture both lumens/port-a-cath. Take FBC, group and save, U&E, lactate (blood gas), LFTs, CRP. If septic also do a coagulation screen (PT and fibrinogen)
- Urinalysis in all children
- CXR only if respiratory signs i.e. increased respiratory rate, auscultatory signs
- Respiratory viral screen if coryzal and/or cough (nasal or throat)
- **Do not wait for results, administer antibiotics**
- 'Door to needle time' must be within 1 hr
- Follow individual trust antibiotic policy or individual patient plan if resistant organisms

No haemodynamic compromise and NOT on chemotherapy block containing IV methotrexate

- Start piperacillin with tazobactam (Tazocin®) 90 mg/kg 6-hrly (maximum single dose 4.5 g) administered over 30 min

No haemodynamic compromise and on chemotherapy block containing IV methotrexate or penicillin allergic or previous Tazocin® resistant gram negative infection

- Use meropenem 20 mg/kg 8-hrly over 5 min (maximum single dose 1 g)
- If previous documented MRSA infection, **add** either teicoplanin 10 mg/kg 12-hrly for 3 doses, then 10 mg/kg once daily, **OR** vancomycin 15 mg/kg 8-hrly given over at least 60 min, maximum 10 mg/min for doses above 600 mg (maximum initial single dose 700 mg until levels available). Target trough level 10–15 mg/L
- Pre-dose vancomycin level before 3rd dose, and no post-dose sample required
- Adjust dose as follows dependent on pre-dose concentration (mg/L):
- <10: give 6-hrly and recheck level before dose 4 or 5
- 10–15: continue current dose and recheck level in 3–5 days
- 15–20: reduce dose by 10–20% and recheck level before dose 4 or 5 (unless higher levels advised by microbiology)
- >20 and <25: extend interval to 12-hrly. Recheck level at 12 hr and give dose without waiting for result
- >25: stop vancomycin and recheck level after 24 hr to see if therapy can be restarted and to determine interval

Haemodynamic compromise

- Check A, B, C and initiate appropriate resuscitation
- Give sodium chloride 0.9% 20 mL/kg bolus
- Start meropenem 20 mg/kg 8-hrly over 5 min
- Closely monitor urine output; may require HDU/PICU care

LOW RISK PATIENTS

- **No** central access **and**
- Neutrophils >0.5 x 10^9 cells/L **and**
- Clinically well
- discuss with oncology team/on-call consultant regarding discharge on oral antibiotics

SUBSEQUENT TREATMENT

- Reassess at 24 hr and chase blood cultures
- **Positive cultures:** discuss patients with positive blood cultures with microbiologist or paediatric oncology team for advice on appropriate treatment. Where blood cultures positive for yeast in presence of suspected line infection, remove lines promptly
- Give culture-positive patients at least 7 days treatment intravenously

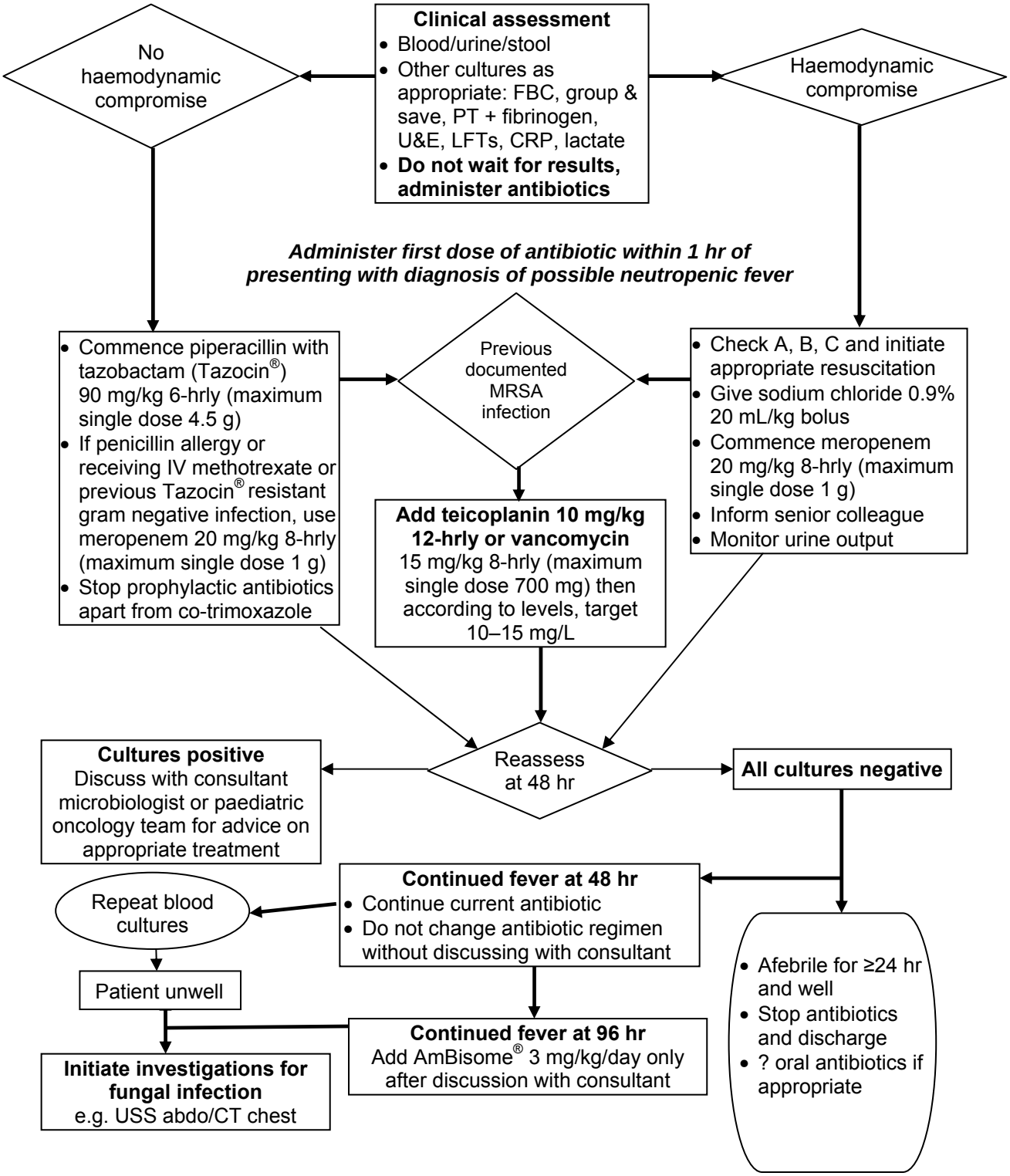
FEBRILE NEUTROPENIA ● 2/3

- **Negative cultures:** do not switch initial empiric antibiotics in patients with unresponsive fever unless there is clinical deterioration or a microbiological indication
- If febrile after 48 hr:
- repeat blood cultures and discuss with on-call consultant/paediatric oncology team
- If febrile after 96 hr or clinically unstable between 48 and 96 hr:
- initiate investigations for fungal infection e.g. US abdo/CXR/CT chest
  - repeat blood cultures
  - add **liposomal amphotericin** (AmBisome®) **3 mg/kg/day** over 30–60 min, give test dose 100 microgram/kg (maximum 1 mg) over 10 min
  - if profoundly neutropenic and after discussion with oncology team consider G-CSF 5 microgram/kg SC once daily

When to discharge

- If clinically well and afebrile for ≥24 hr, and no growth in blood cultures after 48 hr:
- stop antibiotics
- no need for routine inpatient observation after stopping antibiotics

Figure 1: Management of fever in neutropenic/immunocompromised child



FEVER IN THE RETURNING TRAVELLER ● 1/4

Most patients presenting have a mild, self-limiting or easily treatable febrile illness BUT it is important to consider potentially serious imported infections

When to suspect tropical illness

- Fever >37.5°C
- History of travel to tropics/sub-tropics in previous 12 months

POSSIBLE INFECTIONS

Sub-Saharan Africa	• Malaria • Schistosomiasis • Amoebiasis • Rickettsioses • Meningococcal disease • Viral haemorrhagic fever
Asia	• Malaria • Dengue fever • Typhoid fever • Chikungunya • Emerging viral infections
Middle East	• Brucellosis • Leishmaniasis
South America/Caribbean	• Dengue fever • Coccidioidomycosis
North America	• Rocky Mountain spotted fever
Australia	• Q fever
Mainland Europe	• Tick-borne encephalitis

Incubation period

• Malaria • Dengue fever • Rickettsial infection • Leptospirosis • Enteric fevers • Diarrhoeal illness • Viral respiratory infection • Yellow fever • Meningococcal and pneumococcal sepsis meningitis	• Malaria • Enteric fever • Hepatitis A and E • Acute schistosomiasis • Leptospirosis • Amoebic liver abscess • Infectious mononucleosis • Toxoplasmosis	• Malaria • TB • Hepatitis B • Visceral leishmaniasis • Schistosomiasis • Amoebic liver abscess • Brucellosis • Visceral larva migrans

FEBRILE SYNDROMES

Fever and hepatitis

- Hepatitis A, B and E
- Leptospirosis
- Infectious mononucleosis
- Amoebiasis

Fever and eosinophilia

- Schistosomiasis
- Ascariasis
- Strongyloidiasis

Fever and lymphadenopathies

- Toxoplasmosis
- EBV
- CMV

- HIV
- Brucellosis

Fever and arthropathies
- Chikungunya virus
- Dengue fever
- Pyogenic septic arthritis
- Acute rheumatic fever
- Human parvovirus B19

Fever and diarrhoea
- Shigellosis
- Salmonellosis
- Amoebiasis
- Campylobacter
- Clostridium difficile
- *E.coli* infection
- Rotavirus

Chronic relapsing and recurrent fever
- Malaria
- Relapsing fever
- Enteric fever
- Brucellosis
- Q fever
- Leptospirosis
- Familial Mediterranean fever

Fever and haemorrhagic manifestations
- Dengue fever
- Yellow fever
- Lassa fever
- Rift Valley fever
- Viral haemorrhagic fevers
- Meningococcal disease

Fever and exanthema
- Maculopapular
  - dengue fever
  - chikungunya
  - measles
  - rubella
  - enterovirus
  - yellow fever
  - rickettsial
- Petechial/purpura
  - *N. meningitides*
  - rickettsial
- Erythema multiforme
  - drug reactions
- Vesicular
  - chicken pox
  - rickettsial infections
  - herpetic
- Erythema nodosum
  - TB

Fever and central nervous system disease
- Meningitis
- Enterovirus
- Malaria

- Arboviral meningoencephalitis
- Rabies
- Japanese encephalitis virus
- West Nile virus
- TB

Fever and abdominal pain
- Enteric fevers (typhoid and paratyphoid)
- Adenovirus
- Liver abscess

Fever, respiratory symptoms and pneumonia
- Pneumococcal
- Influenza
- RSV
- TB
- Histoplasmosis
- Adenovirus
- Legionellosis
- Q fever
- Diphtheria
- Anthrax

COMMONEST CAUSES OF FEVER IN RETURNING TRAVELLERS
- Diarrhoeal illness
- Malaria
- Dengue
- Enteric fever
- Respiratory infections

TRAVEL HISTORY
- Location and duration of travel
- Reason for travel
- Sources of food and water
- Activities undertaken whilst travelling
- History of insect bites
- Recommended vaccinations received before travelling
- Recommended malaria prophylaxis received and course adherence
- Any illness while abroad and treatment used while travelling (especially antibiotics)

INVESTIGATIONS
- FBC, U&E, LFTs, CRP, ESR and coagulation
- Blood film
- Rapid diagnostic test; has high specificity and sensitivity but gives no information on level of parasitaemia in malaria
  - perform if travel to malaria region within previous 12 months, even if prophylaxis taken
  - repeat 3 films 12 hr apart
- Urine microscopy and culture
- Stool microscopy and culture
- Blood culture (important for typhoid fever)
- CXR (pneumonia/TB)

ADDITIONAL INVESTIGATIONS
- If LFTs deranged, hepatitis serology
- PCR for Dengue virus
- Sputum sample for TB
- HIV antibody
- Serum save
- EDTA save for PCR
- LP

TREATMENT

- Seriously ill child – manage according to APLS principles, broad spectrum antibiotics and early discussion with ID team
- Malaria (see **Malaria** guideline)
- Discuss with local microbiology team and paediatric ID team

INFECTION CONTROL

- Initially manage febrile returning travellers in a side room (specific suspected/confirmed infections may then require more/less intensive infection control measures)
- Inform laboratory personnel of certain suspected infections
- Consider whether notifiable disease (see **Notifiable infectious diseases and food poisoning** guideline)

REMEMBER

- Most patients presenting with fever in the returning traveller have a mild, self-limiting or easily treatable febrile illness commonly seen in the UK
- Consider disease outbreaks and emerging viral infections
- Consider important non-infectious causes of fever and systemic illness e.g. Kawasaki disease, juvenile idiopathic arthritis, SLE, leukaemia, lymphoma, haemophagocytic lymphohistiocytosis (see **Fever of unknown origin** and **Febrile illness** guidelines)

FEVER OF UNKNOWN ORIGIN ● 1/3

RECOGNITION AND ASSESSMENT

Fever

- Type of thermometer used, site, user (factitious)
- Duration, height
- Pattern:
- intermittent [pyogenic, TB, lymphoma, juvenile idiopathic arthritis (JIA)]
- baseline raised (viral, endocarditis, lymphoma)
- sustained (typhoid)
- days between (malaria, lymphoma)
- weeks between (metabolic, CNS, cyclic neutropenia, hyper-IgD)
- Circumstances when fever (e.g. exercise)
- Appearance
- when fever: well (factitious)
- between fever: ill (serious)
- Response to paracetamol and or NSAID (no response: dysautonomia)

Symptoms

- Red eyes (Kawasaki)
- Nasal discharge (sinusitis)
- Recurrent pharyngitis with ulcers (periodic fever)
- GI: salmonella, intra-abdominal abscess, inflammatory bowel disease (IBD)
- Limb pain (leukaemia, osteomyelitis)

Contact

- Human illness
- Animals

Travel

- Years ago (histoplasmosis)
- Part of country
- Prophylaxis and immunisations
- Contaminated water/food
- Bites (tick: arbovirus, malaria)
- Meat: undercooked (brucella, toxoplasma, hepatitis)
- Pica (visceral larva migrans, toxoplasmosis)

Medical history

- Operations

Drug history

- All, including any non-prescription

Ethnic group

- Sephardic Jew, Armenian, Turkish, Arab (Familial Mediterranean Fever)
- Ashkenazi Jew (familial dysautonomia)

Examination

- Sinuses
- Lymph nodes
- Chest: murmur, crackles
- Abdominal: hepato/spleno-megaly (salmonella, cat scratch, endocarditis, malaria)
- Genito-urinary: girls – pelvic tenderness (child sex abuse – STI)

Skin

- Rash only during fever (JIA)
- No sweat (familial dysautonomia)
- Petechiae (endocarditis, rickettsia)
- Papules (cat scratch)
- Eschar (tularaemia)
- Erythema migrans (Lyme)

- Malar (SLE)
- Palpable purpura [polyarteritisnodosa (PAN)]
- Erythema nodosum (JIA, SLE, malignancy, IBD, TB)
- Seborrheic (histiocytosis)
- Sparse hair (ectodermal dysplasia)
- Scars (dysautonomia)

Eyes
- Conjunctivitis:
- palpebral (infectious mononucleosis)
- bulbar (Kawasaki)
- phlyctenular (TB)
- Retinopathy (PAN, miliary TB, toxoplasmosis, vasculitis)
- Pupil dilation (hypothalamic or autonomic dysfunction)

Oropharynx
- Red, no exudates (EBV)
- Stomatitis, pharyngitis, adenitis (PFAPA)
- Dental abscess
- Conical teeth (ectodermal dysplasia)
- Smooth tongue (dysautonomia)
- Gum hypertrophy, tooth loss (leukaemia, histiocytosis)

Musculoskeletal
- Tender:
- bone (osteomyelitis, malignancy)
- muscle (trichinella, arbovirus, dermatomyositis, PAN)
- Trapezius (subdiaphragmatic abscess)
- Reflexes
- brisk (hyperthyroid)
- absent (dysautonomia)

Investigations

Initial
- FBC:
- low Hb (malaria, endocarditis, IBD, SLE, TB)
- high platelets (Kawasaki)
- blasts (leukaemia)
- eosinophils (fungal, parasites, neoplastic, allergic, immune deficiency)
- ESR/CRP: normal (factitious, dysautonomia, drug fever)
- LFTs: abnormal (EBV, CMV)
- Blood cultures: several times (endocarditis)
- Urine: pyuria (Kawasaki, intra-abdominal infection, GU, TB)
- Stool culture
- Throat swab
- CXR

Secondary
- IgG, IgA, IgM
- Serology: EBV, CMV, HIV
- Anti-nuclear antibodies
- Sinus CT
- Abdominal ultrasound
- Whole body MRI

Selective
- Echocardiogram
- Bone marrow with culture (leukaemia, histiocytic-haemophagocytosis, TB)
- Serology (syphilis, brucella, toxoplasma)
- Auto-antibodies (rheumatoid arthritis, SLE)

- IgE (allergy, eosinophilia)
- IgD (periodic fever)
- Gastric aspirate, (induced) sputum (TB)
- Ophthalmologist (uveitis, leukaemia)
- Biopsy (lymph node, liver)

Imaging (as indicated)
- CT/MR chest/abdo (IBD, abscess, lymphadenopathy)
- White cell scan (abscess)
- Bone scan (osteomyelitis)
- PET scan (abscess)

EMPIRICAL TREATMENT
- Critically ill: see **Sepsis (including meningococcal)** guideline
- TB treatment: discuss with TB team
- Otherwise avoid antibiotics until organism isolated

REFERRAL
- Rheumatology (JIA, connective tissue disorder)
- Gastroenterology (IBD)
- Cardiology (endocarditis/Kawasaki)

GASTRO-OESOPHAGEAL REFLUX ● 1/3

RECOGNITION AND ASSESSMENT

Definition

- Gastro-oesophageal reflux (GOR)
  - passive physiological passage of gastric contents into oesophagus
- Gastro-oesophageal reflux disease (GORD): GOR causing symptoms needing treatment or leading to complications
- Vomiting/emesis: active retrograde passage of gastric contents associated with retching, pallor and sweating

It is very important to distinguish between vomiting and GOR

Key points in history

Infants

- Preterm/term
- Breast/bottle feeds
- Volume and number of feeds – overfeeding
- Vomiting
  - volume expelled
  - vomiting versus posseting
  - colour of posset/vomit
    - white
    - bile stained
    - blood
  - projectile/non-projectile
- Choking/gagging whilst feeding
- Excessive crying/unsettled after feeds
- Faltering growth
- Associated diarrhoea/constipation
- Blood in stools
- Family history of atopy
- Chronic cough/recurrent chest infections/pneumonia
- Sandifer's syndrome: episodic torticollis with neck extension and rotation
- Neurodisability

Older children

- Abdominal pain, heartburn, epigastric pain
- Halitosis
- Dental enamel problems
- Hoarseness
- School absenteeism

Examination

- Hydration
- Perfusion
- Abdomen – masses/tenderness
- Hernial sites
- Growth
- Document episode personally
- Parental mobile phone recording

Red flags

- Projectile vomiting: pyloric stenosis, raised intracranial pressure
- Bilious vomiting: intestinal obstruction
- Abdominal distension/tenderness/palpable mass: intestinal obstruction, constipation
- Haematemesis: gastritis, oesophagitis
- Dysphagia
- Late onset >6 months or persistent after aged 1 yr, consider UTI
- Blood in stools: infection, cow's milk protein allergy (CMPA), surgical cause
- Fever: UTI, meningitis, encephalitis, pneumonia
- Dysuria: UTI

- Bulging fontanelle: raised intracranial pressure
- Rapidly increasing head circumference: raised intracranial pressure
- Persistent/early morning headaches: intracranial pathology
- Altered sensorium/irritability: meningitis, encephalitis
- Family history of atopy: CMPA

ADVICE TO PARENTS

- GOR is physiological and common (40%)
- Usually begins aged <8 weeks
- 90% of infants improve by aged 1 yr
- Majority need reassurance, no investigations and treatment
- Inform about red flags

HIGH RISK GROUP

- Preterm
- Neurodisability
- Family history
- Obesity
- Hiatus hernia
- Operated congenital diaphragmatic hernia
- Operated oesophageal atresia

REFER FOR SPECIALIST OPINION

- Red flags
- Unexplained feeding difficulties
- Unexplained distressed behaviour
- Persistent faltering growth
- Feeding aversion with regurgitation
- No improvement after aged 1 yr
- Chronic cough with overt regurgitation
- Second episode of pneumonia with overt regurgitation
- Sandifer's syndrome
- Recurrent otitis media
- Dental enamel defects in a child with neurodisability

NON-PHARMACOLOGICAL TREATMENT

- Review feeding history
- Reduce feed volume if excessive for current weight
- Small and frequent feeds
- Slightly propped position whilst feeding
  - do not use positional management to treat GOR in sleeping infants
- Trial of thickened formula
  - rice starch
  - corn starch
  - Thick & Easy™
  - Carobel
  - Nutilis®
- Family history of atopy
  - trial of extensively hydrolysed formula for 4 weeks
- Obese patient
  - weight management
  - healthy lifestyle choices

PHARMACOLOGICAL TREATMENT

- Treat symptoms
- Does not reduce number of reflux episodes:
  - trial of alginate (Gaviscon®/Gaviscon® Infant) therapy for 2 weeks
  - H_2-receptor antagonists (ranitidine) – easy to administer for 4 weeks

- proton pump inhibitors (PPIs) for 4 weeks
  - omeprazole
  - lansoprazole
  - esomeprazole
- Refer if no response to treatment or recurrence on stopping treatment
- Domperidone
- see **Medicines and Healthcare products Regulatory Agency (MHRA)** guidelines on use of domperidone

INVESTIGATIONS

- Requested by specialist
- 24 hr pH study – detects acid reflux episodes
- 24 hr pH and impedance study – detects both acid and non-acid reflux episodes
- upper gastrointestinal contrast study or barium swallow – detects anatomical defects, hiatus hernia, malrotation and pre-surgery
- flexible upper gastrointestinal endoscopy and biopsies – inflammation

SURGICAL TREATMENT

- Refractory patients
- fundoplication – laproscopic/Nissen
- surgical jejunostomy

GLASGOW COMA SCORE ● 1/1

RESPONSE AGED ≥4 YR

Eye opening	Score
Spontaneously	4
To verbal stimuli	3
To pain	2
No response to pain	1

Best motor response	Score
Obeys verbal commands	6
Localises pain	5
Withdraws from pain	4
Abnormal flexion to pain (decorticate)	3
Abnormal extension to pain (decerebrate)	2
No response to pain	1

Best verbal response	Score
Orientated and converses	5
Disorientated and converses	4
Inappropriate words	3
Incomprehensible sounds	2
No response to pain	1

RESPONSE AGED <4 YR

Eye opening	Score
Spontaneously	4
To verbal stimuli	3
To pain	2
No response to pain	1

Best motor response	Score
Obeys commands or spontaneous	6
Localises pain or withdraws to touch	5
Withdraws from pain	4
Abnormal flexion to pain (decorticate)	3
Abnormal extension to pain (decerebrate)	2
No response to pain	1

Best verbal response	Score
Alert; babbles, coos, words to usual ability	5
Less than usual words, spontaneous irritable cry	4
Cries only to pain	3
Moans to pain	2
No response to pain	1

GLOMERULONEPHRITIS ● 1/2

RECOGNITION AND ASSESSMENT

Definition

- Acute inflammatory process affecting the glomeruli leading to haematuria, proteinuria, oedema, hypertension and renal insufficiency

Symptoms and signs

- Macroscopic haematuria, coca-cola coloured urine
- History of sore throat in preceding 2–3 weeks
- Reduced urine output/oliguria (urine output: infant/child <1 mL/kg/hr)
- Hypertension +/- features of encephalopathy (headache, nausea, vomiting, visual disturbance, restlessness, confusion)
- Oedema variable, periorbital/pedal
- check weight – trend is useful
- check jugular venous pressure (JVP), if raised, indicates volume overload
- Headache/breathlessness, (could be indicative of pulmonary oedema)
- Signs of cardiac failure (tachypnoea, raised JVP, gallop rhythm, basal crackles, enlarged liver)

Investigations

Urine

- Urine dipstick (usually >3 + blood with proteinuria)
- early morning urine protein creatinine ratio (UPCR)
- Urine microscopy (haematuria, red cell and granular casts)

Biochemistry

- U&E, Ca, phosphate, LFTs, blood gas
- low sodium is likely to be dilutional, albumin usually normal/low normal

Haematology

- FBC (low Hb usually dilutional)
- Blood film if haemolytic uraemic syndrome suspected
- Coagulation screen

Microbiology

- Antistreptolysin O titres (ASOT) and Anti-DNase B
- Throat swab for Group A streptococcus

Immunology

- First line: C3, C4, anti-nuclear antibodies (ANA) and IgA
- Second line: dsDNA, ENA, ANCA, anti-GBM (discuss with nephrologist)

Imaging

- Renal ultrasound scan

Differential diagnosis

- Sequelae of other bacterial/viral infections
- Chronic renal failure with acute exacerbation
- IgA nephritis, Henoch-Schönlein purpura (HSP)
- IgA nephropathy
- Mesangiocapillary glomerulonephritis
- Alport hereditary nephritis
- ANCA positive vasculitis
- Anti-GBM disease
- SLE

IMMEDIATE TREATMENT

- Admit (see **Acute kidney injury** guideline)
- Strict fluid balance monitoring and management
- see **Acute kidney injury** guideline
- Treatment of volume overload/hypertension
- furosemide
- see **Hypertension** guideline
- severe cases of fluid overload will require dialysis

- Treatment of abnormal chemistry consequent to renal failure
- see **Acute kidney injury** guideline
- Oral antibiotics: phenoxymethyl penicillin if tolerated/able to take tablets or amoxicillin suspension for 10 days. (If penicillin allergy azithromycin for 5 days) for post-streptococcal glomerulonephritis (PSGN)
- Nutrition: encourage low salt diet, high carbohydrate intake

DISCHARGE FROM HOSPITAL

- BP under control
- Passing urine normally on free fluids
- Renal function improving
- Normal serum potassium

SUBSEQUENT MANAGEMENT

Follow-up/progress for PSGN

- Gross haematuria, oliguria and abnormal chemistry usually resolves by 2–3 weeks
- BP usually normal by 3–4 weeks
- Serum C3 usually normal by 8–10 weeks
- Proteinuria resolves by 6 months
- Microscopic haematuria usually resolves by 12 months

Indications for tertiary referral

- Significant proteinuria (UPCR >200 mg/mmol)
- Family history of glomerular disease
- Microscopic haematuria >2 yr
- Macroscopic haematuria >2 weeks
- Persistent proteinuria (UPCR >50 mg/mmol) >6 weeks
- Oliguria/acute kidney injury (AKI)
- Hypertension
- Low C3 for >8 weeks
- Positive ANA, dsDNA, anti-GBM or ANCA
- Recurrent nephritis

Complement abnormalities at presentation in nephritis

Normal C3 and C4

- IgA nephropathy
- HSP
- ANCA positive GN

Low C3, normal C4

- Acute post-streptococcal glomerulonephritis
- Mesangioproliferative glomerulonephritis

Low C3, low C4

- Systemic lupus erythematosus
- Mesangioproliferative glomerulonephritis
- Shunt nephritis
- Infective endocarditis

DISCHARGE FROM FOLLOW-UP

- Normal BP (when not receiving antihypertensive treatment)
- Normal renal function
- Normal urinalysis

HAEMOLYTIC URAEMIC SYNDROME ● 1/2

RECOGNITION AND ASSESSMENT

Definition

- Triad of features
- microangiopathic haemolytic anaemia
- thrombocytopenia
- acute kidney injury (AKI)

Symptoms and signs

- Diarrhoea with blood and mucus (rarely haemolytic uraemic syndrome can occur in absence of diarrhoea), rectal prolapse
- dehydration if diarrhoea has been severe (see **Diarrhoea and vomiting** guideline)
- check BP: hypotension
- Vomiting
- Abdominal pain
- Pallor, lethargy
- Reduced urine output/facial puffiness
- Tachycardia
- Reduced consciousness: consider cerebral oedema, intracranial thrombosis/haemorrhage
- Seizures: consider hyponatraemia, cerebral oedema, intracranial thrombosis/haemorrhage
- Paralysis: consider intracranial thrombosis/haemorrhage
- Over-hydration
- oedema (periorbital/pedal) variable
- weight gain, observe trend
- raised jugular venous pressure (JVP) indicates volume overload
- oliguria (urine output <1 mL/kg/hr)
- tachypnoea
- liver enlargement
- Non renal complications:
- toxic megacolon
- perforation
- intussusception
- rectal prolapse
- cardiomyopathy
- diabetes mellitus
- intracranial thrombosis, haemorrhage, oedema

Investigations

- FBC and blood film (look for fragmented red cells)
- low Hb and platelets
- Clotting studies (normally activated – should not be DIC picture)
- U&E, creatinine, LDH (to confirm haemolysis)
- Bicarbonate
- Calcium, phosphate, uric acid
- Glucose, amylase
- Liver function tests
- Serum E. coli O157 lipopolysaccharides (LPS) antibodies
- Urine stick test for significant blood and protein (indicating glomerular damage) and leucocytes
- Stool culture for E. coli (and typing for O157 strain)

IMMEDIATE TREATMENT

- Admit, discuss with regional paediatric nephrology team in all cases
- Strict fluid balance, electrolyte monitoring and management, see Acute kidney injury guideline
- Dehydration
- if signs of hypovolaemic shock give circulatory support (sodium chloride 0.9% 20 mL/kg IV immediately)
- correct dehydration (see **Diarrhoea and vomiting** guideline)
- Over-hydration
- if signs of overload/cardiac failure, furosemide 2–4 mg/kg (commence at 2 mg/kg and adjust to response) IV over 1 hr (maximum rate 4 mg/min), repeated 6-hrly if response obtained
- if furosemide ineffective, discuss dialysis with regional paediatric renal centre

- Hypertension (see Hypertension guideline)
- Anaemia
- daily FBC: only transfuse after discussion with regional paediatric nephrology team as may require dialysis. If asymptomatic, Hb can drop as low as 60 g/L
- Thrombocytopenia
- do not transfuse platelets unless there are life-threatening bleeds/instrumentation required
- AVOID antibiotics, anti-diarrhoeal treatment, NSAIDs, and other nephrotoxic medication
- Observe for non-renal complications e.g. encephalopathy and seizures, cardiomyopathy, diabetes mellitus (twice daily BM sticks for the first 48 hr)
- Protein and sodium restriction

Tertiary referral

- If significant renal impairment (oligo/anuria, rising creatinine, severe acidosis, hyperkalaemia or complications) dialysis required (see Acute kidney injury guideline), refer to regional paediatric nephrology team
- Refer urgently if non-diarrhoeal haemolytic uraemic syndrome

DISCHARGE FROM HOSPITAL

- Patient may be discharged when all following criteria met:
- diarrhoea/abdominal pain resolved
- Hb stable (haemolysis ceased)
- drinking fluids freely and passing normal amounts of urine
- urea and electrolytes improving with normal serum potassium
- Prescribe folic acid 2.5 or 5 mg daily until Hb normal

Follow-up

- Weekly until renal function normal
- if impaired renal function or proteinuria persists, arrange paediatric renal follow-up
- Once renal function normal, arrange GP or general paediatric follow-up every year to check BP and early morning urine (protein:creatinine ratio) with a detailed renal specialist review every 5 yr for formal GFR
- Advise that women with history of haemolytic uraemic syndrome require close monitoring during pregnancy
- Advise about avoiding smoking and obesity

DISCHARGE FROM FOLLOW-UP

- Renal function normal
- No proteinuria
- Renal growth and function satisfactory at 5-yrly review for 15 yr

HEADACHE ● 1/3

CAUSES

- Viral illness, ENT infections (sinusitis and throat infections), and minor head trauma
- Primary headache disorders – migraine, tension-type headache
- **Neurological conditions presenting with headache needing urgent attention:**
- bacterial meningitis
- intracranial haemorrhage
- shunt related
- idiopathic intracranial hypertension (IIH)
- new hydrocephalus
- brain tumour
- brain abscess

ASSESSMENT

- Headache history: **L**ocation, **I**ntensity, **Q**uality, **D**uration, **F**requency, **O**ther symptoms (nausea, vomiting, photophobia, dizziness), **E**ffect/degree of impairment due to headache (LIQDIFOE)
- **Associated symptoms:**
- alteration in sensorium (drowsiness or low GCS)
- seizure
- persistent vomiting
- new visual symptoms: diplopia, abnormal eye movement, visual impairment
- behaviour change
- recent change in gait/balance/co-ordination
- any other neurological symptoms
- recent head trauma
- systemic symptoms

Red flags

- Recent onset of severe headache
- Change in headache severity and frequency
- Early morning/waking from sleep
- Postural headache
- Fixed (side locked headache) or unusual location
- Ophthalmological symptoms/signs (especially new onset)
- Abnormal growth/puberty
- Deterioration in school work/personality
- Parental worry

Be cautious of first and worst headache, short history of progressively worse headache – see* Imaging *below

- **General physical examination:**
- fever, skin rash
- abnormal head position, torticollis
- marker of neuro-cutaneous syndrome
- BP, pulse, oxygen saturation, temperature
- weight, height
- BMI
- pubertal status
- scalp, face, neck, oral cavity
- full ENT examination
- **Neurological examination (especially look for):**
- new onset of squint
- cranial nerve palsy
- any other focal neurological deficit
- cerebellar signs, including nystagmus, meningeal signs
- **Fundus**
- if uncertain/abnormal, discuss with ophthalmologist

IMAGING

- Investigations and management based on clinically suspected cause of headache
- MRI brain scan (if contraindication to MRI – CT brain)

Indications

- If any red flags present and headache difficult to classify into one of the primary headaches, e.g. migraine/tension type headache
- First/worst headache
- Short history of progressively worse headaches
- Presence of new neurological symptoms/signs associated with headache
- persistent/recurrent vomiting
- balance/co-ordination problems
- abnormal eye movements
- behaviour change (particularly lethargy)
- seizures
- abnormal head position/head tilt

IDIOPATHIC INTRACRANIAL HYPERTENSION

- **Suspect IIH presenting with papilledema, with/without:**
- sixth cranial nerve palsy causing diplopia
- intact conscious level
- with any pattern of headache
- **Features of raised intracranial pressure:**
- nausea and vomiting
- headache worse lying down/with coughing/bending/exercise
- **Additional features:**
- child waking up in sleep with headache
- pulsatile tinnitus
- dizziness
- ataxia
- back/neck pain or stiffness
- **Common visual symptoms:**
- transient visual loss/blurring of vision
  - request ophthalmologist to confirm papilledema
  - obtain colour vision and visual field charting
- Normal neurological examination (except 6th nerve palsy and papilledema)

Causes

- Obesity – usually association/risk factor
- Drugs (may be cause/contributory factor): steroid therapy or withdrawal, growth hormone, tetracycline, oral contraceptive pills
- Endocrine: hypo/hyperthyroidism, hypo/hyperparathyroidism, adrenal insufficiency, Cushing syndrome
- Haematological: iron deficiency anaemia, sickle cell anaemia
- Infections and systemic disorders: otitis media, Lyme disease, HIV, chronic renal failure, SLE
- Obstructive sleep apnoeas
- Cerebral venous thrombosis

Investigations

- Initial: FBC, bone profile, TFT, U&E, parathyroid
- Other as clinically indicated
- **Imaging:**
- MRI brain modality of choice (CT brain only if contraindication to MRI/significant urgency for examination)
- magnetic resonance venography: discuss with consultant and/or radiologist

Lumbar puncture

- Opening pressure of >28 cm H_2O, normal cell count and biochemistry
- CSF pressure can be falsely high/low
- Hyperventilation can reduce pressure
- Distress, anxiety, Valsalva can increase pressure

- Can be performed under analgesia, sedation or general anaesthetic; sedation can increase pressure
- End tidal CO_2 should be monitored and kept in normal range for LP under general anaesthetic

Treatment
- First line of treatment: acetazolamide

Be careful about child with papilledema suspected on routine eye check in an asymptomatic child. Seek advice before starting investigations

Do not diagnose IIH on high CSF pressure alone in absence of typical clinical features

HEAD INJURY

CT head scan <1 hr if high risk factor:
- Suspicion of non-accidental injury
- Post-traumatic seizure but no history of epilepsy
- On initial emergency department assessment, GCS 14, or for children aged <1 yr GCS (paediatric) <15
- At 2 hr after injury, GCS <15
- Suspected open/depressed skull fracture or tense fontanelle
- Any sign of basal skull fracture [haemotympanum, 'panda' eyes, cerebrospinal fluid leakage from ear/nose, bruising over mastoid process (Battle's sign)]
- Focal neurological deficit
- For children aged <1 yr, presence of bruise, swelling or laceration >5 cm on head

No high risk factor and >1 moderate risk factor CT <1 hr:
- Loss of consciousness lasting >5 min (witnessed)
- Abnormal drowsiness
- >2 discrete episodes of vomiting
- Dangerous mechanism of injury
- high-speed road traffic collision: as pedestrian, cyclist/vehicle occupant
- fall from height of >3 m
- high-speed injury from projectile or other object
- Amnesia (antegrade/retrograde) >5 min

None of above and 1 moderate risk factor:
- Observe 4 hr after head injury. If during observation any of the risk factors below, CT head scan <1 hr:
- GCS <15
- further vomiting
- further episode of abnormal drowsiness

- If none of above risk factors occur during observation, use clinical judgment to determine whether longer period of observation needed

- If on warfarin with no other risk factors:
- CT head scan <8 hr after injury

HEART FAILURE AND WEAK PULSES ● 1/2

CAUSES

- Congenital heart malformations
  - aortic stenosis
  - coarctation of the aorta
  - hypoplastic left heart
- Cardiomyopathies
- Pericardial effusion
- Myocarditis
- Arrhythmias
- Hypoxia
- Hypovolaemia
- Acidosis
- Toxins

RECOGNITION AND ASSESSMENT

Presentation

- Usually during first few weeks of life
- Later triggered by an intercurrent infection, with associated myocarditis or prolonged arrhythmia

Symptoms and signs

- Failure to thrive
- Rapid weight gain
- Sweating
- Breathlessness, particularly during feeding
- Tachypnoea
- Tachycardia
- Absent or low volume peripheral or central pulses
- Enlarged heart
- Prominent cardiac impulses
- Quiet heart sounds in pericardial effusion
- Thrill
- Gallop rhythm
- Enlarged liver

Recognition of cardiogenic shock

- For definition of shock see **Sepsis (including meningococcal)** guideline
- Cardiogenic shock should be considered:
  - when septic shock fails to improve after adequate fluid replacement (e.g. ≥40 mL/kg)
  - with a known heart condition
  - in the presence of a large heart on CXR
  - shock, with a history of poisoning
  - when there is a murmur/pulmonary oedema, or both

INVESTIGATIONS

- Check BP in upper and lower limbs (normal <15 mmHg difference)

SpO_2

- Check pre (right arm) and postductal (lower limbs)
- In air and after giving oxygen

Chest X-ray

- For cardiac conditions, specifically record:
  - cardiac situs (normal or right side of chest)
  - aortic arch left- or right-sided
  - bronchial situs (is right main bronchus on the right?)
  - cardiac size and configuration
  - size of pulmonary vessels and pulmonary vascular markings

Electrocardiogram
- See **ECG interpretation** guideline

Echocardiogram
- Locally, if available, or refer to local paediatric cardiac centre

MONITORING
- ECG monitor
- Non-invasive BP
- Pulse oximetry
- Core-skin temperature difference
- Daily weights
- Urine output (≥1 mL/kg/hr)
- If shocked or ≥40 mL/kg fluid resuscitation:
- intra-arterial BP monitoring
- CVP

THERAPEUTIC MEASURES
- **In all children with heart failure**

1. If breathless, elevate head and trunk
2. If infant not feeding well, give nasogastric feeds
3. In moderate-to-severe failure or if patient hypoxic or distressed, prescribe oxygen therapy via nasal cannulae (maximum 2 L/min) or face mask with reservoir bag (maximum 15 L/min) aiming for SpO_2 94–98%
4. Diuretics: furosemide 1 mg/kg oral or by slow IV injection over 5–10 min and amiloride 100 microgram/kg (maximum 10 mg) both 12-hrly
5. If on IV furosemide check potassium 12-hrly; repeat 4–6 hrly if outside normal range. If serum potassium <4.5 mmol/L, give additional potassium chloride 0.5 mmol/kg 12-hrly enterally
6. Correct acidosis, hypoglycaemia and electrolyte imbalance
7. Relieve pain with morphine: loading dose 100 microgram/kg IV over 5 min (aged >1 month), followed by 50 microgram/kg IV 4–6 hrly over 5 min or 10 microgram/kg/hr via IV infusion (doses can be doubled if necessary)
8. If anaemic (Hb <100 g/L), correct with infusion of packed cells over 3–4 hr to bring Hb to 120–140 g/L

If cardiogenic shock present

1. Monitor CVP and ensure adequate pre-load: give human albumin solution (HAS) 4.5% 10 mL/kg as IV bolus or, if HAS not available, sodium chloride 0.9% 10 mL/kg as IV bolus
2. If shock severe, see **Sepsis (including meningococcal)** guideline, start mechanical ventilation with positive end-expiratory pressure early; if pulmonary oedema present, start urgently
3. If shock severe, give early inotropic drug support: dopamine, dobutamine, adrenaline or noradrenaline as per NNU/PICU protocols

DUCT-DEPENDENT CONGENITAL HEART DISEASE
- May present in first 2 weeks of life

Duct-dependent systemic circulation
- Breathless, grey, collapsed, poor pulses
- severe coarctation of the aorta
- critical aortic stenosis
- hypoplastic left heart syndrome

Duct-dependent pulmonary circulation
- Blue, breathless or shocked
- pulmonary atresia
- critical pulmonary valve stenosis
- tricuspid atresia
- severe Fallot's tetralogy
- transposition of the great arteries

Treatment
- See **Cyanotic congenital heart disease** guideline

HENOCH-SCHÖNLEIN PURPURA (HSP) ● 1/2

RECOGNITION AND ASSESSMENT

- Vasculitic condition of unknown aetiology
- Typical age group aged 2–8 yr

Symptoms and signs

Rash

- Purpuric, raised on extensor surfaces of legs, buttocks and arms, with surrounding erythema

Gastrointestinal tract

- Abdominal pain mostly non-specific typically resolves in 72 hr
  - if severe or persistent, exclude intussusception, testicular torsion or pancreatitis (rare)
- Nausea and vomiting
- Intestinal haemorrhage: haematemesis, melaena, bloody stools (rare)

Joints

- Arthralgia and swelling of large joints, especially ankles and knees. Pain typically resolves in 24–48 hr

Renal

- Microscopic haematuria (common)
- Proteinuria can present 4–6 weeks after initial presentation
- Hypertension
- Nephritic syndrome: haematuria with ≥1 of following:
  - raised urea and creatinine
  - hypertension
  - oliguria
- Nephrotic syndrome: proteinuria +/- oedema and hypoalbuminaemia
- Oedema of hands, feet, sacrum and scrotum

Neurological

- Headache (common)
- Seizures, paresis, coma (rare)

Differential diagnosis

- Purpuric rash:
  - meningococcaemia – clinical diagnosis
  - thrombocytopenia – FBC (rash looks different, ITP not vasculitic)
  - rarer vasculitides – more difficult to exclude; differentiation requires review over a period of time
- Pancreatitis – suspect in abdominal pain

Investigations

- All patients
- BP
- Urine dipstick
  - if proteinuria, send urine for early morning protein:creatinine ratio
  - if haematuria, send urine for microscopy

Additional investigations

- Blood tests if urinalysis abnormal or diagnosis uncertain
- FBC + film
- U&E
- Albumin
- If fever, blood culture and ASO titre
- Coagulation
- Throat swab

IMMEDIATE TREATMENT/SUBSEQUENT MANAGEMENT

Indications for admission

- Orchitis
- Moderate or severe abdominal pain
- Arthritis involving >2 joints

- Proteinuria
- Clear evidence of gastrointestinal bleeding
- Inability to ambulate

Joint pain
- NSAIDs (ibuprofen 1st line. Use with caution if renal involvement or patient asthmatic)

Abdominal pain
- Give prednisolone 1 mg/kg/day for 2 weeks
- Renal involvement not a contraindication
- If severe and persists, exclude pancreatitis, intussusception or spontaneous bowel perforation

MONITORING

Uncomplicated HSP (e.g. urine analysis ≤1+ blood and protein, and normal BP)
- No hospital follow-up required but GP follow-up in 1–2 weeks. Monthly BP for 6 months and weekly urine dipsticks at home until urine clear

HSP with haematuria or proteinuria >1+ and normal renal function
- As above + routine follow-up in children's outpatients

Refer to nephrologist if:
- Urinalysis blood or early morning protein >1+ after 6 months
- Macroscopic haematuria or heavy proteinuria at presentation
- Hypertension (see **Hypertension** guideline)
- Significant proteinuria (early morning urine protein:creatinine ratio >100 g/mmol or 3+ proteinuria for 3 days)
- Impaired renal function

Refer to rheumatologist if:
- Atypical or rapidly evolving rash

DISCHARGE AND FOLLOW-UP

- Inform parents condition may fluctuate for several months but recurrence rare once settled properly
- Very rare risk of renal failure, hence importance of monitoring urine
- Seek medical advice if child develops headache, PR bleeding or severe abdominal pain

Uncomplicated HSP
- GP follow-up as above
- Discharge from GP follow-up if urine analysis **and** BP normal 6 months after onset

HEPATITIS B AND C ● 1/2

Discuss all children with suspected hepatitis B or C with regional liver unit/infectious diseases team for counselling, information, consideration for anti-viral therapy and need for referral

HEPATITIS B

Diagnostic tests

- HBsAg, HBcAb (IgM and IgG) and HBsAb
- If HBsAg +ve then check:
- HBeAg, HBeAb, genotype and HBV DNA PCR viral load
- anti–HDV
- anti-HIV
- anti-HCV
- anti-HAV
- liver function tests including ALT, AST, GGT and albumin
- refer to regional liver unit/infectious diseases team and notify Public Health England
- Serological markers:
- HBsAg: infected
- HBsAb: immune
- HBcAb-IgM: acute infection
- HBcAb-IgG: past infection (>6 months)
- HBeAg: high risk viral replication
- HBeAb: partial sero-conversion
- HBV DNA quantitation: level of virus
- HBV genotype: distribution based on geographical location (subtypes A–G)
  - may be responsible for variations in clinical outcomes and response to antiviral treatment, but not used to determine initial treatment of HBV

Who to screen

- Close contacts of people with confirmed acute and chronic hepatitis B infection
- Migrants from highly endemic areas
- Infants born to hepatitis B positive women when completed vaccination course at aged 12 months

Follow-up of HBsAg +ve children

- HBeAg -ve/HBeAb +ve: yearly
- HBeAg +ve: 6 monthly
- Abnormal liver function tests: 3 monthly

Assessment during follow-up

- Clinical assessment
- Serology (clotted specimen): HBsAg, HBeAg, HBeAb
- Hepatitis B DNA PCR viral load (EDTA)
- LFT (bilirubin, ALT/AST, ALP, albumin)
- GGT
- FBC
- Coagulation (INR, PT, PTT)
- Alpha-fetoprotein
- Abdominal ultrasound every 5 yr
- if family history of hepatocellular carcinoma or rise in alpha-fetoprotein, yearly
- Fibroscan yearly (if available)

Action

- If LFT or alpha-fetoprotein abnormal, or viral titres are rising, inform regional liver unit/infectious diseases team to start antiviral therapy

HEPATITIS C

Diagnostic tests

(For neonates see **Neonatal** guidelines)

- Hepatitis C Virus (HCV) antibody aged >18 months
- HCV PCR if HCV antibody +ve

HEPATITIS B AND C ● 2/2

Who to screen

- Children of women found to be infected with hepatitis C
- Close contacts of people diagnosed with hepatitis C
- Migrants from highly endemic areas

Action

- If HCV Ab -ve, not infected. Discharge
- If HCV Ab +ve and HCV PCR negative in 2 samples taken 6 months apart, not infected (resolved infection or maternal antibody if aged <18 months). Discharge
- If HCV PCR +ve, check genotype, refer to regional liver unit/infectious diseases team for treatment

Yearly follow-up in untreated patients

- Clinical assessment
- HCV PCR viral load (EDTA)
- LFT (bilirubin, ALT/AST, ALP, albumin)
- GGT
- FBC
- Coagulation (INR, PT, PTT)
- Alpha-fetoprotein
- Abdominal ultrasound at diagnosis and every 5 yr
- Fibroscan annually (if available)

HIV AND HEPATITIS B POST-EXPOSURE PROPHYLAXIS (PEP) ● 1/2

RISK ASSESSMENT

No risk
- Intact skin contaminated with blood or body fluids
- Kissing

Low risk
- Mucous membrane or conjunctival contact with blood or body fluids
- Superficial injury that does not draw blood
- Needle/instrument not visibly contaminated with blood

Moderate risk
- Skin penetrating injury that draws blood by needle/instrument contaminated with blood or body fluid
- Wound causing bleeding and produced by sharp instrument visibly contaminated with blood
- Sexual contact with individual of unknown HIV status

High risk
- Significant exposure to blood or body fluids from source known to be HIV, hepatitis B (HBV) or C (HCV) infected
- Sexual assault

MANAGEMENT

No risk
- Reassure and discharge

Low risk
- HBV immunisation standard 0,1, 6 months (or booster if already immunised)

Moderate risk
- HBV immunisation accelerated 0, 1, 2, 12 months (or booster if already immunised)

High risk
- HBV immunisation accelerated 0, 1, 2, 12 months (or booster if already immunised)
- HBV immunoglobulin if source known infected with HBV
- HIV PEP

PEP not indicated
- Low or moderate risk
- Sex with HIV +ve person confirmed viral load <200 copies/mL for >6 months
- Human bite
- Needlestick from a discarded needle in the community

PEP

Age (yrs)	**PEP**
10+	Raltegravir + Truvada®
6–9	Raltegravir + lamivudine + zidovudine
<6	Kaletra® + lamivudine + zidovudine

- >35 kg: Truvada® 1 tab daily – do not use if known renal impairment
- >25 kg: raltegravir 400 mg tab 12-hrly
- or chewable tablets:
  - 25–27 kg: 1½ x 100 mg 12-hrly
  - 28–39 kg: 2 x 100 mg 12-hrly
  - ≥40 kg: 3 x 100 mg 12-hrly
- See CHIVA PEP guidelines for doses https://www.chiva.org.uk/professionals/gui/
- If paediatric formulations of above agents unavailable, do not delay commencing PEP if alternative is available
- If source has drug-resistant virus, seek expert help
- If patient known to have HIV do not give PEP
- Start as soon as possible (ideally within 24 hr)
- Do not start >72 hr after exposure

HIV AND HEPATITIS B POST-EXPOSURE PROPHYLAXIS (PEP) ● 2/2

- Give starter pack for 5 days treatment until seen by specialist in infectious diseases
- Total treatment course will be 28 days

INVESTIGATIONS

Table 1: Recommended monitoring during PEP course and follow-up

	Baseline	14 days	4–6 weeks post-completion
HIV	✓		✓
HBsAg (if no history of vaccination)	✓		✓ Only if not immune
Syphilis, Hep C, HBsAb/cAb	✓		✓
STI	✓	✓	If further unprotected sexual intercourse has taken place
Creatinine	✓	Only if abnormalities at baseline	
ALT	✓	Only if abnormalities at baseline, Hep B/C co-infected or on Kaletra®	
Urinalysis or uPCR	✓	Only if abnormalities at baseline	If abnormalities at baseline or 2 weeks
Pregnancy test	✓	If appropriate	If appropriate
Creatine kinase		Only if symptomatic of myositis	

- After sexual exposure offer emergency contraception and screen for other sexually transmitted infections with urine for chlamydia and gonorrhoea and syphilis serology
- if non-consensual sexual activity refer to child protection co-ordinator
- see www.bashhguidelines.org/current-guidelines/sexual-history-taking-and-sti-testing/sexual-assault-2012/
- Check need for tetanus immunisation

FOLLOW-UP

- Before discharge, provide families embarking on HIV PEP with:
- appointment to see a paediatrician with experience in antiretroviral drugs or member of ID/GUM team the same day or next working day
- for local paediatric HIV team see www.chiva.org.uk/professionals/regional-networks
- for national specialist advice ask for on-call paediatric infectious disease team at St Mary's London (020 3312 6666)
- contact telephone number in case of concerns about any aspect of HIV PEP
- enough antiretroviral medication to last until clinic appointment
- letter for GP
- If PEP given, review at 2 and 4 weeks
- at 2 weeks repeat STI screen following sexual exposure
- at 4–6 weeks repeat HIV, hepatitis and syphilis testing
- If source is HCV RNA PCR +ve, arrange the following enhanced HCV follow-up:
- at 6 weeks: EDTA blood for HCV PCR
- at 12 weeks: EDTA blood for HCV PCR and clotted blood for anti-HCV antibodies
- at 24 weeks: clotted blood for anti-HCV antibodies

HIV TESTING ● 1/2

INTRODUCTION

- HIV is a treatable medical condition
- The majority of those living with the virus are well
- Many are unaware of their HIV infection
- Late diagnosis is life-threatening
- Perinatal infection may not cause symptoms until adulthood
- HIV testing can be done in any medical setting and health professionals can obtain informed consent for an HIV test in the same way they do for any other medical investigation

HOW

Who can test?

