CONSULTATION

Paediatric Common Infections Pathways: Improving antimicrobial stewardship and promoting ambulation for children presenting with common infections to hospitals in the UK and Ireland

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Developed by: The British Society for Antimicrobial Chemotherapy (BSAC): 53 Regent Place, Birmingham, UK. Registered Charity 1093118. Registered as a company limited by guarantee in England & Wales No: 4443910

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Helpful notes

- The aim of this consultation process is to gather feedback and improve the quality of the content of the pathways and to assess applicability and feasibility of the pathways to your practice.
- The format of the pathways (colours, arrows, alignment, references etc) will be adjusted and made uniform among the pathways once comments have been received.
- The final version of the pathways will be freely available in an interactive html format via the BSAC website.
- Methodology describing the development of the pathways has been provided in a separate pdf.
- Please provide comments by completing the consultation form and return to chorner@bsac.org.uk by 5pm on Monday 2 November.
- Thank-you for your contribution to these important pathways.

Pathways available for consultation

1. Acute otitis media and mastoiditis pathway for children presenting to hospital (slides 3-4)
2. Cellulitis pathway for children presenting to hospital (slides 5-6)
3. Infant <90 days of age with fever and no source pathway for children presenting to hospital (slides 7-8)
4. Children with a fever and petechial rash or purpura presenting to hospital (slides 9-10)
5. Cervical lymphadenitis / LN abscess pathway for children presenting to hospital (slides 11-12)
6. Management of children aged ≥3 months with confirmed meningitis (slides 13-14)
7. Pre-septal and post-septal orbital cellulitis pathway for children presenting to hospital (slides 15-16)
8. Community acquired pneumonia (CAP) and empyema pathway for children presenting to hospital (slides 17-18)
9. Pyelonephritis / upper UTI pathway for children presenting to hospital (slides 19-20)
10. Tonsillitis and peritonsillar abscess (quinsy) pathway for children presenting to hospital (slides 20-21)

Abbreviations used

Abbreviation		Abbreviation	
Abx	Antibiotics	ITP	Idiopathic thromocytopaenic purpura
AOM	Acute otitis media	IV	Intravenous
AP	Anterior posterior	LFT	Liver function test
APLS	Antiphospholipid syndrome	LN	Lymph node
BSA	Body surface area	LP	Lumbar puncture
BSO	British Society of Otology	MaxFax	Maxillofacial
BTS	British Thoracic Society	MC&S	Microscopy, culture and susceptibility testing
CMV	Cytomegalovirus	MRI	Magnetic resonance imaging
CRP	C-reactive protein	OPAT	Outpatient parenteral antimicrobial therapy
CSF	Cerebral spinal fluid	PAU	Paediatric Assessment Unit
CT	Computerized Tomography	PCR	Polymerase chain reaction
CXR	Chest X-ray	PHDU	Paediatric high dependency unit
DKA	Diabetic ketoacidosis	PICC	Peripherally inserted central catheter
EBV	Epstein Barr virus	PICU	Paediatric Intensive Care Unit
ED	Emergency department	PN	Pyelonephritis
ENT	Ear, nose and throat	SPA	Suprapubic aspiration
FBC	Full blood count	SSU	Short stay unit
GCS	Glasgow Coma Score	SVC	Superior vena cava
GI	Gastrointestinal	T1DM	Type 1 diabetes mellitus
HSP	Henoch-Schonlein purpura	TUBC	Transurethral bladder catheterisation (in out catheter)
HSV	Herpes simplex virus	U&E	Urea and electrolytes
ICP	Increased intracranial pressure	UTI	Urinary tract infection
ID	Infectious Disease	USS	Ultra sound scan
I&D	Incision and drainage	WCC	White cell count

Acute otitis media (AOM) and mastoiditis pathway for children presenting to hospital