- Anyone: home testing kit available from Public Health England for those at high risk
- Do not delay testing, but discuss result with paediatric HIV specialist **before** parents if any doubt over interpreting result

Who should be offered a test?

- First-line investigation for suspected immune deficiency: unusual type, severity or frequency of infection. See **Table 1**
- Sexually active young people: take a sexual history in post-pubertal children
- Children of HIV positive parents who have not previously been tested
- Looked after children only if specific individual risk factors

Source patient in a needlestick injury or other HIV risk exposure

- Consent must be obtained from source patient before testing
- Person obtaining consent must be a healthcare worker, other than the person who sustained the injury

Pre-test discussion with parents and children able to give consent

- Purpose of pre-test discussion is to establish informed consent:
  - patient/parent must be aware of testing for HIV
  - how result will be disclosed
- Lengthy pre-test HIV counselling is not a requirement
- Document patient's consent to testing
- If patient refuses test, explore why and ensure decision has not resulted from incorrect beliefs about the virus or consequences of testing
  - advise that, if negative, testing will not affect patient's insurance
- Some patients, (e.g. those whose first language is not English) may need additional help to reach a decision
- Test as soon as possible
  - if aged <1 yr and mother known to be positive send RNA PCR (viral load) urgently
  - if maternal status not known, send HIV antibody
  - if negative excludes perinatal infection
  - if 'reactive' result may reflect maternal antibody aged <18 months: phone infectious diseases
- If testing delayed >6 months discuss with child protection team
- Document offer of HIV test in medical notes, together with any relevant discussion and reasons for refusal
- Written consent not necessary but record on laboratory request form that consent has been obtained
- Arrange appointment for result to be disclosed personally by testing clinician

POST-TEST

HIV negative result: post-test discussion

- If still within window period after a specific exposure, discuss need to repeat test
  - for definitive exclusion of HIV infection a further test after 3 months is recommended
- If reported as reactive or equivocal, refer to infectious diseases (may be seroconversion)

HIV positive result: post-test discussion

- For all new HIV reactive results, inform paediatric HIV team
  - confirmatory tests on a 2nd sample will be required
- Testing clinician must give result personally to patient in a confidential environment and in a clear and direct manner
  - arrange follow-up programme with infectious diseases before informing patient of positive result

Table 1: Clinical indicator diseases for HIV infection

	AIDS-defining conditions	Other conditions where HIV testing should be considered
ENT		Chronic parotitis Recurrent and/or troublesome ear infections
Oral		Recurrent oral candidiasis Poor dental hygiene
Respiratory	Pneumocystis CMV pneumonitis Tuberculosis	Recurrent bacterial pneumonia Lymphoid interstitial pneumonitis Bronchiectasis
Neurology	HIV encephalopathy meningitis/encephalitis	Developmental delay Childhood stroke
Dermatology	Kaposi's sarcoma	Severe/recalcitrant dermatitis Multidermatomal or recurrent herpes zoster Recurrent fungal infections Extensive warts or molluscum contagiosum
Gastroenterology	Wasting syndrome Persistent cryptosporidiosis	Unexplained persistent hepatosplenomegaly Hepatitis B infection Hepatitis C infection
Oncology	Lymphoma Kaposi's sarcoma	
Haematology		Any unexplained blood dyscrasia including: • thrombocytopenia • neutropenia • lymphopenia
Ophthalmology	Cytomegalovirus retinitis	Any unexplained retinopathy
Other	Recurrent bacterial infections (e.g. meningitis, sepsis, osteomyelitis, pneumonia etc.) Pyrexia of unknown origin	

RECOGNITION AND ASSESSMENT

- Diagnosis is difficult because symptoms can be minimal and often go unrecognised
- Severe hypertension can cause:
  - loss of consciousness
  - seizure
  - hemiplegia
  - facial palsy

Definition

- Depends on age, sex and height of child
- Measure on ≥3 separate occasions with auscultatory method (if possible)
- Normal: systolic and diastolic BP <90th centile for age, sex and height
- High normal: systolic and diastolic BP between 90th and 95th centile for age, sex and height (>120/80 even if below 90th centile in adolescents)
- Stage 1 hypertension: 95th–99th centile **plus** 5 mmHg
- Stage 2 hypertension: >99th centile **plus** 5 mmHg **and** symptoms

Symptoms and signs

Hypertension

Listed in order of frequency with common presenting features first:

- Infants
  - congestive cardiac failure
  - respiratory distress
  - failure to thrive, vomiting
  - irritability
  - seizures
- Older children
  - headaches
  - nausea, vomiting
  - hypertensive encephalopathy (see below)
  - polydipsia, polyuria
  - visual problems
  - tiredness, irritability
  - cardiac failure
  - facial palsy
  - hemiplegia
  - epistaxis
  - poor growth, weight loss
  - cardiac murmur
  - abdominal pain

Hypertensive encephalopathy (accelerated hypertension)

- Any neurological sign associated with grossly elevated blood pressure, most commonly:
  - severe generalised headache
  - visual disturbance (+/- retinal changes)/blindness
  - seizure
  - posterior reversible encephalopathy syndrome (PRES)

Do not delay initiation of treatment pending investigations once diagnosis has been made

History

- Family history of hypertension, diabetes, cardiovascular and cerebrovascular disease, obesity, hereditary renal and endocrine disease
- Past history of renal, cardiac, endocrine or neurological problems
- Presenting complaints as listed above
- Drug intake such as corticosteroids, ciclosporin, tacrolimus, methylphenidate, antidepressants

Examination

- Detailed clinical examination of all systems
- **Do not** forget fundoscopy

- Height and weight
- Skin for neurocutaneous stigmata
- Check for cardiovascular causes
  - femoral pulses
  - right arm and leg blood pressure
- Thyroid status
- Disorder of sexual differentiation
- Cushingoid
- Abdominal bruit

Investigations
- Check for evidence of renal disease
  - serum creatinine, U&E, calcium, chloride, cholesterol, bicarbonate
  - urinalysis for blood and protein
  - if urine dipstick positive for protein send early morning urine for protein:creatinine ratio
  - renal ultrasound scan +/- Doppler
  - plasma renin and aldosterone concentration (after strict recumbancy for 1–2 hr)
  - DMSA scan may be required to exclude scarring
  - ECG for left ventricular hypertrophy (LVH)
  - echocardiogram
- Check for endocrine/malignant causes
  - fasting plasma glucose
  - 24 hr urinary free cortisol and/or discuss with endocrinologist for further investigations
  - urine metadrenalines (performed at Manchester Children's Hospital)
  - lipid profile

Differential diagnosis
- Incorrectly sized (too small) or placed BP cuff
- Transient hypertension secondary to pain, anxiety, distress

IMMEDIATE TREATMENT

Hypertensive encephalopathy (accelerated hypertension)

Urgent treatment necessary but bring BP under control slowly

Abrupt BP reduction can result in cerebral ischaemia with the risk of permanent neurological sequelae owing to failure of cerebral auto-regulation after sustained elevation of BP
- Excess BP = actual BP – acceptable BP (**Table 1** and **2**)
  - 'acceptable BP' given by the 90th percentile according to height
- Reduce BP gradually. Aim to reduce 'excess BP' by ⅓ in first 8 hr, another ⅓ in next 12 hr, and final ⅓ in next 48 hr
- Mark target BP ranges on chart so nurses know when to ask a doctor to review
- Monitor perfusion: may need volume expansion in first 12 hr if rapid BP drop
- Discuss choice of drug treatment with **consultant**
- Options comprise in following order: (**Table 3**)
  - **labetalol** infusion
    - starting dose 0.5–1 mg/kg/hr
    - increase by 1 mg/kg/hr every 15–30 min until effective
    - maximum dose 3 mg/kg/hr (maximum 120 mg/hr)
    - stop infusion when effective
    - restart as BP starts to rise again
    - normally lasts 4–6 hr
  - **sodium nitroprusside** infusion
    - give in high dependency or intensive care unit as close BP monitoring (intra-arterial) required
    - starting dose 500 nanogram/kg/min
    - increase in increments of 200 nanogram/kg/min
    - maximum 8 microgram/kg/min for first 24 hr, reducing to 4 microgram/kg/min thereafter
    - only effective whilst infused as short half-life
    - protect infusion from light
    - stop infusion slowly over 15–30 min to avoid any rebound effects

- **hydralazine** infusion (or bolus as alternative)
- **nifedipine** oral (not 1st line for encephalopathy)
  - 200–300 microgram/kg 8-hrly (maximum 3 mg/kg/day or 90 mg/day)
  - avoid quick acting, use modified release to prevent large drop in BP
  - can be crushed but may have more rapid onset
  - may be used to clip peaks of BP
  - dose varies with product; check with pharmacy

SUBSEQUENT MANAGEMENT

Essential hypertension

High normal BP

- non pharmacological measures such as weight loss, dietary modification (low salt diet), exercise
- medication (**Table 3**) only if compelling indications such as if symptomatic, diabetes mellitus, heart failure, left ventricular hypertrophy
- Stage 1 hypertension
- non pharmacological measures
- give medications (**Table 3**) if symptomatic, presence of end organ damage, diabetes, persistent hypertension despite non pharmacological measures
- Stage 2 hypertension
- non pharmacological measures
- start medications (**Table 3**)
- add drug therapy only after discussion with a consultant

Renal hypertension

- In children with impaired renal function, keep BP within same target range as for children with normal renal function
- See **Table 1** and **2**

OUT-PATIENT MANAGEMENT

Table 1: Blood pressure (BP) for boys by age and height percentiles

		Systolic (mmHg) percentile of height							Diastolic (mmHg) percentile of height						
Age (yrs)	**BP percentile**	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**
1	Height (in)	30.4	30.8	31.6	32.4	33.3	34.1	34.6	30.4	30.8	31.6	32.4	33.3	34.1	34.6
	Height (cm)	77.2	78.3	80.2	82.4	84.6	86.7	87.9	77.2	78.3	80.2	82.4	84.6	86.7	87.9
	50th	85	85	86	86	87	88	88	40	40	40	41	41	42	42
	90th	98	99	99	100	100	101	101	52	52	53	53	54	54	54
	95th	102	102	103	103	104	105	105	54	54	55	55	56	57	57
	95th+12 mmHg	114	114	115	115	116	117	117	66	66	67	67	68	69	69
2	Height (in)	33.9	34.4	35.3	36.3	37.3	38.2	38.8	33.9	34.4	35.3	36.3	37.3	38.2	38.8
	Height (cm)	86.1	87.4	89.6	92.1	94.7	97.1	98.5	86.1	87.4	89.6	92.1	94.7	97.1	98.5
	50th	87	87	88	89	89	90	91	43	43	44	44	45	46	46
	90th	100	100	101	102	103	103	104	55	55	56	56	57	58	58
	95th	104	105	105	106	107	107	108	57	58	58	59	60	61	61
	95th+12 mmHg	116	117	117	118	119	119	120	69	70	70	71	72	73	73
3	Height (in)	36.4	37	37.9	39	40.1	41.1	41.7	36.4	37	37.9	39	40.1	41.1	41.7
	Height (cm)	92.5	93.9	96.3	99	101.8	104.3	105.8	92.5	93.9	96.3	99	101.8	104.3	105.8
	50th	88	89	89	90	91	92	92	45	46	46	47	48	49	49
	90th	101	102	102	103	104	105	105	58	58	59	59	60	61	61
	95th	106	106	107	107	108	109	109	60	61	61	62	63	64	64
	95th+12 mmHg	118	118	119	119	120	121	121	72	73	73	74	75	76	76
4	Height (in)	38.8	39.4	40.5	41.7	42.9	43.9	44.5	38.8	39.4	40.5	41.7	42.9	43.9	44.5
	Height (cm)	98.5	100.2	102.9	105.9	108.9	111.5	113.2	98.5	100.2	102.9	105.9	108.9	111.5	113.2
	50th	90	90	91	92	93	94	94	48	49	49	50	51	52	52
	90th	102	103	104	105	105	106	107	60	61	62	62	63	64	64
	95th	107	107	108	108	109	110	110	63	64	65	66	67	67	68
	95th+12 mmHg	119	119	120	120	121	122	122	75	76	77	78	79	79	80
5	Height (in)	41.1	41.8	43	44.3	45.5	46.7	47.4	41.1	41.8	43	44.3	45.5	46.7	47.4
	Height (cm)	104.4	106.2	109.1	112.4	115.7	118.6	120.3	104.4	106.2	109.1	112.4	115.7	118.6	120.3
	50th	91	92	93	94	95	96	96	51	51	52	53	54	55	55
	90th	103	104	105	106	107	108	108	63	64	65	65	66	67	67
	95th	107	108	109	109	110	111	112	66	67	68	69	70	70	71
	95th+12 mmHg	119	120	121	121	122	123	124	78	79	80	81	82	82	83
6	Height (in)	43.4	44.2	45.4	46.8	48.2	49.4	50.2	43.4	44.2	45.4	46.8	48.2	49.4	50.2
	Height (cm)	110.3	112.2	115.3	118.9	122.4	125.6	127.5	110.3	112.2	115.3	118.9	122.4	125.6	127.5
	50th	93	93	94	95	96	97	98	54	54	55	56	57	57	58
	90th	105	105	106	107	109	110	110	66	66	67	68	68	69	69
	95th	108	109	110	111	112	113	114	69	70	70	71	72	72	73
	95th+12 mmHg	120	121	122	123	124	125	126	81	82	82	83	84	84	85
7	Height (in)	45.7	46.5	47.8	49.3	50.8	52.1	52.9	45.7	46.5	47.8	49.3	50.8	52.1	52.9
	Height (cm)	116.1	118	121.4	125.1	128.9	132.4	134.5	116.1	118	121.4	125.1	128.9	132.4	134.5
	50th	94	94	95	97	98	98	99	56	56	57	58	58	59	59
	90th	106	107	108	109	110	111	111	68	68	69	70	70	71	71
	95th	110	110	111	112	114	115	116	71	71	72	73	73	74	74
	95th+12 mmHg	122	122	123	124	126	127	128	83	83	84	85	85	86	86
8	Height (in)	47.8	48.6	50	51.6	53.2	54.6	55.5	47.8	48.6	50	51.6	53.2	54.6	55.5
	Height (cm)	121.4	123.5	127	131	135.1	138.8	141	121.4	123.5	127	131	135.1	138.8	141
	50th	95	96	97	98	99	99	100	57	57	58	59	59	60	60
	90th	107	108	109	110	111	112	112	69	70	70	71	72	72	73
	95th	111	112	112	114	115	116	117	72	73	73	74	75	75	75
	95th+12 mmHg	123	124	124	126	127	128	129	84	85	85	86	87	87	87
9	Height (in)	49.6	50.5	52	53.7	55.4	56.9	57.9	49.6	50.5	52	53.7	55.4	56.9	57.9
	Height (cm)	126	128.3	132.1	136.3	140.7	144.7	147.1	126	128.3	132.1	136.3	140.7	144.7	147.1
	50th	96	97	98	99	100	101	101	57	58	59	60	61	62	62
	90th	107	108	109	110	112	113	114	70	71	72	73	74	74	74
	95th	112	112	113	115	116	118	119	74	74	75	76	76	77	77
	95th+12 mmHg	124	124	125	127	128	130	131	86	86	87	88	88	89	89

		Systolic (mmHg) percentile of height							Diastolic (mmHg) percentile of height						
Age (yrs)	**BP percentile**	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**
10	Height (in)	51.3	52.2	53.8	55.6	57.4	59.1	60.1	51.3	52.2	53.8	55.6	57.4	59.1	60.1
	Height (cm)	130.2	132.7	136.7	141.3	145.9	150.1	152.7	130.2	132.7	136.7	141.3	145.9	150.1	152.7
	50th	97	98	99	100	101	102	103	59	60	61	62	63	63	64
	90th	108	109	111	112	113	115	116	72	73	74	74	75	75	76
	95th	112	113	114	116	118	120	121	76	76	77	77	78	78	78
	95th+12 mmHg	124	125	126	128	130	132	133	88	88	89	89	90	90	90
11	Height (in)	53	54	55.7	57.6	59.6	61.3	62.4	53	54	55.7	57.6	59.6	61.3	62.4
	Height (cm)	134.7	137.3	141.5	146.4	151.3	155.8	158.6	134.7	137.3	141.5	146.4	151.3	155.8	158.6
	50th	99	99	101	102	103	104	106	61	61	62	63	63	63	63
	90th	110	111	112	114	116	117	118	74	74	75	75	75	76	76
	95th	114	114	116	118	120	123	124	77	78	78	78	78	78	78
	95th+12 mmHg	126	126	128	130	132	135	136	89	90	90	90	90	90	90
12	Height (in)	55.2	56.3	58.1	60.1	62.2	64	65.2	55.2	56.3	58.1	60.1	62.2	64	65.2
	Height (cm)	140.3	143	147.5	152.7	157.9	162.6	165.5	140.3	143	147.5	152.7	157.9	162.6	165.5
	50th	101	101	102	104	106	108	109	61	62	62	62	62	63	63
	90th	113	114	115	117	119	121	122	75	75	75	75	75	76	76
	95th	116	117	118	121	124	126	128	78	78	78	78	78	79	79
	95th+12 mmHg	128	129	130	133	136	138	140	90	90	90	90	90	91	91
13	Height (in)	57.9	59.1	61	63.1	65.2	67.1	68.3	57.9	59.1	61	63.1	65.2	67.1	68.3
	Height (cm)	147	150	154.9	160.3	165.7	170.5	173.4	147	150	154.9	160.3	165.7	170.5	173.4
	50th	103	104	105	108	110	111	112	61	60	61	62	63	64	65
	90th	115	116	118	121	124	126	126	74	74	74	75	76	77	77
	95th	119	120	122	125	128	130	131	78	78	78	78	80	81	81
	95th+12 mmHg	131	132	134	137	140	142	143	90	90	90	90	92	93	93
14	Height (in)	60.6	61.8	63.8	65.9	68	69.8	70.9	60.6	61.8	63.8	65.9	68	69.8	70.9
	Height (cm)	153.8	156.9	162	167.5	172.7	177.4	180.1	153.8	156.9	162	167.5	172.7	177.4	180.1
	50th	105	106	109	111	112	113	113	60	60	62	64	65	66	67
	90th	119	120	123	126	127	128	129	74	74	75	77	78	79	80
	95th	123	125	127	130	132	133	134	77	78	79	81	82	83	84
	95th+12 mmHg	135	137	139	142	144	145	146	89	90	91	93	94	95	96
15	Height (in)	62.6	63.8	65.7	67.8	69.8	71.5	72.5	62.6	63.8	65.7	67.8	69.8	71.5	72.5
	Height (cm)	159	162	166.9	172.2	177.2	181.6	184.2	159	162	166.9	172.2	177.2	181.6	184.2
	50th	108	110	112	113	114	114	114	61	62	64	65	66	67	68
	90th	123	124	126	128	129	130	130	75	76	78	79	80	81	81
	95th	127	129	131	132	134	135	135	78	79	81	83	84	85	85
	95th+12 mmHg	139	141	143	144	146	147	147	90	91	93	95	96	97	97
16	Height (in)	63.8	64.9	66.8	68.8	70.7	72.4	73.4	63.8	64.9	66.8	68.8	70.7	72.4	73.4
	Height (cm)	162.1	165	169.6	174.6	179.5	183.8	186.4	162.1	165	169.6	174.6	179.5	183.8	186.4
	50th	111	112	114	115	115	116	116	63	64	66	67	68	69	69
	90th	126	127	128	129	131	131	132	77	78	79	80	81	82	82
	95th	130	131	133	134	135	136	137	80	81	83	84	85	86	86
	95th+12 mmHg	142	143	145	146	147	148	149	92	93	95	96	97	98	98
17	Height (in)	64.5	65.5	67.3	69.2	71.1	72.8	73.8	64.5	65.5	67.3	69.2	71.1	72.8	73.8
	Height (cm)	163.8	166.5	170.9	175.8	180.7	184.9	187.5	163.8	166.5	170.9	175.8	180.7	184.9	187.5
	50th	114	115	116	117	117	118	118	65	66	67	68	69	70	70
	90th	128	129	130	131	132	133	134	78	79	80	81	82	82	83
	95th	132	133	134	135	137	138	138	81	82	84	85	86	86	87
	95th+12 mmHg	144	145	146	147	149	150	150	93	94	96	97	98	98	99

Table 2: Blood pressure (BP) for girls by age and height percentiles

		Systolic (mmHg) percentile of height							Diastolic (mmHg) percentile of height						
Age (yrs)	**BP percentile**	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**
1	Height (in)	29.7	30.2	30.9	31.8	32.7	33.4	33.9	29.7	30.2	30.9	31.8	32.7	33.4	33.9
	Height (cm)	75.4	76.6	78.6	80.8	83	84.9	86.1	75.4	76.6	78.6	80.8	83	84.9	86.1
	50th	84	85	86	86	87	88	88	41	42	42	43	44	45	46
	90th	98	99	99	100	101	102	102	54	55	56	56	57	58	58
	95th	101	102	102	103	104	105	105	59	59	60	60	61	62	62
	95th+12 mmHg	113	114	114	115	116	117	117	71	71	72	72	73	74	74
2	Height (in)	33.4	34	34.9	35.9	36.9	37.8	38.4	33.4	34	34.9	35.9	36.9	37.8	38.4
	Height (cm)	84.9	86.3	88.6	91.1	93.7	96	97.4	84.9	86.3	88.6	91.1	93.7	96	97.4
	50th	87	87	88	89	90	91	91	45	46	47	48	49	50	51
	90th	101	101	102	103	104	105	106	58	58	59	60	61	62	62
	95th	104	105	106	106	107	108	109	62	63	63	64	65	66	66
	95th+12 mmHg	116	117	118	118	119	120	121	74	75	75	76	77	78	78
3	Height (in)	35.8	36.4	37.3	38.4	39.6	40.6	41.2	35.8	36.4	37.3	38.4	39.	40.6	41.2
	Height (cm)	91	92.4	94.9	97.6	100.5	103.1	104.6	91	92.4	94.9	97.6	100.5	103.1	104.6
	50th	88	89	89	90	91	92	93	48	48	49	50	51	53	53
	90th	102	103	104	104	105	106	107	60	61	61	62	63	64	65
	95th	106	106	107	108	109	110	110	64	65	65	66	67	68	69
	95th+12 mmHg	118	118	119	120	121	122	122	76	77	77	78	79	80	81
4	Height (in)	38.3	38.9	39.9	41.1	42.4	43.5	44.2	38.3	38.9	39.9	41.1	42.4	43.5	44.2
	Height (cm)	97.2	98.8	101.4	104.5	107.6	110.5	112.2	97.2	98.8	101.4	104.5	107.6	110.5	112.2
	50th	89	90	91	92	93	94	94	50	51	51	53	54	55	55
	90th	103	104	105	106	107	108	108	62	63	64	65	66	67	67
	95th	107	108	109	109	110	111	112	66	67	68	69	70	70	71
	95th+12 mmHg	119	120	121	121	122	123	124	78	79	80	81	82	82	83
5	Height (in)	40.8	41.5	42.6	43.9	45.2	46.5	47.3	40.8	41.5	42.6	43.9	45.2	46.5	47.3
	Height (cm)	103.6	105.3	108.2	111.5	114.9	118.1	120	103.6	105.3	108.2	111.5	114.9	118.1	120
	50th	90	91	92	93	94	95	96	52	52	53	55	56	57	57
	90th	104	105	106	107	108	109	110	64	65	66	67	68	69	70
	95th	108	109	109	110	111	112	113	68	69	70	71	72	73	73
	95th+12 mmHg	120	121	121	122	123	124	125	80	81	82	83	84	85	85
6	Height (in)	43.3	44	45.2	46.6	48.1	49.4	50.3	43.3	44	45.2	46.6	48.1	49.4	50.3
	Height (cm)	110	111.8	114.9	118.4	122.1	125.6	127.7	110	111.8	114.9	118.4	122.1	125.6	127.7
	50th	92	92	93	94	96	97	97	54	54	55	56	57	58	59
	90th	105	106	107	108	109	110	111	67	67	68	69	70	71	71
	95th	109	109	110	111	112	113	114	70	71	72	72	73	74	74
	95th+12 mmHg	121	121	122	123	124	125	126	82	83	84	84	85	86	86
7	Height (in)	45.6	46.4	47.7	49.2	50.7	52.1	53	45.6	46.4	47.7	49.2	50.7	52.1	53
	Height (cm)	115.9	117.8	121.1	124.9	128.8	132.5	134.7	115.9	117.8	121.1	124.9	128.8	132.5	134.7
	50th	92	93	94	95	97	98	99	55	55	56	57	58	59	60
	90th	106	106	107	109	110	111	112	68	68	69	70	71	72	72
	95th	109	110	111	112	113	114	115	72	72	73	73	74	74	75
	95th+12 mmHg	121	122	123	124	125	126	127	84	84	85	85	86	86	87
8	Height (in)	47.6	48.4	49.8	51.4	53	54.5	55.5	47.6	48.4	49.8	51.4	53	54.5	55.5
	Height (cm)	121	123	126.5	130.6	134.7	138.5	140.9	121	123	126.5	130.6	134.7	138.5	140.9
	50th	93	94	95	97	98	99	100	56	56	57	59	60	61	61
	90th	107	107	108	110	111	112	113	69	70	71	72	72	73	73
	95th	110	111	112	113	115	116	117	72	73	74	74	75	75	75
	95th+12 mmHg	122	123	124	125	127	128	129	84	85	86	86	87	87	87
9	Height (in)	49.3	50.2	51.7	53.4	55.1	56.7	57.7	49.3	50.2	51.7	53.4	55.1	56.7	57.7
	Height (cm)	125.3	127.6	131.3	135.6	140.1	144.1	146.6	125.3	127.6	131.3	135.6	140.1	144.1	146.6
	50th	95	95	97	98	99	100	101	57	58	59	60	60	61	61
	90th	108	108	109	111	112	113	114	71	71	72	73	73	73	73
	95th	112	112	113	114	116	117	118	74	74	75	75	75	75	75
	95th+12 mmHg	124	124	125	126	128	129	130	86	86	87	87	87	87	87
10	Height (in)	51.1	52	53.7	55.5	57.4	59.1	60.2	51.1	52	53.7	55.5	57.4	59.1	60.2
	Height (cm)	129.7	132.2	136.3	141	145.8	150.2	152.8	129.7	132.2	136.3	141	145.8	150.2	152.8
	50th	96	97	98	99	101	102	103	58	59	59	60	61	61	62
	90th	109	110	111	112	113	115	116	72	73	73	73	73	73	73
	95th	113	114	114	116	117	119	120	75	75	76	76	76	76	76
	95th+12 mmHg	125	126	126	128	129	131	132	87	87	88	88	88	88	88
11	Height (in)	53.4	54.5	56.2	58.2	60.2	61.9	63	53.4	54.5	56.2	58.2	60.2	61.9	63
	Height (cm)	135.6	138.3	142.8	147.8	152.8	157.3	160	135.6	138.3	142.8	147.8	152.8	157.3	160
	50th	98	99	101	102	104	105	106	60	60	60	61	62	63	64

	90th	111	112	113	114	116	118	120	74	74	74	74	74	75	75
	95th	115	116	117	118	120	123	124	76	77	77	77	77	77	77
	95th+12 mmHg	127	128	129	130	132	135	136	88	89	89	89	89	89	89
12	Height (in)	56.2	57.3	59	60.9	62.8	64.5	65.5	56.2	57.3	59	60.9	62.8	64.5	65.5
	Height (cm)	142.8	145.5	149.9	154.8	159.6	163.8	166.4	142.8	145.5	149.9	154.8	159.6	163.8	166.4
	50th	102	102	104	105	107	108	108	61	61	61	62	64	65	65
	90th	114	115	116	118	120	122	122	75	75	75	75	76	76	76
	95th	118	119	120	122	124	125	126	78	78	78	78	79	79	79
	95th+12 mmHg	130	131	132	134	136	137	138	90	90	90	90	91	91	91
13	Height (in)	58.3	59.3	60.9	62.7	64.5	66.1	67	58.3	59.3	60.9	62.7	64.5	66.1	67
	Height (cm)	148.1	150.6	154.7	159.2	163.7	167.8	170.2	148.1	150.6	154.7	159.2	163.7	167.8	170.2
	50th	104	105	106	107	108	108	109	62	62	63	64	65	65	66
	90th	116	117	119	121	122	123	123	75	75	75	76	76	76	76
	95th	121	122	123	124	126	126	127	79	79	79	79	80	80	81
	95th+12 mmHg	133	134	135	136	138	138	139	91	91	91	91	92	92	93
14	Height (in)	59.3	60.2	61.8	63.5	65.2	66.8	67.7	59.3	60.2	61.8	63.5	65.2	66.8	67.7
	Height (cm)	150.6	153	156.9	161.3	165.7	169.7	172.1	150.6	153	156.9	161.3	165.7	169.7	172.1
	50th	105	106	107	108	109	109	109	63	63	64	65	66	66	66
	90th	118	118	120	122	123	123	123	76	76	76	76	77	77	77
	95th	123	123	124	125	126	127	127	80	80	80	80	81	81	82
	95th+12 mmHg	135	135	136	137	138	139	139	92	92	92	92	93	93	94
15	Height (in)	59.7	60.6	62.2	63.9	65.6	67.2	68.1	59.7	60.6	62.2	63.9	65.6	67.2	68.1
	Height (cm)	151.7	154	157.9	162.3	166.7	170.6	173	151.7	154	157.9	162.3	166.7	170.6	173
	50th	105	106	107	108	109	109	109	64	64	64	65	66	67	67
	90th	118	119	121	122	123	123	124	76	76	76	77	77	78	78
	95th	124	124	125	126	127	127	128	80	80	80	81	82	82	82
	95th+12 mmHg	136	136	137	138	139	139	140	92	92	92	93	94	94	94
16	Height (in)	59.9	60.8	62.4	64.1	65.8	67.3	68.3	59.9	60.8	62.4	64.1	65.8	67.3	68.3
	Height (cm)	152.1	154.5	158.4	162.8	167.1	171.1	173.4	152.1	154.5	158.4	162.8	167.1	171.1	173.4
	50th	106	107	108	109	109	110	110	64	64	65	66	66	67	67
	90th	119	120	122	123	124	124	124	76	76	76	77	78	78	78
	95th	124	125	125	127	127	128	128	80	80	80	81	82	82	82
	95th+12 mmHg	136	137	137	139	139	140	140	92	92	92	93	94	94	94
17	Height (in)	60	60.9	62.5	64.2	65.9	67.4	68.4	60	60.9	62.5	64.2	65.9	67.4	68.4
	Height (cm)	152.4	154.7	158.7	163	167.4	171.3	173.7	152.4	154.7	158.7	163	167.4	171.3	173.7
	50th	107	108	109	110	110	110	111	64	64	65	66	66	66	67
	90th	120	121	123	124	124	125	125	76	76	77	77	78	78	78
	95th	125	125	126	127	128	128	128	80	80	80	81	82	82	82
	95th+12 mmHg	137	137	138	139	140	140	140	92	92	92	93	94	94	94

Table 3: Drugs commonly used for management of hypertension in children

Drug	Mechanism of action	Advice
Atenolol	Beta-adrenoceptor blocker	• Reduces heart contractility – contraindicated in early stages of hypertensive heart failure • Avoid in confirmed asthmatics
Labetalol	Non-cardioselective beta-blocker with additional alpha-blocking properties	• Combining alpha- and beta-blockade reduces tachycardia that can be a problem without beta-blockade • Contraindicated in asthmatics and in heart failure • Injection can be given orally
Nifedipine	Calcium channel blocker	• Can be used in heart failure as any negative inotropic effect offset by a reduction in left ventricular work • Side effects vasodilatation: flushing and headache, ankle swelling
Amlodipine	Calcium channel blocker	• Does not reduce myocardial contractility or produce clinical deterioration in heart failure • Side effects vasodilatation: flushing and headache, ankle swelling • Tablets disperse in water
Enalapril **or** Captopril solution for younger children	Angiotensin-converting enzyme (ACE) inhibitor	• Recommended in children with renal hypertension. First dose should be given at night to prevent transient hypotension • In children with impaired renal function, check serum creatinine and potassium 2–3 days after starting treatment and consider withdrawal if they have risen • Contraindicated in bilateral renal artery stenosis • Tablets can be crushed and dispersed in water
Losartan	Angiotensin II receptor blocker	• In children with impaired renal function, check serum creatinine and potassium 2–3 days after starting treatment and consider withdrawal if they have risen • Contraindicated in bilateral renal artery stenosis
Sodium nitro-prusside	Vasodilator	• Use for hypertensive emergencies • Avoid in hepatic or renal impairment • Monitor blood cyanide if used >3 days • Symptoms of cyanide poisoning (sweating, tachycardia, hyperventilation) see Toxbase

HYPOGLYCAEMIA ● 1/4

Management of unexplained and prolonged hypoglycaemia

RECOGNITION AND ASSESSMENT

Definition

- Blood glucose <2.6 mmol/L in child aged >1 month

Symptoms and signs

- Lethargy
- Tremulousness
- Loss of consciousness
- Seizure
- Autonomic effects
  - sweating
  - shaking
  - tachycardia
  - anxiety
  - hunger

Previous history

- Ask about:
  - antenatal history e.g. small-for-dates, gestational diabetes
  - prematurity
  - history of neonatal hypoglycaemia
  - early or prolonged jaundice
  - family history of sudden infant death
  - development, especially developmental regression
  - medication (steroids)
  - access to glycopaenic agents (e.g. metformin, insulin)
  - onset and frequency of hypoglycaemia
  - history of infection/food intake

Investigations

- ***Certain pointers to cause of unexplained hypoglycaemia are detectable only during episode. Take blood samples BEFORE correcting blood glucose***

Immediate samples

- Before treating, take blood samples (**Table 1**)
- Bloods must arrive in laboratory within 30 min
- Include clear clinical details on request form
- If sample volumes limited prioritise glucose, insulin and C-peptide
- Request urgent analysis of insulin and C-peptide (discuss with duty biochemist)
  - routine analysis for obese child with insulin resistance
- Blood ketones for ketone bodies on ward (glucometer)
- Once samples obtained, correct hypoglycaemia. See **Immediate treatment**
- Collect first urine voided after correction. Check for ketones using urine dipstick, send remaining urine for organic/amino acid metabolites and reducing substances

Table 1: Total blood requirement (5 mL minimum)

Fluoride (grey top)	1.3 mL (1 bottle)	Glucose, lactate, beta-hydroxybutyrate, free fatty acids
Lithium heparin (green top)	2.6 mL (2 bottles – 1 bottle on ice)	U&Es, LFTs, blood amino acids, Acylcarnitines, ammonia
Clotted (red top)	2.6 mL (2 bottles)	Insulin, C-peptide, growth hormone, cortisol

Investigations

- In all prolonged unexplained hypoglycaemia:
  - glucose – point of care
  - ketones. Urine dipstick or blood ketones (glucometer)
  - capillary blood gas

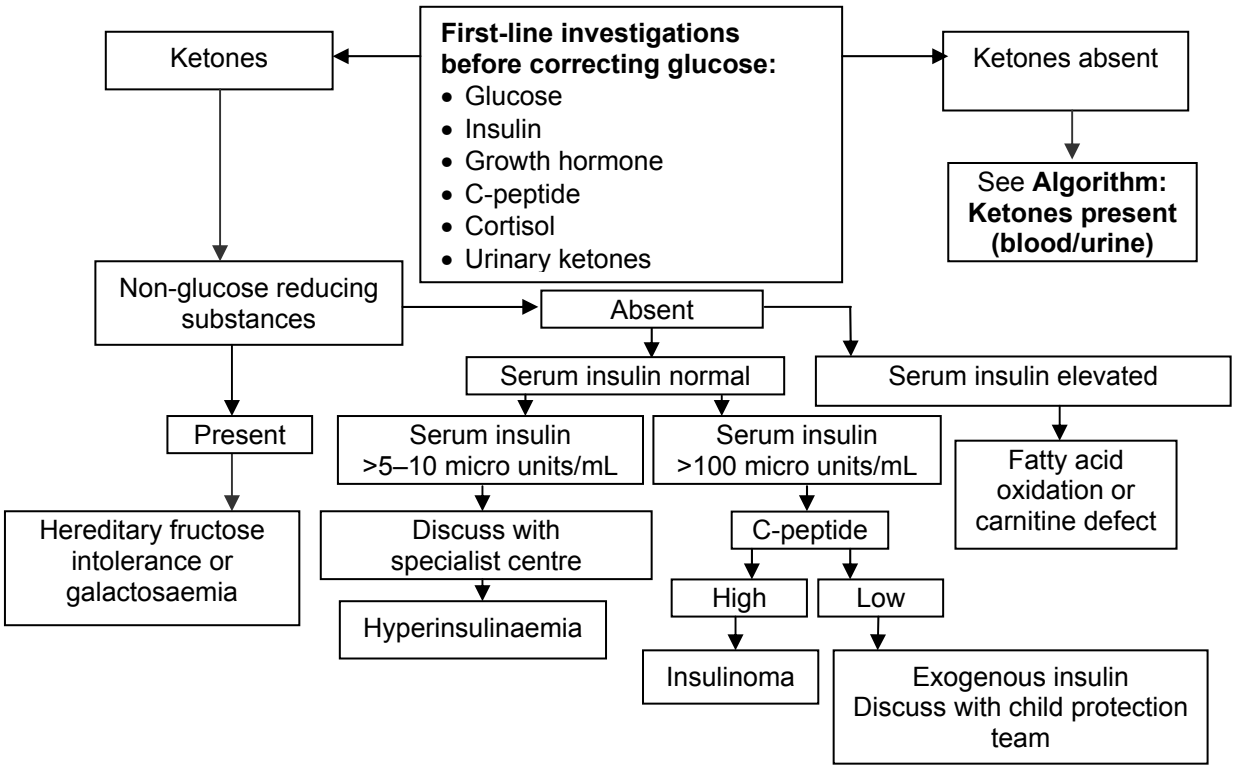
- laboratory glucose to confirm hypoglycaemia
- insulin
- C-peptide
- U&E
- growth hormone
- cortisol
- 17-hydroxyprogesterone in infant if hyponatraemia present
  - **if urgent analysis required contact duty biochemist**

- Further investigations may be required, depending on results from above:
- IGF-1
- beta-hydroxybutyrate
- free fatty acids
- carnitines
- urinary reducing substances
- urine organic acids
- urine and plasma amino acids

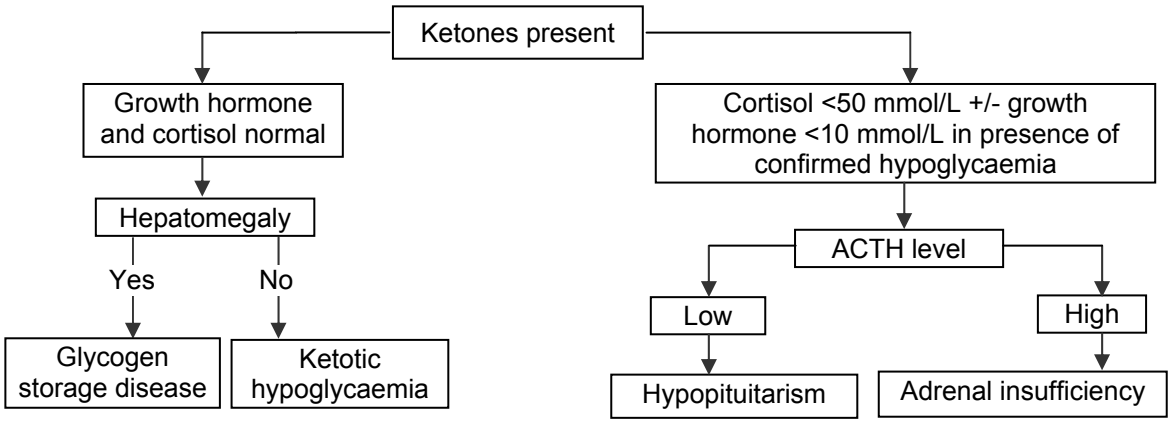
Physical examination

- Height and weight
- Midline defects, micropenis, optic nerve hypoplasia (pituitary disorder)
- Dysmorphic features: macroglossia, macrosomia, ear lobe crease (Beckwith-Wiedemann)
- Skin hyperpigmentation (adrenal insufficiency)
- Hepatomegaly (glycogen storage disorder)

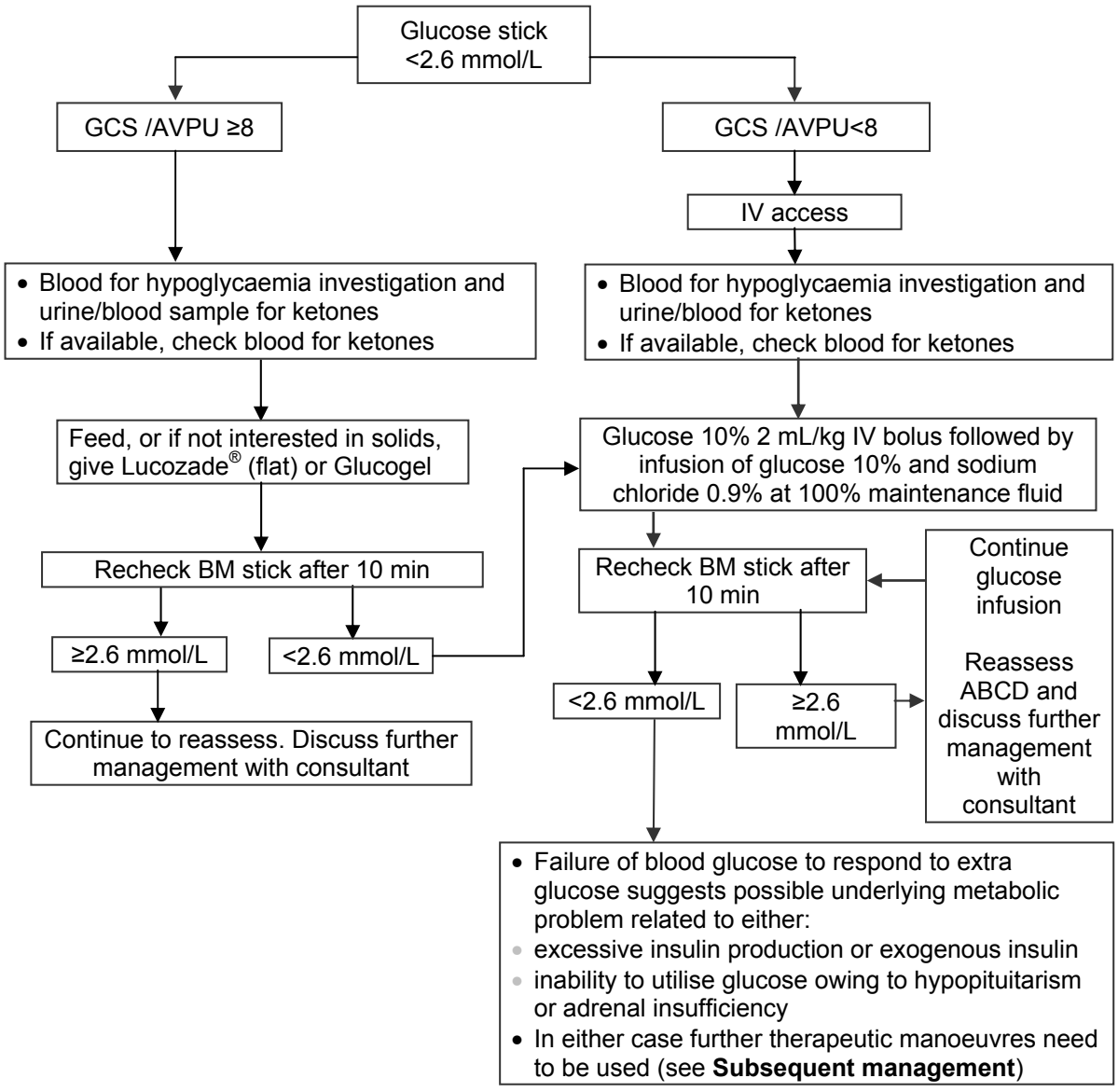
Differential diagnosis



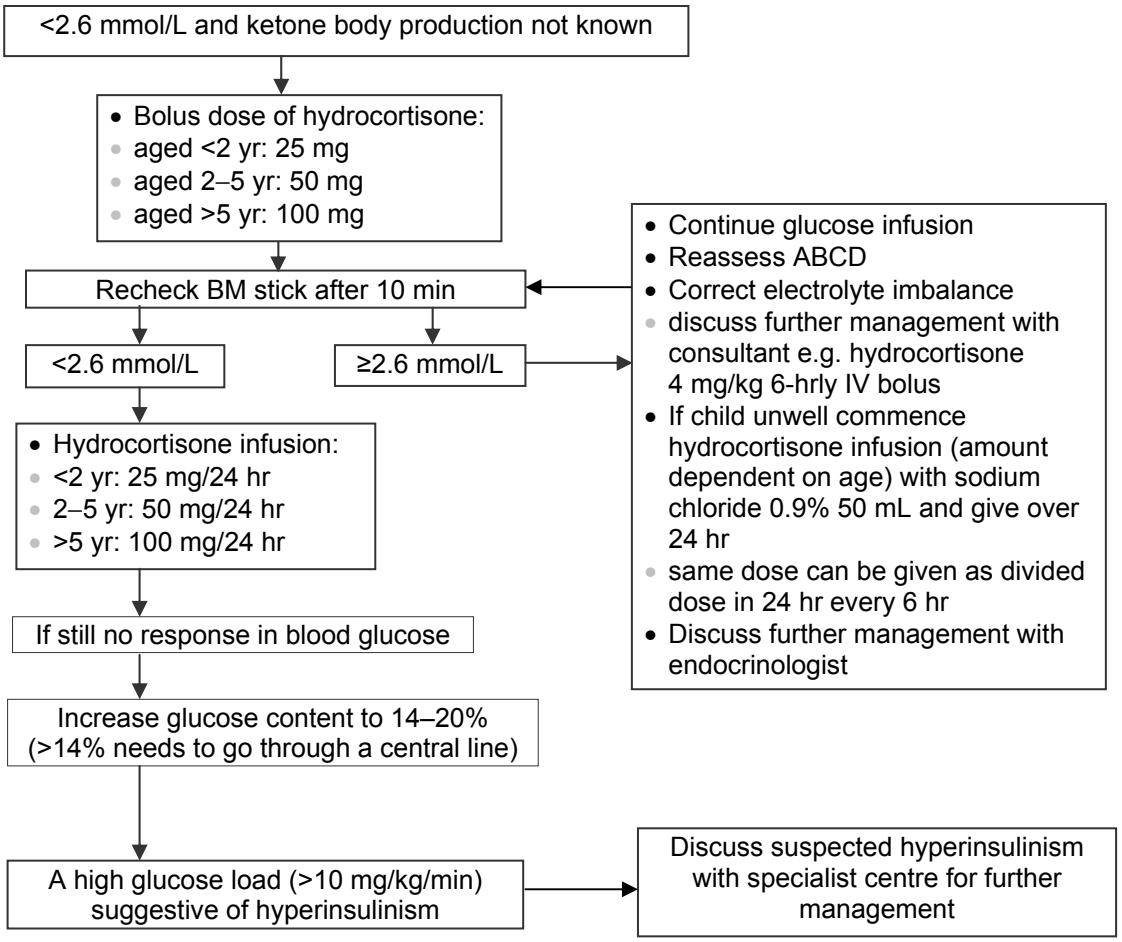
Algorithm: Ketones present (blood/urine)



IMMEDIATE TREATMENT



SUBSEQUENT MANAGEMENT



To calculate the amount of mg glucose/kg/min: $\frac{\text{\% glucose x 10 x mL volume/hr}}{\text{60 x wt (kg)}}$

IMMUNE THROMBOCYTOPENIC PURPURA (ITP) ● 1/2

RECOGNITION AND ASSESSMENT

Definition

- Platelets <100 $\times$ 10^9/L, usually <20 $\times$ 10^9/L
- Self-limiting disease with shortened platelet survival and increased megakaryocytes
- Good prognosis
- Acute 0–3 months
- Persistent 3–12 months
- Chronic >12 months

Symptoms and signs

- Acute onset bruising, purpura and petechiae
- serious mucosal bleeding unusual, look for other causes
- Preceding infection
- Absence of:
- hepatosplenomegaly
- lymphadenopathy
- evidence of serious cause/chronic underlying illness

Investigations

- FBC, blood film and clotting
- Blood group
- If headache and/or neurological signs, urgent CT scan of head
- Bone marrow aspiration unnecessary unless:
- neutropenia or severe anaemia
- hepatosplenomegaly
- lymphadenopathy
- pallor and lassitude
- pain limb/abdomen/back
- limp
- CMV and EBV IgM
- If risk factors: HIV, hepatitis B and C

IMMEDIATE TREATMENT

- None regardless of platelet count, unless life-threatening owing to significant bleeding
- If **significant bleeding** (e.g. uncontrollable epistaxis, GI haemorrhage, intracranial bleed), give:
- platelets (see **Blood and platelet transfusions** guideline). Result will be short lived
- methylprednisolone 30 mg/kg/day by IV infusion maximum 1 g per dose for 3 days
- immunoglobulin 0.8–1 g/kg (see local policy) can be repeated once within 3 days if required – red indication in the **Demand Management Programme for Immunoglobulin**
- If **moderate bleeding** e.g. prolonged mucosal bleeds, give prednisolone 2 mg/kg daily for 14 days then taper over 21 days **OR**
- prednisolone 4 mg/kg for 4 days **OR**
- immunoglobulin 0.8 g/kg IV single dose
- Consider tranexamic acid for small bleeds
- Avoid NSAIDs e.g. ibuprofen
- Reassure parents
- Discuss newly diagnosed ITP with paediatric haematologist/paediatric consultant with a haematology interest
- Discuss treatment with platelets with paediatric haematologist in event of:
- essential operations
- emergency dental extractions

SUBSEQUENT MANAGEMENT

- 75–80% resolve in 6 months
- favourable outcome irrespective of treatment
- Avoid contact sports
- impossible to prevent fighting/rigorous knockabout games at home
- Parents can find additional information from ITP support association: www.itpsupport.org.uk

IMMUNE THROMBOCYTOPENIC PURPURA (ITP) ● 2/2

MONITORING TREATMENT

- FBC and film monthly until diagnosis clear or recovery
- Repeat sooner if bleeding or increased bruising

DISCHARGE AND FOLLOW-UP

- Discharge from long-term follow-up when platelets >100 $\times$ 10^9/L and asymptomatic
- Advise of risk of relapse (20%)
- Note that mothers with history of ITP (even if they have normal platelet counts) can give birth to thrombocytopenic babies

CHRONIC IMMUNE THROMBOCYTOPENIC PURPURA

- Avoid NSAIDs
- Avoid contact sports
- Investigate for autoimmune disease (ANA antinuclear antibody; APLA antiphospholipid antibodies; ACA, anticardiolipin antibody; and LAC, lupus anticoagulant) and immune deficiency (HIV, IgG, IgA, IgM)
- Treat only:
  - profound thrombocytopenia (<10 $\times$ 10^9/L) with repeated mucosal bleeding
  - older girls with menorrhagia
  - trauma
  - acute neurological signs
- If treatment indicated, give prednisolone 2 mg/kg/day 14 days, then taper over 21 days **OR** dexamethasone 0.6 mg/kg/day (maximum 40 mg) orally for 4 days if ongoing bleeding
  - must have bone marrow aspirate before treatment
- If unresponsive, discuss with paediatric haematologist about treatment with rituximab or thrombopoietin receptor agonists
- Splenectomy reserved for those with persistent/significant bleeding non-responsive or intolerant of other therapies

IMMUNODEFICIENCY ● 1/2

RECOGNITION AND ASSESSMENT

- SPUR to recognition: **S**erious, **P**ersistent, **U**nusual, or **R**ecurrent infections
- The younger the onset, the more life-threatening the immune defect likely to be
  - bacterial infection; early presentation: antibody defect
  - viral/fungal infection; later presentation: cellular defect
- Family history of primary immunodeficiency (PID): focused investigations and refer

Warning signs of PID:

- ≥4 new bacterial ear infections within 1 yr
- ≥2 serious sinus infections within 1 yr
- ≥2 months on antibiotics without resolution of symptoms
- ≥2 episodes of pneumonia within 1 yr
- Failure to thrive with prolonged or recurrent diarrhoea
- Recurrent, deep skin or organ abscess
- Persistent candida in mouth or napkin area
- Need for IV antibiotics to clear infections
- ≥2 severe infections (e.g. meningitis, osteomyelitis, cellulitis or sepsis)
- Family history of PID

Symptoms of immune deficiency

- Delayed umbilical cord separation of ≥3 weeks, omphalitis
- Delayed shedding of primary teeth
- Severe adverse reaction to immunisation e.g. BCGitis
- Unusually severe course of measles or chickenpox
- Family history of any syndrome associated with immunodeficiency, (e.g. DiGeorge anomaly or Wiskott-Aldrich syndrome); or of death during early childhood
- High risk group for HIV and no antenatal HIV test (a negative antenatal HIV test does not exclude HIV in the child)
- Autoimmune liver disease, diabetes, vasculitis, ITP
- Poor wound healing
- Unexplained bronchiectasis or pneumatoceles
- >1 unexpected fracture

Signs of immune deficiency

- Congenital abnormalities: dysmorphic features, congenital heart disease, situs inversus, white forelock, albinism, microcephaly
- Children who appear chronically ill
- Scarring or perforation of tympanic membranes from frequent infection
- Periodontitis
- Enlargement of liver and spleen
- Hypoplastic tonsils and small lymph nodes
- Lymphadenopathy
- Skin: telangiectasia, severe eczema, erythroderma, granuloma, acneiform rash, molluscum, zoster
- Ataxia

Other investigations suggestive of immune deficiency

- Haemolytic anaemia
- Neutropenia
- Eosinophilia
- Hypocalcaemia

Unusual organisms or unusual diseases with common organisms

- Viruses: CMV, EBV, VZV, warts
- Fungi: candida, aspergillus, cryptococcus, pneumocystis, nocardia
- Protozoa: cryptosporidium, toxoplasma
- Bacteria: salmonella, giardia, mycobacterium (including BCG), serratia
- Recurrent infection with common organisms: *H. influenzae, S. pneumoniae, N. meningitidis, S. aureus*

Investigations

- If severe combined immunodeficiency disease possible urgent initial tests below
  - failure to thrive, diarrhoea, severe/disseminated infections, opportunistic infections, rash

Table 1: Investigations

INVESTIGATIONS	SAMPLE	VOLUME	
		Minimum	Ideal
Initial tests (complete all tests for any suspected immune deficiency)			
FBC and differential white cell count	EDTA	1.3 mL	4 mL
Immunoglobulins (G, A, M, D, E)	Clotted	0.5 mL	4 mL
Complement	Clotted	1 mL to reach lab within 2 hr	4 mL to reach lab within 2 hr or separate and freeze immediately
HIV antibody	Clotted	0.5 mL	4 mL
Lymphocyte subsets	EDTA	1 mL	4 mL
Second-line tests (with immunology advice)			
Lymphocyte proliferation	Lithium heparin	Discuss with local immunology centre	
Normal neutrophils			
Neutrophil function test for CGD	EDTA or lithium heparin	0.25 mL	4 mL
		Discuss with local immunology centre	
Recurrent or case with family history of meningococcal disease			
IgG function (antibody response to tetanus, Hib) Retest 4 weeks after vaccination	Clotted	0.5 mL	4 mL

RESULTS

- Isolated neutropenia or lymphopenia: if concerns possible immune deficiency, recheck 1–2 weeks. If persistent:
- auto-antibodies (ANA), allo-antibodies, Coombs' test (neonates), C3, C4, rheumatoid factor, urine/saliva CMV
- pancytopenia: discuss with haematology
- hypogammaglobulinaemia: discuss with local immunology centre

SUBSEQUENT MANAGEMENT

- Avoid live vaccines (e.g. BCG, MMR and varicella)
- Ensure that any blood products given to patients with suspected or proven T-cell immunodeficiency are irradiated and CMV negative
- For specific infections, use same antibiotics as in immunocompetent patients, at higher recommended dosage
- Obtain throat, blood and other culture specimens before starting treatment
- Treat infectious episodes for longer than usually recommended (approximately double)
- In patients with B-cell, T-cell or phagocytic defects, request regular pulmonary function tests and home treatment plan of physiotherapy and inhalation therapy similar to that used in cystic fibrosis
- In children with significant primary or secondary cellular (T-cell) immunodeficiency (e.g. aged <1 yr CD4 <25%, aged 1–5 yr CD4 <15% or aged >5 yr <200 CD4 cells/mm^3), give *Pneumocystis jiroveci* (PCP) prophylaxis with co-trimoxazole

INFECTION PREVENTION • 1/4

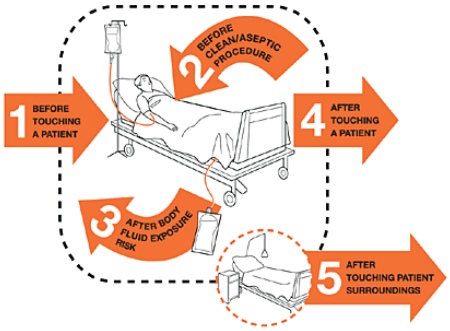
HAND HYGIENE

- Describes decontamination of hands using soap and water, antiseptic wash or alcohol hand rub solution
- Good hand hygiene is the most effective way to prevent spread of infection
- Use this safe method of working at all times to protect staff, patients and others from infection
- All practitioners are personally accountable for their hand hygiene practices

ASSESSMENT OF NEED TO DECONTAMINATE HANDS

Hands must be decontaminated at critical points before, during and after patient care to prevent cross-infection of micro-organisms – see World Health Organisation (WHO) **5 moments for hand hygiene**

- Hand decontamination must be carried out at the following 5 moments of care regardless of whether or not gloves have been worn
- before touching a patient
- before and after aseptic non-touch technique (ANTT)/aseptic procedure
- after body fluid exposure
- after touching a patient
- after touching patient surroundings



- Hands must also be decontaminated
- on arrival at and before leaving ward/department
- after visiting the toilet
- before serving/preparing food or drinks
- after any activity or contact that potentially results in hands becoming contaminated
- on entering and leaving an isolation cubicle
- after removing personal protective equipment

CHOICE OF HAND HYGIENE PREPARATIONS

- Alcohol hand rub is an effective method of hand decontamination on visibly clean hands but is not recommended when hands are visibly dirty

Alcohol hand rub alone must not be used after caring for patients (or their equipment/environment) with suspected or known infectious diarrhoea e.g. **C. difficile** ***or Norovirus, regardless of whether gloves are worn***

- Hand washing with liquid soap and water removes dirt, organic matter and transient flora by mechanical action, to be used:
- when hands are visibly dirty/visibly soiled with body fluids or other organic matter
- when caring for patients with:
  - suspected or confirmed diarrhoea and/or vomiting
  - *C. difficile*/Norovirus and during outbreaks of these organisms on wards/in bays
- after several consecutive applications of alcohol hand rub
- after visiting the toilet
- Liquid soap alone does not provide sufficient hand disinfection before invasive procedures and surgery

DRESS CODE

- Bare below elbow for all staff working within clinical areas (e.g. no sleeves below elbow, no wrist watches, wrist jewellery or plaster casts/wrist splints)
- Do not wear false nails, nail extensions, gel nails or nail varnish
- Keep nails short and clean
- No stoned rings (acceptable to wear a plain wedding band)
- Long hair tied back

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Aprons

- <2 metres of child with respiratory tract infection
- Contact with infectious materials or equipment anticipated
- Using hazardous chemicals
- ANTT – see below

Gloves (non–sterile)

- Contact with respiratory secretions or other infectious material of contaminated surfaces
- Single patient use; new gloves and apron for every procedure
- Take gloves and apron off at point of use and clean hands
- Do not carry gloves in your pocket
- Do not use alcohol hand rub on gloves
- ANTT if not touching key parts/key sites

Remove gloves and aprons as soon as clinical activity completed before touching pens, notes, phone, computer etc.

Sterile gloves and gown

- For central venous line (CVL) including peripheral long line (PICC)
- Sterile gloves for ANTT if touching key parts/key sites

Masks

- Surgical face mask
- <2 metres child with respiratory tract infection
- FFP3 mask (fit-tested) aerosol generating procedure (e.g. intubation, CPAP) with respiratory tract infection and when advised by infection prevention team
- in conjunction with eye protection when increased risk of splashing of body fluids into eyes/nose/mouth

Eye protection

- <2 metres of child with persistent coughing or sneezing
- When increased risk of splashing of body fluids in to eyes

ANTT

- See local ANTT guidelines

Definition

- Essential procedure aimed at protecting patients from infection during invasive procedures
- Achieved by minimising presence of pathogenic micro-organisms as is practically possible
- Specific type of aseptic technique with a unique theory and practice framework, providing core principles for safe aseptic technique and a standardised approach to assessing and applying safe aseptic technique to any invasive clinical procedure
- Do not touch and protect ‘key parts’ or ‘key sites’ e.g. use caps and covers for end of syringes/needles

Preparation phase

- Decontaminate hands
- Decontaminate tray or trolley choice using Trust approved disinfectant
- Clean hands
- PPE (as above)
- Prepare and assemble equipment using a non-touch technique protecting key parts at all times by not touching them
- Remove gloves and decontaminate hands

Patient phase
- Decontaminate hands at point of care
- Apply appropriate PPE non-sterile gloves not touching key parts (e.g. IV drug administration, venepuncture/cannulation) sterile gloves if touching key parts (e.g. urinary catheterisation, central line/PICC insertion)
- Prepare all equipment using a non-touch technique, protecting key parts at all times by not touching them
- Decontaminate key parts/key sites using single use chlorhexidine 2% in alcohol 70% (SEPP/FREPP or ChloraPrep® 3 mL) and allow drying for 30 sec
- Perform procedure, ensuring protection of key parts/sites at all times

Decontamination phase
- Dispose of sharps into sharps box immediately at point of use
- Remove PPE at patient's bedside
- Dispose of all equipment as clinical waste in nearest clinical waste bin, return equipment to clinical room ensuring it is cleaned with detergent wipes
- Decontaminate hands

ISOLATION

If unsure, discuss with infection prevention team

Indications for cubicle when available
- Infectious disease
  - airborne: always isolate
  - droplet: always isolate
  - contact: isolate or cohort
  - enteric: isolate if possible
- Immune deficiency
- Special risk of infection

Cohort several children with same illness
- Bronchiolitis cohort (intermediate risk – see below)
- Diarrhoea or vomiting (high risk)

First 24 hr treatment, then can move to multi-occupancy bay if responding and apyrexial
- Meningitis (no rash) intermediate risk
- Meningococcal disease (purpuric rash) high risk
- Group A strep (e.g. scarlet fever) high risk

Low risk: move to bay if no cubicle in hospital
- Shingles (if rash on none exposed part of body), impetigo, scabies, lice, herpes
- Non-pulmonary TB
- Transfer from another hospital pending screening results
- HIV CD4 >350 x 10^6/L or >25%

Intermediate risk: **move to bay if no cubicle in region**
- Preterm infants aged <2 months
- Symptomatic congenital heart disease
- Chronic lung disease in oxygen
- MRSA colonised no skin lesions
- ESBL, VRE or *C. difficile* with diarrhoea
- HIV CD4 200–350 x10^6/L or 15–25%

High risk: **move to bay only if no cubicle in country**
- Neutropenic (<0.5 x 10^9/L)
- Cystic fibrosis, burns
- PVL *S. aureus*
- MRSA with skin lesions or in sputum
- Carbapenemase colonised
- Gastroenteritis or *E. coli* 0157

- Mumps, hepatitis A
- HIV CD4 <200 x 10^6/L or <15%

Always isolate or manage at home

- Measles
- Chickenpox
- Smear +ve TB and coughing <1 week into treatment
- Consult with infection prevention or infectious diseases team

Above lists are not exhaustive. Consult with infection prevention or on-call microbiologist as required

INTRAOSSEOUS INFUSION ● 1/2

INDICATIONS

- Severely ill infants and children when immediate vascular access needed and peripheral access not possible (maximum 2 attempts)
- Cardiac arrest
- allows rapid expansion of circulating volume
- gives time to obtain IV access and facilitates procedure by increasing venous filling

EQUIPMENT

- EZ-IO drill and needles (<40 kg: 15 mm pink; >40 kg: 25 mm blue) or intraosseous infusion needles for manual insertion on resuscitation trolley
- 5 mL syringe with extension and 3-way tap to aspirate and confirm correct position
- 10 mL sodium chloride 0.9% flush
- 20 or 50 mL syringe to administer fluid boluses
- Infusion fluid

For manual insertion, infiltrate skin with lidocaine 1% 1–2 mL [maximum dose 3 mg/kg (0.3 mL/kg)] if patient responds to pain

PROCEDURE

EZ-IO

1. Locate landmarks
2. Aseptic non-touch technique: clean site
3. Choose appropriate size needle and attach to drill magnetically
4. Hold drill and needle at 90° to skin surface and push through skin without drilling, until bone is felt
5. Push drill button and drill continuously and push until there is loss of resistance – there is a palpable give as needle breaches the cortex
6. Remove drill and unscrew trocar
7. If possible aspirate the marrow
8. Attach pre-prepared connection tube
9. Secure needle (with EZ-IO fixator if available)
10. If awake, give lidocaine 1% (preservative free) 0.5 mg/kg (0.025 mL/kg) over 2 min through IO leave 1 min then flush with sodium chloride 0.9% 2 mL
11. Proceed with required therapy

Preferred sites

Avoid fractured bones and limbs with fractures proximal to possible sites

Proximal tibia

- Identify anteromedial surface of tibia 1–3 cm below tibial tuberosity
- Direct needle away from knee at approximately 90° to long axis of tibia

Figure 1: Access site on proximal tibia – lateral view

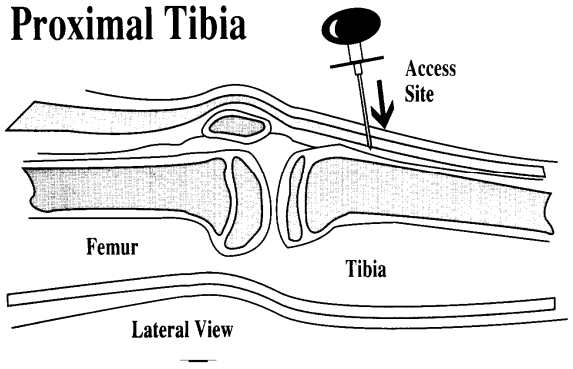
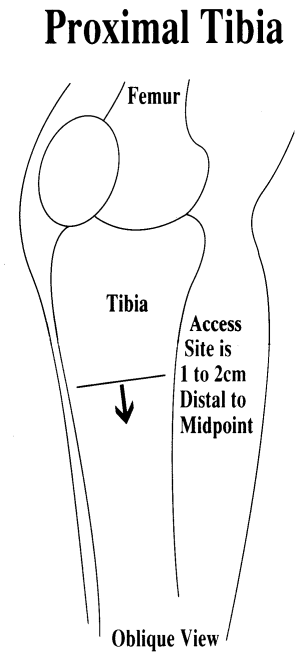


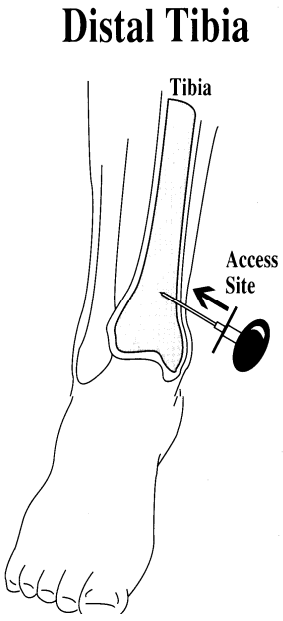
Figure 2: Access site on proximal tibia – oblique view



Distal tibia

- Access site on medial surface of tibia proximal to medial malleolus

Figure 3: Access site on distal tibia



Distal femur

- If tibia fractured, use lower end of femur on anterolateral surface, 3 cm above lateral condyle, directing needle away from epiphysis

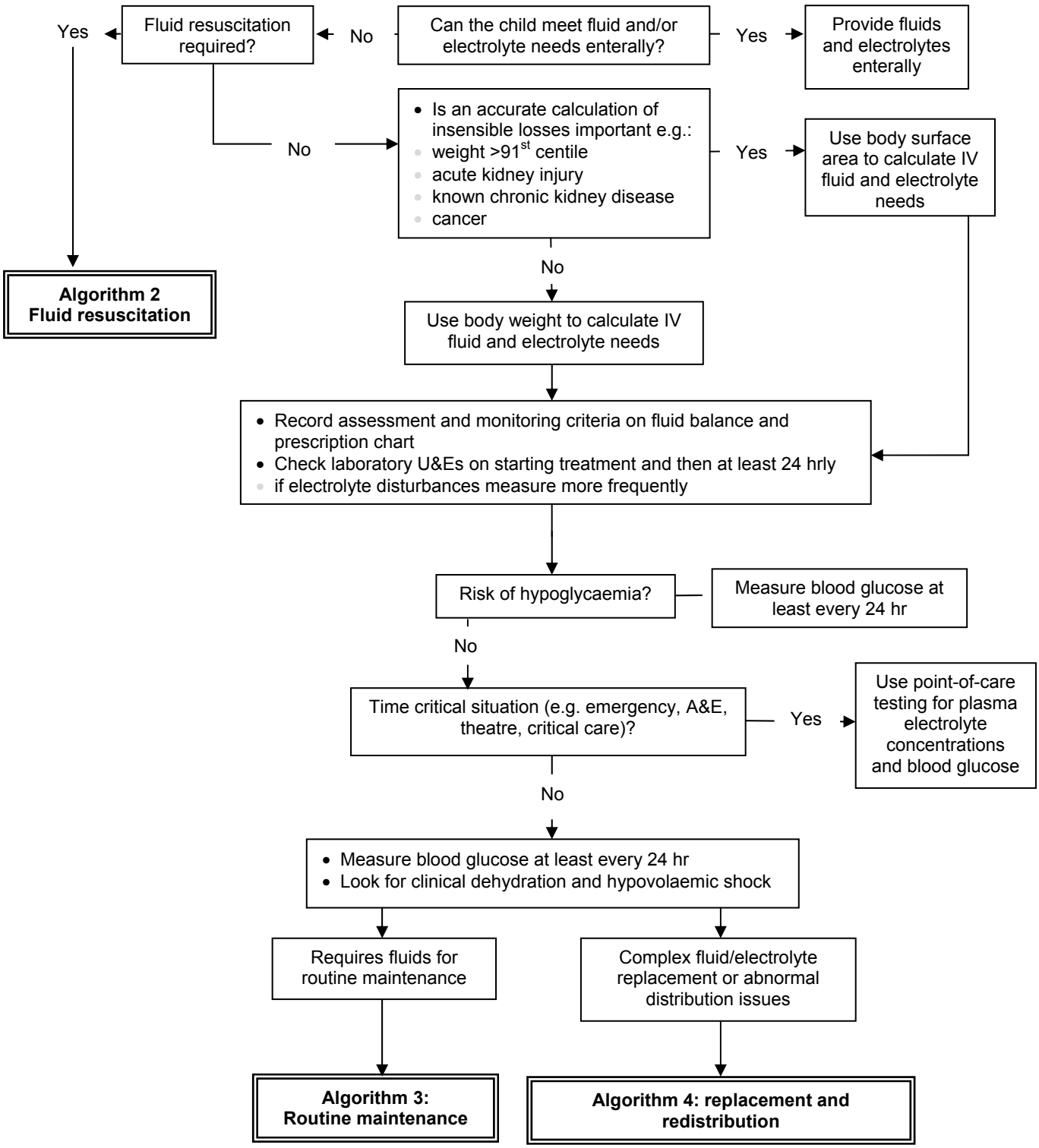
COMPLICATIONS

- Bleeding
- Infection
- revert to central or peripheral venous access as soon as possible
- Compartment syndrome
- observe and measure limb circumference regularly
- palpate distal pulses and assess perfusion distal to IO access site
- Pain from rapid infusion: give lidocaine 1% 0.5 mg/kg over 5 min

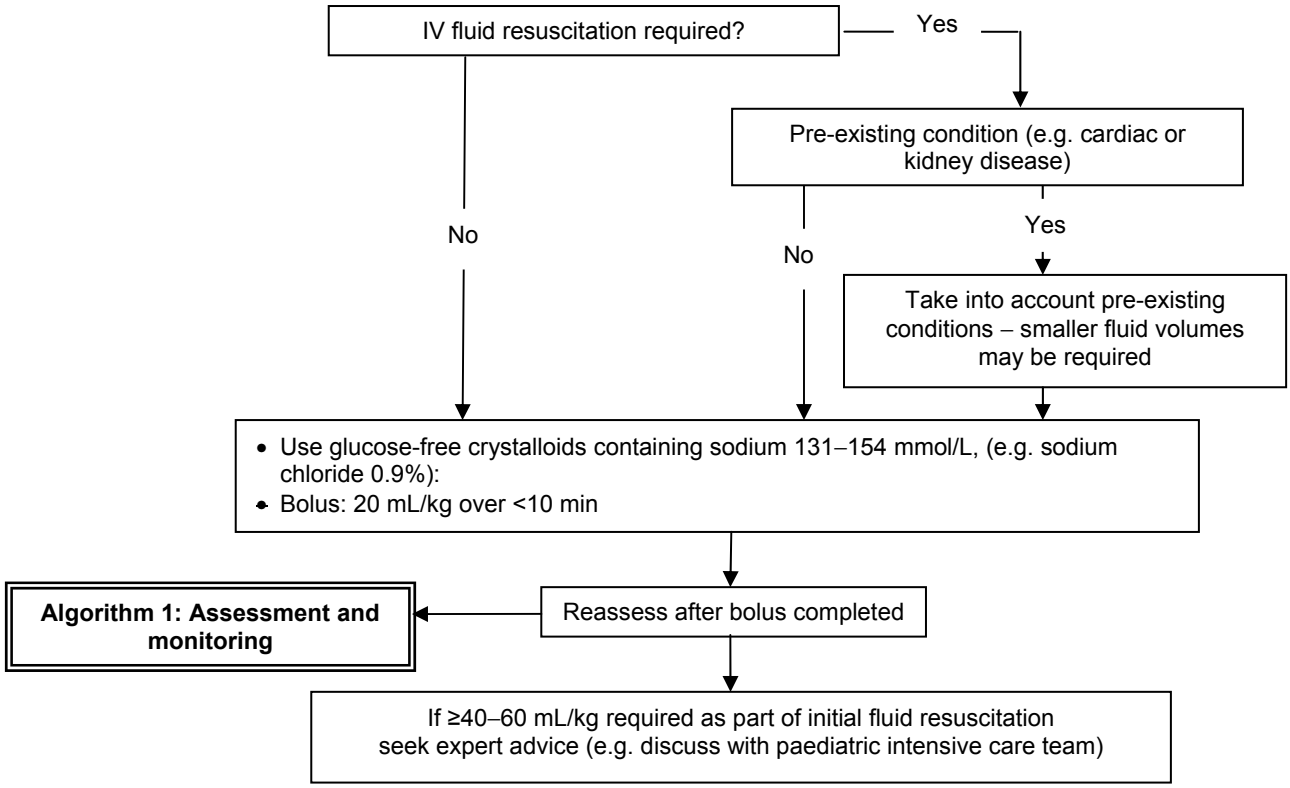
Use volumetric pump to administer IV fluids

- Nurse to check and document following hourly:
  - infusion rate
  - infusion equipment
  - site of infusion
- Close all clamps and switch off pump before removing giving set

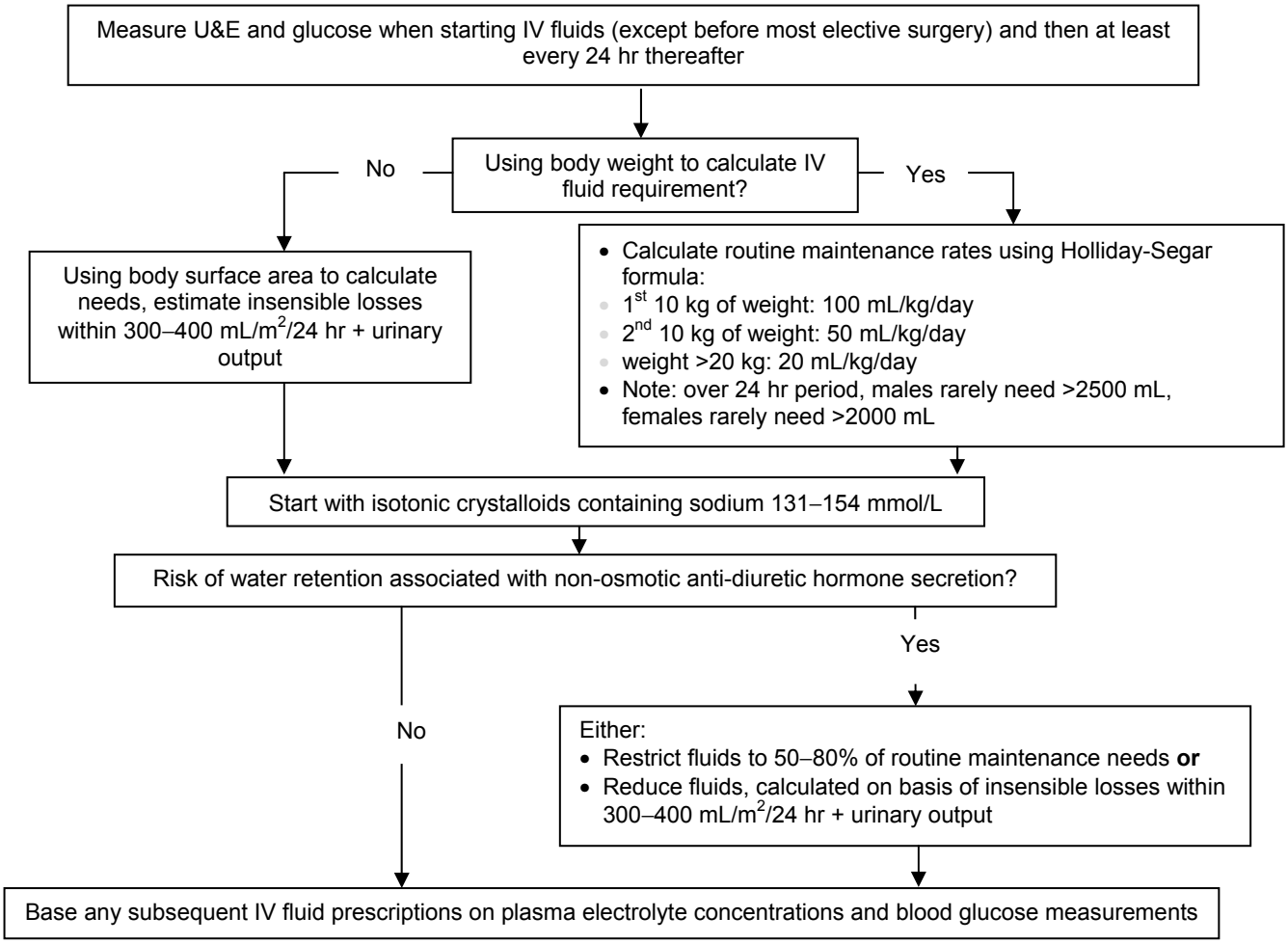
Algorithm 1: Assessment and monitoring



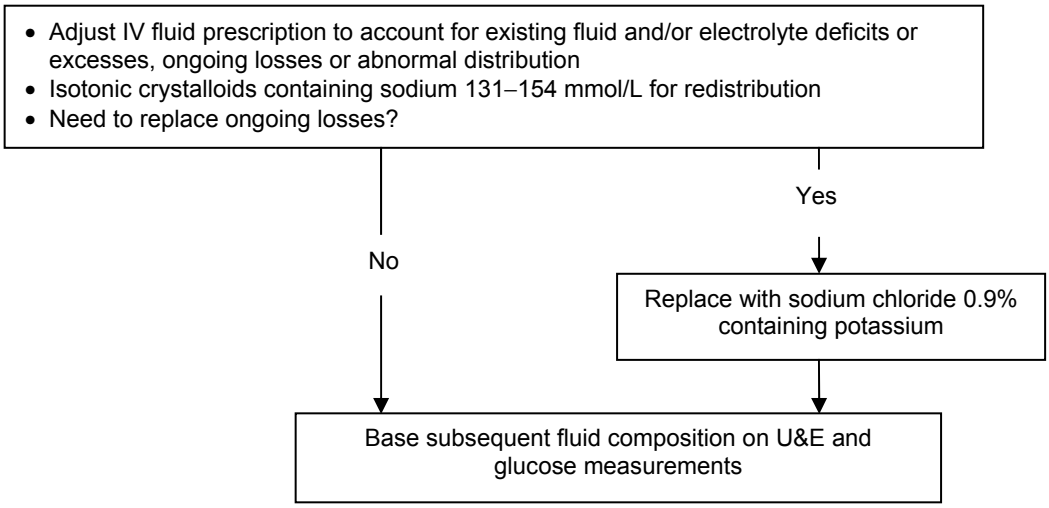
Algorithm 2: Fluid resuscitation



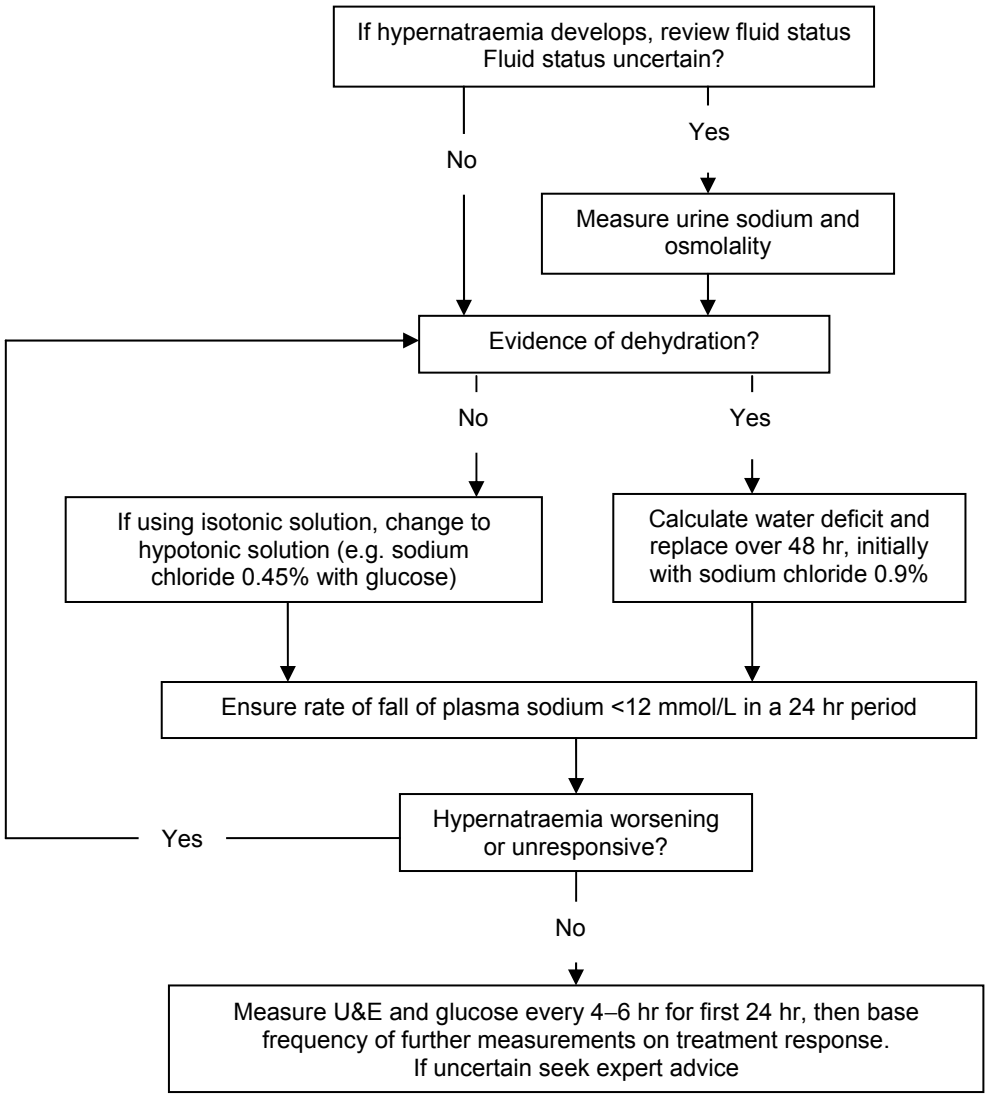
Algorithm 3: Routine maintenance



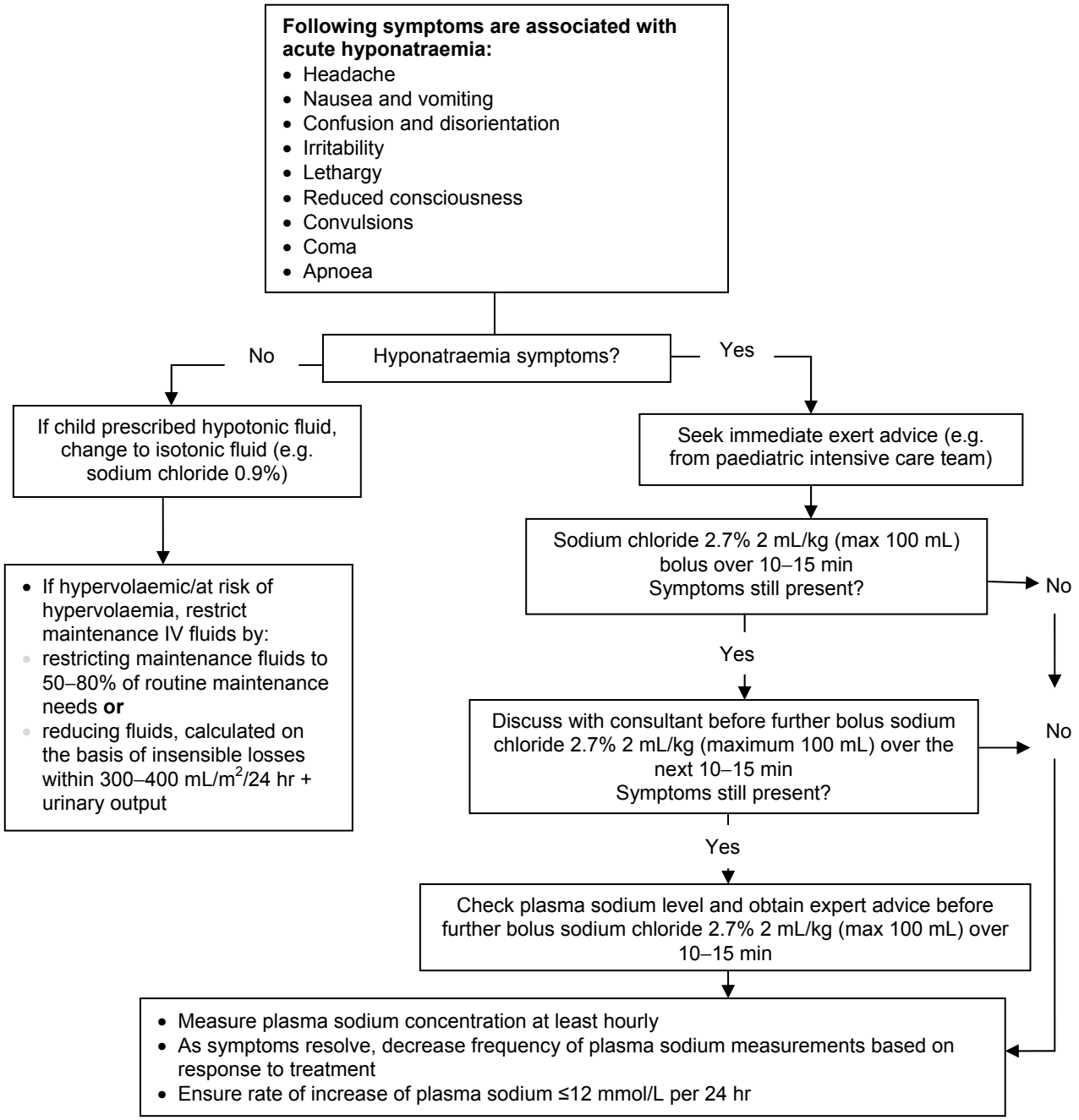
Algorithm 4: Replacement and redistribution



Algorithm 5: Managing hypernatraemia (plasma sodium >145 mmol/L) developing during IV fluid therapy



Algorithm 6: Managing hyponatraemia (plasma sodium <135 mmol/L) that develops during IV fluid therapy



JAUNDICE IN NEONATES ● 1/3

Jaundice in neonates aged >7 days (aged <7 days see **Neonatal** guidelines)

RECOGNITION AND ASSESSMENT

Symptoms and signs

- Any visible yellow colouration of skin in any infant
- Yellow conjunctivae in dark-skinned infants
- In an infant aged >14 days (or >21 days preterm infants <37/40)

Assess for red flags

- Stools (pale and/or chalky; refer to CLDF stool colour chart) and urine colour (yellow or orange is abnormal and suggests conjugated hyperbilirubinaemia. Most infants have colourless urine)
- Pallor (haemolysis)
- Poor feeding, drowsiness (neurotoxicity)
- Poor weight gain (plot on centile chart, is growth satisfactory and has infant regained birth weight?)
- Hepatosplenomegaly (blood-group incompatibility or cytomegalovirus, liver disease)
- Splenomegaly (e.g. haemolytic anaemia, spherocytosis)
- Dysmorphic features

Causes of persistent jaundice >14 days in term infants and >21 days in preterm

- Physiological/breast milk jaundice
- Prematurity
- Increased bilirubin load (e.g. bruising, blood group incompatibility)
- G6PD deficiency and other red cell enzyme deficiencies
- congenital spherocytosis
- cephalohaematoma
- Rarely infection (e.g. UTI, congenital infection)
- Metabolic disorder (e.g. galactosaemia, tyrosinaemia)
- Endocrine disorders (e.g. hypothyroidism, hypopituitarism)
- Biliary atresia
- Liver disease (e.g. neonatal hepatitis, alpha-1-antitrypsin deficiency)
- TPN-induced cholestasis

Investigations

All

- Total bilirubin
- Conjugated bilirubin on all babies aged >14 days. Can wait until next working day in the absence of red flags (as above)
- Document stool and urine colour
- Blood glucose if baby is unwell

Second-line investigations – indicated if ≥1 red flags present

- Check routine metabolic screening has been performed (serum and urine organic acid)
- If conjugated bilirubin >20% of total bilirubin, seek advice of specialist liver unit as infant may require further investigations
- If conjugated bilirubin >20% of total bilirubin perform following:
- save stool sample for senior review
- U&E and bicarbonate
- LFTs (ALT/AST, alkaline phosphatase, gamma GT, albumin)
- pre-feed blood glucose, perform for at least first 24 hr of admission
- FBC, retics and blood film
- blood group and direct Coombs' test
- coagulation screen including PT and/or INR [give 300 microgram/kg phytomenadione IV (vitamin K) if prolonged and repeat after 12 hr]
- G6PD screen in African, Asian or Mediterranean patients
- thyroid function tests: ask for 'FT4 priority and then TSH'
- congenital infection screen:
  - CMV PCR: in urine first 2 weeks of life, later test newborn blood spot card
  - toxoplasma ISAGA-IgM and
  - HSV PCR

- metabolic investigations:
  - blood galactose-1-phosphate uridyltransferase
  - urine dipstick for protein
  - urine for reducing substances
  - urine for amino acid and organic acid
  - alpha-1-antitrypsin level and phenotype
  - cortisol
  - cholesterol and triglycerides
  - immunoreactive trypsinogen (IRT)

Third-line investigations that may be recommended by paediatric gastroenterologist or hepatologist

- Liver and abdominal ultrasound
- DESIDA or HIDA radionucleotide scan
- Lactate, ammonia and pyruvate
- Very long chain fatty acids
- Urine and serum bile acids
- Acyl carnitine
- Isoelectric focussing of transferrin
- Ferritin and transferrin saturation
- Muscle biopsy
- Bone marrow for storage disorders
- Skin biopsy for fibroblast culture
- Liver biopsy
- If Alagille syndrome suspected: CXR to look for butterfly vertebrae
- Syphilis serology
- Ophthalmological examination (for Alagille syndrome and panhypopituitarism)

If conjugated bilirubin elevated at any age (>20% of total bilirubin), discuss with consultant urgently

Limits (micromol/L) for phototherapy and exchange transfusion for infants ≥38 weeks' gestation

Age (hours)	Repeat transcutaneous bilirubin/serum bilirubin (6–12 hours)*	Consider phototherapy#	Phototherapy	Exchange transfusion
0			>100	>100
6	>100	>112	>125	>150
12	>100	>125	>150	>200
18	>100	>137	>175	>250
24	>100	>150	>200	>300
30	>112	>162	>212	>350
36	>125	>175	>225	>400
42	>137	>187	>237	>450
48	>150	>200	>250	>450
54	>162	>212	>262	>450
60	>175	>225	>275	>450
66	>187	>237	>287	>450
72	>200	>250	>300	>450
78	>212	>262	>312	>450
84	>225	>275	>325	>450
90	>237	>287	>337	>450
96+	>250	>300	>350	>450

***** Result in this category repeat transcutaneous measurement in 6–12 hr
# Result in this category repeat serum bilirubin measurement in 6 hr whether or not phototherapy started

- For other gestations see **Neonatal** guidelines

TREATMENT OF UNCONJUGATED JAUNDICE

- Adequate fluid and energy intake
- Phototherapy

Phototherapy

- If bilirubin near exchange threshold or still rising:
- increase power number of lights
- increase area exposed (e.g. biliblanket and overhead)

Exchange transfusion

- See **Exchange transfusion** in **Neonatal** guidelines

IVIG

- For dose information see https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/216671/dh_131107.pdf for dose information
- Use as an adjunct to multiple phototherapy in rhesus disease when bilirubin continues to rise by >8.5 micromol/L/hr

MONITORING TREATMENT

- If haemolysis present, check bilirubin 4–6 hrly until rate of rise flattens
- If bilirubin concentration approaching threshold for exchange transfusion, or rising rapidly (>10 micromol/hr), check 4-hrly

SUBSEQUENT MANAGEMENT

- When bilirubin concentration has fallen below threshold for phototherapy (see above), discontinue phototherapy
- If jaundice persists after aged 14 days, review and treat cause

TREATMENT OF CONJUGATED JAUNDICE

- Fat soluble vitamins (A,D,E and K)
- Ursodeoxycholic acid (after discussions with liver unit)

FOLLOW-UP

Conjugated jaundice

- Conjugated bilirubin <20% of total bilirubin in a well baby without red flags
- discharge to routine community care
- advise parents to look out for ‘worrying features’
- Conjugated fraction >20%
- discuss with consultant as this will depend on cause and severity of conjugated jaundice

Unconjugated jaundice

- GP follow-up with routine examination at 6–8 weeks
- If exchange transfusion necessary or considered, request development follow-up and hearing test
- In babies with positive Coombs’ test who require phototherapy, check haemoglobin at aged 2 and 4 weeks because of risk of continuing haemolysis and give folic acid daily

KAWASAKI DISEASE ● 1/3

Early treatment reduces mortality from coronary artery aneurysms

RECOGNITION AND ASSESSMENT

Symptoms and signs

- Fever ≥5 days and 4 of the following:
  - conjunctivitis: bilateral, bulbar, non-exudative
  - oral changes: red lips/pharynx/tongue
  - peripheral oedema: erythema palms and soles, followed by desquamation fingertips10–15 days after onset of fever
  - rash: polymorphous (no vesicles or crusts)
  - lymph nodes: acutely enlarged cervical nodes >1.5 cm diameter
- Absence of another diagnosis e.g. group A streptococcal infection (GAS), measles
- Presence of a coronary artery aneurysm with any 1 of the above features is diagnostic

Other features

- Most common in children aged <5 yr, peak 18–24 months
- Atypical cases may not fulfil all the above criteria
  - if fever <5 days but 4 signs above
  - persistent raised CRP and no other diagnosis and suspicion of Kawasaki disease (KD)
  - fever usually precedes the other signs, unresponsive to antipyretics
  - common features: irritability, erythema of BCG site
  - other symptoms include aseptic meningitis, uveitis, cough, vomiting, diarrhoea, abdominal pain, urethritis, arthralgia and arthritis

High risk features

- Already failed IVIG
- Aged <1 yr
- Severe inflammation (persistently raised CRP despite IVIG, liver dysfunction, hypoalbuminaemia, anaemia)
- Features of haemophagocytic lymphohistiocytosis (persistent fever, hepatosplenomegaly, cytopenia >2 cell lines, hypertriglycideridaemia, hypofibrinogenaemia, increased D-dimers, hyperferritinaemia)
- Shock
- Evolving coronary or peripheral aneurysms
- Kobayashi risk score >5
  - Na ≤133 mmol/L = 2
  - ≤4 days of illness = 2
  - ALT ≥100 iu/L = 1
  - platelets ≤300 x 10^9/L = 1
  - CRP ≥100 mg/L = 1
  - aged ≤1 yr = 1
  - ≥80% neutrophils = 2

Investigations

None is diagnostic

- FBC: neutrophilia and thrombocytopenia early
- ESR and CRP elevated
- LFTs: raised bilirubin, ALT, low albumin
- Urine: sterile pyuria
- CSF: lymphocytes
- ECG: ST depression, T wave inversion, heart block
- Echo: do not delay therapy before echocardiogram
- Throat swab for Group A strep
- Anti-streptolysin O titre (ASOT) or anti-DNase B for evidence of streptococcal infection
- Blood culture
- Urinalysis, microscopy and culture
- If rash present, serology for enterovirus, parvovirus, EBV, CMV; if features of measles urine or throat swab in viral transport medium for PCR

KAWASAKI DISEASE ● 2/3

Incomplete Kawasaki disease

- Children with fever ≥5 days and 2 or 3 compatible clinical criteria **or**
- Infants with fever ≥7 days with other explanation
- CRP <30 mg/L and ESR <40 mm/hr
  - if fever persists, serial clinical and laboratory re-evaluation
  - if typical peeling develops, echocardiogram
- CRP ≥30 mg/L and/or ESR ≥40 mm/hr treat if:
  - anaemia for age
  - platelets ≥450 x 10^9/L after 7^{th} day of fever
  - albumin <30 g/L
  - elevated ALT
  - WBC >15 x 10^9/L
  - urine ≥10 WBC/microlitre

IMMEDIATE TREATMENT

- Aspirin 7.5–12.5 mg/kg oral 6-hrly until afebrile or a minimum of 2 weeks
- Intravenous immunoglobulin (IVIG) 2 g/kg
  - check concentration (g/mL) for preparation used in your Trust
  - administer at gradually increasing rate, as below:

Rate*	Duration
30 mg/kg/hr	30 min
60 mg/kg/hr	30 min
120 mg/kg/hr	30 min
240 mg/kg/hr*	30 min
360 mg/kg/hr*	30 min
480 mg/kg/hr*	To completion

*** Volume will depend on concentration used and maximum rate may be restricted by product literature**

Start IVIG as soon as possible (delayed treatment increases risk of aneurysm)

MONITORING IVIG INFUSION

- Monitor temperature, heart rate, BP and respiratory rate:
  - every 5 min for first 15 min
  - then every 15 min for first hour
- Anticipate anaphylaxis, flushing, fever, headache, shivering
- If tolerated, increase infusion rate to give total dose over remaining 10 hr and monitor hourly
- If mild reaction, stop infusion for 15 min then restart at slower rate

HIGH RISK

- Aspirin and IVIG as above
- Methylprednisolone 0.8 mg/kg IV 12-hrly for 5–7 days or until CRP normalises
  - then prednisolone 2 mg/kg/day oral and wean over 2–3 weeks

SUBSEQUENT MANAGEMENT

- If fever persists 36 hr after completion of IVIG, consider a single repeat dose of IVIG (as above)
- If fever persists after second dose IVIG give methylprednisolone IV as above if not already given
- Discuss with cardiologist about infliximab (6 mg/kg) IV 1–2 doses (2 weeks apart if 2 doses)
- Fever settled for 48 hr, clinical improvement and falling CRP, reduce dose of aspirin to 2–5 mg/kg (maximum 75 mg) oral as single daily dose for minimum 6 weeks (until result of echocardiogram known)

DISCHARGE AND FOLLOW-UP

- Discharge when fever settles
- Echocardiogram at 10–14 days and 6 weeks from onset of signs and symptoms
- Outpatient appointment 1 week after echocardiogram
- Advise to avoid excessive strenuous activity until outpatient appointment after echocardiogram
- Advise to avoid all live vaccines (e.g. MMR) for 3 months following IVIG therapy

KAWASAKI DISEASE ● 3/3

OUTPATIENT MANAGEMENT

- No aneurysms at 6 weeks echocardiogram
  - stop aspirin
  - no restriction on activity
  - follow-up at 12 months and discharge if well
- Single aneurysm <8 mm diameter
  - aspirin 2–5 mg/kg (maximum 75 mg) once daily until aneurysm disappears
  - cardiologist will advise on limitation of activity, exercise stress test, MR/CT angiogram
  - 6-monthly ECG and echocardiogram
  - lifelong follow-up and advice on reduction of cardiovascular risk factors
- Multiple or giant aneurysm or stenosis
  - as for single aneurysm **and**
    - lifelong aspirin 2–5 mg/kg/day
    - warfarin (after heparinisation)

KETONE MONITORING ● 1/2

Blood ketone monitoring for all SC insulin regimens and insulin pump therapy

Negative ketones <0.6 mmol/L	**Small to moderate ketones** 0.6–1.5 mmol/L	**Moderate to large ketones** >1.5 mmol/L
Give correction dose to correct high blood glucose in addition to normal bolus for carbohydrates eaten	Give: • 10% of total daily dose of insulin as additional fast acting insulin **OR** • 0.1 unit/kg body weight as additional fast acting insulin	Give: • 20% of total daily dose of insulin as additional fast acting insulin **OR** • 0.2 units/kg body weight as additional fast acting insulin
Then: • Re-check blood glucose and ketones in 2 hr	Then: • Monitor fluid intake and ensure remains well-hydrated • Re-check blood glucose and ketones in 2 hr (see below)	Then: • Monitor fluid intake and ensure remains well-hydrated • Re-check blood glucose and ketones in 2 hr (see below)
If blood glucose is going down that is a good sign, but monitor closely throughout the day **If blood glucose increasing but ketones <0.6 mmol/L:** • Give another correction dose using pen If ketones 0.6–1.5 mmol/L, follow **small/mod** column advice If ketones >1.5 mmol/L, follow **mod/large** column advice	If ketone negative follow **negative** column advice **If blood glucose increasing but ketones remain 0.6–1.5 mmol/L:** • Continue to give 10% of total daily dose **OR** • 0.1 unit/kg as additional fast acting insulin every 2 hr using pen • Give usual boluses for food • Re-check blood glucose and ketones every 2 hr, including through night If ketones increase to >1.5 mmol/L follow **mod/large** column advice	If ketones negative follow **negative** column advice **If blood glucose increasing but ketones reduced to 0.6–1.5 mmol/L:** follow **small/mod** column advice If ketones still >1.5 mmol/L: • Give another 20% total daily dose **OR** • 0.2 units/kg as additional fast acting insulin every 2 hr using pen • Give usual boluses for food • If vomiting with high ketones, have low threshold for admission to hospital

SICK DAY DOSES

Insulin pumps

- When unwell, if blood glucose levels are high carry out standard checks on pump for:
  - occlusions
  - disconnection
  - battery failures
- Blood ketone level:
  - ≤0.6 mmol/L: give correction dose through pump
  - >0.6 mmol/L: give additional fast acting insulin using pen
- If 1 correction dose via pump has no effect in 1 hr, repeat correction dose with insulin pen
- Monitor blood glucose regularly
- If blood glucose levels rising in unwell child needing frequent additional insulin doses, consider using higher temporary basal rates – up to 200% of normal basal rates may be needed in some patients

PRE-ADMISSION MANAGEMENT OF INFECTIONS USUALLY ASSOCIATED WITH HYPOGLYCAEMIA (E.G. GASTROENTERITIS)

- Encourage regular small sips of sugar-containing drinks (**not** diet drinks)
- Monitor blood glucose ≤2-hrly
- If oral intake reduced and blood glucose in normal/low range: decrease usual fast acting insulin while illness persists

KETONE MONITORING ● 2/2

- Blood glucose :
- 10–14 mmol/L: give usual fast acting dose of insulin
- >14 mmol/L: see above for extra insulin doses
- Once oral intake tolerated again, give normal dose of insulin
- If not tolerating anything orally and blood glucose <4 mmol/L advise attend hospital
- If drowsy or reduced conscious level advise give glucagon IM as follows and dial 999:
- aged >1 month and <25 kg: 500 microgram glucagon IM
- ≥25 kg: 1 mg glucagon IM
- if then able to tolerate oral intake and blood glucose ≥4 mmol/L can go home
- If not tolerating anything orally or blood glucose still <4 mmol/L, admit for observation and IV glucose if necessary
- If child has been vomiting and not eating they may have ketones with normal blood glucose (starvation ketones)
- Monitor blood glucose frequently and encourage fluids containing sugar
- If blood glucose >14 mmol/L with ketones and vomiting, this is DKA; advise attend hospital urgently

LIMPING CHILD ● 1/5

DEFINITION

- Abnormal gait usually caused by:
- pain
- weakness
- deformity
- Typically due to shortened ‘stance phase’ in gait cycle
- Parents/carers may use the term 'limping' to describe any abnormality of gait

RECOGNITION AND ASSESSMENT

History

- Trauma
- Weight loss
- Tiredness
- Birth history including presentation at delivery and hip screening
- Development disorders, e.g. cerebral palsy
- Fever
- Recent viral infection
- Joint swelling
- Joint stiffness (particularly early morning if considering inflammatory causes)
- Sickle cell status
- Duration of symptoms
- if delay in presentation consider non-accidental injury (see **Child protection** guideline)

Examination

- Observations including:
- temperature
- weight
- Look for:
- rashes
- pallor
- lymphadenopathy
- hepatosplenomegaly
- Torsion can present as limp – examine testes

pGALS screening

- Gait – is it antalgic/Trendelenberg?
- Toe and heel walking
- Arms
- look for:
  - restricted range of motion
  - stiffness
  - swelling
  - erythema
- Legs
- look for:
  - bruising
  - deformity
  - erythema
  - is the pelvis level and leg lengths equal?
- feel for:
  - knee effusion and warmth
  - passive and active knee flexion with internal and external rotation of hip – compare internal rotation of both hips, restricted internal rotation is a sensitive sign of hip pathology
- Spine
- observe from side and behind
- ask child to touch toes and observe curve
- If joint abnormality found on screening examination: more detailed **LOOK, FEEL, MOVE** approach may be needed
- Interaction between child and parents
- in non-accidental injury mechanism may not fit injury found (see **Child protection** guideline)

DIFFERENTIAL DIAGNOSIS

Always consider septic arthritis, malignancy and non-accidental injury as possible causes of a limp in childhood

Primary differentials of atraumatic limp by age

0–3 yr	• Septic arthritis/osteomyelitis • Developmental hip dysplasia • Fracture/soft tissue injury (toddler's fractures/non-accidental injury)
3–10 yr	• Transient synovitis/irritable hip • Septic arthritis/osteomyelitis • Perthes' disease • Fracture/soft tissue injury (stress fracture)
10–15 yr	• Slipped upper femoral epiphysis (SUFE) • Septic arthritis/osteomyelitis • Perthes' disease • Fracture/soft tissue injury (stress fracture)
Other important differential diagnoses	• **In all age groups consider non-accidental injury** • Neoplastic disease, e.g. acute lymphoblastic leukaemia • Haematological disease, e.g. sickle cell anaemia • Infective disease, e.g. pyomyositis or discitis • Metabolic disease, e.g. rickets • Neuromuscular disease, e.g. cerebral palsy or muscular dystrophy • Primary anatomical abnormality, e.g. limb length inequality • Rheumatological disease, e.g. juvenile idiopathic arthritis (see **Arthritis** guideline)

Transient synovitis

- Commonest atraumatic cause of limp – usually occurring in children aged 3–8 yr
- Male predominance
- Diagnose with caution in aged <3 yr due to increased risk of non-accidental injury/septic arthritis
- Recent history of URTI (not always)
- Child able to walk but in pain
- Otherwise well – afebrile and with normal systemic examination
- Mild reduction of internal rotation of hip
- Diagnosis of exclusion – always consider septic arthritis
- Symptoms <48 hr and following brief period of observation child systemically well, afebrile and able to weight bear: no further investigations necessary
- Follow-up in 48 hr and investigate if symptoms persist
- Aged >8 yr and risk factors for SUFE: further investigations including AP and frog lateral X-rays of pelvis

Septic arthritis

- If not treated urgently joint destruction and growth arrest may occur
- Predominantly due to haematogenous spread
- blood cultures +ve in majority of cases
- Particularly prone joints:
- hip
- ankle
- shoulder
- elbow
- *Staph. aureus* most common cause (can be caused by group B streptococcus in neonates)
- Aged <18 months more vulnerable as physis does not prevent blood entering epiphysis

Children aged <3 yr are vulnerable to septic arthritis and non-accidental injury, with transient synovitis being a rare diagnosis
Investigate all aged <3 yr

Perthes' disease

- Idiopathic avascular necrosis of capital femoral epiphysis
- More common in boys aged 4–8 yr

- Diagnosed on plain AP pelvis X-ray showing sclerosis, fragmentation and flattening of capital femoral epiphysis – may need bone scan/MRI
- Symptoms >2 weeks
- 20% bilateral

Slipped upper femoral epiphysis
- Typically affects children aged >10 yr
- Male predominance
- Often overweight
- Associated with hypothyroidism and growth hormone deficiency
- May present with knee pain
- Hip can appear shortened and externally rotated
- Plain AP films may be normal – lateral projection required if suspected
- Urgent fixation improves outcome
- Can be bilateral
- If aged >9 yr consider slipped capital femoral epiphysis – request AP and lateral X-rays/pelvis

RED FLAGS
- Child aged <3 yr
- Unable to weight bear
- Pseudoparesis
- Fever
- Systemically unwell
- Lymphadenopathy/hepatosplenomegally
- Night pain/night sweats
- Multiple joints affected/symptoms lasting >6 weeks
- Child aged >9 yr with pain/restricted hip movement

INVESTIGATIONS
- FBC and blood film
- ESR
- CRP
- If febrile, blood cultures
- X-ray 2 views; site of pain and pelvis
- If SUFE suspected obtain AP and frog lateral views of pelvis
- If suspicion of transient synovitis or septic arthritis perform joint aspiration, microscopy and culture (these cannot usually be differentiated by ultrasound and require laboratory and clinical correlation)
- If osteomyelitis/other abnormality suspected, or no clear diagnosis with persisting symptoms, further investigations may be needed; these may include:
  - MRI pelvis (with/without contrast) with paediatric radiologist
  - bone scan
  - CT (usually as addition to MRI or in unusual situations – discuss with paediatric radiologist)
- CK, sickle screen

SEPTIC ARTHRITIS
- Fever >38.5°C
- Unable to weight bear
- ESR >40 mm in first hour
- CRP >20 mg/L
- White cell count >12 x 10^9/L

Septic arthritis can still be present in the absence of these criteria

MANAGEMENT
- If any features consistent with septic arthritis:
  - severe pain
  - range of movement <75% normal
  - fever >38.5°C
  - unable to weight bear

- ESR >40 mm in first hour
- CRP >20 mg/L
- WBC >12 x 10^9/L

or

- X-ray abnormal or suggests orthopaedic problem (e.g. Perthes' disease, SUFE)
- Refer to orthopaedics for diagnostic aspiration/washout **before** starting antibiotics (see **Osteomyelitis and septic arthritis** guideline)

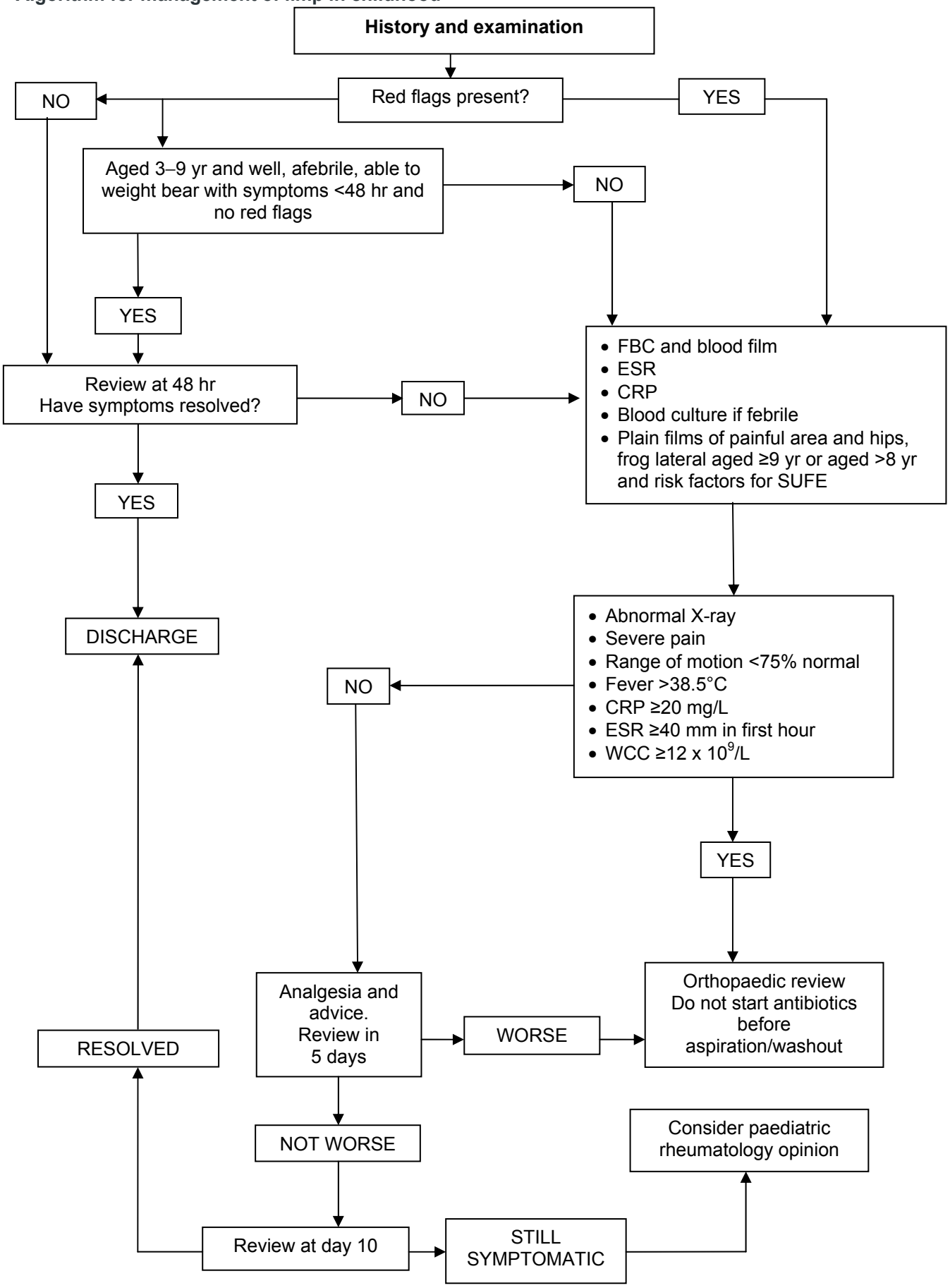
DISCHARGE AND FOLLOW-UP

- If blood tests and X-ray normal, irritable hip (reactive arthritis) likely
- discharge with analgesia, information leaflet and reassurance
- advise return if fever occurs or problem becomes worse

Review after 5 days

- If worse, refer for orthopaedic opinion
- If no worse, review after a further 5 days
- If still no better, arrange joint orthopaedic/paediatric review, and consider referral for paediatric rheumatology opinion
- If normal at 5 or 10 days, discharge

Algorithm for management of limp in childhood



LONG LINE INSERTION ● 1/4

INDICATIONS

- Midlines for patients where proposed IV therapy is 5–14 days duration and not requiring central administration
- Peripherally inserted central catheter (PICC)
- for drugs that have to be given centrally (e.g. if they cause phlebitis)
- if risk of infection high (e.g. parenteral nutrition)
- for access >14 days

INSERTION SITES

- Commonly long saphenous at ankle or medial/lateral antecubital veins
- Where access is difficult, other large peripheral vein or scalp vein can be used

EQUIPMENT

- Assistant
- Midline:
- Leaderflex 22 G (2.5 F) line 6, 8 or 20 cm
- PICC:
- Vygon PICC 3, 4 or 4.5 F 60 cm Lifecath
- Vygon Nutriline 2, 3 or 4 F 30 cm
- Vygon Neocath or Epicutaneo-cave catheter 2 F (23 G) 15, 30 or 50 cm has different insertion technique, not recommended except neonates

- ***DO NOT ATTEMPT INSERTION UNLESS YOU ARE FULLY TRAINED***
- ***Use whichever line you have been trained to use***

- Flush solution: sodium chloride 0.9% 5 mL
- Single dressing pack
- Sterile gown, mask and hat for operator and assistant
- Sterile gloves
- Sterile scissors
- 2 extra sterile towels
- 5 mL syringe/green needle
- Tape measure
- Sterile clear dressing (e.g. Opsite®/Tegaderm®)
- 2 extra packs gauze swabs
- Single-use application of chlorhexidine 2% in isopropyl alcohol 70%
- if sensitivity use povidine-iodine
- 3 wide Steri-strips™ (optional to secure line)
- Sterile non-toothed forceps
- Needle holder
- Sutures
- Instrument checklist

PROCEDURE

Measure insertion distance

- Upper limb: measure from insertion site to upper sternum – line tip to be within the superior vena cava
- Lower limb: measure from insertion site to xiphisternum – line tip to be within inferior vena cava

PICC line preparation

- Check patient's notes for comments regarding previous line insertions. Some veins can be particularly difficult and patient can often provide guidance
- Assess whether patient will need sedation. Rarely, children with needle phobia or difficult vascular access issues will need the line inserted under general anaesthetic. Arrange appropriate person to administer sedation
- If necessary, remove hair from insertion site using clippers (single use disposable razor can be used if clippers unavailable) to allow dressing to be applied post insertion and avoid hair plucking when dressing removed

- If using topical local anaesthetic cream, specify exactly where you would like this sited. Apply anaesthetic cream to chosen veins (3 sites) ≥1 hr before starting procedure (depending on manufacture's recommendation)
- if ventilated additional sedation, analgesia or muscle relaxant may be required
- Use single patient use tourniquet
- Check whether blood samples required
- Gather all necessary equipment including spare line (unopened)

Consent
- Explain procedure and reassure patient and parent/carer
- Obtain and record consent

Premedication and position of patient
- Position patient seated in chair or lying with his/her arm or leg out-stretched and supported by table or bed (on a utility drape)
- ensure patient in position and comfortable, and lighting optimal

Surgical aseptic non-touch technique (ANTT)
- Always use ANTT
- Put on surgical mask and hat
- Wash hands with chlorhexidine, iodine or betadine and put on apron/gown and sterile gloves
- Clean patient's skin thoroughly with single-use application of chlorhexidine 2% in isopropyl alcohol 70% and allow to dry for ≥30 sec
- if patient has sensitivity use povidine-iodine (for neonate skin preparation see **Neonatal** guidelines)
- Drape sterile sheet to expose only chosen vein, and cover surrounding areas to provide working room and a flat surface on which to rest your line, forceps and flush
- if sterility compromised at any stage abandon procedure and restart with new equipment

Lifecath 3, 4 or 4.5 F
- Assemble line fully and flush with sodium chloride 0.9% 1 mL to ensure patency
- Insert using aseptic Seldinger technique
- **Lifecath can be cut to desired length**
- ensure stiffening wire within the Lifecath is withdrawn beyond site to be cut, to ensure that wire is not damaged/weakened (may lead to wire snapping within the patient)
- Place everything you will need onto sterile sheet within reach
- Ask assistant to apply tourniquet, but remain ready to release
- Check patient is ready for you to start
- Clean insertion area [see **Surgical aseptic non-touch technique (ANTT)**]
- Access vein with introducer supplied with line or cannula
- be careful: introducer for the PICC line is **much stiffer** than a standard cannula and more likely to perforate the entire vein
- Insert guidewire via cannula or introducer
- wire does not need to be fully inserted and may cause arrhythmias if inserted too far
- do not force the guidewire – this will damage the vessel and may weaken the wire causing it to bend or snap
- it is important that, at any time, operator is able to grasp directly either free end of wire or wire itself as it passes through skin, to ensure that it does not pass entirely into vein
- Remove cannula or introducer
- Insert dilator and peelable sheaf over guidewire until blood flowing freely (in some patients this will come quite quickly so have catheter ready)
- Release/ask assistant to release tourniquet to reduce blood flow
- Remove dilator and guidewire then insert PICC line via sheaf. At approximately 6–7 cm you will reach the tip of the sheaf line. If line passes easily beyond 6 cm, you have probably succeeded. Resistance at any point usually indicates failure to thread vein, or curling of line. Insert line to previously measured distance from site of insertion. Manipulation of the limb may be helpful if there is difficulty in advancing the line past a joint
- When tip of line judged to be in correct position, carefully withdraw sheath and remove from around line by pulling apart the 2 wings, then remove the stiffening wire from within the line
- Apply pressure on entry site (it may bleed for a few minutes). Aspirate then flush line with sodium chloride 0.9% 2 mL. Secure line with suture or Steri-strips™ (according to local policy). Once any bleeding has stopped, apply biopatch over entry site

- Cover entry site, connections and any exposed line with piece of clear dressing (e.g. Opsite®)
- X-ray line to check tip position if near heart or if no blood flushes back up line. Do not draw blood back up the line (this increases risk of line blockage). While waiting for X-ray confirmation of tip position infuse sodium chloride 0.9% 0.5–1 mL via each lumen of line to ensure continued line patency. Confirm removal of complete guide and stiffening wires with assistant
- Following confirmation of line position flush once more and line is then ready to use

Leaderflex lines

- Insert using surgical ANTT Seldinger technique
- **DO NOT** cut lines
- Cannulate target vein with either needle provided or a 24 G Jelco® cannula or blue cannula
- Feed guidewire into vein through cannula sheath and remove sheath leaving wire *in situ*
- Feed line over guidewire and into vein with a gentle twisting action. It is important that, at any time, operator is able to grasp directly either free end of wire or wire itself as it passes through skin, to ensure that it does not pass entirely into vein
- Remove guidewire and secure line in place
- Once any bleeding has stopped apply biopatch over the entry site (if local policy)
- Cover entry site, connections and any exposed line with piece of clear dressing (e.g. Opsite®)
- It is not necessary to verify position of 6 or 8 cm lines radiologically unless inserted into axillary vein

Nutriline PICC line

- Insert using surgical ANTT
- Assemble line fully and flush with sodium chloride 0.9% 1 mL to ensure patency
- Place everything you will need onto sterile sheet within reach
- Ask assistant to apply single patient use tourniquet but remain ready to release
- Check patient is ready for you to start
- Clean insertion area [see **Surgical aseptic non-touch technique (ANTT)**]
- Access vein with introducer supplied with line
- be careful: introducer for PICC line is **much stiffer** than standard cannula and more likely to perforate entire vein
- Remove needle leaving peelable sheaf *in situ* and insert line using forceps
- Release or ask assistant to release tourniquet to reduce blood flow
- At approximately 6 cm you will reach tip of sheaf. If line passes easily beyond 6 cm, you have probably succeeded. Resistance at any point usually indicates failure to thread vein, or curling of line. Insert line to previously measured distance from site of insertion. Manipulation of the limb may be helpful if difficulty advancing line past a joint
- When tip of line judged to be in correct position, carefully withdraw sheath and remove from around line by pulling apart the 2 wings
- Without releasing pressure on entry site (it may bleed for a few minutes) flush with sodium chloride 0.9% 2 mL using a 10 mL syringe (smaller syringes cause greater pressure and may rupture the line)
- With sterile scissors, cut rectangle of gauze (1 x 2 cm) to prevent hub of line rubbing skin
- Check all connections are firmly tightened. Coil any unused line next to insertion site and secure with Steri-strips™
- Once any bleeding has stopped apply biopatch over the entry site (if used locally)
- Cover entry site, connections and any exposed line with one piece of clear dressing (e.g. Opsite®
- X-ray line [0.5 mL of contrast (e.g. Omnipaque 240) may be required to adequately see line tip position – use according to local guidelines] to check tip position if near heart or if no blood flushes back up line. Do not draw blood back up line (this increases risk of line blockage)

Use standard ANTT when accessing the system or for dressing changes

AFTERCARE

- Confirm removal of all guidewires with assistant and document using instrument checklist
- Document insertion and all interventions in patient notes
- Flush after each use with sodium chloride 0.9% 2 mL in 10 mL syringe (or bigger) using a pulsed, push-pause technique, and clamped whilst flushing to create positive pressure in the line
- Ensure each lumen has continuous infusion of 0.5–1 mL/hr of IV fluid to maintain patency or use heparin 100 units/mL to line lock if line accessed less than every 7 days
- Decontaminate access port using chlorhexidine 2% in isopropyl alcohol 70% and allow to dry
- if patient has sensitivity use povidine- iodine in alcohol 70%

- Curos caps are a needle free device for each port and alternative to wiping port
- require 1 min contact time to disinfect port
- single-use curos caps to be placed on all ports, if port not accessed must be changed every 7 days
- Change dressings every 7 days (or sooner if visibly soiled or coming away)
- Cleaning of the access site should be carried out using single use chlorhexidine 2% in isopropyl alcohol 70%
- if patient has sensitivity use povidine-iodine in alcohol 70%
- Maintain standard ANTT for accessing system and dressing changes. Before accessing system, disinfect hub and ports with disinfectant compatible with catheter (e.g. alcohol or povidone-iodine)
- Prescribe skin decontamination wash e.g. Octenisan® to reduce risk of line infection
- Assess site at least daily for any signs of infection and remove if signs of infection present
- Minimise number of times the longline is accessed
- Replace administration sets depending on what is being infused according to local policy. Routine catheter replacement is unnecessary
- **Assess need for device daily and remove as soon as possible**
- When removed document date of removal and reason for removal in notes

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COMPLICATIONS

- Clinical deterioration of a patient with a central venous catheter should raise the question of catheter related complication
- Commonest complication is sepsis
- Extravasation of fluids into pleural, pericardial and subcutaneous compartments – seek immediate senior advice and follow local extravasation guidelines
- Suspect pericardial tamponade if:
- acute or refractory hypotension
- acute respiratory deterioration
- arrhythmias
- tachycardia
- unexplained metabolic acidosis
- Confirm pericardial tamponade by X-ray or echocardiogram
- drain pericardial fluid to treat
- To reduce risk of damaged or snapped lines:
- avoid using small syringes <2 mL for bolus injections – generate high pressures
- avoid using alcohol/acetone to clean around catheter – may weaken line
- do not exceed recommended pressure limits or flow rates (found on product packaging) for individual lines
- If forced on removal lines can snap
- If retained line/line fragments suspected, inform consultant – may require surgical removal

REMOVAL

Indications

- Clinical use no longer justified
- Complication associated with indwelling line identified

Technique

- Use standard ANTT
- Carefully remove dressing
- Pull line gently in direction of vein
- Ensure line has been removed intact
- If sepsis suspected send line tip (length <4 cm) for culture
- Apply pressure over line site to prevent bleeding
- Document removal in notes

MALARIA ● 1/3

Falciparum is a medical emergency; immediate treatment is essential

- Test for malaria in anyone with fever
- who has travelled to a malarial area within the last 12 months
- or febrile infant whose mother has travelled to a malarial area in pregnancy

Clinical features

Non-specific	Severe (complicated) malaria
• Fever	• Persistent vomiting, severe dehydration
• Malaise	• Shock, renal failure (oliguria <0.5 mL/kg/hr)
• Headache	• Depressed conscious state, seizures
• Sweating	• Tachypnoea or increased work of breathing
• Diarrhoea	• Hypoxia (SpO_2 <95%)
• Vomiting	• Metabolic acidosis (base deficit >8)
• Abdominal pain	• Severe hyperkalaemia (K >5.5 mmol/L)
• Splenomegaly	• Hypoglycaemia <3 mmol/L
• Anaemia	• Severe anaemia (<80 g/L)
• Thrombocytopenia	• Unable to walk
• Jaundice	• Parasitaemia >2% or schizonts on film

Investigations

- EDTA blood sample sent to haematology for urgent thick blood film
- 3 blood films 12 hr apart
- Negative malaria rapid diagnostic test (ICT) does not exclude malaria
- Do not treat unless proven on blood test
- Admit all patients with falciparum to a unit with experience in managing severe malaria (e.g. infectious disease unit)
- Opportunistic screen for other imported diseases; hepatitis B, HIV, blood culture

- ***If malaria is diagnosed on blood film, but type unclear, treat as falciparum malaria***

SEVERE (COMPLICATED) MALARIA

Anti-malaria treatment

- Artesunate:
- <20 kg: 3 mg/kg IV
- ≥20 kg: 2.4 mg/kg IV
- in 1 mL sodium bicarbonate (vial provided with drug), dilute further in 5 mL sodium chloride 0.9% to make 10 mg/mL solution and inject dose over approximately 3–4 min at 0, 12 and 24 hr and then daily
- When parasitaemia resolving and patient improving, switch to oral agent:
- artemether+lumefantrine (Riamet®) 6 doses – see **Treatment of uncomplicated falciparum malaria**
- if Riamet® unavailable give Malarone®, or oral quinine (if neither other agent available)

If artesunate unavailable

- Quinine IV diluted to 2 mg/mL with sodium chloride 0.9% or glucose 5%
- loading dose 20 mg/kg (maximum 1.4 g) as infusion over 4 hr (NEVER as IV bolus)
- omit loading dose if mefloquine or quinine used in previous 24 hr
- BM sticks 2-hrly during IV quinine, cardiac monitor and daily ECG (check QTc)
- then 8 hr after start of loading dose, 10 mg/kg infusion (maximum 700 mg) over 4 hr every 8 hr
- when able to swallow give Malarone® (see **Treatment of uncomplicated falciparum malaria**)
- daily FBC, U&E and blood films as inpatient until asexual parasites undetectable

Complications

- Parasitaemia >10%: admit PICU
- Renal failure: discuss early filtration/dialysis with PICU
- Hypovolaemia: cautious rehydration (high risk pulmonary oedema)
- Shock: add cefotaxime
- Hypoglycaemia: common, give glucose 10% 2 mL/kg IV bolus then glucose 10% 5 mL/kg/hr with sodium chloride 0.45%/0.9% if serum Na <135 mmol/L
- Anaemia: common, transfuse if Hb <80 g/L
- Thrombocytopenia: expected, transfuse only if bleeding and platelets $<20 \times 10^9$/L

CEREBRAL MALARIA

Impaired level of consciousness

- Correct hypoglycaemia
- Monitor GCS, reflexes, pupils
- Plan for intubation and transfer to PICU if:
- signs of raised ICP
- persisting shock after 40 mL/kg fluid
- or pulmonary oedema

TREATMENT OF UNCOMPLICATED FALCIPARUM MALARIA (no clinical features of severe malaria)

- If child can tolerate oral intake:

Riamet® 20 mg/120 mg tablets [artemether with lumefantrine (can be crushed)]

- Not if given treatment overseas for this episode already

Weight (kg)	Dose ((repeat at 8, 24, 36, 48 and 60 hr)	Total over 60 hr
5–14	1	6
15–24	2	12
25–34	3	18
35+ (aged 12–18 yr)	4	24

- No second agent required

Or

Artenimol with piperaquine phosphate

- Euratesim (320 mg/40 mg tablets)

Or

Malarone® (proguanil with atovaquone) once a day for 3 days (can be crushed)

- Not if on Malarone® prophylaxis

Weight (kg)	5–8	9–10	11–20	21–30	31–40	>40
Dose	2 paed tablets	3 paed tablets	1 standard tablet	2 standard tablets	3 standard tablets	4 standard tablets

- Paediatric tablet contains proguanil 25 mg + atovaquone 62.5 mg
- Standard tablet contains proguanil 100 mg + atovaquone 250 mg
- No second agent required

Or

Quinine sulphate

- 10 mg/kg (maximum 600 mg) oral 8-hrly
- Reduce to a 12-hrly regimen if severe cinchonism (severe tinnitus, deafness, unsteadiness)
- Mild tinnitus and feeling of 'blocked' ears are expected on quinine and resolve once therapy completed
- Continue until blood films negative or for a 7 day course (whichever is longer). A shorter course may be possible but only at infectious diseases consultant's discretion

Weight (kg)	Paediatric dosing of oral quinine sulphate
5–7	50 mg (¼ x 200 mg tablet)
8–12	100 mg (½ x 200 mg tablet)
13–17	150 mg (¾ x 200 mg tablet)
18–22	200 mg (1 x 200 mg tablet)
23–27	250 mg (½ x 300 mg + ½ x 200 mg tablet)
28–37	300 mg (1 x 300 mg tablet)
38–45	400 mg (2 x 200 mg tablet)
46–57	500 mg (1 x 200 mg tablet and 1 x 300 mg tablet)
>57	600 mg (2 x 300 mg tablet)

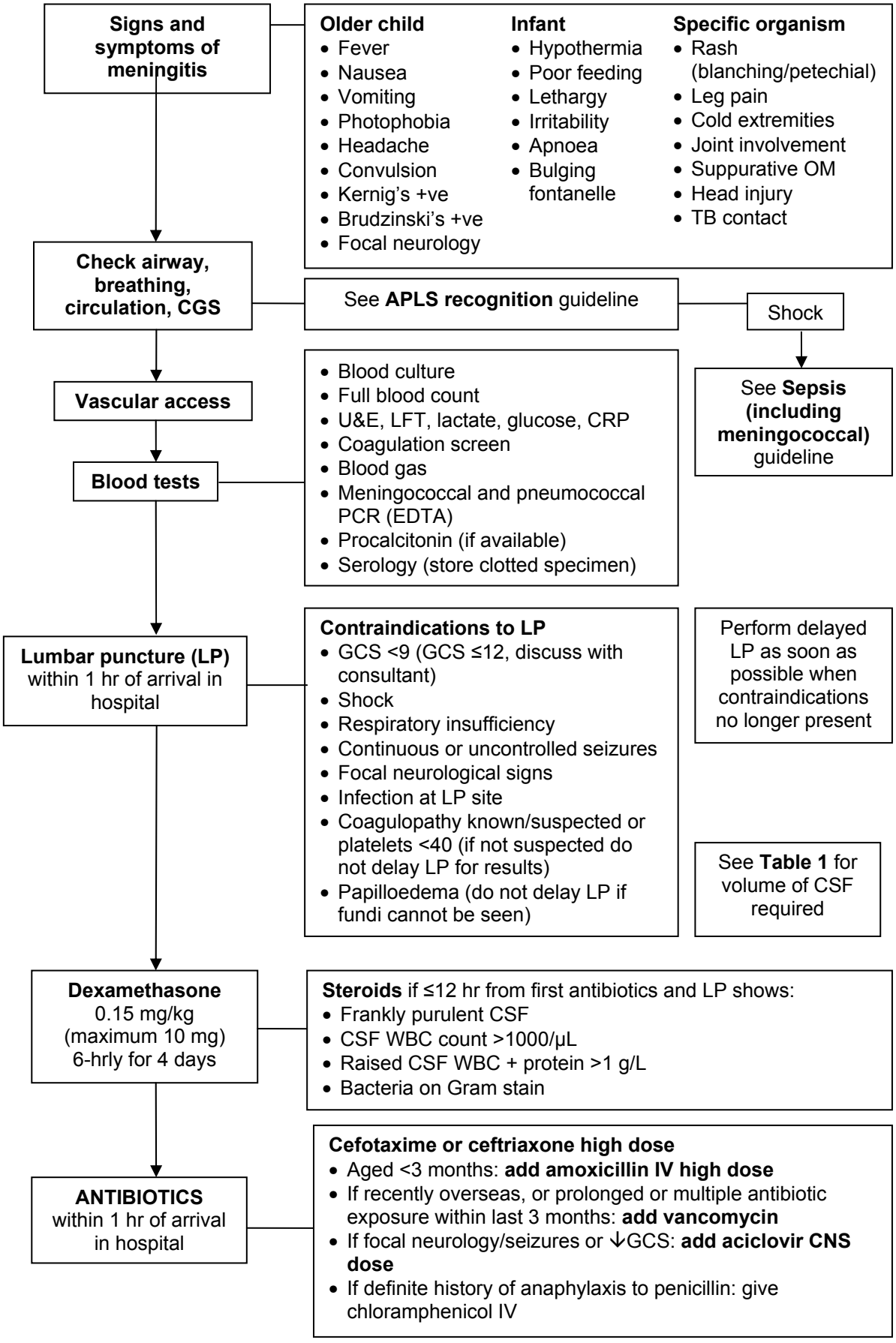
- With quinine give second agent
- aged <12 yr clindamycin 7–13 mg/kg (maximum 450 mg) 8-hrly for 7 days
- aged ≥12 yr doxycycline 200 mg once/day for 7 days

- ***If in doubt treat as severe (complicated) malaria***

NON-FALCIPARUM MALARIA

- Chloroquine 10 mg (base)/kg oral initial dose (maximum 620 mg)
- then 5 mg/kg (maximum 310 mg) after 6 hr, then once daily for 2 days
- liquid chloroquine 50 mg/5 mL
- itch is common, does not respond to antihistamines, if severe give quinine
- If Riamet already started, or chloroquine not available, complete course with Riamet and continue with primaquine as soon as G6PD levels available (as for chloroquine below)
- Check G6PD levels
- if normal G6PD levels and aged >6 months give primaquine 250 microgram/kg oral (maximum 15 mg) daily for *P. ovale* and 500 microgram/kg (maximum 30 mg) daily for *P. vivax* for 14 days
- in mild G6PD-deficiency aged >6 months, primaquine 750 microgram/kg (maximum 45 mg) once a week for 8 weeks
- Otherwise contact ID specialist

MENINGITIS ● 1/3



CSF specimens

- One fluoride tube (and 4 CSF bottles)
- If tap traumatic, may need more samples
- If insufficient CSF discuss priorities with microbiology

Table 1: Collection of specimens (stated volumes represent minimum required)

Department	Specimens (6 drops = approx 0.2 mL)
Biochemistry	• 0.2 mL in fluoride tube for glucose (also send blood glucose) • 0.2 mL in CSF bottle for protein • 0.2 mL for lactate if metabolic disorder suspected (telephone biochemistry in advance)
Microbiology	• 0.2 mL in CSF bottle for MC&S • 0.5 mL for meningococcal and pneumococcal PCR • 1 mL for AFB, TB culture and PCR if TB suspected
Virology	If possible viral meningitis or encephalitis: • 0.5 mL for herpes simplex virus, enterovirus and VZV PCR • 0.3 mL for Human Herpes Virus 6 if rash, high temperature or rapid recovery
Cytology	• 0.2 mL if TB suspected
Save	• 0.5 mL in plain bottle for additional neurology tests (e.g. oligoclonal bands) depending on other results and progress

Other investigations

- If signs of meningococcal sepsis, throat swab for bacterial culture
- If lymphocytes in CSF, stool for enterovirus PCR
- If antibiotics given before LP and no growth in CSF or blood despite raised CSF white cell count, discuss with microbiologist

RESULTS

- See **Encephalitis** guideline for interpretation of results
- If history of travel, low CSF: blood glucose ratio +/- raised protein, discuss with TB team urgently about starting TB treatment
- Manage as meningitis if:
- aged <28 days: ≥20 white cells/μL
- aged >28 days: >5 white cells/μL or >1 neutrophil/μL
- if lower cell count, still consider bacterial meningitis if other symptoms and signs suggest the diagnosis, especially in neonates

MONITORING TREATMENT

- In a semi-conscious patient, monitor hourly until improvement evident:
- respiratory rate
- pulse and BP
- level of consciousness and pupils
- in young infants, measure head circumference daily
- If persistent pyrexia and not improving look for other foci
- repeat blood cultures and other investigations according to signs
- CT scan at 10 days for microabscess or hypodensity
- if CT normal, repeat LP

SUBSEQUENT MANAGEMENT

Length of antibiotic course

- Meningococcus: 7 days
- *Haemophilus influenzae:* 10 days
- Pneumococcus or Group B Streptococcus: 14 days
- Gram-negatives: 21 days
- Listeria: 21 days (with gentamicin for first 7 days)
- No organism identified:
- aged >3 months, 10 days
- aged <3 months, 14 days
- Other, discuss with microbiologist

Fluid restriction

- Maintenance fluids: sodium chloride 0.9% with glucose 5% with potassium chloride 10 mmol/500 mL if not hyperkalaemic
- Restrict fluid to 80% maintenance if:
- severe illness
- hyponatraemia
- raised intracranial pressure
- Measure urine and plasma osmolalities daily whilst severely ill

Public health

- Inform Public Health consultant of a case of suspected meningitis (see **Notifiable infectious diseases and food poisoning** guideline)
- Public Health England Department will arrange prophylaxis for close contacts
- Meningococcal meningitis
- if ceftriaxone given as treatment, eradication treatment not required for patient
- close contacts (all ages): ciprofloxacin single dose
- *Haemophilus influenzae*
- close contact aged <10 yr, give rifampicin oral once daily for 4 days

DISCHARGE AND FOLLOW-UP

- Organise formal hearing test 6 weeks after discharge from hospital
- If severely ill during admission, discuss with consultant about follow-up to monitor developmental progress
- If viral cause unconfirmed but still possible, repeat viral titres 6 weeks after day of admission
- If >1 episode of meningococcal disease serogroup for which immunised (MenB, aged 8 and 16 weeks; MenB and C, aged 1 yr; MenACWY aged 14 yr), recurrent serious bacterial infections or family history of meningococcal disease or immune deficiency, refer to immunology or infectious diseases

MONITORING EX-PREMATURE INFANTS POST GENERAL ANAESTHETIC ● 1/1

- Risk of apnoea after general anaesthetic (GA)
- increased if anaemic
- with chronic lung disease who have required oxygen treatment within last 6 months

MANAGEMENT

Pre-operative

- Check Hb
- if Hb <90 g/L, arrange transfusion
- Arrange overnight stay for post-operative monitoring if:
- full term (≥37 weeks), and aged <1 month
- preterm (<37 weeks), and <60 weeks post-conceptional age
- Overnight stay may also be at discretion of anaesthetist and surgeon

Immediate post-GA period

- Transfer patient with oxygen supply, continuous SpO_2 monitoring and full resuscitative equipment
- Admit patient to a designated HDU ward area

Subsequent post-GA management

- High dependency nursing care
- Monitoring to include:
- continuous pulse oximetry
- continuous ECG
- continuous respiratory rate
- transcutaneous CO_2
- If apnoea >15 sec:
- immediate respiratory support by nurse (airway manoeuvres, bag and mask ventilation)
- contact on-call paediatric middle grade, or resident anaesthetist in charge
- liaise with anaesthetist responsible for patient
- review period of HDU care

DISCHARGE AND FOLLOW-UP

- Discharge patient home same day or next day providing there have been no apnoeic episodes

NEPHROTIC SYNDROME ● 1/4

RECOGNITION AND ASSESSMENT

Definition

- Oedema
- Hypoalbuminaemia: plasma albumin <25 g/L
- Heavy proteinuria, defined as:
- dipstick 3+ or more, or
- urinary protein >40 mg/m^2/hr, or
- early morning protein:creatinine ratio >200 mg/mmol
- Hypercholesterolaemia

Symptoms and signs

Oedema

- Peri-orbital, pedal, sacral, scrotal
- Also ascites or pleural effusion

Cardiovascular – can be difficult to assess due to oedema

Assess for hypovolaemia carefully

- Child with diarrhoea and vomiting and looks unwell
- Abdominal pain: strongly suggestive
- Poor peripheral perfusion and capillary refill >2 sec
- Pulse character: thready, low volume, difficult to palpate
- Tachycardia or upward trend in pulse rate
- Hypertension may be an early sign, hypotension a late sign
- Jugular venous pressure (JVP) low

Muffled heart sounds suggest pericardial effusion

Respiratory

- Tachypnoea and recession: suggest pleural effusion

Abdomen

- Swelling and shifting dullness: suggest ascites
- Tenderness with fever, umbilical flare: suggest peritonitis
- Scrotal oedema: stretching can cause ulceration or infection

Investigations

Femoral blood sampling is contraindicated because of risk of thrombosis

Urine

- Urinalysis
- Early morning urine protein:creatinine ratio first morning after admission
- normal value <20 mg/mmol; nephrotic >200 mg/mmol, usually >600 mg/mmol
- low urine sodium (<10 mmol) suggests hypovolaemia

Baseline bloods

- U&E and creatinine
- Albumin
- FBC
- Immunoglobulins G, A and M
- Complement C3 and C4
- Zoster immune status: as a baseline
- Hepatitis B and C serology

Second-line tests

Request only if features suggestive of more aggressive nephritis (hypertension, macroscopic haematuria, high creatinine, no response to corticosteroids)

- Anti-streptolysin O titre and anti-DNase B
- Anti-nuclear antibodies
- Anti-dsDNA antibodies

Interpretation
- High haematocrit suggests hypovolaemia
- Raised creatinine or urea suggests hypovolaemia, tubular plugging or other nephritis
- Serum cholesterol and triglycerides: often elevated
- IgG usually low
- C3 normal

Differential diagnosis
- Minimal change disease (95%)
- Focal segmental glomerular sclerosis (FSGS)
- Multisystem disorders (e.g. HSP, diabetes mellitus, SLE)
- Congenital nephrotic syndrome very rare and seen in under 2s

IMMEDIATE TREATMENT

General
- Admit
- Strict fluid balance monitoring
- daily weight: **mandatory**
- Avoid added salt, but a low salt diet not indicated
- Manage hypovolaemia – see **Complications**
- seek **senior advice before volume resuscitation**, as risk of volume overload

Fluid restriction
- Restrict to insensible losses e.g. 300 mL/m^2 plus urine output
- If not tolerated, aim for:
- 600 mL/day in children aged <5 yr
- 800 mL/day in children aged 5–10 yr
- 1000 mL/day in children aged >10 yr

Medication
- Prednisolone 60 mg/m^2 oral once daily (maximum 80 mg), in the morning (see **BNFc** for surface area)
- Phenoxymethylpenicillin (penicillin V) for pneumococcal prophylaxis (**presentation only**)
- If oedema upsetting to patient or causing discomfort, add furosemide 1–2 mg/kg oral **OR** 1 mg/kg IV over 10 min
- may intensify hypovolaemia, in which case use albumin 20%: discuss with **consultant or specialist centre**
- If disease severe, especially with hypovolaemia, as judged by poor perfusion, high Hb, thrombophilia, or abdominal pain, treat with:
- dipyridamole to reduce risk of thrombotic complications. Discuss need for heparin/warfarin with paediatric nephrologist
- Give omeprazole for gastro protection whilst on high dose steroids

COMPLICATIONS

Hypovolaemia
- Abdominal pain, looks unwell, tachycardia, poor perfusion, high Hb
- Seek senior **advice before volume resuscitation**, as risk of volume overload
- give sodium chloride 0.9% 10 mL/kg

Do not confuse 4.5% albumin with 20% as the latter is hyperosmolar and can easily cause fluid overload

- Start dipyridamole
- Looks unwell, abdominal pain and vomiting
- Low JVP, rising urea and creatinine, and poor response to diuretics
- Treatment: check with consultant first
- salt-poor hyperosmolar albumin **20%** 0.5–1 g/kg (2.5–5 mL/kg) over 2–4 hr with furosemide 1–2 mg/kg IV midway through infusion over 5–10 min (maximum 4 mg/min)
- regular observations for signs of circulatory overload (e.g. raised JVP, tachycardia, gallop rhythm, breathlessness, low SpO_2)
- often required daily: liaise with specialist centre

Peritonitis
- Difficult to recognise
- steroids may mask signs, including fever, or cause leucocytosis
- Abdominal pain
- consider hypovolaemia and appendicitis: request early surgical opinion
- Obtain blood culture and peritoneal fluid (for Gram stain and culture) if possible, then start piperacillin with tazobactam (Tazocin®) IV pending culture results
- if penicillin allergic discuss with microbiologist or consultant in infectious diseases

Cellulitis
- Commonly caused by haemolytic streptococci and pneumococci – treat promptly

Thrombosis
- Renal vein: an important differential in abdominal pain
- Cerebral vasculature
- Pulmonary vein
- Femoral vein: femoral blood sampling contraindicated
- A fall in platelets, rise in D-dimers and reduced PTT are suggestive
- USS with Doppler study to look at perfusion and to image renal vein and IVC can be helpful
- If in any doubt, seek advice from paediatric nephrologist regarding investigation/management

DISCHARGE POLICY AND SUBSEQUENT MANAGEMENT
- Discharge once in remission
- defined as trace/negative urine protein for 3 days
- patients with normal BP and stable weight who are well may be allowed home on ward leave with **consultant approval**. Normally twice weekly review will be required until in remission
- Arrange plan of care with patient and carers – see **below**
- Outpatient review in 4 weeks

New patients
- Prednisolone 60 mg/m^2 (maximum 80 mg) once daily for 4–6 weeks
- Then 40 mg/m^2 (maximum 40 mg) alternate days for 4–6 weeks
- gradually reduce dose aiming to stop after 3–4 weeks
- Response usually apparent in 7–10 days
- No response after 4 weeks daily steroid 60 mg/m^2 suggests corticosteroid resistance

Relapsing patients
- 3 consecutive days of 3+ or more early morning proteinuria, having previously been in remission = relapse
- Start prednisolone 60 mg/m^2 (maximum 80 mg) once daily
- continue until nil or trace proteinuria for 3 days
- then 40 mg/m^2 (maximum 40 mg) alternate days for a further 4 weeks, gradually reduce dose aiming to stop after 3 weeks
- If relapses frequent despite alternate-day prednisolone, discuss with paediatric nephrologist

Oral prednisolone
- While on prednisolone 60 mg/m^2 once daily advise to:
- carry a corticosteroid card
- seek prompt medical attention for illness, especially zoster contacts (if not zoster immune)

Other management
- Urine testing
- teach technique and provide appropriate dipsticks
- test only first daily urine sample
- keep a daily proteinuria diary and bring to **every** clinic attendance
- Corticosteroid diary with instructions regarding corticosteroid dosage

Infectious precautions
- Avoid live immunisations for 3 months after completion of treatment with high-dose corticosteroids

- Benefit of inactivated vaccines can be impaired by high-dose corticosteroids and so a similar delay advisable where possible
- where not possible because of frequent relapse, give INACTIVATED vaccines after a shorter delay and check for an antibody response
- Continue phenoxymethylpenicillin (penicillin V) (**presentation only**) prophylaxis until oedema has resolved (if penicillin allergic give azithromycin)
- If zoster non-immune (VZV IgG negative) and on high-dose corticosteroids, give IM zoster immunoglobulin (obtain from local Public Health England laboratory)
- after definite zoster contact. A contact is infectious 2 days before onset of rash until all lesions crusted over
- can be given up to 10 days after exposure. Contact consultant microbiologist on duty (or local virology laboratory) for release of VZIG
- at first sign of illness give aciclovir IV
- varicella vaccine (live vaccine) available and should be given if a suitable opportunity arises between relapses
- Give pneumococcal vaccine if child has not received pneumococcal conjugate vaccine – see **BNFc** for schedule

Refer for paediatric nephrologist advice if:

- Corticosteroid-resistant disease
- non-responsive after 4 weeks of daily prednisolone, but start discussions with specialist centre in third week, or if relapses frequently
- Corticosteroid-dependent disease
- 2 consecutive relapses during corticosteroid treatment or within 14 days of cessation
- Significant corticosteroid toxicity
- Aged <1 yr or >12 yr at first presentation
- Mixed nephritic/nephrotic picture: macroscopic (not microscopic) haematuria, renal insufficiency or hypertension
- Low complement C3/C4
- ANA +ve

NEUROMUSCULAR DISORDERS ● 1/2

ON ADMISSION

- Ask parents if they have a copy of a care plan
- Inform child's long-term consultant

CLINICAL HISTORY

- Adequacy of cough and swallowing
- Previous sleep difficulties, wakefulness at night (nocturnal hypoventilation)
- Difficulty waking in morning, early morning headache (nocturnal hypoventilation)
- Poor appetite, weight loss (chronic respiratory failure)
- Learning or behavioural problems, school absence (chronic respiratory failure)
- Palpitations, breathlessness, chest pain (cardiomyopathy)
- Muscle cramps, skeletal pain, back pain (for fractures)
- Abdominal pain, distension, melaena (GI perforation)

ASSESSMENT

- May not show overt signs of respiratory distress such as tachypnoea, recessions and use of accessory muscles even in respiratory failure
- Assess adequacy of chest wall excursion and cough
- Look for pallor, tachycardia, signs of circulatory compromise
- Assess for abdominal signs (GI bleed, perforation, gastritis)
- Measure:
- SpO_2 in air
- CO_2 by blood gas, transcutaneous CO_2 or end-tidal CO_2, especially if on oxygen
- spirometry: FVC most useful if previous readings available
- ECG
- Blood gas for cardiac status
- CXR: clinical signs can fail to detect collapse/consolidation/cardiomegaly
- Consider skeletal/spinal X-rays for possible fractures

Medical problems commonly found in children with myopathy

- Respiratory failure (hypoxaemia and hypercapnia) without signs of respiratory distress. Susceptibility to respiratory failure due to:
- muscle weakness (upper airway, intercostals, diaphragm)
- scoliosis
- poor secretion clearance
- aspiration, chest infections
- sleep disordered breathing
- cardiac failure
- Lower respiratory infection, aspiration pneumonitis
- Cardiomyopathy and cardiac decompensation
- Gastro-oesophageal reflux, gastritis and gastric ulceration (especially if on corticosteroids)
- Adrenal insufficiency (if on corticosteroids)
- Fractures, especially vertebral, if on long-term corticosteroids
- Malignant hyperthermia following anaesthesia in certain muscular dystrophies and myopathies

MANAGEMENT

- If unwell, on **long-term corticosteroids,** double usual daily dose of steroids for 2–3 days. If unable to tolerate oral steroids, see **Steroid dependence** guideline

Respiratory failure

- Prescribe and carefully titrate administration of oxygen by mask/nasal cannulae to achieve SpO_2 between 94–98%. Monitor CO_2 and respiratory effort as risk of rising CO_2 and respiratory failure (despite normal oxygen saturations) if hypoxic respiratory drive overcome by oxygen therapy
- High-flow high-humidity air or oxygen (e.g. Optiflow™): monitor CO_2
- Mask ventilation (bi-level positive airway pressure, BIPAP)
- Chest physiotherapy and postural drainage
- Use insufflator-exsufflator (e.g. Cough Assist) if patient has one

- Suction
- if copious loose secretions, use glycopyrronium given as oral solution (Sialanar) or IV solution (200 microgram/mL) given orally, via PEG or IV
- if thick tenacious secretions use nebulised sodium chloride 0.9%/sodium chloride 3%, or nebulised acetylcysteine
- Antibiotics
- obtain cough swab or sputum specimen, ideally before starting treatment
- check previous culture results
- choice same as for community acquired pneumonia
- if bronchiectasis use broad spectrum for 14 days to cover pseudomonas (discuss with senior)
- if not improving on first line antibiotics add macrolide for atypical pneumonia
- Consult senior to discuss need for ITU care, escalation of respiratory support

Cardiac failure
- Fluid restriction
- Diuretics
- Oxygen and respiratory support
- Cardiology consultation

GI tract bleed: prevention and treatment
- Nil-by-mouth and IV fluids
- Ranitidine (omeprazole if severe reflux)
- Senior advice

Fractures
- Analgesia
- Orthopaedic consultation
- Check calcium and vitamin D
- Discuss with metabolic bone expert about IV bisphosphonates for vertebral fractures

Malignant hyperthermia

Malignant hyperthermia is a medical emergency

- Occurs following general anaesthesia and may be first presentation of a neuromuscular disorder
- Check creatine kinase, calcium, renal function, urine output and for myoglobinuria: dialysis may be needed
- In addition to temperature control and general life support measures, use IV dantrolene to control excessive muscle contraction
- Obtain senior anaesthetic advice and liaise with PICU

NOTIFIABLE INFECTIOUS DISEASES AND FOOD POISONING ● 1/2

URGENT NOTIFICATION

- Urgent out-of-hours notifications (to be followed by normal paper notification later)
- meningitis (suspected bacterial)
- meningococcal infection (clinical diagnosis)
- haemolytic uraemic disease (suspected)
- infectious bloody diarrhoea

NOTIFIABLE DISEASES

Admitting doctor required to notify **suspected** or confirmed cases of the following to Health Protection Unit:

- Cluster or outbreak suspected (≥2 cases epidemiologically linked)
- Any other case where potential for transmission significant (e.g. highly infectious)
- Where contacts are particularly susceptible (e.g. healthcare worker, school)
- Where public health action is known to be effective (e.g. prophylaxis, immunisation)
- Other infections or contaminations (e.g. chemical) not listed below if potential risk of further harm
- Anthrax
- Botulism
- Brucellosis
- Cholera
- Diphtheria
- Diarrhoea, infectious bloody
- Encephalitis
- Food poisoning*
- Group A streptococcal invasive disease
- Haemolytic uraemic syndrome
- Hepatitis (viral)
- Legionnaires'
- Leprosy
- Malaria
- Measles*
- Meningitis (viral, bacterial or fungal)
- Meningococcal disease
- Mumps
- Paratyphoid fever
- Plague
- Poliomyelitis
- Rabies
- Rubella*
- Severe acute respiratory syndrome (SARS)
- Scarlet fever*
- Smallpox
- Tetanus
- Tuberculosis*
- Typhoid fever
- Typhus
- Viral haemorrhagic fever
- Whooping cough*
- Yellow fever

***Definitions**

- **Food poisoning or suspected food poisoning:** inform Public Health if acquired abroad or if family member is a food handler or healthcare worker
- **Measles:** fever, maculopapular rash for ≥3 days and ≥2 of following: Koplik's spots, coryza, conjunctivitis, raised measles IgM, measles encephalitis or pneumonitis. Inform Public Health of MMR or measles vaccination history. Do not bring children with suspected measles in primary care to hospital for diagnosis, only if hospital based treatment required or if immunocompromised: arrange for immediate isolation on arrival
- **Rubella:** rash and occipital lymphadenopathy or arthralgia (if not parvovirus), **or** congenital rubella or raised IgM to rubella. Inform Public Health of MMR vaccine history
- **Scarlet fever:** tonsillitis, fever, rash with either culture of *Streptococcus pyogenes* from throat or raised ASO or anti-DNaseB titre

NOTIFIABLE INFECTIOUS DISEASES AND FOOD POISONING ● 2/2

- **Tuberculosis:** diagnosed clinically, not just microbiologically (atypical mycobacterial infection or patients given chemoprophylaxis but not thought to have TB are not notifiable)
- **Whooping cough:** cough with a whoop, with history of contact with similar illness **or** positive pernasal swabs for *Bordetella pertussis* or raised IgM to *B. pertussis* in an adult or child. Inform Public Health of pertussis immunisation history

Non-statutory notifiable diseases
It has been agreed that, although they are not statutorily notifiable, the following diseases will nevertheless be reported to the consultant in communicable disease control:

- AIDS/HIV infection
- Legionnaires' disease
- Listeriosis
- Psittacosis
- Cryptosporidiosis
- Giardiasis
- Creutzfeldt-Jakob disease and other prion diseases

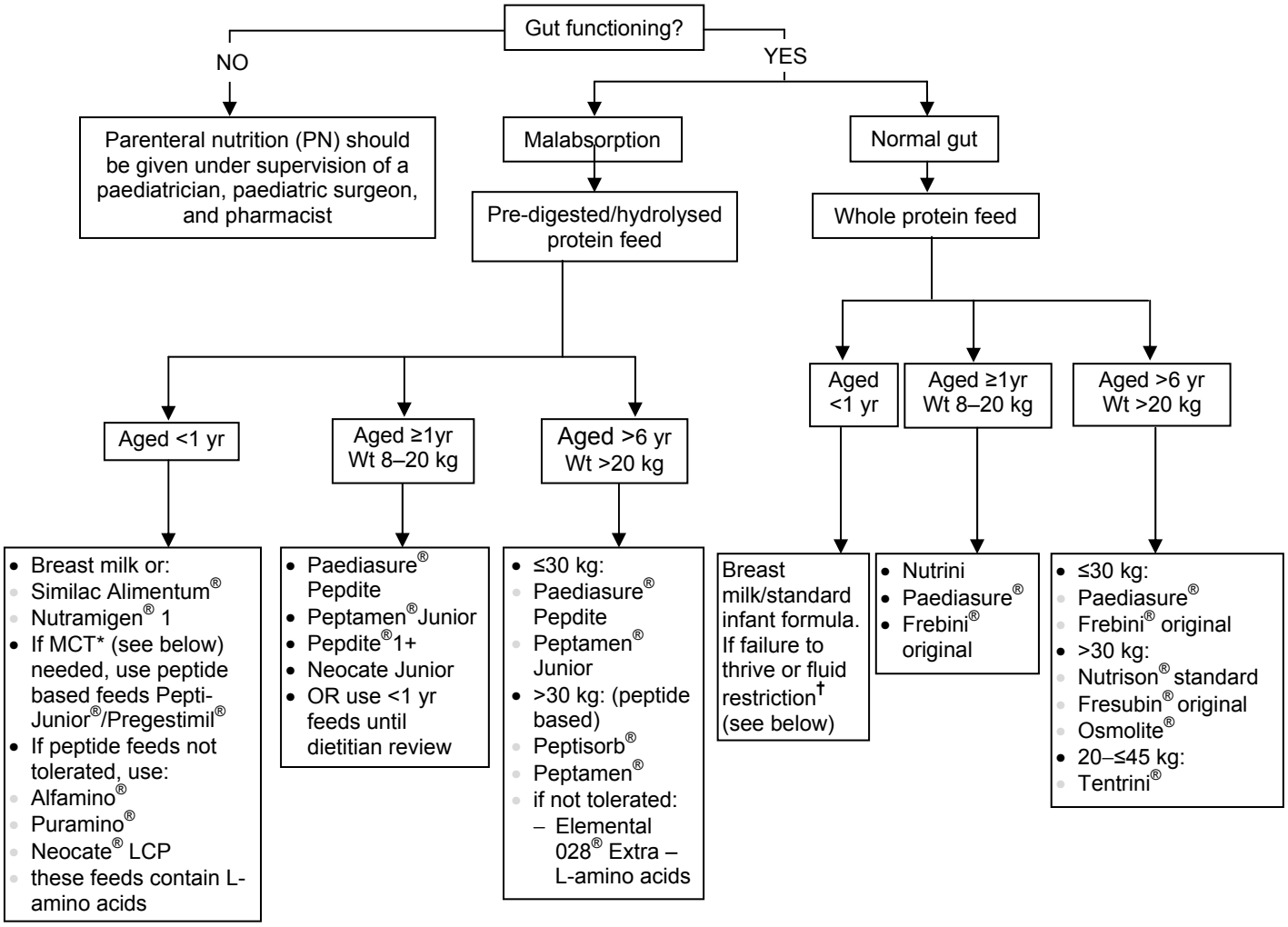
CONTACT DETAILS

- Complete a notification form immediately on diagnosis of a suspected notifiable disease: https://www.gov.uk/government/publications/notifiable-diseases-form-for-registered-medical-practitioners
- Do not wait for laboratory confirmation of a suspected infection or contamination before notification – https://www.gov.uk/guidance/notifiable-diseases-and-causative-organisms-how-to-report

NUTRITIONAL FIRST LINE ADVICE ● 1/2

Initial guide to feeding when child not able to eat normally and dietitian not available
Choose appropriate feed for age
If very underweight for age, **use appropriate feed for actual bodyweight**

If patient nil-by-mouth see* Intravenous fluid therapy *guideline before starting parenteral nutrition (PN)



* Indications for medium chain triglycerides (MCT): problems with digestion, absorption or transport of long chain fats e.g. cholestasis, short gut, pancreatic insufficiency

† If failure to thrive or fluid restricted:
- If using breast milk, dietitian to advise on fortification of breast milk
- If using standard infant formula, change to **Similac High Energy or Infatrini**
- Nutritional composition of milks – see **BNFc**

For suspected cow's milk allergy both IgE and non IgE use an extensively hydrolysed formula or amino acid formula i.e. **Simlilac Alimentum®**, **Nutramigen® 1**, **Pepti-Junior®, Pregestimil®, Alfamino®, Puraminio®, Neocate® LCP**, Neocate Junior and **Elemental 028®**

- Contact dietitian to assess individual requirements and appropriate feed at the first available opportunity Monday–Friday. Check telephone or bleep number via hospital intranet or switchboard
- Feeds in **bold** must be prescribed
- Hospital pharmacy will advise which feed is used locally (all similar composition for ages but different manufacturers)
- See **Table 1** for daily fluid and nutritional requirements

Table 1: Fluid and energy requirements

Age	Fluid* mL/kg/day	Energy † Kcal/kg/day
0–3 months	150	111
4–6 months	130	91
7–9 months	120	82
10–12 months	110	82
1–3 yr	95	81
4–6 yr	90	78
7–10 yr	75	64
11–14 yr	55	55
15–18 yr	50	46

* Department of Health Report No 41, Dietary Reference Values 1991
† Scientific Advisory Committee on Nutrition (SACN) 2011

How to calculate energy requirements for tube feeds

- Choose appropriate feed for age. **If very underweight for age**, use appropriate feed for **actual bodyweight** (see **Initial guide to feeding when child not able to eat normally and dietitian not available)**
- Calculate amount of feed to use in 24 hr based on:
- kcal/kg in children
- Calculate fluid requirement; if restricted, continue to use feeds above until reviewed by dietitian
- if extra fluid required, give water
- Feeding method depends on clinical condition:
- if risk of refeeding syndrome (e.g. anorexia nervosa, Crohn's), introduce feed slowly over 3–4 days starting at 25% of kcal intake day 1. Increase daily by 25% until full feeds at day 4. Only increase feeds if bloods are normal
- Bolus feed can be given at 1, 2, 3, 4 hrly intervals depending on tolerance
- If on continuous feeds (i.e. over 24 hr), start at 25% of final hourly requirement. Increase to 50%, 75% and full feeds every 4–6 hr as tolerated. When full feeds tolerated, aim to give full requirement over 20 hr

Monitoring

- Check plasma electrolytes daily with particular reference to phosphate, potassium, magnesium, calcium and sodium: correct accordingly. Stop once clinical condition stable
- Refeeding syndrome can occur up to 2 weeks after refeeding. Monitor electrolytes daily for 2 weeks or until electrolyte parameters are stable (this maybe be less than 2 weeks)

RECOGNITION AND ASSESSMENT

Definition

- Body mass index (BMI) >98th centile using age- and gender-specific BMI charts
- Overweight defined in UK as >91st centile
- Use Royal College of Paediatrics and Child Health UK WHO growth charts, where available

History

- Age of onset
- peripubertal common (related to imbalance between calorie intake and expenditure)
- infancy onset or onset aged <5 yr is rarer and may suggest a genetic cause
- Bullying
- Low self-esteem and depressed mood
- Osmotic symptoms suggestive of diabetes mellitus:
- thirst
- nocturia
- ask about eating and exercise patterns

Significant features

- Acanthosis nigricans; thickened velvety darkened skin in neck and flexures suggestive of hyperinsulinaemia
- Obstructive sleep apnoea
- night-time snoring with daytime somnolence
- Signs of steroid excess
- growth failure
- recent onset purple striae
- hypertension
- hirsutism
- Early onset associated with vision/hearing problems/learning difficulties/hypogonadism – suggest a genetic syndrome
- Non-alcoholic steato-hepatitis
- hepatomegaly
- Polycystic ovarian syndrome, ask about:
- disordered periods
- hirsutism

Causes

- Primary or environmental
- imbalance between calories consumed and calories expended
- Secondary to genetic disorder
- chromosomal: Prader Willi/Down's syndrome
- autosomal recessive: Bardet Biedl/Alstrom/Carpenter/Cohen syndrome
- mutations in leptin pathway: melanocortin 4, prohormone convertase 1, leptin or receptor
- Secondary endocrine/metabolic:
- Cushing's syndrome
- autoimmune hypothyroidism
- hypothalamic obesity related to septo-optic dysplasia, hypothalamic damage during surgery

Review in secondary care if:

- Extreme obesity [BMI >3.5 standard deviations above mean (99.6th centile)]
- BMI >98th centile plus possible secondary cause of obesity. Look for:
- short stature in relation to expected for parental height
- dysmorphic features
- learning difficulties
- Obesity with significant/high risk for comorbidities
- If involvement of safeguarding services required

Investigations

All

- Urine test for glucose
- Blood pressure

- Pubertal assessment (for hypogonadism in males)
- Thyroid function
- Random glucose, glycated haemoglobin, ($HbA1_c$)
- Lipid profile (total and HDL-cholesterol, triglycerides)
- Liver function

Second-line investigations (if indicated by presence of significant features – see above)
- Genetic studies, including microarrays
  - all children with extreme obesity
  - children with obesity and dysmorphic features and/or learning difficulties
- 24-hr ambulatory blood pressure monitoring
- Calcium and phosphate (pseudohypoparathyroidism)
- 24-hr urinary free cortisol (if growth failure, hirsutism, hypertension)
- Oral glucose tolerance test (if glycated Hb raised)
- If suspecting polycystic ovarian syndrome measure:
  - LH
  - FSH (looking for LH greater than FSH)
  - serum testosterone
  - 17-hydroxy-progesterone
  - sex hormone binding globulin
  - prolactin
  - pelvic ultrasound
- Sleep study (usually overnight pulse oximetry recording in first instance)

TREATMENT

- Lifestyle, diet and exercise advice – reduce calorie intake, increase calorie expenditure
  - behaviour strategies: goal setting, problem solving, involve parents/carers
  - physical activity: ≥20 min, ideally 60 min, of vigorous physical activity ≥5 days/week; reduce sedentary time
  - diet: individual approach to reducing calorie intake; avoid nutritionally unbalanced diets; energy intake to be below energy expenditure, but sustainable
- Bariatric surgery – only considered in exceptional circumstances if physiological maturity, in children with BMI ≥40 kg/m^2 or 35 kg/m^2 with co-morbidities. To be carried out by specialist multidisciplinary team after extensive psychological and physical assessment
- Management of comorbidities

Type 2 diabetes
- Involve paediatric diabetes team within 24 hr
- Initial pharmacological treatment with metformin 200 mg oral once a day from aged 8–9 yr, gradually increasing to maximum dose of 2 g/day in 2–3 divided doses (see BNFc)
  - metabolically unstable patients (glycated Hb ≥8.5% and/or osmotic symptoms) will need insulin treatment immediately

Microalbuminuria
- Defined as albumin:creatinine ratio ≥3.5 mg/mmol (female) or 2.5 mg/mmol (male) in early morning urine sample, on 2 out of 3 samples
- Involve paediatric renal and diabetic teams for commencement of angiotensin receptor antagonist

Hypertension
- Defined as average systolic or diastolic blood pressure >95th percentile for age, sex, and height percentiles
  - confirm on ambulatory blood pressure monitoring
- First-line treatment: diet and exercise advice, limitation of dietary salt
- Second-line treatment: pharmacological treatment angiotensin receptor antagonist

Dyslipidaemia
- Definitions:
  - LDL-cholesterol ≥2.5 mmol/L
  - HDL-cholesterol ≤0.91 mmol/L
  - triglycerides ≥1.7 mmol/L
  - confirm on fasting samples

- First-line treatment: dietetic advice
- Pharmacologic therapy with statin (usually reserved for familial hypercholesterolaemia)

Non-alcoholic fatty liver disease
- First-line treatment: diet and exercise advice
- Hepatic transaminases >2x upper limit of normal is a surrogate marker for fatty liver disease – refer to paediatric hepatologist

Polycystic ovarian syndrome
- Defined by 2 out of 3 of following criteria:
- oligo- or an-ovulation
- biochemical or clinical evidence of hyperandrogenism
- multiple ovarian cysts on ultrasound scan
- Refer to adolescent gynaecology clinic and consider metformin if HbA_{1c} elevated

Obstructive sleep apnoea
- Oxygen desaturation while sleeping, diagnosed on oximetry monitoring
- discuss with consultant with respiratory interest regarding screening children who complain of snoring at night, and daytime somnolence
- First-line treatment: refer to ENT for possible adeno-tonsillectomy

Depression
- Low self-esteem
- Disordered body image
- Have a low threshold for referring to child and adolescent mental health services for assessment
- Consider requirement for safeguarding

MONITORING TREATMENT
- Regular follow-up and assessment
- best delivered in community rather than secondary care
- Principles include:
- setting realistic, achievable targets
- regular contact
- non-judgemental approach
- Complications i.e. type 2 diabetes require 3-monthly follow-up in secondary care
- Other complications require secondary care follow-up by paediatric team

SUBSEQUENT MANAGEMENT
- Primary obesity
- annual screen for complications
- Most secondary causes of obesity are chronic conditions that require specific management

FOLLOW-UP
- Children with:
- extreme obesity (BMI >99.6th centile for age and sex)
- secondary obesity

DISCHARGE
- GP follow-up once secondary obesity excluded
- If secondary obesity, involve paediatric team

ORBITAL CELLULITIS AND SINUSITIS ● 1/1

RECOGNITION AND ASSESSMENT

Preseptal	Orbital
Facial erythema and tenderness	Painful eye movements
Normal eye movements	Orbital pain and tenderness
Normal vision	Visual impairment (red-green colour differentiation lost early)
Preceding superficial trauma	Proptosis
Eye pain	Chemosis
Periorbital swelling	Ophthalmoplegia
Fever	Preceding sinusitis

- If uncertain, manage as orbital cellulitis pending CT and ophthalmologist review

Investigations
- Eye swab (send pus if present)
- FBC
- Blood culture
- CT scan if:
  - orbital involvement suspected
  - central neurological signs
  - unable to assess eye movements/vision or if eyelid cannot be opened
  - bilateral oedema
  - deterioration despite treatment
- MRI if neurological signs or suspicion/evidence of intracranial involvement on CT

MANAGEMENT

Preseptal peri-orbital cellulitis
- If limited to upper eyelid oral co-amoxiclav
- Review eye movements and red-green colour vision twice daily
- If both eyelids, severe or no improvement after 48 hr, give IV co-amoxiclav
  - if improving, convert to oral high dose co-amoxiclav
  - if penicillin allergy give clindamycin
- Total duration of treatment (including IV) 14 days

Orbital cellulitis
- Urgent ophthalmology/ENT review within 4 hr for assessment for surgical drainage
- IV ceftriaxone 100 mg/kg maximum 2 g (or cefotaxime 50 mg/kg maximum 3 g if ceftriaxone contra-indicated)
- If toxaemic add clindamycin 6.25–10 mg/kg 6-hrly
- If history of anaphylaxis to penicillin give ciprofloxacin and clindamycin
- If improving, convert to oral high dose co-amoxiclav
- If penicillin allergy give clindamycin
- Total duration of treatment (including IV) 21 days (up to 6 weeks if bone involvement)

Intracerebral complications
- Urgent neurosurgical review

Sinusitis
- URTI symptoms ≥10 days and ≥1 of:
  - nasal congestion and discharge
  - persistent cough (often nocturnal)
- If acute treat with amoxicillin
- Change to co-amoxiclav if no response after 48 hr (IV if severe)
- Total 7 days antibiotics
- Severe if:
  - falling GCS, temperature >39°C, purulent discharge
- ENT, neurosurgical review
- If complications are present:
  - orbital – CT with contrast
  - neurological – MRI with contrast
- Plain CT of sinuses for sinusitis
  - if stable can be done as outpatient

OSTEOMYELITIS AND SEPTIC ARTHRITIS ● 1/3

See also **Limping child** guideline

RECOGNITION AND ASSESSMENT

Symptoms and signs

- Fever
- Loss of function e.g. limp
- Pain in bone/joint
  - localised
  - constant
  - increasing
- Restricted range of movement
- Soft tissue swelling
- Point tenderness of bone
- Effusion

Above symptoms and signs are indicative of osteomyelitis or septic arthritis (in absence of clear history of obvious trauma) irrespective of WBC, CRP, ESR and fever or radiological appearance; keep nil-by-mouth pending orthopaedic aspiration/surgery

Previous history

- Ask about:
  - duration of symptoms
  - injuries
  - fever
  - antibiotics
  - antipyretics/anti-inflammatories
  - haemoglobinopathies (e.g. thalassaemia, sickle cell disease)

Urgent investigations

- FBC
- ESR
- CRP
- Blood culture **before antibiotics** (minimum 4 mL older children, 2 mL neonates)
- If cause of fever uncertain, collect other specimens (e.g. urine) for culture before antibiotics
  - if immunocompromised, penetrating injury or failed primary treatment, also anaerobic and TB culture

Osteomyelitis

- Plain X-ray AP and lateral of affected part
- If surgically explored or needle aspiration, tissue/pus for Gram stain and culture

Septic arthritis

- Aspiration of joint for Gram stain and culture
  - interventional radiologist or orthopaedic registrar/consultant
  - for sedation and analgesia contact paediatric registrar or on-call paediatric anaesthetist

Further investigations

Perform as soon as possible (must be within 36 hr)

- If plain X-ray normal, infection clinically localised and urgent MRI is available:
  - consultant paediatrician or orthopaedic surgeon to authorise urgent MRI of bone
  - if deep sedation or general anaesthetic required, contact on-call paediatric anaesthetist
- If plain X-ray normal, infection clinically localised and MRI not available, request ultrasound scan to look for fluid and synovial thickening in knee and hip joint
- If localising signs poor or possible multifocal infection, request isotope bone scan
- If cardiac murmur or multifocal *Staph. aureus*, request echocardiogram

IMMEDIATE TREATMENT

- Admit
- Nil-by-mouth and maintenance fluids IV

- Bed rest
- Refer immediately to orthopaedic and on-call paediatric registrar for urgent assessment
- Early involvement of on-call consultant orthopaedic surgeon

Antibiotics (see BNFc for neonatal doses)
- Commence following surgery, unless it will take >4 hr from admission to get to theatre
- Severe sepsis with organ dysfunction (e.g. hypotension, oxygen requirement, GCS <12, platelet <80, creatinine x 2 normal, abnormal LFTs)
- after blood and urine cultures taken, commence cefotaxime 50 mg/kg 6-hrly (high dose; maximum 12 g/day) IV over 3–4 min
- No organ dysfunction: as soon as possible (must be within 4 hr)
- aged <3 months: cefotaxime 50 mg/kg (maximum 3 g/dose) 6-hrly (neonate doses – see **BNFc**) **OR** for severe infection, ceftriaxone 50–100 mg/kg (maximum 4 g) daily
- aged 3 months–5 yr: cefuroxime 50 mg/kg 8-hrly
- aged >5 yr: flucloxacillin 50 mg/kg IV (maximum 2 g/dose) 6-hrly
- Targeted antibiotic therapy
- if organism identified, use narrowest spectrum possible with good bone/joint penetration
- *Staph. aureus* sensitive to flucloxacillin 50 mg/kg 6-hrly IV (high dose maximum 2 g/dose)
- Penicillin allergy, substitute flucloxacillin for:
- history of rash: cefuroxime
- history of anaphylaxis or high risk MRSA: clindamycin high dose
- Bomb blast injuries: see **Public Health England** advice www.gov.uk/government/uploads/system/uploads/attachment_data/file/616113/Antimicrobial_prophylaxis_guidance_for_bomb_blast_victims.pdf

Analgesia
- If necessary initially to allow splintage, use morphine IV (see **Analgesia** guideline)
- elevate and splint affected limb
- plaster backslab for peripheral joints
- rest in skin traction on a pillow for central joints

Surgery
- Ask parent(s) to stay with child until consent obtained
- Resuscitate if severe sepsis
- Emergency theatres to be alerted as soon as possible
- Contact:
- anaesthetic office to arrange paediatric anaesthetist
- orthopaedic registrar to book patient onto suitable list
- consultant paediatrician and orthopaedic surgeon

SUBSEQUENT MANAGEMENT

Inform paediatric orthopaedic surgeon and consultant paediatrician

Uncomplicated septic arthritis (not complicated by associated osteomyelitis)
- Aspirate or drain joint in theatre
- Request long line insertion under GA and repeat any blood tests required
- If discharged for hospital at home IV treatment, change to ceftriaxone
- If treatment started within **24 hr** of first symptoms and clinically improving, discuss with consultant about changing IV to oral antibiotics after 72 hr if:
- recovery of joint movement
- absence of pyrexia after 4-hrly monitoring for 48 hr
- WCC <11, CRP and ESR falling on 2 successive specimens ≥24 hr apart
- If agreed by orthopaedic consultant, give oral antibiotic to complete treatment
- no organism identified: co-amoxiclav [double dose (see **BNFc**)]
- organism identified: narrowest spectrum with good bone penetration
  - if *Staph. aureus* sensitive to flucloxacillin: flucloxacillin oral (high dose) if capsules tolerated; **OR** co-amoxiclav (double dose) if can only take suspension
- allergic to penicillin: clindamycin oral
- Stop treatment only if CRP is normal: agree duration of treatment with orthopaedic consultant depending on individual case

Early-presenting osteomyelitis

- If IV antibiotics started within 24 hr of onset of symptoms with a good clinical response as above, follow **Uncomplicated septic arthritis**

Established osteomyelitis or complicated septic arthritis

- Presentation >24 hr after onset of symptoms or partial treatment (e.g. oral antibiotics)
- Formal debridement in theatre with insertion of Hickman line
- Antibiotics IV as above. Discuss with orthopaedic consultant about switch to oral antibiotics after 14 days, if afebrile, pain free for 48 hr and CRP <20
- Continue oral antibiotics until all inflammatory markers are normal and clear evidence of healing established on radiographs
- Discuss duration of antibiotics with orthopaedic consultant in each case

Septic arthritis or osteomyelitis (deteriorating condition/failure to improve within 48 hr)

- Inform orthopaedic team for exploration to drain pus
- Review culture result
- Discuss with consultant microbiologist and paediatrician
- Arrange for repeat blood cultures
- if culture positive target antibiotic therapy
- Complete or repeat any investigations listed above
- Consultant paediatric medical and orthopaedic review
- Exclude important differential diagnoses
- systemic inflammatory response as seen in juvenile chronic arthritis
- transient synovitis, associated with intercurrent infection
- acute leukaemia, septicaemia, multifocal disease, endocarditis, Ewing sarcoma
- Continuing problems with local sepsis
- return to theatre for further debridement and insertion of Hickman line

MONITORING TREATMENT

- Peripheral colour, warmth, movement of affected limb: hourly for first 4 hr then 4-hrly for 24 hr
- Respiratory rate, pulse, temperature 4-hrly
- If not improving:
- repeat blood cultures
- additional imaging for metastatic infection
- assess for deep vein thrombosis
- discuss with infectious diseases/microbiology about increasing antimicrobial spectrum

PAIN ASSESSMENT ● 1/1

FLACC

SUGGESTED AGE GROUP: 2 months–7 yr

Behavioural CATEGORIES	SCORING 0	1	2
Face	No particular expression or smile	Occasional grimace or frown, withdrawn, disinterested	Frequent to constant quivering chin, clenched jaw
Legs	Normal position or relaxed	Uneasy, restless, tense	Kicking, or legs drawn up
Activity	Lying quietly, normal position, moves easily	Squirming, shifting back and forth, tense	Arched, rigid or jerking
Cry	No cry (awake or asleep)	Moans or whimpers, occasional complaint	Crying steadily, screams or sobs, frequent complaints
Consolability	Content, relaxed	Reassured by occasional touching, hugging or being talked to, distractible	Difficult to console or comfort
Each of the 5 categories: (F) Face; (L) Legs; (A) Activity; (C) Cry; (C) Consolability; is scored from 0–2 which results in a score between 0 and 10 *(Merkel et al 1997)*			

See management ladder below for score

WONG AND BAKER PAIN ASSESSMENT – SELF REPORT

Suggested age group ≥4 yr
Point to each face using the words to describe the pain intensity
Ask child to choose a face that best describes their own pain and record appropriate number

Wong-Baker FACES Foundation (2016). Wong-Baker FACES® Pain Rating Scale.
Retrieved 20.07.16 with permission from http://www.WongBakerFACES.org

See management ladder below for score

ANALGESIC INTERVENTIONS

Analgesic ladder (omit NSAIDs if contra-indicated)
Review analgesia daily and step up or down dependent on pain score
Review need for paracetamol at day 3

					Systemic morphine
				Oral morphine (pain dose)	
			Oral morphine (low dose)		
		NSAID	NSAID	NSAID	NSAID
	Paracetamol	Paracetamol	Regular Paracetamol	Regular Paracetamol	Regular Paracetamol
No pain	Mild	Mild to moderate	Moderate	Moderate to severe	Severe
0	2	4	6	8	10

Play specialist

Intervention by play staff

Preparation aid used: doll, verbal

Explanation: photos

Distraction: toys, bubbles, music, multi sensory, books

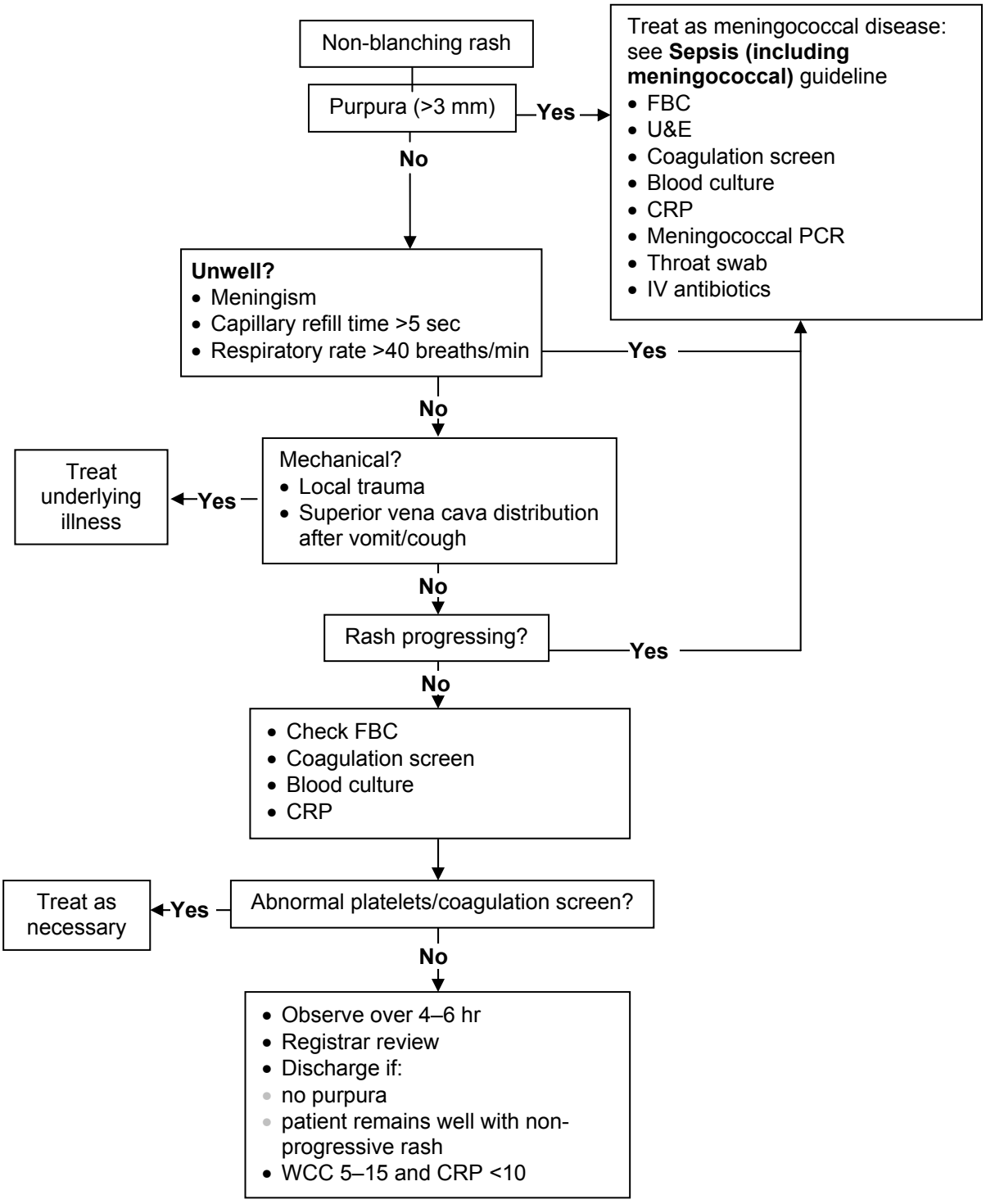
Refer all in need of analgesia and with behavioural concerns

If learning disabilities apply assessment using tool appropriate for mental age

Check BNFc for contraindications/interactions/precautions

PETECHIAL/PURPURIC RASHES ● 1/1

RECOGNITION AND ASSESSMENT



PLEURAL EFFUSION ● 1/2

RECOGNITION AND ASSESSMENT

Symptoms and signs

- Investigate for effusion if persistent pyrexia or unwell 48 hr after treatment started for pneumonia

Differential diagnosis

- Uncomplicated pneumonia
- Malignancy
- Heart failure
- Pancreatitis
- Pulmonary embolism

Investigations

- FBC, clotting screen, U&E, LDH, protein, albumin, glucose, CRP
- Blood cultures
- Sputum culture, if possible
- If recurrent infections, investigate for immune deficiency (first line: FBC, IgG, A, M, functional antibodies and HIV antibody)
- CXR PA or AP (no need for lateral)
- Ultrasound (US) scan to:
- confirm presence of effusion
- maximum depth in dependent position
- differentiate between simple and complicated effusion (e.g. loculations, heterogeneous material)
- localise effusion at time of drain insertion
- If history, CXR or US suggestive of malignancy, request CT chest
- If risk factors for coagulopathy or thrombocytopenia check and correct before drain insertion
- Pleural fluid analysis for:
- Gram stain and bacterial culture
- differential cell count
- cytology
- AAFB and TB PCR and culture

If cause likely to be infective, it is not necessary to obtain sample for pleural fluid culture routinely before chest drain insertion. If alternative cause suspected, try to avoid unnecessary chest drain insertion by obtaining diagnostic aspirate of pleural fluid for cytology

IMMEDIATE TREATMENT

Supportive

- ABC
- Oxygen and fluid resuscitation as indicated
- Analgesia

Antibiotic therapy

Type of effusion suspected	Choice of antibiotics
Effusion following community-acquired pneumonia	Co-amoxiclav IV + clindamycin IV (Penicillin allergy: clindamycin IV alone)
Effusion following hospital-acquired pneumonia, trauma, aspiration or in immune-compromised child	Piperacillin/tazobactam (Penicillin allergy: clindamycin IV)
Effusion possibly tuberculous	Discuss with TB team

- Narrow antibiotic spectrum with culture results

Refer to respiratory paediatrician

- Early active treatment reduces length of illness
- Except small effusions (<2 cm deep) which are not enlarging or compromising respiratory function and do not need to be drained
- Underlying cavitating disease may lead to bronchopleural fistulae

Chest drain insertion

- Discuss with respiratory team, consultant paediatrician, paediatric anaesthetic team (usually GA used)
- support may also be required from cardiothoracic team +/- interventional radiologist

- Consider simultaneous insertion of long line during general anaesthetic, if possible
- Ensure vascular access before starting procedure
- CXR after drain insertion

Chest drain management

- Ensure nursing staff trained in care of children with chest drains
- Attach chest drain to low level suction (5–10 cm H2O) via underwater seal
- If altitude chest drainage system used, set wall suction to 160 mmHg/22 kPa and set dial on drainage system to 20
- Keep underwater seal below level of chest at all times
- If >10 mL/kg/hr has been drained, clamp chest drain for 1 hr to prevent re-expansion pulmonary oedema
- **Never clamp a bubbling chest drain** – this indicates presence of pneumothorax
- If clamped and chest pain or breathlessness, unclamp immediately
- When there is a sudden cessation of fluid draining, the drain must be checked for obstruction (blockage or kinking) by flushing
- Ensure adequate analgesia (see **Analgesia** guideline) and encourage patient to move freely when well enough

Intrapleural fibrinolytics

- Indicated if thick fluid with loculations or pus
- Instill urokinase, as follows:
- ≥10 kg: urokinase 40,000 units in 40 mL sodium chloride 0.9%
- <10 kg: urokinase 10,000 units in 10 mL sodium chloride 0.9%
- administer via chest drain 12-hrly for 3 days (total 6 doses)
- clamp chest drain for 4 hr after instillation of urokinase, then drain for 8 hr
- Record fluid volumes into and out of pleural space carefully and accurately

SUBSEQUENT MANAGEMENT

Act on response to treatment and clinical assessment of patient

- Monitor symptoms and re-examine patient to assess progress
- Repeat CRP as needed
- if falling rapidly, continue with current regimen
- if not falling after 72 hr, treat as non-resolution (see below)
- Chase pleural fluid aspirate results
- if unexpected organisms grown, adjust antibiotic therapy with antibiotic sensitivities
- if differential cell count shows lymphocytosis, discuss with TB team, send aspirate for cytology and consider CT scan of chest
- Chase blood and sputum culture results – if no growth, continue empirical treatment until patient improves
- Remove chest drain when drainage minimal and in agreement with respiratory paediatrician: appose skin with Steri-Strips™ rather than sutures
- Continue IV antibiotics at least until afebrile. Change to oral co-amoxiclav (penicillin allergy: oral clindamycin) when clinical improvement obvious. Complete minimum 14 days antibiotics
- Continue antibiotics until CRP <10
- Encourage early mobilisation and exercise

Non-resolution

- Non-resolution of effusion after 3 days or further complications occur, consider CT scan of chest
- If no fluid draining, check for obstruction by flushing
- If drain cannot be unblocked, remove and replace if significant effusion remains
- Discuss referral for thoracotomy with respiratory paediatrician

Surgery

- Discuss with paediatric thoracic surgeon if:
- effusion has not resolved
- child is still septic

DISCHARGE AND FOLLOW-UP

- Arrange review by respiratory paediatrician, initial appointment 6 weeks after discharge (CXR on arrival)
- if symptoms persist or recur, early referral to respiratory paediatrician

If aged <1 month, refer to Neonatal guidelines

RECOGNITION AND ASSESSMENT

Definition

- Inflammation and consolidation of the lung caused by a bacterial, viral or mycoplasma infection
- Absence of clinical signs **AND** negative CXR makes pneumonia unlikely
- Up to 35% of lower respiratory tract infections have single virus as causative organism
- Can be presenting illness in cystic fibrosis and immunodeficiency states

Symptoms and signs

- Cough
- Fever
- Irritability
- Poor feeding
- Vomiting
- Tachypnoea at rest (most useful sign)

Awake or unsettled infants can have high respiratory rate on a single measurement; measure at rest and repeat

Table 1: WHO definition of tachypnoea

Age	Counted breath rate
<2 months	≥60/min
2–11 months	≥50/min
1–5 yr	≥40/min

- Bronchial breathing, inspiratory crackles
- Recession
- Abdominal pain (referred pleural pain)

Severe pneumonia

- >1 of following:
- temp >38.5°C
- respiratory rate >50 (>70 infant)
- infant moderate
  - severe recession
  - not feeding
  - apnoea
- infant severe (regardless of respiratory rate)
  - difficulty breathing
  - nasal flaring
  - grunting
- cyanosis
- tachycardia, capillary refill time >2 sec
- signs of dehydration

Investigations if severe

- Pulse oximetry
- FBC, blood culture
- Serum electrolytes (may have hyponatraemia owing to SIADH), CRP
- If mycoplasma pneumonia suspected, mycoplasma titre (indicate date of onset on request form) or PCR
- Sputum if able to provide good quality specimen
- Nasopharyngeal aspirate or nasal swab in viral transport medium for respiratory viruses
- If pertussis suspected, pernasal swab in charcoal transport medium
- Pleural fluid culture and pneumococcal PCR if aspirated
- If severe pneumonia, pneumococcal antigen in urine
- Routine chest radiography not advised if:
- community acquired pneumonia
- not admitted to hospital
- Do not perform lateral X-ray routinely

Differential diagnosis
- Bronchiolitis with atelectasis (usually aged <1 yr)
- Foreign body aspiration
- Tumour (‘round’ pneumonia)
- Empyema/lung abscess
- Tracheobronchitis
- Whooping cough

IMMEDIATE TREATMENT
See **Flowchart**

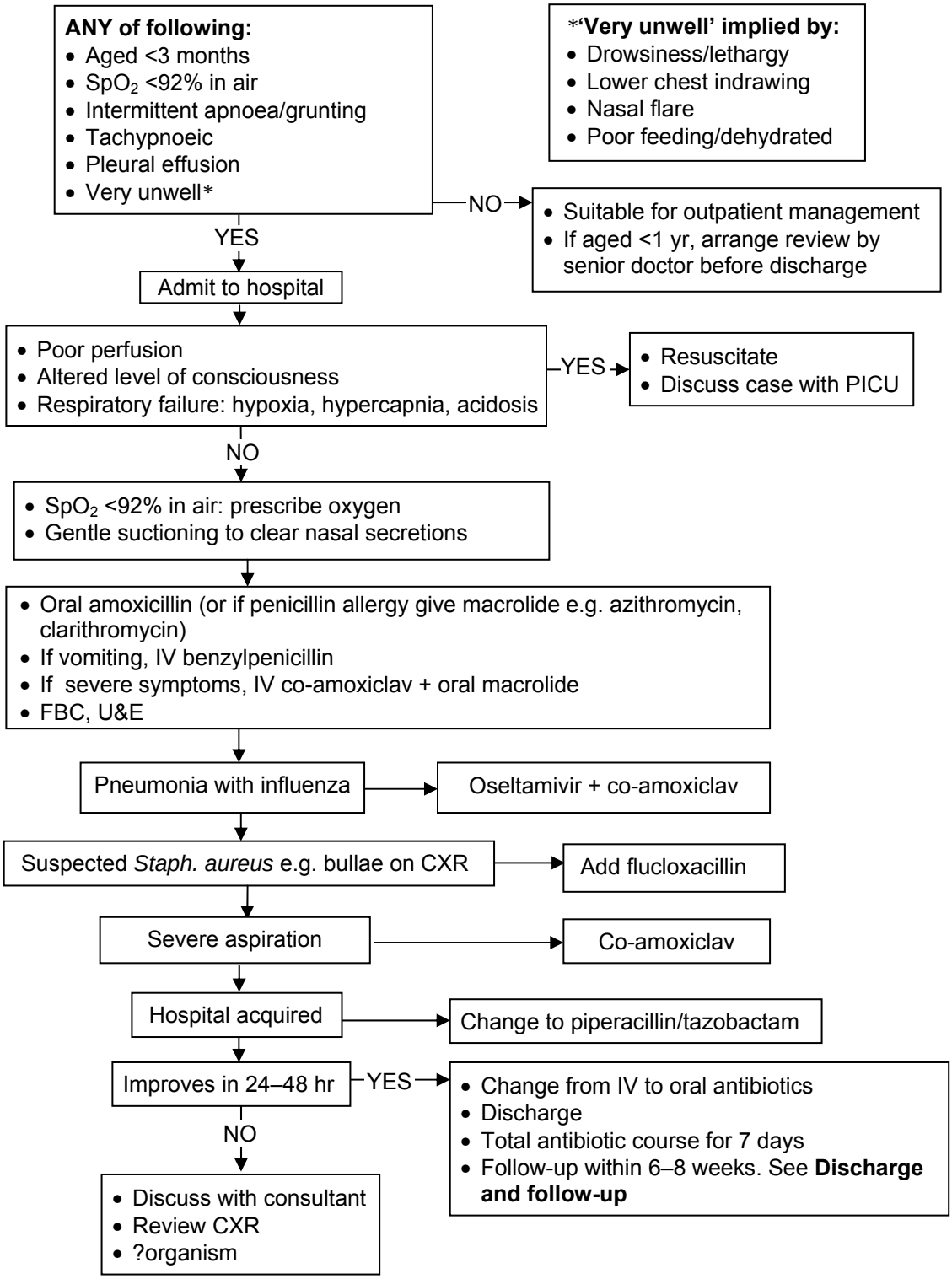
Pleural effusion
- See **Pleural effusion** guideline

SUBSEQUENT MANAGEMENT
- Change IV to oral within 24–48 hr
- If uncomplicated, total antibiotic course 7 days
- If complicated or staphylococcal pneumonia, treat for 14 days and 14–21 days for severe community acquired pneumonia
- Physiotherapy once cough productive
  - important if neuromuscular impairment results in poor clearance
- Maintain hydration
  - oral fluids if tolerated
  - if unable to take oral fluids use sodium chloride 0.9% with glucose 5% with potassium via IV infusion
  - restrict IV fluid replacement to 80% maintenance
  - monitor electrolytes

MONITORING TREATMENT
- Continuous SpO_2 monitoring if needing oxygen
- 1–4 hrly observation depending on severity of illness
- If no improvement in 24–48 hr, review diagnosis (repeat CXR) or treatment

DISCHARGE AND FOLLOW-UP
- Radiography follow-up if:
  - round pneumonia
  - collapse
  - persisting symptoms
- If previously healthy and recovering well radiography follow-up not required
  - previous lower respiratory tract infections
  - failure to thrive
- GP follow-up for all others within 6–8 weeks
- Convalescent mycoplasma titre can be obtained at this visit (indicate date of onset on request form)

Flowchart: Management of community acquired pneumonia in a previously well patient aged >1 month



PNEUMOTHORAX ● 1/2

RECOGNITION AND ASSESSMENT

Symptoms and signs

Tension pneumothorax (very rare)

- Severe dyspnoea
- Circulatory compromise
- Trachea +/- apex beat displaced
- Hyperresonant percussion note
- Absent or decreased breath sounds on affected side

Treat immediately

- Give oxygen 15 L/min with mask with reservoir bag
- Insert a large bore cannula (14 or 16 G) ≥4.5 cm in length into 2nd anterior intercostal space, midclavicular line
- Insert chest drain mid axillary line 5th intercostal space
- Remove emergency cannula when bubbling in underwater seal system confirms intercostal tube system functioning

Spontaneous pneumothorax

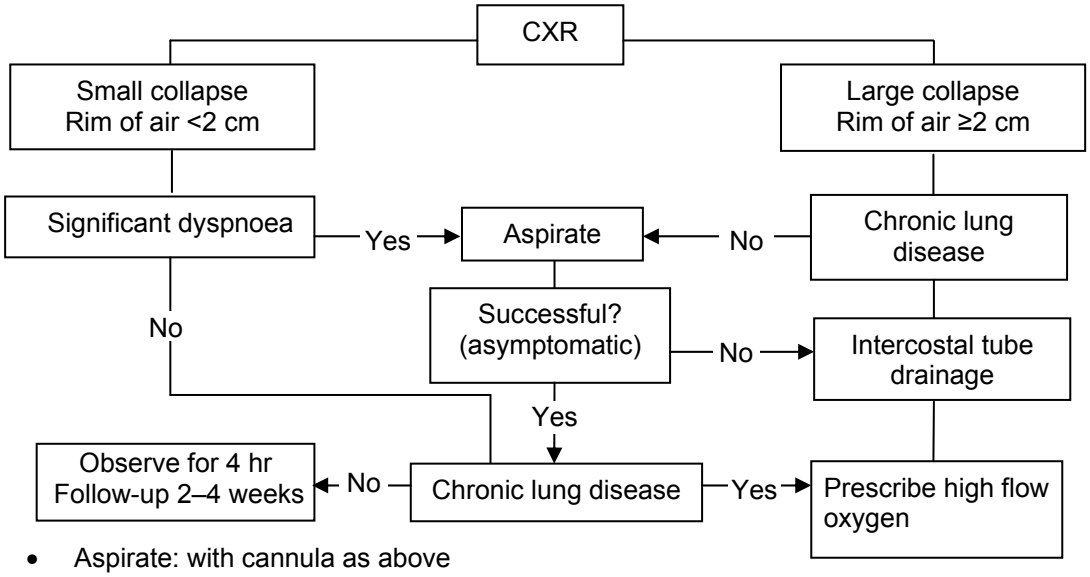
- Symptoms may be minimal
- Sudden onset, occasionally at rest
- Chest pain (unilateral)
- Dyspnoea
- Resonance on percussion, with reduced vocal fremitus and breath sounds (if moderate-large)

Investigations

- PA CXR
- If findings are unclear on PA, lateral (if possible, decubitus) film may help
- If findings obscured by surgical emphysema or complex bulla disease, CT scan may help

- ***BEWARE: suspected basal pneumothorax usually implies a bulla. CT scan will differentiate bullae from pneumothorax***

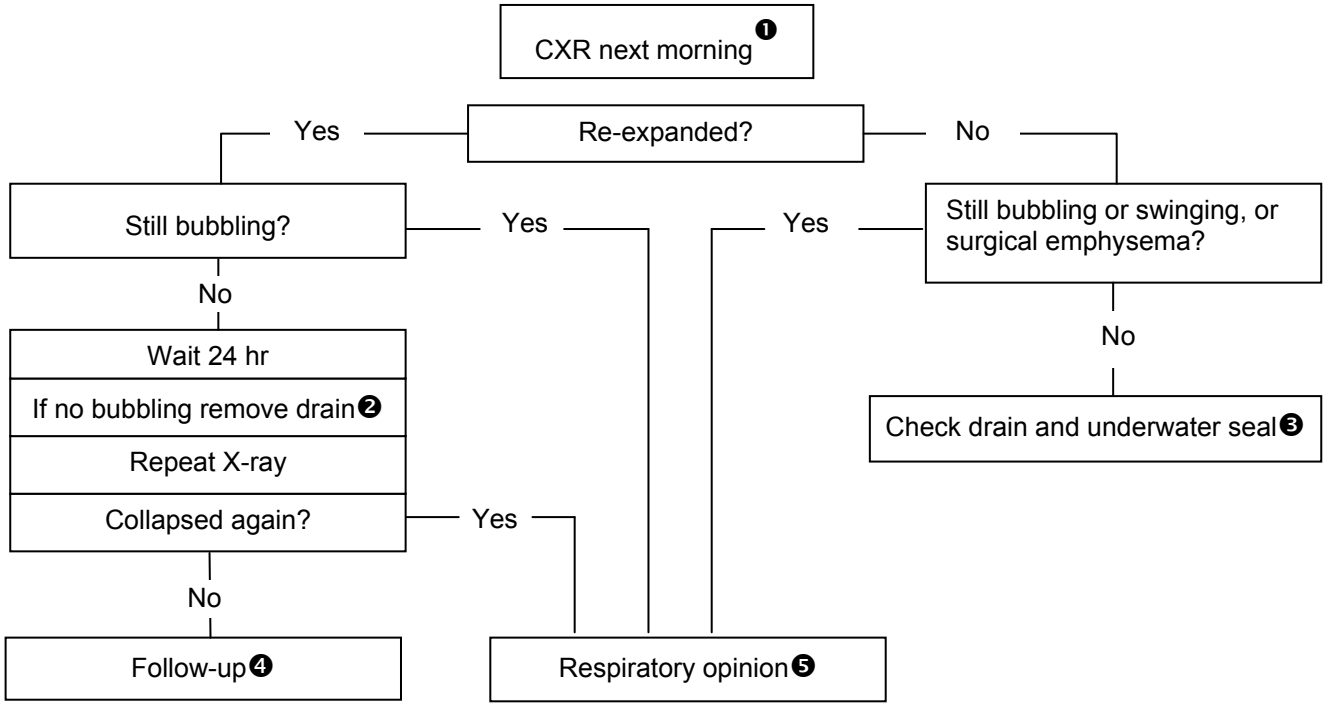
IMMEDIATE TREATMENT



- Aspirate: with cannula as above
- Suction not routinely required for chest drain
- Discuss all with respiratory paediatrician within 24 hr

PNEUMOTHORAX ● 2/2

Management of intercostal drains



Do not clamp chest tube unless advised by respiratory paediatrician or thoracic surgeon. If clamped and chest pain or breathless unclamp immediately

1: CXR
- keep underwater seal below level of chest at all times

2: Removal of chest drain:
- bubbling stopped for at least 24 hr
- cut drain-securing suture
- withdraw tube while patient holds breath in expiration
- close wound with Steri-Strips™

3: Check drain:
- if lung not re-inflated and no bubbling in underwater bottle: Try to remove **block** or **kink**
- if unsuccessful, remove drain. Insert new drain through clean incision

4: Follow-up:
- in 7–10 days then with respiratory paediatrician
- patient given discharge letter and written advice to return immediately if deteriorates
- no air travel until CXR changes resolved

5: Respiratory paediatrician's opinion:
- if no re-expansion consider air leak, displaced/blocked tube, bronchopleural fistula, underlying pulmonary disease
- use high volume/low pressure suction, 1–2 kPa/Barr, (8–16 mmHg; 8–20 cm H_2O)
- if Altitude™ chest drainage system used, set wall suction to 160 mmHg/22 kPa and set dial on drainage system to 20
- early thoracic surgery. Refer when pneumothorax fails to resolve after 5 days of above management or after 3 days if patient has chronic lung disease

POISONING AND DRUG OVERDOSE ● 1/3

Always follow your local child safeguarding policies and procedures.
The safety of children is everyone's responsibility

Toxbase
- Check **Toxbase** for poisoning and drug overdose management
- www.toxbase.org access and password available in A&E
- if further information required, contact UK National Poisons Information Service (NPIS) 0344 892 0111

The poisoned
- Toddlers (typically accidental poisoning)
- Older children, particularly girls (intentional self-poisoning most common)

The poisoners
- Most childhood poisonings are accidental
- Intentional poisoning may be by the child or an adult
- Inadvertent poisoning may occur in a medical setting

The poison
- Children will eat and drink almost anything

RECOGNITION AND ASSESSMENT

Symptoms and signs
- Depressed respiration suggests centrally-acting drug
- Skin blisters (at pressure points) common after barbiturates and tricyclics
- Hypothermia after exposure or barbiturates
- Venepuncture marks and pinpoint pupils suggest opioid overdose
- Burns around mouth

Life-threatening features
- Coma
- Cyanosis
- Hypotension
- Paralytic ileus

Poison(s)/drug(s) information
- Ask patient, relatives, GP, ambulance crew. Retain any containers found
- if identification doubtful, ask parents to retrieve poison from home
- Ask about visitors to the house/visits to other houses (e.g. grandparents)
- Quantity ingested: difficult to quantify but parents may know how full a bottle should have been
- assume child has ingested something even if found with a few tablets or an empty bottle
- Time of ingestion, including multiple doses/staggered overdose
- Other possible poisons/drugs taken
- If child presents with no clear history to suggest button battery ingestion but symptoms e.g. haematemesis, haemoptysis and respiratory difficulties present, see **Known/suspected button battery ingestion**

Investigations
- Save blood and urine for toxicological analysis
- all suspected cases of paracetamol ingestion should have concentrations measured
- if history of ingestion, urgent measurement of plasma/serum concentration is essential in diagnosis and management of poisoning with ethylene glycol, iron, lithium, methanol, paracetamol, theophylline and salicylate
- Other investigations as recommended by **Toxbase** or clinical condition: U&E, blood gases and acid-base

Request plasma paracetamol concentration in all unconscious patients in whom drug overdose considered

Always admit a child who is symptomatic or who has ingested iron, digoxin, aspirin or a tricyclic antidepressant

POISONING AND DRUG OVERDOSE ● 2/3

IMMEDIATE MANAGEMENT

Separate guidelines give more detailed advice on management of overdose with alcohol, iron, paracetamol, phenothiazines, salicylates and tricyclic antidepressants

Assess airway, breathing and circulation

- Maintain airway
  - if airway not protected, consider airway adjunct or intubation and ventilation
  - if cyanosed or rate and depth of respiration obviously low, arterial blood gases indicated
  - if $PaCO_2$ high or rising, mechanical ventilation indicated
- Correct hypotension
  - raise foot of bed
  - if in haemodynamic shock, give IV bolus of sodium chloride 0.9% (20 mL/kg over 10 min). Assess and repeat if still in shock
  - consider need for central venous pressure (CVP) monitoring

Neurological

- Control convulsions (follow local seizure protocol)
  - if unconscious, treat as head injury until proved otherwise

Drug absorption

- Give antidote if appropriate (see **Toxbase**)
- If child has ingested potentially life-threatening amount of toxic agent within last hour give activated charcoal 1g/kg (maximum dose 50g) oral (disguised with soft drink/fruit juice) or via NG tube
  - do not give if child unconscious and airway cannot be protected
  - activated charcoal does not affect absorption of acids, alkalis, alcohols, cyanide, ethylene glycol, petroleum distillates, malathion, and metal salts including iron or lithium
- Do not give ipecacuanha, it does not empty the stomach reliably and can be dangerous
- Do not perform gastric lavage or whole bowel irrigation unless specifically recommended by **Toxbase**, or after consultation with NPIS (0344 892 0111)
- Stop any regular medication that might enhance effect of substance taken in overdose

Button (disc) battery ingestion

See **Flowchart: Known/suspected button battery ingestion**

SUBSEQUENT MANAGEMENT

- Follow additional guidance on www.toxbase.org
- If unconscious, admit to a high-dependency nursing area and attach ECG monitor
- Supportive care alone required for majority of acutely poisoned patients
- If deliberate self-harm, follow local protocol for referral (see **Self-harm** guideline)
- Share information with other agencies as relevant e.g. school nurse, social services
- Give advice to seek further medical assistance if symptoms develop after discharge

Monitoring treatment

- Monitor conscious level, temperature, respiration, pulse and BP until these return to normal
- No need to monitor drug concentrations other than to guide use of measures to enhance drug elimination
- If unconscious, make full head injury observations
  - record pulse, respiratory rate, BP, pupil size and reaction, and level of consciousness hourly for ≥4 hr, then increase interval if stable

PSYCHIATRIC REVIEW

- All deliberate acute self-poisoning or drug overdose must be seen by the psychiatric priority referral team within 24 hr of admission or regaining consciousness and before discharge

Safeguarding

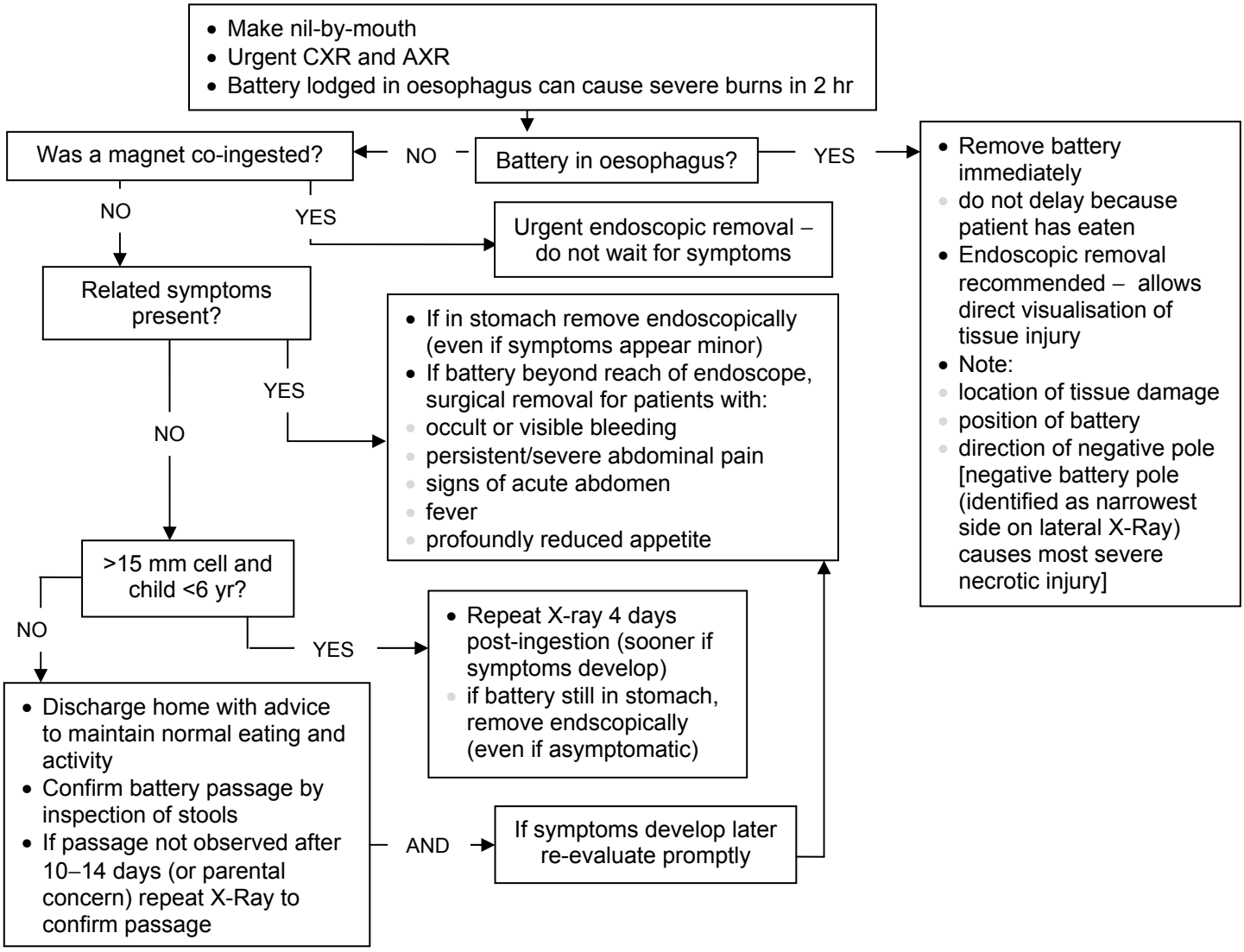
- If not referred to social services complete information sharing form for all deliberate or accidental poisonings or overdoses

DISCHARGE AND FOLLOW-UP

- **When discharged from hospital patients should have:**
  - been conscious and alert with normal vital signs for ≥6 hr
  - no evidence of significant organ dysfunction as a result of poisoning/drug toxicity
  - been interviewed by a member of the psychiatric priority referral team where indicated
  - follow-up appointment in psychiatric clinic (if recommended by psychiatrist)
  - follow-up appointment in paediatric clinic (if persistent sequelae of poisoning require review)

KNOWN/SUSPECTED BUTTON BATTERY INGESTION

A battery lodged in the oesophagus is a medical emergency. Follow pathway below



POST-OPERATIVE NAUSEA AND VOMITING AGED >2 YR ● 1/1

AT RISK

- History of travel sickness or post-operative nausea/vomiting
- Pre-operative pain
- Opioid analgesics
- Post pubertal girls
- >30 min surgery
- Age risk increases from aged 3 yr and rises throughout childhood

Prophylaxis

- Ondansetron 100 microgram/kg (maximum 4 mg) IV over 3–5 min **OR**
- Ondansetron oral:
- <10 kg: 2 mg
- ≥10 kg: 4 mg

HIGH-RISK

- Tonsillectomy
- Adenoidectomy
- Strabismus surgery
- Major ear surgery

Prophylaxis

- Ondansetron 100 microgram/kg IV over 3–5 min (maximum 4 mg)
- Dexamethasone 150 microgram/kg IV over 3–4 min (maximum 6.6 mg)
- If high-risk, give both

PERSISTENT NAUSEA/>1 EPISODE VOMITING

Ondansetron within last 8 hr

- Dexamethasone 150 microgram/kg IV slowly (maximum 6.6 mg)
- contraindicated in tumour lysis syndrome; use droperidol (aged 2–17 yr) 25 microgram/kg IV maximum 1.25 mg (not if prolonged QT interval)
- Metoclopramide, cyclizine and prochlorperazine are less effective in children
- P6 acupressure
- If tolerance of oral fluids is mandatory before discharge from day case surgery, post-operative vomiting may be increased

No ondansetron within last 8 hr

- Ondansetron 100 microgram/kg (maximum 4 mg) IV over 3–5 min **OR**
- Ondansetron oral:
- <10 kg: 2 mg
- ≥10 kg: 4 mg

STIMULATION OF P6 ACUPUNCTURE POINT

- P6 acupressure point:
- 1/6 distance from wrist crease to elbow crease or 2–3 finger breadths proximal to wrist crease, between the 2 prominent tendons in centre of forearm
- Apply gentle pressure with finger-tip

PRE-OPERATIVE FASTING ● 1/1

PRINCIPLES

- Do not fast patients for longer than necessary for their safety under general anaesthesia
- Do not deny fluids for excessively long periods; allow patients to drink within these guidelines
- Use theatre time efficiently

Ideally give all children (especially those aged <2 yr) clear fluids up to 2 hr pre-operatively. Liaise closely with theatre to discover approximate time of patient's operation

POLICY

- Solid food and milk (including formula) up to 6 hr before elective surgery
- Breast milk up to 4 hr before elective surgery
- Encourage patients to take clear oral fluids up to 2 hr before elective surgery. Thereafter, sips of water may be taken to enable tablets to be swallowed
- clear fluids do **not** include fizzy drinks

PROCEDURE

All children aged ≥1 yr

Morning operating lists

- No solid food after midnight
- Water or diluted squash to finish before 0630 hr

Afternoon operating lists

- Light breakfast (including toast, or small bowl of cereal), to finish before 0700 hr
- Water or diluted squash to finish before 1100 hr

Infants/children aged <1 yr

Morning operating lists

- Last formula milk feed before 0230 hr
- Last breast milk feed before 0430 hr
- Water or diluted squash to finish before 0630 hr

Afternoon operating lists

- Last formula milk feed before 0700 hr
- Last breast milk feed before 0900 hr
- Water or diluted squash to finish before 1100 hr

Nursing and medical staff should ensure all children are encouraged to drink clear fluids (e.g. water or diluted squash) until 2 hr before anaesthesia/surgery

RENAL CALCULI ● 1/4

RECOGNITION AND ASSESSMENT

Definition

- Presence of crystalline material within urinary tract

Symptoms and signs

- Non-specific recurrent abdominal pain
- Dysuria or painful micturition
- Classical renal colic
- Urinary infection (particularly *Proteus* spp)
- Persistent pyuria
- Macroscopic or microscopic haematuria
- Passage of gravel/stones
- Renal failure

Initial investigations

- Renal ultrasound scan
- KUB AXR
- Urine microscopy, pH and culture

Further investigations

- DMSA scan
  - to determine function when calculi multiple or large
- Repeat renal ultrasound scan
  - to see if stones have been passed
  - to monitor progress of stones
  - 6 weeks after treatment (see below)

IMMEDIATE TREATMENT

- Analgesia for severe pain
- If obstruction present, urgent referral to paediatric urology
- Cefalexin oral if symptomatic for urinary tract infection, adjusted once sensitivities available
  - antibiotic treatment unlikely to eradicate organism in presence of stones

OUTPATIENT MANAGEMENT

Investigations in patients with proven renal calculi

- Blood sample for:
  - creatinine
  - calcium
  - phosphate
  - parathyroid hormone (if calcium raised)
  - uric acid
  - venous bicarbonate
  - pH (warm arterialised capillary sample to coincide with urine pH)
- Random mid-stream urine
  - microscopy, culture and sensitivity
- Early morning urine (first voided specimen) and 24 hr collection (request ‘urinary stone screen’ and record height and weight on request form) for:
  - calcium
  - oxalate
  - citrate
  - uric acid
  - cystine
  - creatinine
  - pH (to coincide with blood pH)
  - if 24 hr urine collection unsuccessful request:
    - calcium:creatinine ratio
    - oxalate:creatinine ratio
    - urate:creatinine ratio

Stone analysis

- May give useful information about aetiology
- If stone passage is frequent or associated with symptoms, ask parents to strain urine

Table 1: Characteristics of urinary stones

Type	Appearance	Causes	Radio-opaque*
Magnesium ammonium phosphate	Very soft, white, toothpaste consistency or gravel fragments	• Infection with urea-splitting organisms, especially in children with urinary stasis	No
Calcium oxalate	Hard grey-brown rough surface	• Hypercalciuria (any cause) • Hyperoxaluria	Yes
Calcium phosphate	Large, smooth, pale, friable	• Infection • Renal tubular acidosis • Vitamin D toxicity • Idiopathic hypercalciuria • Immobilisation • Hyperparathyroidism • Sarcoidosis	Yes
Cystine	Pale-yellow, crystalline Maple syrup	• Cystinuria	Yes
Uric acid	Hard, yellow	• Lesch-Nyhan syndrome • Dietary • Induction in haematological malignancies	No
Xanthine	Smooth, soft, brown yellow	• Xanthinuria	No
Dihydroxyadenine	Friable, grey-blue	• Adenine phosphoribosyl transferase deficiency	No

* Radiolucency depends on amount of calcium in the stone and individual patient can have >1 type of stone, each with different radiolucencies

Interpretation of results

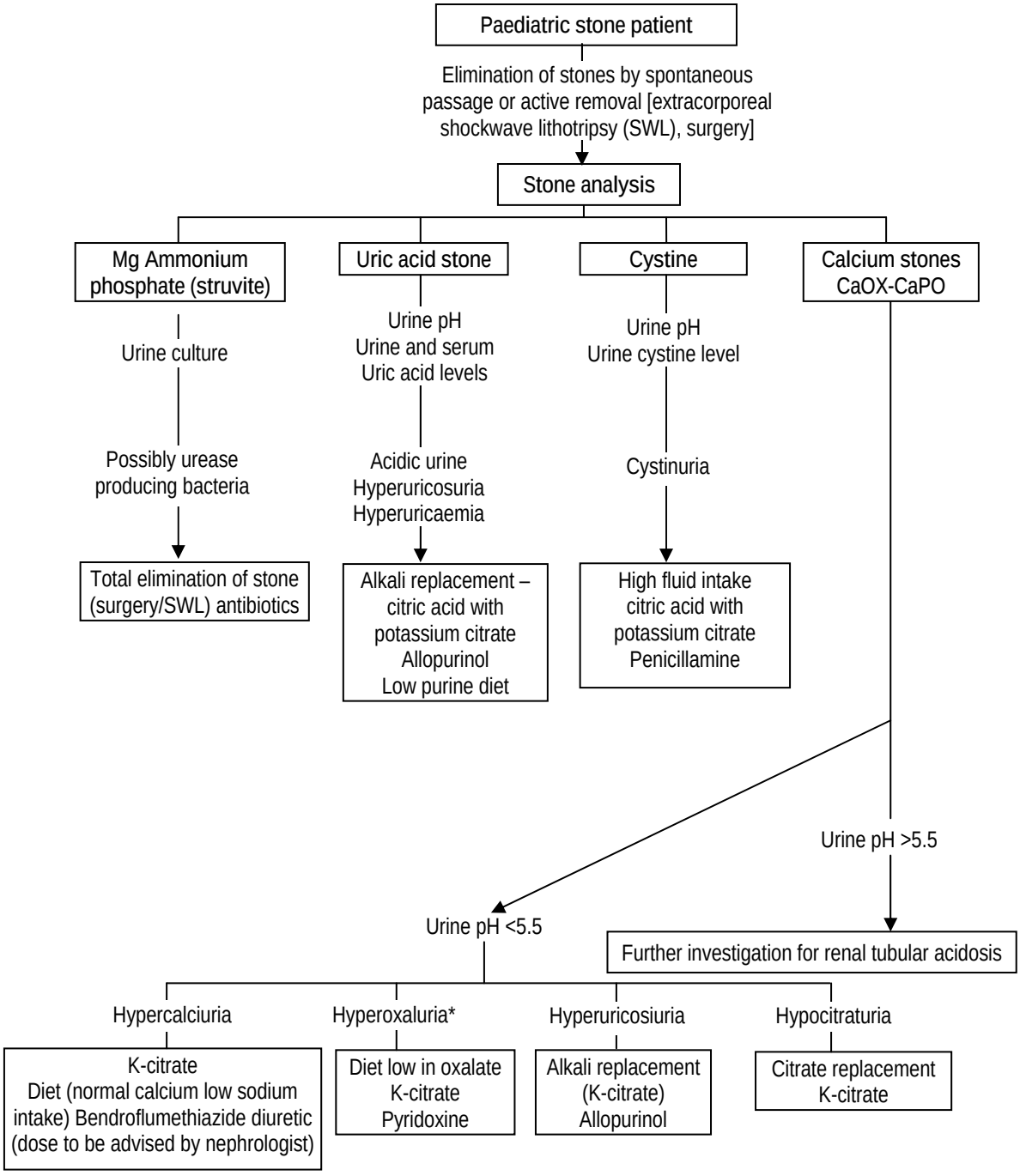
- Urinary pH
  - pH <5.3 in presence of normal capillary pH and bicarbonate excludes distal renal tubular acidosis
  - when above criteria not met, a more formal test of renal acidification required in those with nephrocalcinosis or in recurrent stone formers
  - pH >6 with capillary bicarbonate <18 mmol/L is seen in mild distal tubular acidosis
- Calcium:creatinine (mmol/mmol) ratio consistently >0.2 indicates hypercalciuria
  - absorptive hypercalcuria – normal fasting calcium:creatinine ratio raised post-milk
  - renal hypercalcuria – calcium:creatinine ratio raised fasting and post-milk
- Oxalate:creatinine (mmol/mmol) ratio is age-dependent, and suggestive of hyperoxaluria if it exceeds following thresholds:
  - aged <6 months: 0.35
  - aged 6–11 months: 0.2
  - aged 1–2 yr: 0.18
  - aged 3–6 yr: 0.11
  - aged 7–14 yr: 0.08
  - aged >14 yr: 0.065
- Uric acid/creatinine (mmol/mmol) ratio is age-dependent, and suggestive of hyperuricaemia if it exceeds following thresholds:
  - aged <1 yr: 1.5
  - aged 1–2 yr: 1.26
  - aged 3–6 yr: 0.83
  - aged 7–10 yr: 0.67
  - aged 11–14 yr: 0.45
  - aged >14 yr: 0.4
- Magnesium:creatinine ratio <0.2 may increase stone formation
- Calcium:citrate ratio <0.6 may increase stone formation
- Cystine, if present, is indicative of cystinuria

- Overall solubility index (RS value)
  - negative value: stable urine
  - value 0–1: metastable (liable to precipitate if seeded)
  - value >1: spontaneous precipitation

TREATMENT

- Treat any metabolic disorder identified by above investigations, seek advice from regional nephrology service
- Keep urine free from infection, particularly in those with history of *Proteus mirabilis* infection by prompt treatment if symptomatic
- Advise liberal fluid intake
  - adolescent 3 L/day
  - pre-puberty (school age) 1.5 L/day
- Additional measures for recurrent stone formation or idiopathic hypercalciuria (in order):
  - dietary assessment to optimise oxalate, vitamin C, calcium, and vitamin D intake
  - reduced sodium intake in idiopathic hypercalciuria, if sodium excretion >3 mmol/kg/day
  - high fibre diet with cellulose or whole wheat flour to reduce calcium and oxalate absorption
- For specific treatments – see **Algorithm for metabolic investigations** and discuss with regional nephrology service

Algorithm for metabolic investigations



*Hyperoxaluria patients should be referred to the regional nephrology service renal centre

RENAL INVESTIGATIONS ● 1/3

PROTEIN EXCRETION

- As a diagnostic indicator in any child thought to have an underlying renal disorder
- To monitor progress in renal disorders
- Normally glomerular, rarely tubular in origin
- Investigate as below in patients with persistent proteinuria where cause is unknown
- Request protein:creatinine ratio (**must** be first urine specimen voided in the morning)

Protein:creatinine ratio

- Performed on first urine specimen voided in the morning
- Upper limit of normal 20 mg/mmol
- Significant proteinuria >100 mg/mmol
- Heavy proteinuria (nephrotic) >200 mg/mmol

Albumin:creatinine ratio

- Request albumin:creatinine ratio if need to confirm glomerular proteinuria

Timed urine collection

- Only appropriate for older patients (out of nappies)
- Night-time collection to rule out orthostatic proteinuria
  - empty bladder at bedtime and discard sample
  - collect all urine passed during the night
  - empty bladder on rising in morning and collect urine
  - record time from bladder emptying at night to bladder emptying in morning
- Calculate protein output as mg/m^2/hr (see **BNFc** for surface area)
- Upper limit of normal = 2.5 mg/m^2/hr
- Heavy proteinuria >40 mg/m^2/hr

Tubular proteinuria

- Request retinol binding protein (RBP):creatinine ratio, elevation confirms tubular proteinuria

OSMOLALITY

- Used to exclude urinary concentrating disorders
  - patients with polyuria (may present as wetting or excessive drinking)
- Test early morning urine after overnight fast, >870 mOsm/kg virtually excludes a concentrating defect
  - if concern re diabetes insipidus, do water deprivation test during the day

SODIUM EXCRETION

- Fractional sodium excretion (FE_{Na}) assesses capacity to retain sodium
  - ensure normal sodium intake (dietitian to advise)
  - stop any existing supplements 6 hr before taking samples
  - document weight loss after supplements stopped, may provide useful supporting evidence
  - random urine sample for urinary sodium (U_{Na}) and creatinine (U_{Cr})
  - blood sample immediately after voiding for plasma sodium (P_{Na}) and creatinine (P_{Cr})
  - enter results into equation (using same units for U and P; 1000 micromol = 1 mmol)
  - $FE_{Na} = \frac{U_{Na} . P_{Cr}}{P_{Na} . U_{Cr}} \times 100$
  - normal values for FE_{Na} aged 0–3 months <3
    aged >3 months <1

PLASMA CREATININE

- Mean and upper limit dependent on height but can be determined roughly from child's age if height not available

GLOMERULAR FILTRATION RATE (GFR)

- Serial measurements of GFR (in mL/min/1.73 m^2) predict rate of deterioration when renal function impaired

Table 1

Age	Mean GFR (mL/min/1.73 m^2)	Range (2 SD)
Up to 1 month	48	28–68
1–6 months	77	41–103
6–12 months	103	49–157
1–2 yr	127	63–191
2–12 yr	127	89–165

Plasma creatinine method

- Estimates GFR in children with reasonable accuracy from P_{Cr} and height, using following formula:
  GFR (mL/min/1.73 m^2) = $\frac{30^* \times \text{height (cm)}}{P_{Cr}\ (\mu\text{mol/L})}$

*check local laboratory method of creatinine measurement as constant may vary

- Not suitable for children:
- aged <3 yr
- with muscle disease/wasting

^{51}Cr-EDTA slope clearance

- Use only when GFR needs to be determined very accurately
- Request via nuclear medicine
- Provide height and weight of child
- 'correct' result for surface area and express as per 1.73 m^2
- if result expressed as mL/min 'correct' for surface area

ULTRASOUND

Indications

- To indentify structural abnormalities of urinary tract or to monitor growth (e.g. in a child with a solitary kidney)

Table 2: Normal values for renal ultrasound measurement

Age	Length (mm)	Range (mm)
Up to 3 months	45	35–60
3–6 months	50	50–60
6–9 months	55	52–60
9–12 months	58	54–64
1–3 yr	65	54–72
3–6 yr	75	64–88
6–9 yr	80	73–86
9–12 yr	86	73–100

ISOTOPE SCANS

Dynamic imaging (MAG3)

Indications

- To assess obstruction in dilated system
- To assess drainage 6 months after pyeloplasty
- Indirect cystography in older children before and/or after surgical correction of reflux

Operational notes

- Request via nuclear medicine
- SHO or nurse required to insert venous cannula in young children
- Consider sedation if child has had previous problems lying still during examinations
- Maintain good hydration
- When assessing obstruction in dilated system or outcome of pyeloplasty, give furosemide 0.5 mg/kg slow IV bolus over 3–10 min (maximum rate 4 mg/min) 15 min before giving isotope. Helps to differentiate genuine obstruction from isotope pooling, provided function of affected kidney not severely impaired
- Do not use furosemide for indirect cystography

Static imaging (^{99m}Tc-DMSA)

Indications

- To assess differential function between kidneys and within duplex kidneys
- To locate an ectopic kidney
- To identify renal scars after recovery from urine infection
- atypical UTI aged <3 yr or recurrent UTI any age

Operational notes

- Request via nuclear medicine
- Scan kidney 2–6 hr after injection
- Sedation rarely required
- Delay DMSA for 4–6 months after infection to avoid false positive

X-RAY IMAGING

Micturating cystourethrogram (MCUG)

- To assess bladder for vesicoureteric reflux (VUR), to view urethra

Indications

- Atypical or recurrent UTI aged <6 months
- Recurrent or atypical UTI in children aged >6 months, but <3 yr if:
- dilatation on ultrasound
- poor urine flow
- non-*E. coli* infection
- family history of VUR

Operational notes

- **Patients already taking prophylactic antibiotics:** double dose on day before, day of the test and day after
- **Patients not on antibiotics:** give treatment dose covering day before, day of the test and day after
- Urethral catheter will be passed in X-ray department

ASSESSMENT

Sedation and anaesthesia belong to the spectrum of impaired consciousness. A sedated patient needs to be able to maintain the following vital functions without assistance:

- Protection of airway, swallowing, cough reflex
- Respiration
- Cardiovascular stability

Cautions

Discuss with anaesthetist before sedation if any of following present:

- Abnormal airway (including large tonsils)
- Sleep apnoea
- Respiratory failure
- Respiratory disease with significant functional compromise
- Active respiratory tract infection
- Cardiac failure
- Raised intracranial pressure
- Decreased conscious level
- Neuromuscular disease
- Bowel obstruction
- Significant gastro-oesophageal reflux
- Renal impairment
- Liver impairment
- Previous adverse reaction to sedation
- Very distressed child

Potential difficulties

Sedation can be difficult in children:

- Taking anti-epileptics (can result in increased or reduced effect of sedating drug)
- Already taking sedating drugs
- With behavioural difficulties

PREPARATION FOR SEDATION

Information required

- Age
- Weight
- Procedure for which sedation required
- Previous sedation history
- Other drugs being taken
- Other major diagnoses and implications in terms of respiratory function and upper airway competence
- Current health, including coughs, colds, pyrexia
- Oral intake status

Consent for sedation (all cases)

Discuss with parent(s):

- Unpredictable response to medication
- Paradoxical excitation
- Failure of sedation (may need repeat dose or general anaesthetic at future date)
- Over-sedation
- problem maintaining airway
- aspiration

Fasting for moderate–heavy sedation

- Interval before procedure:
- after a full meal/formula milk: 6 hr
- after breast milk: 4 hr
- after clear fluids: 1 hr

For short, painless procedures (e.g. CT or X-ray), give infants aged <4 months normal milk feed only and allow them to sleep naturally

EQUIPMENT

- Portable oxygen
- Portable suction
- Appropriately sized face mask and self-inflating resuscitation bag
- 2 healthcare professionals trained in airway management with patient during sedation

DRUG CHOICE

Sedation drugs

Drug	Route	Onset	Duration	Dose	Comments
Chloral hydrate	• Oral • Rectal	15–20 min	45 min–2 hr	Night sedation: 30 mg/kg Pre-anaesthesia: 50 mg/kg Scans: 70 mg/kg ◦ max dose 2 g	• More efficacious in infants <15 kg or aged <18 months
Melatonin	• Oral	30 min	2–5 hr	Aged ≤5 yr: 5 mg Aged >5 yr: 5–10 mg	• Use for sedation before EEG and MRI • Use 5 mg initially, if no response, give further 5 mg
Temaze-pam	• Oral	45–90 min	up to 4 hr	• Aged 12–18 yr: 10–20 mg 1 hr before procedure	• Only if aged ≥12 yr • CT, MAG3 scan
Midazolam	• Oral	30 min	1–2 hr	Aged 1 month–18 yr: 500 microgram/kg (max 20 mg)	• Have flumazenil ready to give for all routes
	• Rectal	15–30 min		Aged 6 months–12 yr: 300–500 microgram/kg (max 20 mg)	
	• Buccal	15 min		• Aged ≥3 yr: ◦ 12–16.9 kg: 2.5 mg ◦ 17–30.9 kg: 5 mg ◦ 31–40 kg: 7.5 mg ◦ 40.1–50 kg: 10 mg ◦ >50 kg: use alternative route/drug	• Buccal and IV routes – consultant led only (anaesthetist or PICU) • Ensure availability of flumazenil • IV preparation can be given orally diluted in juice • IV cannulation (+ local anaesthetic cream) • More suitable for older children (not suitable for infants) • Not for CT scan • Care with obese children – consider using ideal rather than actual body weight
	• IV	2–3 min		• 25–50 microgram/kg over 2–3 min, 5–10 min before procedure (aged 1–6 yr max 2 mg; aged 6–12 yr max 6 mg; aged 12–18 yr max 7.5 mg)	
Morphine sulphate	• Oral	30 min	2–3 hr	• Aged >1 yr: 200–300 microgram/kg (max 10 mg)	• May be combined with midazolam 500 microgram/kg oral for painful procedures

MONITORING

- Keep under direct observation
- Once asleep or if <1 yr, monitor SpO_2 continuously
- Record SpO_2, heart rate and colour every 15 min
- Discontinue once conscious level returned to normal

SUBSEQUENT MANAGEMENT

Failed sedation

- Only repeat maximum dose of initial dose after expected period of onset if patient spat out initial dose
- If repeat dose fails:
  - call anaesthetist who may give IV sedation (apply local anaesthetic cream), **or**
  - reschedule procedure for later time/date under general anaesthetic

- If change in breathing pattern or concern of aspiration, CXR may be required; call for review by paediatric registrar or consultant

Paradoxical excitement

- Do not attempt further drug dose
- Discuss with anaesthetist on-call to reschedule at a more convenient time for general anaesthetic

SELF-HARM ● 1/2

Always follow your local child safeguarding policies and procedures.
The safety of children is everyone's responsibility

- Self-harm can take a number of forms, including:
- cutting or burning
- self poisoning with medicines or tablets
- punching
- self strangulation
- pulling out hair or eyelashes
- scratching or picking at skin
- inhaling or sniffing harmful substances
- swallowing non-food substances
- inserting objects into the body either through orifices or the skin
- head banging

ASSESSMENT

- Identifying behaviour, intended behaviour or suicidal/self-harming thoughts
- Who knows about the behaviour
- How often this occurred
- If at risk from others
- Stressors e.g. bullying, bereavement, relationships
- Difficulties, abuse, sexuality issues
- General health
- Use of drugs and alcohol
- Education
- Family and social issues
- Support network available
- Child protection issues

MANAGEMENT

- Patients who have self-harmed, admit overnight or contact CAMHS crisis team for advice, if available in your trust
- See **Poisoning and drug overdose** guideline
- Advise carers to remove all medications or other means of self-harm
- Manage child protection issues according to local policy and procedures. On-call consultant available 24 hr for child protection advice
- Assess risk/need for ongoing psychological treatment or support and psychiatric observation levels required whilst on ward
- Obtain valid consent for a referral to CAMHS from parent/other adult with parental responsibility or the young person if they are deemed to have capacity (Gillick competence). Clearly document in medical records who obtained consent, who gave consent and when it was obtained i.e. date and time

Documentation

- Clearly document assessment in notes with any decisions made and reasons

REFERRALS

Criteria for referral to priority referral team (PRT)

- Deliberate self-harm (e.g. overdose, self strangulation, serious cuts)
- Deliberate harm from substance misuse (e.g. poisoning from excessive alcohol and/or illicit drugs if **intention** was to self-harm)
- Mental health symptoms:
- depression/low or elevated mood with active suicidality
- psychotic symptoms
- aggression or severe agitation
- low weight anorexia nervosa i.e. BMI <15 or accompanied by rapid weight loss
- Make referral as soon as possible to facilitate same day review

SELF-HARM ● 2/2

DISCHARGE AND FOLLOW-UP

- Discharge when medically fit **and** have been assessed by PRT
- Discuss with CAMHS to ensure child has an agreed management plan in place
- If there are safety concerns, refer to children's social care
- Ensure health professionals i.e. GP and school nurse are aware of admission and management plan

SEPSIS (INCLUDING MENINGOCOCCAL) ● 1/4

Follow **Sepsis Six** pathway

RECOGNITION AND ASSESSMENT

High risk criteria

- Behaviour:
- appears ill to healthcare professional
- no response to social cues
- does not wake, or if roused does not stay awake
- weak, high pitched/continuous cry
- objective evidence of new altered behaviour/mental state

- Respiratory:
- respiratory rate in red (see **Table 1**)
- grunting
- moderate – severe chest indrawing
- new need for oxygen >40% to maintainSpO_2 >92%
- cyanosis

- Cardiovascular:
- heart rate in high risk range (see **Table 1**)
- systolic BP in high risk range (see **Table 1**)
- reduced skin turgor
- no wet nappies/not passed urine in 18 hr, or <0.5 mL/kg/hr if catheterised
- colour of skin, lips/tongue: pale, mottled/ashen

- Non-blanching rash
- Temp <36°C
- If aged <3 months temp ≥38°C

Moderate risk criteria

- Behaviour:
- not responding normally to social cues, not wanting to play, no smile
- decreased activity
- wakes only with prolonged stimulation
- parent/carer concern that child is behaving differently to usual
- acute deterioration of functional ability

- Respiratory:
- respiratory rate moderate risk (see **Table 1**)
- increased work of breathing – nasal flaring
- if aged <5 yr:
  - SpO_2 <94% in air
  - crackles in chest

- Cardiovascular:
- heart rate in moderate risk range (see **Table 1**)
- systolic BP in moderate risk range (see **Table 2**)
- not passed urine/reduced urine output in last 12–18 hr, or 0.5–1 mL/kg/hr if catheterised
- capillary refill ≥3
- poor feeding in infants

- History of rigors
- Temp <36°C
- Temp ≥39°C if aged 3–6 months
- Factor putting at a higher risk of developing sepsis (see above)
- Leg pain/cold hands and feet

Low risk criteria

- Behaving normally, responds to social cues, content/smiles
- Stays awake/awakens quickly

- Strong normal cry/not crying
- Normal colour
- No high/moderate risk criteria met

Table 1

Age	High risk		Moderate risk	
	Resp rate	Heart rate	Resp rate	Heart rate
<1 yr	>60	>160 or <60	50–59	150–159
1–2 yr	>50	>150 or <60	40–49	140–149
3–4 yr	>40	>140 or <60	35–39	130–139
5 yr	>29	>130 or <60	27–28	120–129
6–7 yr	>27	>120 or <60	24–26	110–119
8–11 yr	>25	>115 or <60	22–24	105–114
>12 yr	>25	>130	21–24	91–130

Table 2

Age	High risk	Moderate risk
	Systolic BP	Systolic BP
>12 yr	≤90 or >40 mmHg below norm	91–100 mmHg

- Suspect sepsis if signs/symptoms indicate possible infection even if normal temperature
- do not rely on fever or hypothermia to rule sepsis in/out
- May present with non-specific, non-localised signs
- Give attention to concerns by family/carers
- Assess carefully if unable to gain clear history (language barrier/communication problems)
- Take into account factors putting people at higher risk of developing sepsis
- aged <1 yr
- impaired immunity/immunosuppression
- surgery/trauma in last 6 weeks
- indwelling lines
- breach in skin integrity (wound infection/breakdown)
- Neonates: be alert to risk factors for early-onset neonatal infection, see **Neonatal infection** guidelines
- Assess temperature, heart rate, respiratory rate, systolic BP, level of consciousness, capillary refill time, oxygen saturation, and apply an early warning score
- Assess history for risk factors for sepsis
- Carry out clinical assessment/examination taking into account baseline physiology
- Stratify risk of mortality and morbidity from sepsis into high, moderate or low risk

IMMEDIATE MANAGEMENT

*Asses **A**irway, **B**reathing, **C**irculation **D**on't forget glucose*
Treat IMMEDIATELY (<1 hr) as delay increases mortality

- Give oxygen if suspected sepsis and signs of shock or SpO_2 <92% in air

High risk
- Give IV antibiotics at maximum recommended dose within 1 hr
- Discuss with consultant
- Arrange immediate review by senior clinical decision maker (≥ST3)

- **Investigations:**
- blood culture
- meningococcal PCR
- FBC
- clotting screen
- group and save
- U&E

- CRP
- cortisol
- glucose
- gas (including lactate)

- **Lactate**
- If lactate >4, **OR** systolic BP <90 if aged >12 yr: give 20 mL/kg IV fluid bolus isotonic crystalloid without delay and refer for critical care review/admission (central access, inotropes)
- If lactate 2–4: give IV fluid bolus (20 mL/kg isotonic crystalloid) e.g. sodium chloride 0.9% (neonate 10–20 mL/kg) without delay
- reassess after completion, if no improvement repeat
- if no improvement after second bolus alert consultant to attend
- use human albumin solution 4.5 % for fluid resuscitation only in patients with sepsis with fluid refractory shock (>60 mL/kg)

- **Discuss with critical care**
- Call anaesthetist for ventilation, invasive monitoring and central access
- Peripheral access only: give dopamine
- prepare dopamine infusion as per local policy e.g. dopamine 3 mg/kg, weight (kg) × 3 = mg dopamine made up to 50 mL with glucose 5% or sodium chloride 0.9% (maximum concentration peripherally 3.2 mg/mL) 10 mL/hr = 10 microgram/kg/min
- Central/IO access use adrenaline 0.05–1.5 microgram/kg/min
- prepare adrenaline infusion as per local policy e.g. weight (kg) × 0.3 = mg of adrenaline (1:1000 1 mg/mL) made up to 50 mL sodium chloride 0.9% at 1 mL/hr = 0.1 microgram/kg/min

- **If lactate <2**
- start IV fluids
- Carry out observations ≤30 min, or continuously in ED
- Monitor mental state with GCS or AVPU scale
- Consultant to attend in person, if not already present, if:
- patient does not improve within 1 hr of initial IV antibiotic and/or IV fluid resuscitation
- lactate not decreased by ≥20% or <2 mmol
- decreased level of consciousness
- respiratory rate or systolic BP still in high risk range (see **Table 1** and **2**)

Moderate risk

If ≥2 moderate to high risk criteria

- Perform venous blood for:
- blood culture
- FBC
- CRP
- U&E
- gas for lactate
- Clinician and results review ≤1 hr of meeting ≥2 moderate criteria
- If lactate >2 OR assessed as having acute kidney injury (AKI), escalate to high risk
- If lactate <2 and no AKI:
- manage defined condition/infection if identified
- if no definitive condition identified, repeat structured assessment at least hourly, and ensure review by senior clinical decision maker (≥ST3) within 3 hr of meeting ≥2 moderate criteria

If only 1 moderate–high risk criterion

- Clinician review and consider/perform blood tests ≤1 hr of meeting moderate criteria for assessment
- Manage defined condition/infection if identified and discharge home if appropriate with information
- If no definitive condition identified, lactate <2 and no AKI: repeat structured assessment hourly and ensure review by senior clinical decision maker (≥ST3) ≤3 hr of meeting more moderate criteria

Low risk

- Clinical assessment and management according to clinical judgement

ANTIBIOTICS

- Give IV antibiotics to infants aged <3 months as follows:
  - infants aged <1 month with fever
  - all infants aged 1–3 months with fever moderate/high risk above
  - infants aged 1–3 months with WBC count $<5 \times 10^9$/L or $>15 \times 10^9$/L
- Take microbiological samples before prescribing an antimicrobial
  - within 1 hr of meeting a high risk criterion
- Review prescription when results available
- If suspected sepsis take blood cultures before antibiotics are given
- Follow local antibiotic guideline for antibiotic choice and doses

Empiric antibiotics

- Give ceftriaxone 100 mg/kg (maximum 4 g) daily over 30–60 min (see **BNFc** for dose aged <4 weeks)
  OR
  - cefotaxime 50 mg/kg (maximum 3 g) IV bolus
- Do not give ceftriaxone:
  - with calcium IV (including PN) or
  - <41 weeks postmenstrual age or
  - neonate with hyperbilirubinaemia, hypoalbuminaemia jaundice or acidosis
- If documented history of definite anaphylaxis to cephalosporin: give vancomycin and ciprofloxacin

Specific antimicrobials

- If aged <1 month and rash or raised AST/ALT: add aciclovir
- If aged <3 months: add amoxicillin high dose IV
- If group A streptococcal infection suspected (chickenpox or other skin lesion, painful cellulitis): add clindamycin
- If MRSA suspected: add vancomycin IV
- If anaerobic infection suspected: add metronidazole IV
- If hospital acquired: give piperacillin with tazobactam (Tazocin®)
- If neutropenic: give piperacillin with tazobactam (Tazocin®)

Treat with antimicrobials for:

- If no organism identified or meningococcus: give 10 days antibiotics
- If group A streptococcus: treat 10 days
- If *Staphylococcus aureus* treat 14 days
- If meningococcus discuss prophylaxis with Public Health England (e.g. ciprofloxacin all ages) for close contacts

FURTHER INVESTIGATION

- Carry out thorough clinical examination to look for sources of infection
- Tailor investigations to clinical history and examination
- Urine analysis and CXR aged >5 yr with suspected sepsis
- If no likely sources identified – ultrasound abdomen/pelvis
- If intra-abdominal or pelvic infection suspected involve paediatric surgical teams early
- Perform lumbar puncture in following with suspected sepsis (unless contraindicated):
  - infants aged <1 month
  - all infants aged 1–3 months who appear unwell
  - infants aged 1–3 months with a WBC $<5 \times 10^9$/L or $>15 \times 10^9$/L

DISCHARGE AND FOLLOW-UP

- Ensure patient and family/carer aware of diagnosis of sepsis
- Discharge notification to GP to include diagnosis of sepsis
- Give patient and family/carer opportunity to discuss concerns (why they developed sepsis, whether they will get it again, recovery, short and long-term problems)
- Give the following:
  - information about follow-up/further tests (if needed)
  - information about community care details (if needed)
  - information about patient support groups

STATUS EPILEPTICUS ● 1/1

- Follow each step until seizures resolve, but do not treat post-ictal posturing as seizure
- Prepare next step in algorithm immediately after previous one administered
- Do not give more than 2 doses of benzodiazepine, including any pre-hospital doses

Table 1: Management of status epilepticus

Step	Time from start of seizure (min)	Action	Comments
1	0	• Check ABC • High flow oxygen • Check blood glucose	• Clinically confirm epileptic seizure
2	5	• Midazolam – see **Table 2** • If IV access established, lorazepam 100 microgram/kg (max 4 mg)	• Midazolam may be given by parents, carers or ambulance crew in non-hospital setting
3	15	• Give second dose of lorazepam 100 microgram/kg (max 4 mg) IV	• To take place in hospital setting • Call for senior help • Start to prepare for phenytoin (see **Step 4**) • Re-confirm it is an epileptic seizure
4	25	• Give phenytoin 20 mg/kg IV (irritant to veins – see below) over 20 min **or** • If on regular phenytoin, phenobarbitone 20 mg/kg IV over 5–10 min	• Paraldehyde 0.8 mL/kg of mixture (50:50 diluted in olive oil) may be given as enema (seek senior advice) • Inform PICU staff and/or senior anaesthetist
5	45	• Rapid sequence induction of anaesthesia using thiopental sodium 4 mg/kg IV	• Transfer to PICU

Phenytoin IV

- Dilute to 10 mg/mL solution using sodium chloride 0.9%
- Administer over 20 min into large vein (or centrally if available) through 0.22–0.5 micron in line filter to remove any particulate material
- Ensure infusion complete within 1 hr of preparation
- Flush before and after with sodium chloride 0.9%
- Observe infusion site regularly during and post infusion for pain, local irritation and any skin discolouration
- Escalate any extravasation or problems to medical team urgently

Table 2: Midazolam (buccal) dose

Age	Dose
<3 months:	300 microgram/kg (max 2.5 mg)
3–11 months:	2.5 mg
1–4 yr:	5 mg
5–9 yr:	7.5 mg
≥10 yr	10 mg

STEROID DEPENDENCE ● 1/2

Hypothalmic-pituitary-adrenal axis impairment

RECOGNITION AND ASSESSMENT

Definition

- Children with the following conditions are corticosteroid-dependent with a depressed or absent pituitary-adrenal axis:
- hypopituitarism
- adrenal insufficiency
- congenital adrenal hyperplasia
- growth hormone insufficiency
- prolonged oral corticosteroid use >2 months

Corticosteroid-dependent children cannot mount an appropriate adrenal response when shocked or stressed

- Corticosteroid-dependent children are encountered in a number of ways:
- at presentation and first diagnosis
- for elective surgical and investigative procedures
- for emergency surgery or when acutely unwell
- with hyponatraemia, hyperkalaemia +/- hypoglycaemia and hypotension

MANAGEMENT

Dose guidance for hydrocortisone IV whilst nil by mouth:

Age	Single stress dose	Continuous infusion dose	6-hrly bolus dose
<2 yr	25 mg	25 mg/day	6 mg
2–5 yr	50 mg	50 mg/day	12.5 mg
>5 yr	100 mg	100 mg/day	25 mg

- Continuous hydrocortisone infusion – avoids peaks and troughs (should be first line of treatment)
- Dilute required amount of hydrocortisone in sodium chloride 0.9% 50 mL and infuse over 24 hr

Minor surgery, or general anaesthesia/sedation for imaging or other minor procedure, or mild systemic illness

- Give single stress dose of hydrocortisone IV at induction pre-surgery
- On return from theatre give stress dose hydrocortisone i.e. 30 mg/m^2/day oral
- divide dose into 4 equal doses 6-hrly, for 1 day only
- If unable to tolerate oral fluids 4 hr after theatre, commence IV maintenance fluids and give hydrocortisone IV see **Dose guidance for hydrocortisone IV whilst nil-by-mouth**
- Change to 30 mg/m^2/day oral in 4 divided doses for 1 day once tolerating oral fluids
- Patient to carry steroid card
- Discuss any concerns with consultant endocrinologist

Major surgery

- Check pre-operative endocrine management discussion has taken place
- Give single stress dose of hydrocortisone IV at induction in anaesthetic room pre-surgery, followed by either continuous infusion or 6-hrly divided doses as above
- Commence maintenance fluids of glucose 5% and sodium chloride 0.9% in theatre and continue until child is eating and drinking post-operatively – maintain blood sugar >4 mmol/L
- Continue hydrocortisone IV in above doses until child is eating and drinking, then change to oral stress dose, equal to 30 mg/m^2/day
- divide dose into 4 equal 6-hrly oral doses
- Recommend reduction of hydrocortisone to usual oral supplementation doses 2 days after discharge
- Continue usual medications, e.g. fludrocortisone, levothyroxine, desmopressin

Acute illness

- During illness, corticosteroid-dependent children can usually be managed at home
- if able to take hydrocortisone orally, give stress dose of hydrocortisone 30 mg/m^2/day as 4 divided doses 6 hrly for 2–3 days

- if unable to take oral corticosteroids (e.g. vomiting or acute collapse), parents to administer hydrocortisone IM:
  - aged <2 yr: 25 mg
  - aged 2–5 yr: 50 mg
  - aged >5 yr: 100 mg
- If hydrocortisone IM required, hospital assessment necessary
- If hydrocortisone IM not available and child too unwell to take oral corticosteroids call 999
- Continue usual dose of other medication e.g. fludrocortisone, levothyroxine, desmopressin, growth hormone etc.

Management of unwell corticosteroid-dependent children requiring hospital assessment

- Resuscitate (ABC)
- Monitor BP and GCS
- Obtain IV access
- Take blood for glucose, FBC, blood culture, U&E, bicarbonate and blood gas
- If blood glucose <4 mmol/L: give bolus of glucose 10% 2 mL/kg and monitor blood glucose

First line treatment

- Give hydrocortisone IV as single stat dose, followed by either continuous infusion or 6-hrly divided doses to avoid peaks and troughs see **Dose guidance for IV hydrocortisone whilst nil-by-mouth**
- Maintain blood sugar >4 mmol/L
- If shock give sodium chloride 0.9% 20 mL/kg
- Commence IV maintenance with sodium chloride 0.9% and glucose 5% at maintenance rate (extra if dehydrated)
- add potassium depending on electrolyte result
- Severely ill: commence hydrocortisone infusion (see **Dose guidance for hydrocortisone IV whilst nil-by-mouth**)
- When oral fluids tolerated change to hydrocortisone 30 mg/m^2/day oral 6-hrly in 4 divided doses, and continue for 2–3 days after recovery from acute episode
- Discuss any concerns with on-call consultant endocrinologist

SUPRAVENTRICULAR TACHYCARDIA

Early diagnosis and effective management of supraventricular tachycardia (SVT) are vital as there is a small risk of death

RECOGNITION AND ASSESSMENT

Symptoms and signs

- Recurrent condition
- Infants
  - gradual onset of increasing tachypnoea
  - poor feeding
  - pallor
  - occasionally more dramatic presentation with a rapid onset of severe cardiac failure
- Toddlers
  - recurrent episodes of breathlessness, cold sweats and pallor
- Older children
  - recurrent palpitations, episodes of dizziness and pallor

Investigations

- Confirm diagnosis with 12-lead ECG
- Continuous ECG monitoring **and** recording is essential
- Assess for cardiac failure

Differential diagnosis

- Sinus tachycardia, particularly in infants, can be >200/min. However, rates of 220–300/min are most likely to be SVT
- If first presentation, check for any other cause of cardiac failure
- Failure to respond to adenosine can be used to distinguish origin of a tachycardia in a stable patient

Causes of tachyarrhythmias

- Re-entrant congenital conduction pathway abnormality (common)
- Poisoning
- Metabolic disturbance
- After cardiac surgery
- Cardiomyopathy
- Long QT syndrome

ECG DIAGNOSIS

Infants

- Majority have a P wave before every QRS complex, usually by >70 msec (2 mm at 25 mm/sec)
- QRS complexes are generally normal but may be wide
- Accessory pathway frequently capable of anterograde as well as retrograde conduction
  - this will be revealed during normal sinus rhythm by short P-R interval and presence of a delta wave (classic Wolff-Parkinson-White syndrome)

Older children

- Nodal tachycardias become more common with increasing age
  - characterised by fast, regular, narrow QRS complexes without visible P waves
- Wide QRS complex or bundle branch block in childhood is rare
  - changes also present in sinus rhythm
  - review previous ECGs

- ***If in doubt, seek more experienced help***

IMMEDIATE TREATMENT

- Resuscitate (ABC) first
- If first presentation, refer to consultant
- See following **Algorithms**

Vagal manoeuvres
These may include:
- Diving reflex
- wrap infants in a towel and immerse their whole face into iced water for about 5–10 sec, or in children place a bag or rubber glove containing iced water over face
- One side carotid massage
- Valsalva manoeuvre
- Where possible, maintain ECG monitoring **and** recording during all procedures

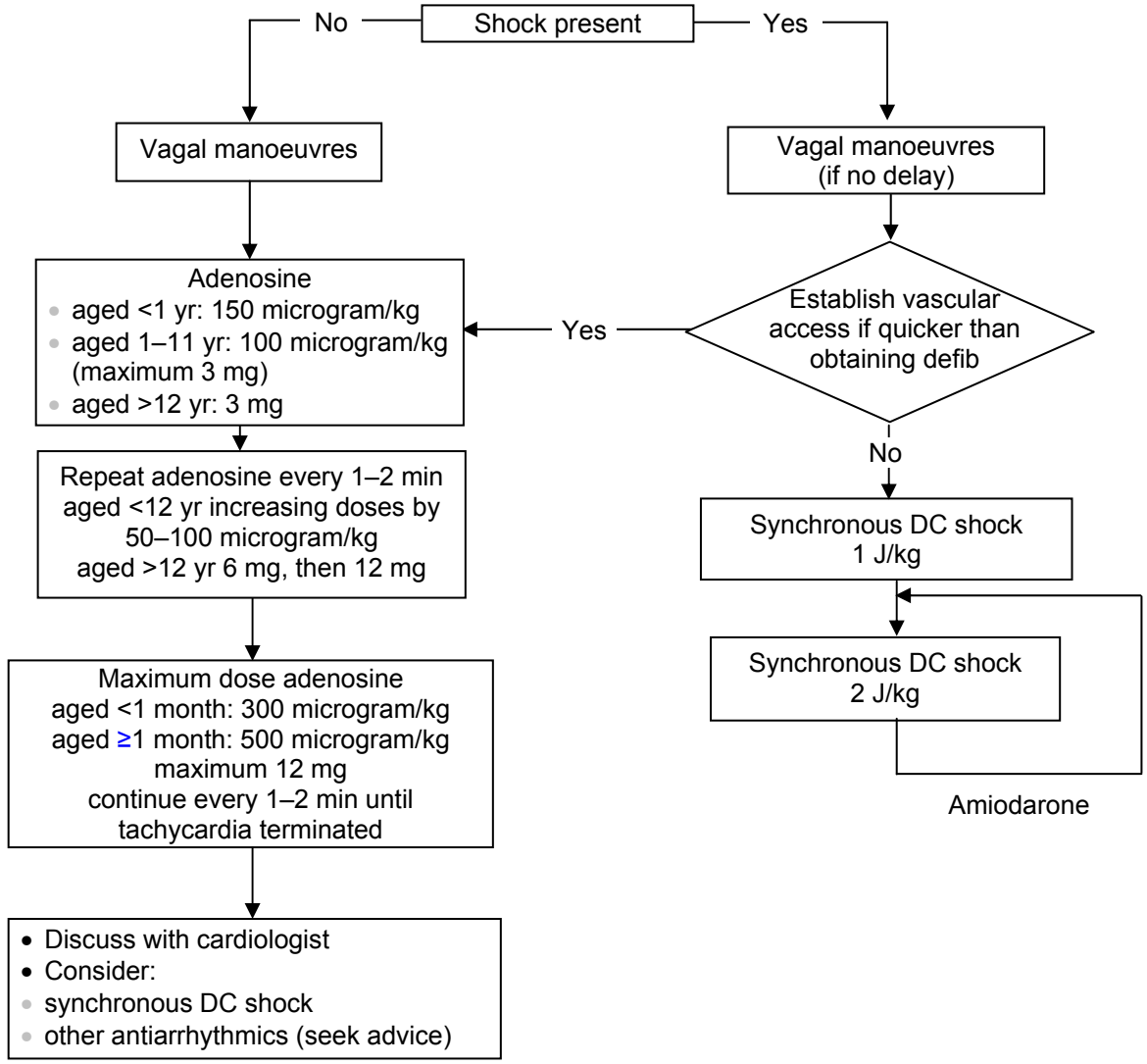
Do NOT use eyeball pressure because of risk of ocular damage

Adenosine
- Drug of choice as it has a rapid onset of action and is not negatively inotropic
- Very short half-life (10–15 sec) giving short-lived side-effects (flushing, nausea, dyspnoea, chest tightness)
- Effective in >80% of junctional tachycardias and will not convert ventricular tachycardias into ventricular fibrillation
- Can be used in broad-complex tachycardia of uncertain origin
- Must be given as a rapid bolus IV via a large peripheral or central vein and followed by sodium chloride 0.9% flush
- In patients with sinus tachycardia, heart rate will slow to bradycardia but will rapidly increase again

Other drugs
- If adenosine ineffective, seek advice from a paediatric cardiologist
- In refractory Wolff-Parkinson-White tachycardia, flecainide is particularly useful
- In refractory atrial tachycardia, amiodarone is useful

Do not use verapamil and propranolol in same patient, as both have negative inotropic effects. Do not use verapamil in children aged <1 yr

Supraventricular tachycardia



- Adenosine may be used in preference to electrical shock
- if patient taking dipyridamole or has had a heart transplant give ¼ adenosine dose
- An anaesthetic must be given for DC shock if patient responsive to pain

WIDE COMPLEX TACHYCARDIA

RECOGNITION AND ASSESSMENT

Definition

- Ventricular tachycardia
- ≥3 successive ectopic ventricular beats
- sustained if it continues >30 sec

Causes

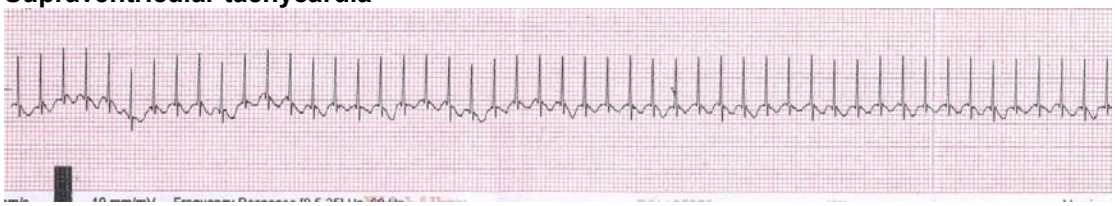
- Underlying cause (e.g. myocarditis, cardiomyopathy, or patient with congenital heart disease)
- Poisoning (e.g. phenothiazines, tricyclic antidepressants, quinidine and procainamide)
- Electrolyte disturbance (e.g. hypokalaemia, hypomagnesaemia)
- Ventricular tachycardia can degenerate into ventricular fibrillation

Diagnosis

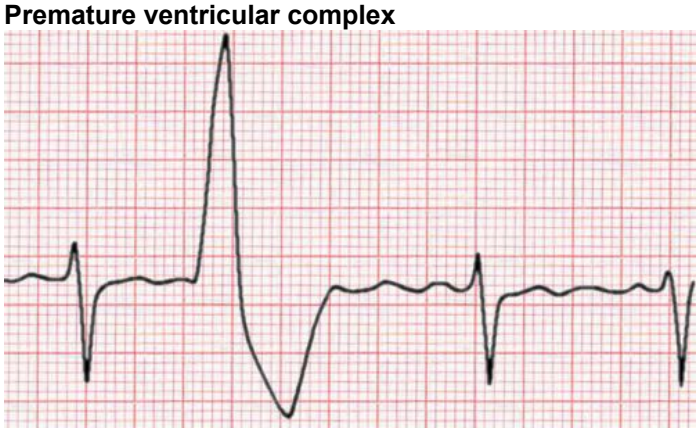
- Wide-QRS SVT (SVT with aberrant conduction) is uncommon in infants and children. Correct diagnosis and differentiation from VT depends on careful analysis of at least a 12-lead ECG +/- an oesophageal lead

- Assess patient and obtain family history to identify presence of an underlying condition predisposing to stable ventricular tachycardia
- SVT or VT can cause haemodynamic instability: response to adenosine can help identify underlying aetiology of the arrhythmia, but adenosine should be used with extreme caution in haemodynamically stable children with wide-complex tachycardia because of the risk of acceleration of tachycardia and significant hypotension. This should not delay definitive treatment in children with shock
- Seek advice
- Ventricular tachycardia not always obvious on ECG, clues are:
- rate varies between 120 and 250 beats/min (rarely 300 beats/min)
- QRS complexes are almost regular though wide
- QRS axis abnormal for age (normal for aged >6 months is <+90°)
- no preceding P wave, or A-V dissociation
- fusion beats (normally conducted QRS complex merges with an abnormal discharge)

Supraventricular tachycardia

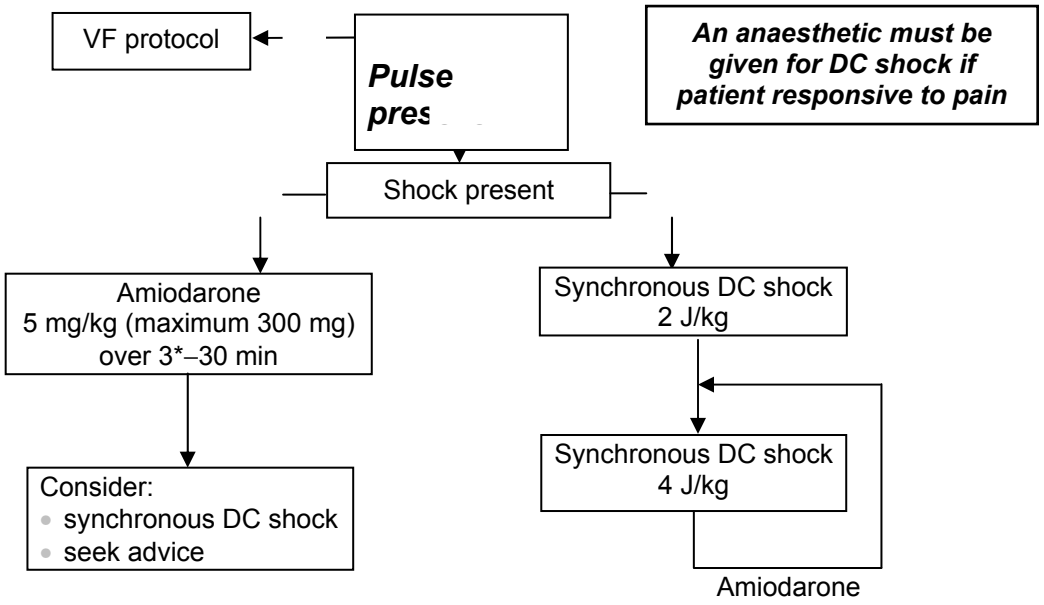


Premature ventricular complex



IMMEDIATE TREATMENT

Ventricular tachycardia



- Treatment of haemodynamically stable child with ventricular tachycardia should always include early consultation with a paediatric cardiologist. They may suggest amiodarone: can cause hypotension, which should be treated with volume expansion
- Use synchronous shocks initially, as these are less likely than an asynchronous shock to produce ventricular fibrillation. If synchronous shocks are ineffectual, and child is profoundly hypotensive, subsequent attempts will have to be asynchronous
- Treatment of torsade de pointes ventricular tachycardia is magnesium sulphate 25–50 mg/kg (maximum dose 2 g) diluted to 100 mg/mL in sodium chloride 0.9% over 10–15 min. Can be repeated once if necessary
- *Amiodarone 5 mg/kg (maximum 300 mg) may be given over 3 min in ventricular tachycardia if child in severe shock

BRADYARRHYTHMIAS

- Urgently manage:
- pre-terminal event in hypoxia or shock
- raised intracranial pressure
- vagal stimulation

Investigations

- ECG to look for:
- conduction pathway damage after cardiac surgery
- congenital heart block (rare)
- long QT syndrome

Management

- ABC approach: ensure adequate oxygenation and ventilation
- if above ineffective give a bolus of adrenaline 10 microgram/kg IV and
- if above ineffective try an infusion of adrenaline 0.05–1.5 microgram/kg/min IV
- If vagal stimulation is cause
- give atropine 20 microgram/kg (minimum 100 microgram; maximum 600 microgram)
- dose may be repeated after 5 min [maximum total dose 20–40 microgram/kg (1.2 mg)]
- Contact paediatric cardiologist for advice
- send ECG to cardiologist

TUBERCULOSIS ● 1/4

RECOGNITION AND ASSESSMENT

History is most important factor in diagnosing tuberculosis (TB)

Symptoms
Suspect TB when following symptoms persist for weeks:
- Persistent, non-remitting cough for 2–4 weeks
- Weight loss
- Failure to thrive
- Lack of energy
- Fever and sweats
- Lymph nodes, especially if painless and matted
- Headache or irritability for >1 week
- Limp, stiff back
- Joint swelling
- Abdominal distension

Signs
- Delayed growth: plot weight and height on growth chart and compare with earlier records
- Fever
- Wasting
- Lymphadenopathy
- Chest signs
- Cardiac tamponade
- Ascites
- Meningism
- Conjunctivitis
- Limited flexion of spine
- Kyphosis
- Swollen joint
- Cold abscess

Family and social history
- Ask about recent contact with any family member (specifically grandparent or parent) who has:
- chronic cough
- previous treatment for TB, especially multi-drug resistant (MDR) TB, failed/defaulted TB treatment, or recurrent TB
- travelled to regions/countries with a high prevalence of TB/MDR TB
- recently died

INVESTIGATIONS
- For suspected active TB do not request Tuberculin purified protein derivative (PPD) skin test (Mantoux) or interferon-gamma release assay (IGRA e.g. QuanitFERON® TB Gold or T-SPOT® TB) which are used for diagnosis of latent TB
- if active TB suspected discuss with expert in paediatric TB, even if rapid diagnostic tests are negative

Pulmonary TB
- CXR: look for hilar lymphadenopathy, apical consolidation, pleural effusion, miliary nodules
- Sputum: send ≥3 (1 early morning) for AFB and TB culture in cooperative child, expectoration may require physio +/- nebulised sodium chloride 0.9% as necessary (with FFP3 mask and HEPA filtered ventilation if available)
- If unable to provide sputum specimen, send gastric aspirate (for TB culture only as microscopy is unreliable) early morning before feed, daily for 3 days
- if no aspirate, rinse stomach with small volumes of sodium chloride 0.9% (5 mL aliquots maximum 20 mL)
- do not send saliva
- Discuss broncho-alveolar lavage for AFB and TB culture via bronchoscopy with respiratory consultant
- Request 1 TB PCR test per specimen type

Pleural effusion
- CXR (preferably PA erect film)
- 3 x respiratory sample (deep cough sputum, induced sputum or gastric aspirate)
- Pleural biopsy for histology and microbiology (AFB and TB culture)
- Pleural fluid AFB, TB culture, cytology and adenosine deaminase
- Discuss with cardiothoracic surgeons

Lymphadenopathy
- If single node, excision biopsy
- If large matted nodes, ultrasound scan +/- simultaneous guided aspiration (discuss before scan)
- Lymph node aspirate: fine needle aspiration biopsy (FNAB; 23 G needle)
- low risk, high yield with sedation and local anaesthetic
- Send aspirate in 2 separate bottles:
- 1 to microbiology for AFB, TB culture and PCR with no preservative
- 1 to histology in 10% formalin
- If atypical mycobacterial infection suspected, excision biopsy

Meningism
- MRI: preferred (CT if GA required but too sick to tolerate)
- CSF: AFB, TB culture, cytology, PCR and adenosine deaminase

Bone/joint pain
- Plain X-ray initial imaging modality. CT and/or MRI, may be needed to evaluate extent and bone destruction – discuss with paediatric radiologist
- Biopsy/aspiration important for diagnosis and sensitivities
- Spinal TB: LP

Abdominal distension
- Ultrasound then CT abdomen
- Ascites/bowel biopsy AFB, TB culture, cytology, adenosine deaminase

Pyuria
- Urinalysis: if blood and leucocytes present, send for culture
- non-tuberculous acid-fast bacteria common in urine
- Ultrasound kidneys
- Early morning urine culture

Pericardial effusion
- Echocardiogram
- Pericardial fluid AFB, TB culture and PCR, cytology, adenosine deaminase

Disseminated (including miliary)
- CT thorax and ultrasound abdomen
- LP (CT or MR first if CNS signs or symptoms)
- Bronchial wash
- Blood for TB culture
- Bone marrow biopsy if diagnosis uncertain

IMMEDIATE MANAGEMENT

Discuss treatment with local TB team and lead paediatrician for TB

- If clinical signs and symptoms consistent with diagnosis of TB, start treatment – do not wait for culture results
- Send specimens for microscopy and culture before starting treatment unless life-threatening disease
- Inform Public Health through TB nurse team, who will organise CXR and Mantoux for all close and visiting contacts
- Inform infection prevention team: advise anyone with cough to avoid visiting ward
- Admission not mandatory but useful to ensure adherence with treatment. If supervision can be guaranteed, allow treatment at home, contact TB nurse team before discharge
- If sputum +ve and hospitalisation necessary, strict barrier nurse in single room for 2 weeks or until discharge
- Patient should wear a surgical mask if leaves room

- Masks, gowns and barrier nursing unnecessary unless MDR TB or aerosol generating procedure
- Negative pressure room for aerosol generating procedure if TB considered (e.g. nebuliser)

Drugs

- Isoniazid (H): 10 mg/kg once daily (7–15 mg/kg) up to maximum 300 mg
- suspension 50 mg in 5 mL, 50 mg, 100 mg tab
- Rifampicin (R): 15 mg/kg once daily (10–20 mg/kg) up to maximum 450 mg if <50 kg; up to maximum 600 mg if ≥50 kg
- suspension 150 mg, 300 mg capsule
- Pyrazinamide (Z): 35 mg/kg once daily (30–40 mg/kg) up to maximum 1.5 g if <50 kg; up to maximum 2 g if ≥50 kg
- suspension 500 mg/5 mL, 500 mg tablets can be crushed
- Round up doses of HRZ to give easily measured volumes of syrup or appropriate strengths of tablet. Re-calculate doses with weight gain
- Ethambutol (E): 20 mg/kg once daily (15–25 mg/kg)
- suspension 400 mg/5 mL; 100 mg, 400 mg tablets can be crushed
- check renal function and visual acuity with Snellen chart if possible first
- Use drug combinations if possible
- Rimstar® (Voractiv®) H 75 mg; R 150 mg; Z 400 mg; E 275 mg
  - 40–54 kg 3 tab daily
  - 55–70 kg 4 tab daily
  - >70 kg 5 tab daily

- Rifater®: H 50 mg; R 120 mg; Z 300 mg and ethambutol (round down to closest tablet size)
  - 40–49 kg 4 tab + ethambutol
  - 50–64 kg 5 tab + ethambutol
  - ≥65 kg 6 tab + ethambutol

- Rifinah® **150/100**: R 150 mg; H 100 mg; **300/150**: R 300 mg; H 150 mg
  - 15–19 kg 2 tab Rifinah® 150/100
  - 20–24 kg 1 tab Rifinah® 150/100 + 1 tab Rifinah® 300/150
  - 25–49 kg 3 tab Rifinah® 150/100
  - ≥50 kg 2 tab Rifinah® 300/150

Presentation	Treatment
TB without CNS involvement	Rifampicin and isoniazid for 6 months Pyrazinamide and ethambutol for first 2 months
TB with CNS involvement	Rifampicin and isoniazid for 12 months Pyrazinamide and ethambutol for first 2 months Prednisolone 2 mg/kg (severe 4 mg/kg maximum 60 mg), with gradual withdrawal over 4–8 weeks

- Add pyridoxine10 mg (neonates 5 mg) to prevent isoniazid neuropathy
- Pericardial TB: add prednisolone 1 mg/kg/day (maximum 40 mg/day)
- Inform patient/parents of both common (gastrointestinal upset, rash) and rare but important side effects (staining of secretions, signs of hepatotoxicity)
- Advise patient/parents and GP of indications for seeking advice: fever, malaise, vomiting, jaundice or unexplained deterioration. Consider co-existent viral hepatitis. If AST/ALT level rises to 5x normal, stop treatment and seek advice re alternate regimen

SUBSEQUENT MANAGEMENT

- HIV test
- Other drugs may be necessary once sensitivities available: if resistant, seek specialist advice

MONITORING TREATMENT

- If baseline ALT/AST raised but ≤2x normal, repeat at 2 weeks; if falling only recheck if fever, malaise, vomiting, jaundice or unexplained deterioration
- If ALT/AST >2x, monitor weekly for 2 weeks then 2-weekly until normal, check viral hepatitis serology
- Stop treatment only if ≥5x normal
- If on ethambutol and unable to report visual problems, check visual evoked response

DISCHARGE AND FOLLOW-UP

- If tolerating treatment and adherence guaranteed, discharge
- If concerns about adherence, will need direct observed therapy, organised through TB nurse team
- Review to ensure adherence:
  - at least monthly for first 2 months
  - 2-monthly until treatment complete
  - for 3 months after end of treatment
  - further as clinically indicated

LATENT TB

Asymptomatic close contact with pulmonary TB or new entrant from high-incidence country

- If immunocompromised discuss with TB specialist
- If treatment for latent TB indicated but not taken: CXR at 3 and 12 months
- If treating for latent TB: test for HIV, hepatitis B and C

Neonate

- Assess for active disease
- Treat with isoniazid for 3 months then Mantoux
  - if ≥5 mm: assess for active disease, if not active TB, continue isoniazid total 6 months
  - if <5 mm, IGRA: if both -ve stop isoniazid and refer to TB nurse team for BCG, if +ve assess for active disease, if not active TB, continue isoniazid for total 6 months

Aged 4 weeks–2 yr

- Start rifampicin and isoniazid and refer to TB nurse team for Mantoux
- If ≥5 mm: assess for active TB, if not active TB treat for latent TB rifampicin and isoniazid for 3 months or isoniazid for 6 months
- If <5 mm: continue rifampicin and isoniazid for 6 weeks, then repeat Mantoux and do IGRA
- If both -ve: stop isoniazid
- If either +ve: assess for active TB, if not active TB, complete treatment for latent TB

Aged >2 yr

Mantoux:

- if ≥5 mm assess for active TB: if not active TB, treat for latent TB
- If <5 mm and contact smear +ve: after 6 weeks repeat Mantoux and do IGRA
  - if both -ve: stop isoniazid
  - if either +ve: assess for active TB
    - if not active TB: complete treatment for latent TB

URINARY TRACT INFECTION ● 1/4

RECOGNITION AND ASSESSMENT

Treat symptomatic urinary tract infection (UTI) in infants promptly to reduce risk of renal scarring

Symptoms and signs

Age group		Most common	Intermediate	Least common
Infants aged <3 months		• Fever • Vomiting • Lethargy • Irritability	• Poor feeding • Failure to thrive	• Abdominal pain • Jaundice • Haematuria • Offensive urine
Infants ≥3 months and children	**Pre-verbal**	• Fever	• Abdominal pain • Loin tenderness • Vomiting • Poor feeding	• Lethargy • Irritability • Haematuria • Offensive urine • Failure to thrive
	Verbal	• Frequency • Dysuria	• Dysfunctional voiding • Changes to continence • Abdominal pain • Loin tenderness	• Fever • Malaise • Vomiting • Haematuria • Offensive urine • Cloudy urine

Risk factors for UTI and serious underlying pathology

- The following should always be recorded in suspected cases of UTI:
  - poor urine flow in males
  - history suggesting recurrent UTI
  - recurrent fever of uncertain origin
  - antenatally diagnosed renal or urinary tract abnormality
  - family history of vesico-ureteric reflux (VUR)
  - constipation
  - dysfunctional voiding (i.e. any of: frequency, urgency, urge incontinence)
  - enlarged bladder
  - abdominal mass
  - evidence of spinal lesion
  - poor growth
  - high blood pressure

Investigations

- Dipstick test fresh urine for leukocytes and nitrites in:
  - all symptomatic children (see **Table** above)
  - all unexplained febrile admissions with temp >38°C
  - with an alternative site of infection but who remain unwell
- Culture urine if:
  - aged <3 yr
  - a single positive result for leukocyte esterase or nitrite
  - recurrent UTI
  - infection that does not respond to treatment within 24–48 hr
  - clinical symptoms and dipstick tests do not correlate
  - suspected pyelonephritis
- If child seriously unwell, measure serum electrolytes, take blood cultures and insert cannula

Collection of specimens

- Collect urine before antibiotics unless severe sepsis [see **Sepsis (including meningococcal)** guideline]
- **Clean catch** in sterile container is recommended method:
  - in babies too young to co-operate, eliciting lateral abdominal reflex may provoke micturition
  - collect mid-stream urine in those old enough to co-operate
- Pad urine specimens can be used in babies and young children (only useful if negative)
  - make sure nappy area thoroughly cleaned before applying pad
  - urine extracted from specially designed pads with a syringe
  - always follow manufacturer's instructions

- do not use cotton wool balls or 'home made' equipment
- for urinalysis (do not send for culture: if +ve nitrites and +ve leukocytes collect another urine sample by clean method)
- In severe sepsis, catheterise for diagnostic urine collection

Handling specimens
- Use plain, white top, sterile bottles for hospital-collected samples
- Use borate only when child large enough to fill bottle
- During working hours, transfer specimens to laboratory within 2 hr
- out-of-hours, keep specimen in fridge at 4°C until laboratory open
- state date and time of collection on specimen bottle

Interpretation of results
Always take clinical symptoms into account when interpreting results
- **Children aged ≥3 yr:** use dipstick to identify possible UTI
- **Both leukocyte esterase and nitrite positive:** start antibiotic treatment for UTI
- **Leukocyte esterase negative and nitrite positive:** start antibiotic treatment, if fresh sample was tested. Send urine sample for culture
- **Leukocyte esterase positive and nitrite negative:** only start antibiotic treatment for UTI if there is good clinical evidence of UTI. Send urine sample for microscopy and culture
- **Both leukocyte esterase and nitrite negative:** do not send urine sample for culture unless recommended in indications for culture. Do not start treatment for UTI

Microscopy of fresh sample
- Indications:
- aged <3 yr with fever
- aged >3 yr, fever with:
  - specific urinary symptoms
  - history of recurrent UTI
  - seriously ill
  - leukocyte esterase or nitrite on urinalysis (see **Interpretation of results**)
- Very useful method of confirming acute infection
- bacteria and leukocytes (UTI)
- bacteria only (UTI presumed if symptomatic, but may be contaminant)
- leukocytes only (treat if symptomatic)
- no bacteria or leukocytes (no UTI if culture results also negative)
- Pyuria
- normal $<10 \times 10^6$/L
- vulvitis, vaginitis or balanitis can also give rise to high counts
- viruses (echovirus, adenovirus and CMV) can cause sterile pyuria
- Colony counts
- organism count $>10^5$ organisms/mL pure growth of single organism confirms infection in properly collected and stored mid-stream sample
- certainty reduced to 80% with pad urine
- low counts do not exclude infection

IMMEDIATE TREATMENT
If child systemically unwell, do not delay treatment while trying to obtain urine specimen
- Ensure good hydration with maintenance fluids
- Empirical antibiotics (narrow spectrum as soon as organism and sensitivities known)
- If pyelophephritis: systemic illness (fever >38°C or loin pain/tenderness)
- aged <3 months: cefotaxime 50 mg/kg or ceftriaxone 50 mg/kg
- aged ≥3 months: co-amoxiclav oral if tolerated or IV for 7 days
  - if penicillin allergy give high dose cefuroxime IV 8-hrly (unless severe type 1 allergic reaction), or gentamicin IV (once daily dosage regimen) over 30 min for 48 hr minimum (follow local antibiotic guidelines)
  - if shocked refer to **Sepsis (including meningococcal)** guideline
  - ongoing treatment depends on response
- if cystitis: minor systemic disturbance, give cefalexin oral for 3 days
- high rates of trimethoprim resistance (no longer empirical first line)
- when child on prophylaxis already, always give an alternative antibiotic for acute infection

SUBSEQUENT MANAGEMENT

Imaging

Dependent on age and type of infection

- Simple UTI: responds within 48 hr
- Atypical UTI:
  - seriously ill child
  - poor urine flow
  - abdominal or bladder mass
  - raised creatinine
  - septicaemia
  - failure to respond to treatment within 48 hr
  - infection with organisms other than *E. coli*
- Recurrent UTI:
  - ≥2 episodes of UTI with acute pyelonephritis/upper UTI
  - 1 episode of UTI with acute pyelonephritis/upper UTI **plus** ≥1 episode or UTI with cystitis/lower UTI
  - ≥3 episodes or UTI with cystitis/lower UTI

Test	Simple UTI	Atypical UTI	Recurrent UTI
Aged 0–6 months			
US during acute infection	No	Yes	Yes
US within 6 weeks	Yes	No	No
DMSA	No	Yes	Yes
MCUG	No	Yes	Yes
Aged 6 months–3 yr			
US during acute infection	No	Yes	No
US within 6 weeks	No	No	Yes
DMSA	No	Yes	Yes
MCUG	No	No	No
Aged >3 yr			
US during acute infection	No	Yes	No
US within 6 weeks	No	No	Yes
DMSA	No	No	Yes
MCUG	No	No	No

- Renal and bladder USS 6 weeks after infection when not indicated urgently (see above)
- Bladder scan pre/post micturition helpful to exclude incomplete bladder emptying (older child)
- DMSA (dimercaptosuccinic acid) scan 4–6 months after infection
- If child has subsequent UTI while awaiting DMSA, review timing of test and consider doing it sooner
- MCUG (micturating cysto-urethrography) after infection is treated
  - also required where there are voiding problems or abnormalities on US scan requiring further investigation (discuss with consultant)
  - requires 3 days of prophylactic antibiotics, usually nitrofurantoin aged ≥3 months 1 mg/kg (maximum 100 mg, avoid in G6PD deficiency or renal impairment) or cefalexin aged <3 months 12.5 mg/kg at night according to previous culture sensitivities, with test on middle day or following MCUG
  - MCUG for neonates with hydronephrosis give a single dose of gentamicin IV 5 mg/kg over 3–5 min just before MCUG (avoid MCUG in neonates with UTI)

DISCHARGE AND FOLLOW-UP

- Home when:
  - symptoms mild, or severe symptoms controlled
  - taking oral antibiotics and tolerating them
- Discuss and advise to avoid risk factors at discharge:
  - constipation
  - poor perineal hygiene
  - low fluid intake
  - infrequent bladder emptying
- Repeat urine test not required in asymptomatic children
- Prompt treatment of recurrences with co-amoxiclav (check previous culture sensitivities)

- Outpatient review
- check BP
- not required for simple UTI
- in 8–10 weeks where ultrasound imaging has been indicated
- **Prophylactic antibiotics**
- not required following first simple UTI
- Required for:
- proven grade 3+ reflux until out of nappies during the day (provided infections well controlled)
- urinary tract obstruction pending surgical management
- any child with frequent symptomatic infections (>3 UTIs per year)
- aged >3 months: trimethoprim **or** nitrofurantoin prophylaxis
- Surgical management
- antireflux surgery not routinely indicated in VUR
- refer for antireflux surgery for obstructive mega-ureters with reflux
- refer for antireflux surgery if failure to control infections with prophylaxis in grade 3+ reflux
- refer all neuropathic bladder patients
- Circumcision may be considered for recurrent UTI in males with structurally abnormal urinary tracts

Management of children with renal scars

- No follow-up for minor unilateral parenchymal defect unless recurrent UTI or family history or lifestyle risk factors for hypertension
- In cases of significant scarring:
- annual BP measurement
- females must book early when pregnant and inform obstetric team
- Where scarring bilateral:
- annual BP measurement
- assessment of urinary protein excretion and renal function every 3–4 yr
- long-term follow-up in the renal clinic
- transfer to adult service

VANCOMYCIN ● 1/1

INDICATIONS

- MRSA
- Neutropenic sepsis with meropenem as 2nd line treatment
- Teicoplanin is alternative, particularly for coagulase negative staphylococcal infection

DOSE

- Frequency of administration varies with corrected gestational age (CGA) (gestation + age in weeks) as it is removed exclusively by the kidneys

29–34 weeks CGA

- 15 mg/kg 12-hrly adjusted according to trough levels

≥35 weeks CGA–aged 18 yr

- 15 mg/kg 8-hrly, adjusted according to trough levels (up to maximum initial dose 700 mg 8-hrly)

PRESCRIBING

- Prescribe in antibiotic section of drug chart
- specify time of administration using 24 hr clock
- Avoid in renal impairment
- In obese children use ideal weight for height
- Avoid if on furosemide/other nephrotoxic medication
- Correct dehydration first

ADMINISTRATION

- Give over ≥60 min, at a rate ≤10 mg/min to avoid anaphylactoid reactions
- Dilute with sodium chloride 0.9% or glucose 5%, to maximum concentration of 5 mg/mL for peripheral administration
- If fluid restriction can be administered at concentration of 10 mg/mL **centrally**

MONITORING

General monitoring

- Daily creatinine and urea levels, and urine output (vancomycin is nephrotoxic)

Therapeutic monitoring

- Microbiology laboratory tests levels between 0830–1600 hr
- Measure levels immediately before 3rd dose (before 2nd dose if concerns about renal function)
- Do not withhold next dose if awaiting results (unless concerns about renal function due to increase creatinine and urea, or reduced urine output)
- Therapeutic trough levels required to maintain efficacy
- Pre-dose trough levels should usually be 10–15 mg/L [15–20 mg/L for less sensitive (e.g. MRSA) organisms]
- If level below desired therapeutic level, reduce time between dosing to next dose interval e.g. if 8-hrly give 6-hrly and repeat levels before 3rd dose
- If level >20 mg/L but <25 mg/L increase time between dosing to next time interval and repeat levels on 3rd dose, e.g. if 8-hrly increase to 12-hrly
- If level >25 mg/L: do not administer further doses but check levels every 12 hr until 10–15 mg/L (use time since last dose as dose interval)

VITAMIN D DEFICIENCY ● 1/2

Routine screening is not recommended

RECOGNITION AND ASSESSMENT

Symptoms and signs

Rickets

- Progressive bowing of legs (bowing of legs can be a normal finding in toddlers)
- Progressive knock knees
- Wrist swelling
- Rachitic rosary (swelling of the costochondral junctions)
- Craniotabes (skull softening with frontal bossing and delayed fontanelle closure)
- Delayed tooth eruption and enamel hypoplasia

Other symptoms or conditions associated with vitamin D deficiency

- Long-standing (>3 months), unexplained bone pain
- Muscular weakness (e.g. difficulty climbing stairs, waddling gait, difficulty rising from a chair or delayed walking)
- Tetany due to low serum calcium
- Seizures due to low serum calcium (usually in infancy)
- Infantile cardiomyopathy

Abnormal investigations

- Low serum calcium or phosphate, high alkaline phosphatase (≥local age-appropriate reference range)
- Radiographs: showing osteopenia, rickets or pathological fractures

Chronic disease that may increase risk of vitamin D deficiency

- Chronic renal disease, chronic liver disease
- Malabsorption syndromes (e.g. coeliac disease, Crohn's disease, cystic fibrosis)

Bone diseases in children where vitamin D deficiency should be corrected before specific treatment is given

- Osteogenesis imperfecta
- Idiopathic juvenile osteoporosis
- Osteoporosis secondary to glucocorticoids, inflammatory disorders, immobility and other metabolic bone conditions

Serum 25-OHD nmol/L	Serum 25-OHD ug/L	Vitamin D status	Manifestation	Management
<25	<10	Deficient	Rickets Osteomalacia	Treatment dose of vitamin D
25–50	10–20	Insufficient	Associated with disease risk	Prevention dose of vitamin D
50–75	20–30	Adequate	Healthy	Lifestyle advice
>75	>30	Optimal	Healthy	None

PREVENTION

Standard prevention doses

Age	Daily dose	Examples of preparations
<1 month	300–400 units	Abidec, Baby Ddrops® and 'Healthy Start' vitamins
≥1 month–18 yr	400–1000 units	Abidec, Baby Ddrops®, Sunvit D3®, DLux oral spray, Vitabiotics vitamin D tablets

Treatment of deficiency

Age	Daily dose	Duration (weeks)
<6 month	1000 units	4–8
≥6 month–12 yr	6000 units	4–8
≥12–18 yr	10,000 units	4–8

VITAMIN D DEFICIENCY ● 2/2

INDICATIONS FOR REFERRAL TO SECONDARY CARE

- Repeated low serum calcium concentration with/without symptoms (irritability, brisk reflexes, tetany, seizures or other neurological abnormalities)
- Symptomatic: requires immediate referral to A&E
- Underlying complex medical disorders (e.g. liver disease, intestinal malabsorption)
- Deformities or abnormalities probably related to rickets
- Poor response to treatment despite good adherence (level of 25-OHD <50 nmol/L after 6 weeks of adherent therapy)
- Persisting low serum phosphate or low/high alkaline phosphatase

Administration

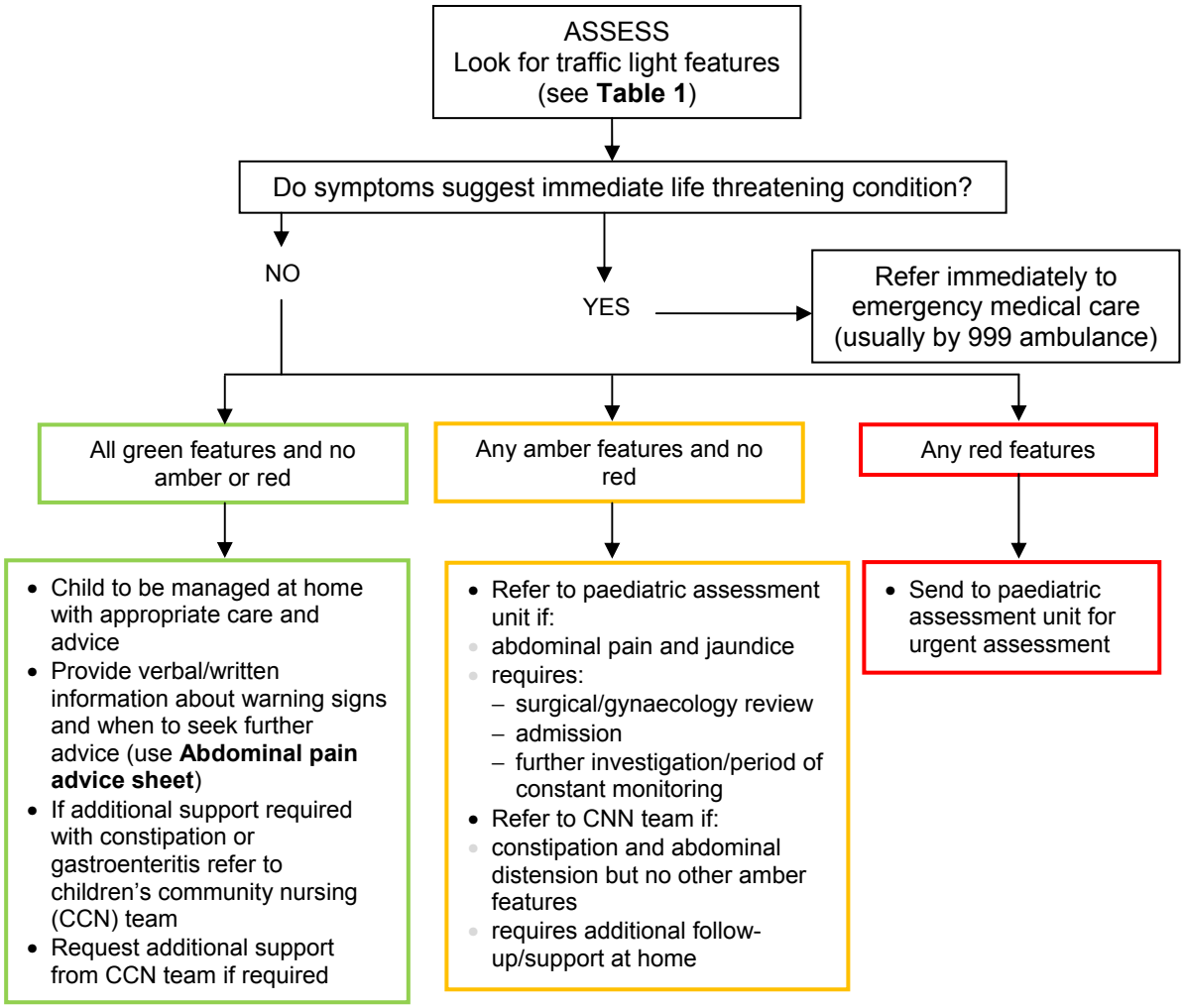
- All children who can swallow normal food can take the small colecalciferol available as 400, 1000, 10,000 and 20,000 unit capsule. Children who have swallowing difficulties (aged <1 yr or disabled), a liquid preparation may be used but is less palatable e.g.Thorens solution 10,000 units/mL
- If non-compliant give larger dose less frequently:
- aged 0–18 yr: Invita D3® solution 25,000 units once every 2 weeks for 6 weeks (3 doses)
- aged 12–18 yr: colecalciferol capsule e.g. Plenachol® 20,000 units once every 2 weeks for 6 weeks (3 doses)
- Colecalciferol and ergocalciferol liquid preparation doses are equivalent
- If insufficient calcium intake, prescribe

MONITORING

- At end of treatment check bone profile, vitamin D
- If 25-OHD >50 nmol/L bone profile normal
- Give advice on safe sun exposure, oily fish, egg, vitamin D fortified food and prevention dose until growth complete
- If recommended nutritional intake of 400 units/day (10 microgram/day) unlikely to be met, give routine supplementation of vitamin D as multivitamin formulation e.g. healthy start vitamin drops. Patient groups include:
- exclusively breastfed infant aged 1–6 months
- aged 6 months–5 yr taking <500 mL formula feed/day
- not spending substantial time outdoors
- wearing concealing clothing
- dark skin
- If 25-OHD <50 nmol/L:
- consider poor compliance, drug interactions and underlying disease e.g. renal disease, liver disease and malabsorption
- if poor compliance suspected, consider high-dose treatment if aged 12–18 yr (e.g. 300,000 units as single or divided dose)
- **If unimproved symptoms/signs despite satisfactory 25-OHD concentration: unlikely to be related to vitamin D deficiency**
- **Alfacalcidol should not be used for the treatment of simple vitamin D deficiency**

Community Guidelines

ABDOMINAL PAIN (COMMUNITY) ● 1/3



- If GP review in a specific time period clinically appropriate but falls outside of in-hours GP service:
  - advise patient/family to call NHS 111 (at an agreed time interval/level of deterioration – depending on concerns)
  - provide letter detailing clinical findings and concerns to assist out-of-hours GP assessment

Table 1: Traffic light system to identify severity of illness

	Green Low risk	Amber Immediate risk	Red High risk
Activity	• Active • Responds normally to social cues		• Drowsy • No response to social cues
Respiratory rate	• Respiratory rate normal (RR) ◦ infant: 40 ◦ toddler: 35 ◦ pre-school: 31 ◦ school age: 27		>60/min
SpO_2 in air	• ≥95%	• 92–94%	• <92%
Feeding/hydration	• >75% of normal intake – no vomiting	• 50–75% fluid intake over 3–4 feeds +/- vomiting • Reduced urine input	• <50% fluid intake over 2–3 feeds +/- vomiting • Significantly reduced urine output • Clinically dehydrated
Circulation	• CRT <2 sec • Heart rate normal (bpm):		• Heart rate (bpm): ◦ <1 yr: >190

	• <1 yr: 120–170 • 1–2 yr: 80–110 • 2–5 yr: 70–110 • >5 yr: 70–110		• >1 yr: >140
Other	• Negative urine dipstick	• Fever [see **Fever (community)** guideline] • Abdominal distension • Sexually active/missed period • Palpable abdominal mass • Localised pain • Jaundice • Yellow vomit • Severe/increasing pain	• Abdominal guarding/rigidity • Bile (green) stained vomit • Blood stained vomit • 'Red currant jelly' stool • Trauma associated • Acute testicular pain

Table 2: Signs and symptoms of specific illness (common causes of abdominal pain by age)

<2 yr	2–12 yr	>12–16 yr
Gastroenteritis Constipation Intussusception Infantile colic UTI Incarcerated inguinal hernia Trauma Pneumonia Diabetes	Gastroenteritis Acute appendicitis Mesenteric adenitis Constipation UTI Pneumonia Diabetes Testicular torsion Onset of menstruation Psychogenic Trauma	Mesenteric adenitis Acute appendicitis Menstruation Mittelschemerz Ovarian cyst torsion UTI Pregnancy Ectopic pregnancy Testicular torsion Psychogenic trauma Pneumonia Diabetes

Table 3: Signs/symptoms of specific illness (diagnoses to be considered)

Illness	Signs/symptoms
Gastroenteritis	• Vomiting • Diarrhoea (can occur in other conditions e.g. intussusception, pelvic appendicitis, pelvic abscess and inflammatory bowel disease)
Intestinal obstruction e.g. intussusception or volvulus	• Bile stained vomit • Colicky abdominal pain • Absence of normal stool/flatus • Abdominal distension • Increased bowel sounds • Visible distended loops of bowel • Visible peristalsis • Scars • Swellings at site of hernia orifices and of external genitalia • Stool containing blood mixed with mucus
Infective diarrhoea	• Blood mixed with stools • Ask about travel history and recent antibiotic therapy
Inflammatory bowel disease	• Blood in stools (may have signs of obstruction)
Midgut volvulus (shocked child)	• Bilious vomiting
Henoch schönlein pupura	• Blood in stools • Typical rash
Haemolytic uraemic syndrome	• Blood in stools
Lower lobe pneumonia	• Fever • Cough • Tachypnoea

ABDOMINAL PAIN (COMMUNITY) ● 3/3

	• Desaturation
Poisoning	• Ask about: ◦ history of possible ingestions (including batteries) ◦ drugs and other toxic agents available at home
Irreducible inguinal hernia	• Examine inguino-scrotal region
Torsion of testis	• If suspected contact surgeon (preferably urologist) immediately – surgical emergency
Jaundice	• Hepatitis may present with pain due to liver swelling
UTI	• Carry out routine urine analysis for children presenting with abdominal pain
Bites and stings	• Ask about possibility of bites and stings • Adder envenomation can result in abdominal pain and vomiting
Peritonitis	• Refusal/inability to walk • Slow walk/stooped forward • Pain on coughing or jolting • Lying motionless • Decreased/absent abdominal wall movements with respiration • Abdominal distension • Abdominal tenderness – localised/generalised • Abdominal guarding/rigidity • Percussion tenderness • Palpable abdominal mass • Bowel sounds – absent/decreased (peritonitis) • Associated non-specific signs – tachycardia, fever
Constipation	• Infrequent bowel activity • Foul smelling wind and stools • Excessive flatulence • Irregular stool texture • Passing occasional enormous stools or frequent small pellets withholding or straining to stop passage of stools (using Bristol stool chart) • Soiling/overflow • Abdominal distension • Poor appetite • Lack of energy • Unhappy, angry or irritable mood and general malaise
If post-menarchal female	• Suggest pregnancy test • Consider ectopic pregnancy, pelvic inflammatory disease or other STD • Other gynaecological problems • Mittelschmerz • Torsion of the ovary • Pelvic inflammatory disease • Imperforate hymen with hydrometrocolpos
Known congenital pre-existing condition	• Previous abdominal surgery (adhesions) • Nephrotic syndrome (primary peritonitis) • Mediterranean background (familial Mediterranean fever) • Hereditary spherocytosis (gall stones) • Cystic fibrosis (meconium ileus equivalent) • Cystinuria • Porphyria

ACUTE ASTHMA (COMMUNITY) ● 1/1

Child presenting with suspected acute exacerbation of asthma

If any of following present consider alternative diagnosis:
- Fever
- Asymmetry on auscultation
- Inspiratory stridor
- Breathlessness with light headedness and peripheral tingling (hyperventilation)
- Dysphagia
- Excessive vomiting
- Productive cough

NO → Suspected acute exacerbation of asthma **ASSESS**

YES → It may not be asthma; seek expert help (consider use of another pathway)

All green features and no amber/red

- SpO_2 ≥94% in air
- PEF >75% best/predicted aged ≥7 yr
- Speech/feeding normal
- Heart rate: aged 2–5 yr: ≤140/min, 5–12 yr: ≤125/min, >12 yr: ≤110/min
- Respiratory rate: aged 2–5 yr: ≤40/min, 5–12 yr: ≤30/min, >12 yr:≤25/min

Moderate exacerbation
- Give 2–10 puffs of β-agonist via spacer (with face mask aged ≤3 yr using tidal breathing)
- Use patient own spacer where available
- Increase β-agonist dose by 2 puffs every 2 min up to 10 puffs according to response
- Consider prednisolone 1–2 mg/kg: aged 2–4 yr: max 20 mg, 5–11 yr: max 30–40 mg, ≥12 yr: max 40–50 mg, once daily

ASSESS RESPONSE

Good response (green features)

- No response or deterioration, consider referral to paediatric assessment unit
- If amber or red features present refer to paediatric assessment unit

Good response
- Advise patient to continue using β-agonist via spacer as needed, but not exceeding 4-hrly
- Give asthma advice/information sheet
- Continue prednisolone for up to 3 days
- Arrange asthma clinic/clinical follow-up within 2 working days
- Review inhaler technique
- Refer to CCN team for follow-up

Any amber features and no red

- SpO_2 92–94% in air
- PEF <75% and >33% best/predicted aged ≥7 yr
- Can't complete sentences/too breathless to talk
- Heart rate: aged 2–5 yr: >140/min, 5–12 yr: >125/min, >12 yr: >110/min
- Respiratory rate: aged 2–5 yr: >40/min, 5–12 yr: >25/min, >12 yr: >30/min

Severe exacerbation
- Give oxygen via face mask/nasal prongs to achieve SpO_2 94–98%
- Give β-agonist 10 puffs via spacer +/- face mask or nebulised salbutamol (aged 2–4 yr: 2.5 mg, ≥5 yr: 5 mg), **OR** terbutaline (aged 2–4 yr: 5 mg, 5–12 yr: 5–10 mg, ≥12 yr: 10 mg), driven by 6–8 L oxygen
- Give prednisolone 1–2 mg/kg: aged 2–4 yr: max 20 mg, aged 5–11 yr: max 30–40 mg, aged ≥12 yr: max 40–50 mg, once daily

- If symptoms not controlled repeat β-agonist via 6–8 L oxygen driven nebuliser
- Call 999 for emergency ambulance to emergency department
- Stay with child until ambulance arrives

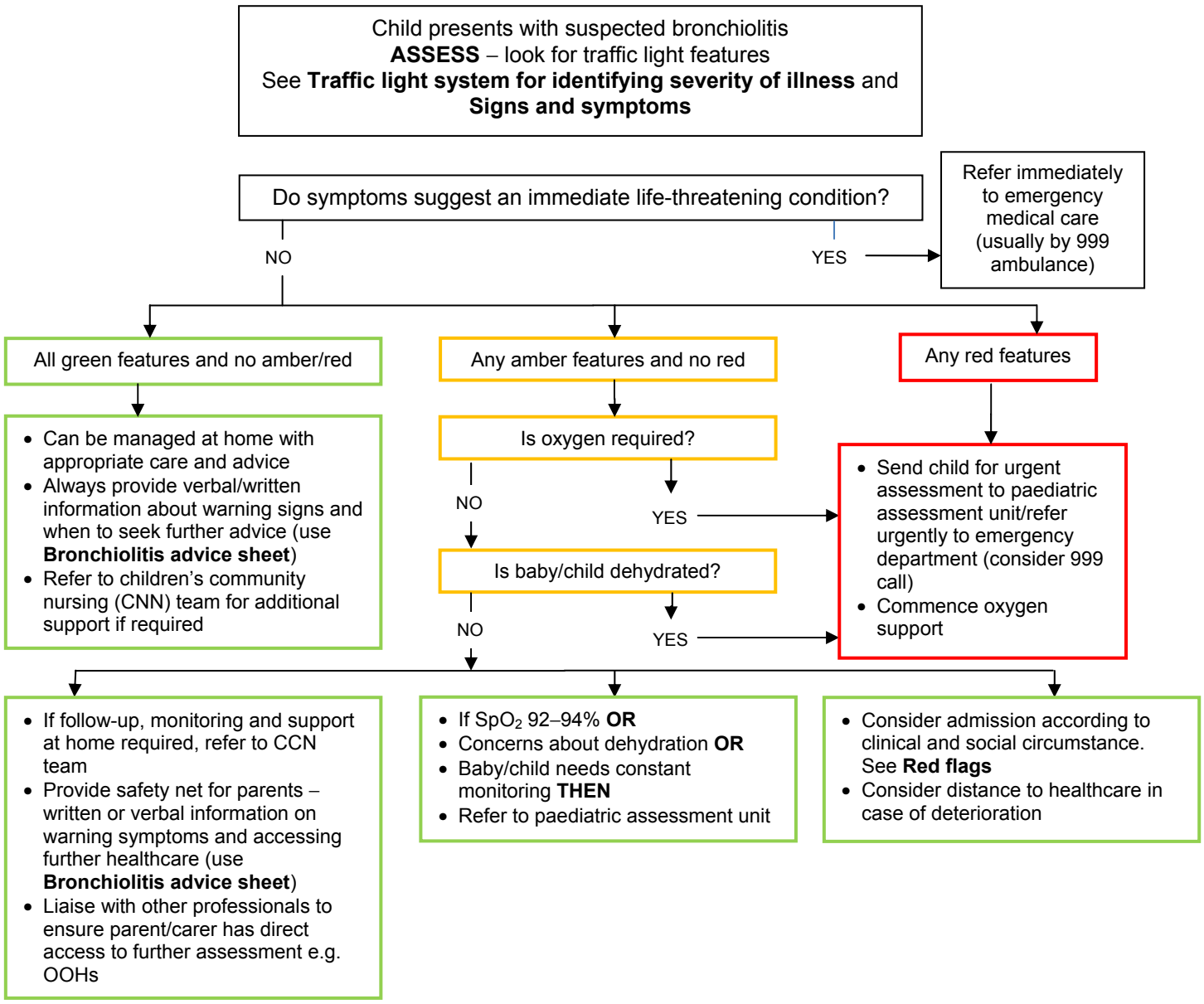
Any red features

- SpO_2 <92%
- Aged ≥7 yr: PEF <33% best/predicted
- Silent chest, cyanosis
- Poor respiratory effort
- Arrhythmia or hypotension
- Exhaustion, altered consciousness

Life threatening
- Give oxygen via face mask to achieve SpO_2 94–98%
- Call 999 for emergency ambulance to emergency department
- Give nebulised salbutamol, aged 2–4 yr: 2.5 mg, ≥5 yr: 5–10 mg, **OR** terbutaline (aged 2–4 yr: 5 mg, 5–11 yr: 5–10 mg ≥12 year: 10 mg) and ipratropium (aged 2–11 yr: 250 microgram, ≥12 yr: 500 microgram) driven by 6–8 L oxygen
- Give prednisolone 1–2 mg/kg up to (aged 2–4 yr: 20 mg, 5–11 yr: 30–40 mg, ≥12 yr: 40–50 mg) oral daily
- Repeat β-agonist up to every 15–30 min whilst waiting for ambulance to arrive
- Continually assess child after each intervention
- Ensure continuous oxygen delivery to maintain SpO_2 >94%
- Stay with child whilst waiting for ambulance to arrive
- Send written assessment and referral details

Lower threshold for admission if:
- Attack in late afternoon/night
- Recent hospital admission/previous severe attack
- Concern re social circumstances/ability to cope at home

BRONCHIOLITIS AGED <2 YR (COMMUNITY) ● 1/2



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Traffic light system to identify severity of illness

	Green Low risk	Amber Immediate risk	Red High risk
Behaviour	• Alert • Normal	• Irritable • Not responding normally to social cues • Decreased activity • No smile	• Unable to rouse • Wakes only with prolonged stimulation • No response to social cues • Weak, high pitched or continuous cry • Appears ill to healthcare professional
Feeding/ hydration	• >75% of normal intake – no vomiting	• 50–75% fluid intake over 3–4 feeds+/- vomiting • Reduced urine output	• <50% fluid intake over 2–3 feeds +/- vomiting • Significantly reduced urine output • Child clinically dehydrated
Circulation	• Normal colour skin,	• Pale/mottled	• Pale/mottled/ashen blue

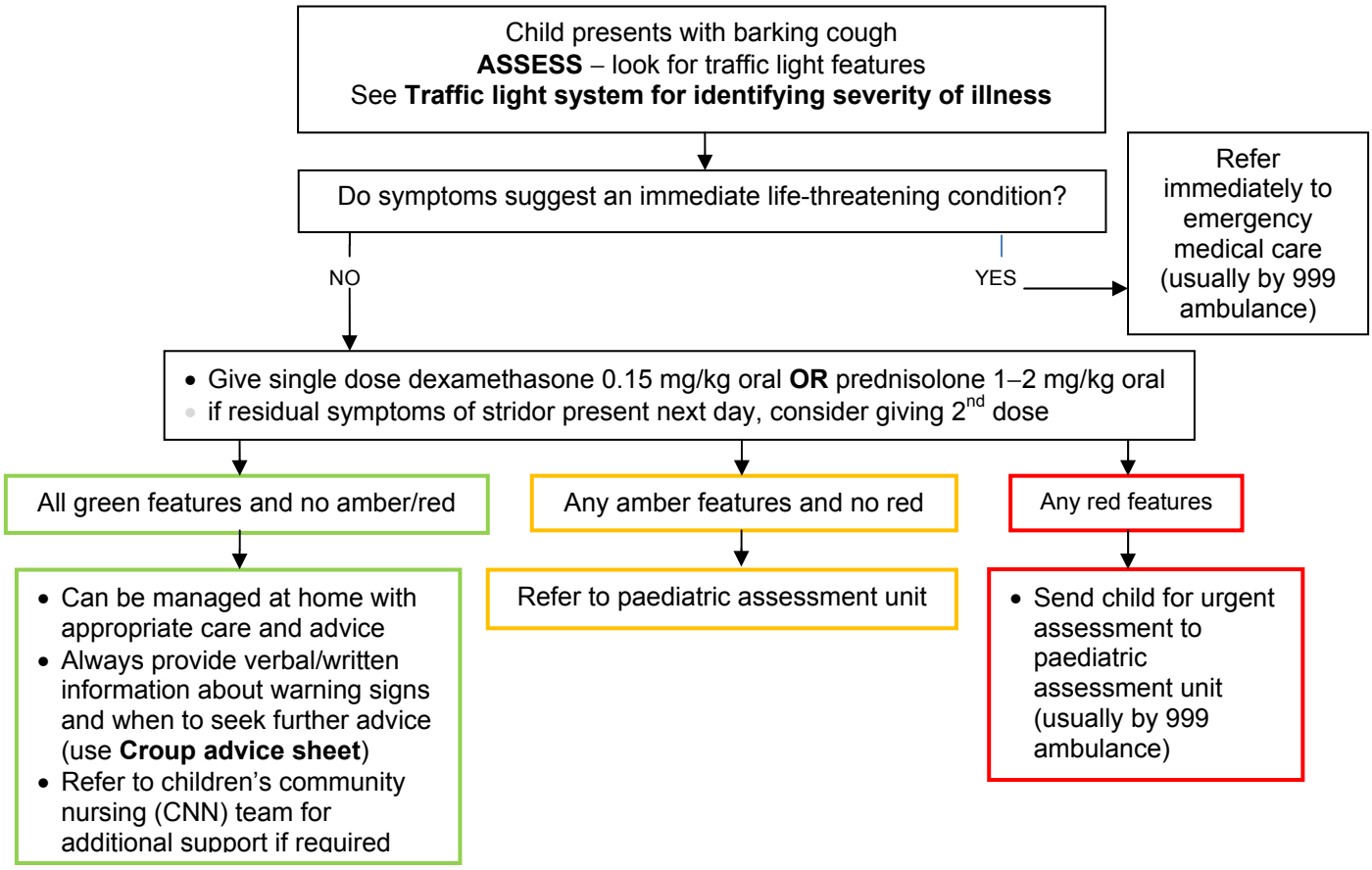
BRONCHIOLITIS AGED <2 YR (COMMUNITY) ● 2/2

	lips and tongue • Moist mucous membranes	• Pallor colour reported by parent/carer • Cool peripheries	• Cyanotic lips and tongue
Respiratory rate	• Aged <1 yr: <50 breaths/min • Aged ≥1 yr: <40 breaths/min • No respiratory distress	• Aged 1 yr: 50–60 breaths/min • Aged ≥1 yr: 40–60 breaths/min	• All ages >60 breaths/min
SpO_2 in air	• ≥95%	• 92–94%	• <92%
Chest recession	• None	• Moderate	• Severe
Nasal flaring	• Absent	• May be present	• Present
Grunting	• Absent	• Absent	• Present
Apnoea	• Absent	• Absent	• Present • for 10–15 sec or shorter if accompanied by a sudden decrease in saturations/central cyanosis or bradycardia

Signs and symptoms
- Rhinorrhea (runny nose)
- Cough
- Poor feeding
- Vomiting
- Pyrexia
- Respiratory distress
- Apnoea
- Inspiratory crackles +/- wheeze
- Cyanosis

Red flags
- When deciding whether to admit child take into account following risk factors for more severe bronchiolitis:
- chronic lung disease (including bronchopulmonary dysplasia)
- haemodynamically significant congenital heart disease
- aged <3 months
- premature birth, particularly <32 weeks
- neuromuscular disorders
- immunodeficiency

CROUP AGED 3 MONTHS–6 YR (COMMUNITY) • 1/2



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- advise patient/family to call NHS 111 (at agreed time interval/level of deterioration – depending on concerns)
- provide letter detailing clinical findings and concerns to assist out-of-hours GP assessment

Traffic light system to identify severity of illness

	Green Low risk	Amber Immediate risk	Red High risk
Colour	• Normal	•	• Pale/lethargy
Activity	• Child alert	• Quieter than normal	• Distress/agitation
Respiratory rate	• Aged <1 yr: <50 breaths/min • Aged ≥1 yr <40 breaths/min	• Aged <1 yr: 50–60 breaths/min • Aged ≥1 yr: 40–60 breaths/min	• All ages >60 breaths/min
SpO_2 in air	• ≥96%	• 92–95%	• <92%
Cough	• Occasional barking cough • No stridor	• Frequent barking cough and stridor at rest	• Struggling with persistent cough
Chest recession	• None	• Subcostal and retrosternal recession	• Marked subcostal and retrosternal recession
Other	• CRT <2 sec	• Poor response to initial treatment • Reduced fluid intake • Uncertain diagnosis • Significant parental anxiety or late evening/night presentation • No access to transport/ long way from hospital	• History of possible foreign body aspiration • Temperature ≥39ºC

Signs and symptoms

- Rhinorrhoea (runny nose)
- Cough
- Poor feeding
- Vomiting
- Pyrexia
- Respiratory distress
- Apnoea
- Inspiratory crackles +/- wheeze
- Cyanosis

Red flags

- When deciding whether to admit child take into account following risk factors for more severe bronchiolitis:
- chronic lung disease (including bronchopulmonary dysplasia)
- haemodynamically significant congenital heart disease
- aged <3 months
- premature birth, particularly <32 weeks
- neuromuscular disorders
- immunodeficiency

FEVER (COMMUNITY) ● 1/3

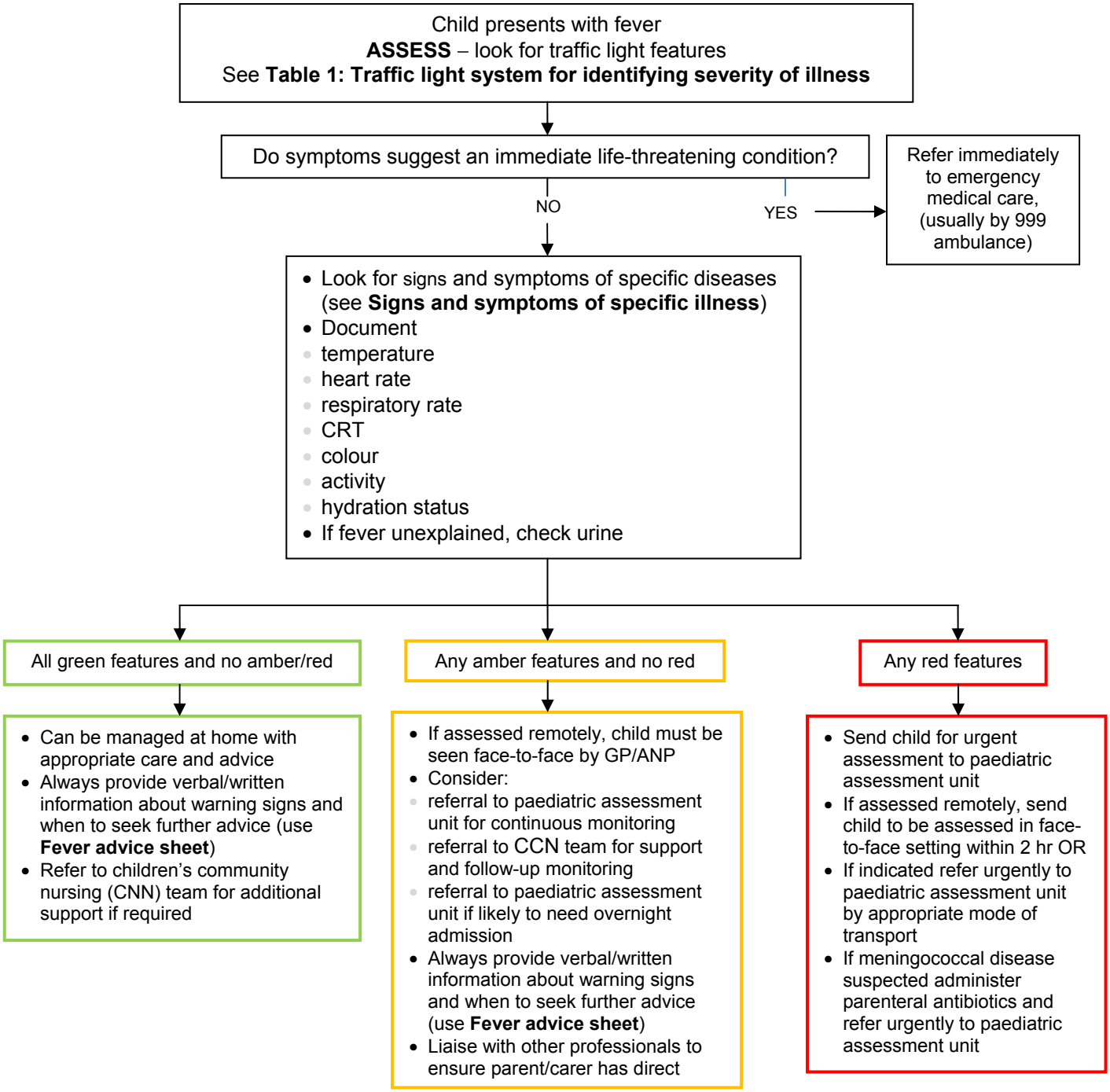

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Table 1: Traffic light system to identify severity of illness

	Green Low risk	Amber Immediate risk	Red High risk
Colour	• Normal colour of skin, lips and tongue	• Pallor reported by parent/carer	• Pale/lethargy
Activity	• Responds normally to social cues • Content/smiles • Stays awake/ awakens quickly • Strong normal	• Not responding normally to social cues • Wakes only with prolonged stimulation • Decreased activity • No smile	• Distress/agitation

	cry/not crying		
Respiratory rate	• Normal breathing	• Nasal flaring • Tachypnoea ◦ aged 6–12 months: >50 breaths/min ◦ aged >1 year: >40 breaths/min • SpO_2 <95% in air • Crackles in chest	• All ages >60 breaths/min
Circulation and hydration	• Normal skin and eyes • Moist mucous membranes	• Dry mucous membranes • Poor feeding in infants • CRT >3 sec • Tachycardia: ◦ aged 1 yr: >160 bpm ◦ aged 2–4 yr: >150 bpm ◦ aged ≥5 yr: >140 bpm • Reduced urine output	• SpO_2 <95%
Other	• No amber or red signs/symptoms	• Fever >5 days • Swelling of limb/joint • Non weight bearing/not using extremity • New lump >2 cm • Aged 3–6 months: temp >39ºC • Rigors	• Aged 0–3 months: temp >38ºC • Non-blanching rash • Bulging fontanelle • Neck stiffness • Status epilepticus • Focal neurological signs • Focal seizure

Table 2: Signs and symptoms of specific illness – diagnoses to be considered

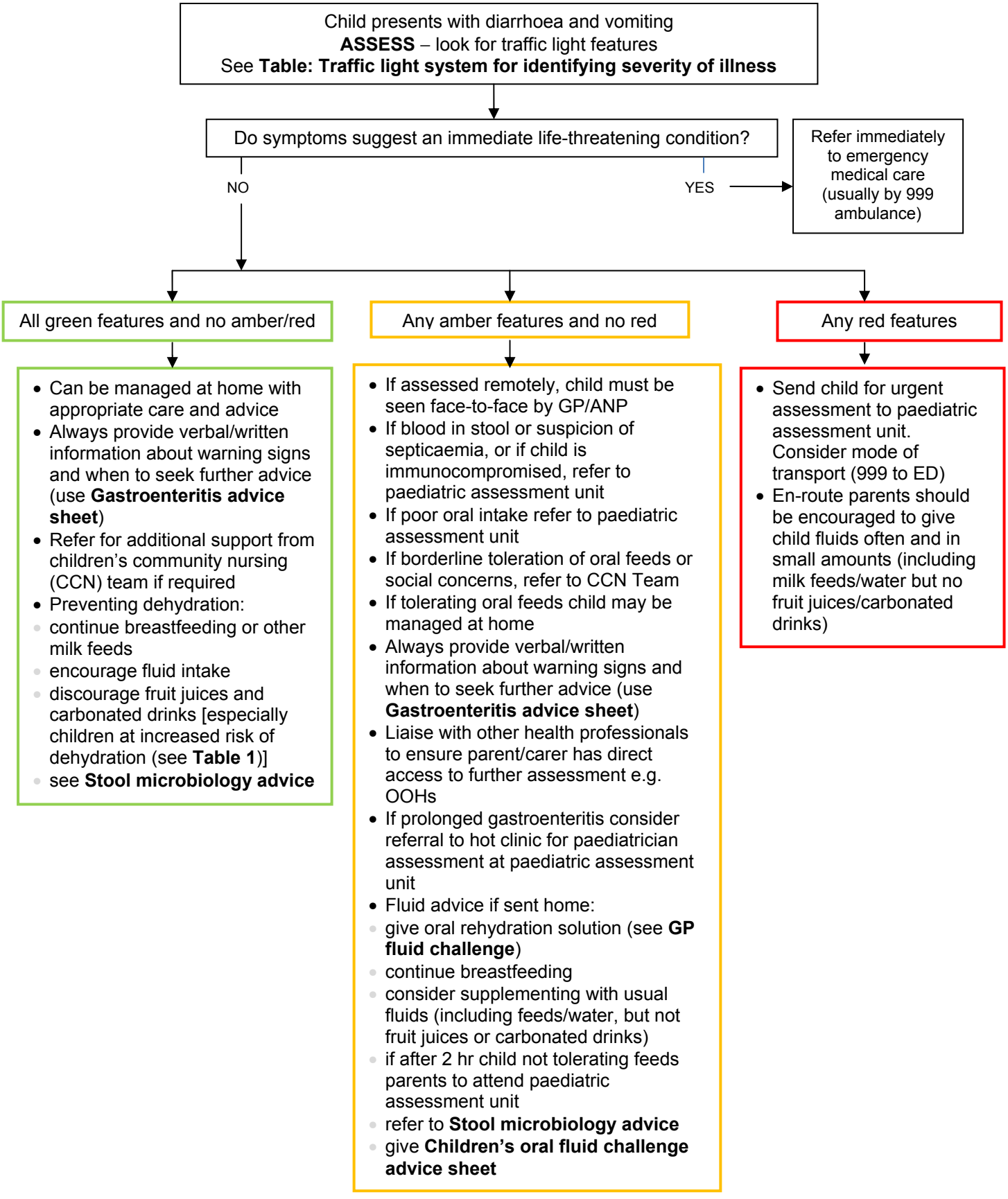
Meningococcal disease	• Non-blanching rash, particularly with ≥1 of the following: ◦ ill-looking child ◦ lesions >2 mm in diameter (purpura) ◦ CRT >3 sec ◦ neck stiffness
Meningitis	• Neck stiffness • Bulging fontanelle • Decreased level of consciousness • Convulsive status epilepticus • Classic signs (neck stiffness, bulging fontanelle, high-pitched cry) are often absent in infants with bacterial meningitis
Herpes simplex encephalitis	• Focal neurological signs • Focal seizures • Decreased level of consciousness
Pneumonia	• Tachypnea: ◦ aged 0–5 months: >60 breaths/min ◦ aged 6–12 months: >50 breaths/min ◦ aged >12 months: >40 breaths/min • Crackles in chest • Nasal flaring • Chest 'indrawing' • Cyanosis • SpO_2 <95%
Urinary tract infection aged >3 months (consider in any child aged <3 months with fever)	• Vomiting • Poor feeding • Lethargy • Irritability • Abdominal pain/tenderness • Urinary frequency/dysuria • Offensive urine/haematuria
Septic arthritis/osteomyelitis	• Swelling of limb/joint • Not using an extremity • Non weight bearing

Kawasaki disease	• Fever >5 days and ≥4 of the following: ◦ bilateral conjunctival injection ◦ change in upper respiratory tract mucous membrances (e.g. injected pharynx, dry cracked lips or strawberry tongue) ◦ change in peripheral extremities (e.g.: oedema, erythema or desquamation) ◦ polymorphous rash ◦ cervical lymphadenopathy • In rare cases, incomplete/atypical Kawasaki disease may be diagnosed with fewer features than above

Red flags

- When deciding whether to admit child take into account following risk factors for more severe bronchiolitis:
  - chronic lung disease (including bronchopulmonary dysplasia)
  - haemodynamically significant congenital heart disease
  - aged <3 months
  - premature birth, particularly <32 weeks
  - neuromuscular disorders
  - immunodeficiency

GASTROENTERITIS (COMMUNITY) ● 1/3



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  - provide letter detailing clinical findings and concerns to assist out-of-hours GP assessment

Table 1: Traffic light system to identify severity of illness

GASTROENTERITIS (COMMUNITY) ● 2/3

	Green Low risk	Amber Immediate risk	Red High risk
Activity	• Responds normally to cues • Content/smiles • Stays awake/awakens quickly • Strong normal cry/not crying	• Altered response to social cues • Decreased activity • No smile	• Not responding normally to/no response to social cues • Appears ill to healthcare professional • Unable to rouse/if roused does not stay awake • Weak, high pitched or continuous cry
Skin	• Normal skin colour • Normal turgor	• Normal skin colour • Warm extremities	• Pale/mottled/ashen blue • Cold extremeties
Respiratory	• Normal breathing	• Nasal flaring • Tachypnoea • Aged 6–12 months: RR >50 breaths/min • Aged >1 year: RR >40 breaths/min • SpO_2 <95% in air • Crackles in chest	• Grunting • Tachypnoea >60 breaths/min
Hydration	• Moist mucous membranes (except after a drink) • Normal urine	• Dry mucous membranes (except after a drink) • Reduced urine output	• No urine output
Circulation	• CRT ≤2 sec • Heart rate normal • Peripheral pulses normal	• CRT 2–3 sec • Tachycardia: ◦ aged <1 yr: >160 bm ◦ aged 2–5 yr: >150 bpm ◦ aged >5 yr: >130 bpm • Peripheral pulses weak	• CRT >3 sec
Blood pressure	• Normal	• Normal	• Hypotensive
Eyes	• Normal eyes	• Sunken eyes	•

Alternative diagnosis in presence of following signs and symptoms

- Temperature:
  - aged <3 months: ≥38ºC
  - aged ≥3 months: ≥39ºC
- Shortness of breath
- Altered conscious state
- Neck stiffness
- Abdominal distension or rebound tenderness
- History/suspicion of poisoning
- Bulging fontanelle (in infants)
- Non-blanching rash
- Blood and/or mucous in stools
- Bilious (green) vomit
- Severe/localised abdominal pain
- History of head injury
  - consider non-accidental injury

Children at increased risk of dehydration

- Aged <1 yr (especially aged <6 months)
- Low birth weight
- ≥6 diarrhoeal stools in past 24 hr
- Vomited ≥3 times in last 24 hr
- Not been offered/unable to tolerate supplementary fluids before presentation
- Infant stopped breastfeeding during illness
- Signs of malnutrition

Stool microbiology advice

- Recently been abroad
- Diarrhoea has not improved by day 7

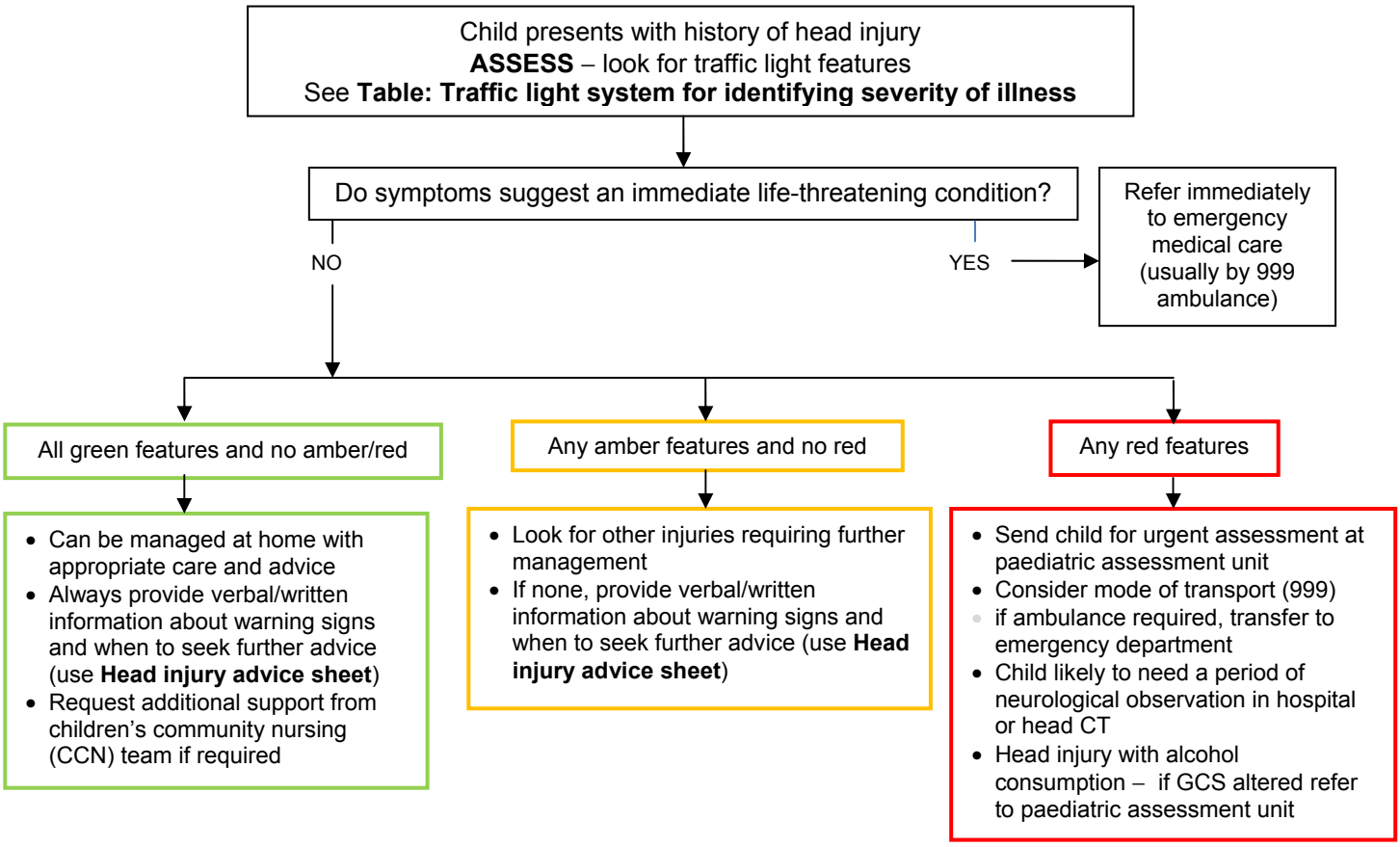
GP fluid challenge

- Fluid should be clear, ideally oral rehydration solutions e.g. Dioralyte™
- If child is breastfed continue breastfeeding
- Seek review if:
- not taking fluids
- not keeping fluids down
- becoming more unwell
- reduced urine output

Table 2: Normal maintenance fluid volumes for children not dehydrated and rehydration volumes for children at risk of/clinically dehydrated

Weight (kg)	Maintenance fluid volume (mL/hr)	Rehydration fluid volume (mL/10 min)
2	8	6
3	12	8
4	16	12
5	20	14
6	24	16
7	28	20
8	32	22
9	36	24
10	40	28
11	42	30
12	44	32
13	46	34
14	48	38
15	50	40
16	52	42
17	54	44
18	56	46
19	58	50
20	60	52
21	61	54
22	62	56
23	63	58
24	64	60
25	65	64

HEAD INJURY (COMMUNITY) ● 1/2



- If GP review in a specific time period clinically appropriate but falls outside of in-hours GP service:
  - advise patient/family to call NHS 111 (at agreed time interval/level of deterioration – depending on concerns)
  - provide letter detailing clinical findings and concerns to assist out-of-hours GP assessment

Table: Traffic light system to identify severity of illness

Green Low risk	Amber Immediate risk	Red High risk

• Has not been knocked unconscious at any time
• Is alert and interacts with you
• Has vomited, but only once
• Has bruising/minor cuts to the head
• Cried immediately but is otherwise normal
• 15 on Glasgow coma scale (see **Glasgow coma scale** guideline)
	• Has fallen from a height greater than child's own height
	• Has fallen from >1 m
	• Has fallen downstairs and no red high risk features
		• Any loss of consciousness as a result of injury
		• Amnesia for events before and after injury
		• Abnormal drowsiness
		• Seizure since the head injury
		• Vomiting episodes since the injury
		• Drug or alcohol intoxication
		• Clinical suspicion of non-accidental injury or any safeguarding concerns
		• Persistent headache since the injury
		• Aged >1 yr: GCS 14
		• Aged <1 yr: GCS (paediatric <15 on assessment)
		• 2 hr post-injury: GCS <15
		• Suspicion of open/depressed skull injury or tense fontanelle
		• Aged <1 yr: presence of bruise, swelling or laceration of >5 cm on head
		• Any sign of basal skull fracture:
		  ○ haemotympanum 'panda' eyes
		  ○ cerebrospinal fluid leakage from ears/nose
		  ○ Battle's sign
		• Focal neurological deficit
		• Dangerous mechanism of injury:

		◦ high speed road traffic collision ◦ fall from >3 m ◦ high speed injury from projective/object • Has blood clotting disorder/on anti-coagulants • Any previous brain surgery

Glasgow coma scale
See **Glasgow coma scale** guideline

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These guidelines are advisory, not mandatory. Every effort has been made to ensure accuracy. The authors cannot accept any responsibility for adverse outcomes.

Suggestions for improvement and additional guidelines would be most welcome by Partners in Paediatrics, please contact via www.partnersinpaediatrics.org

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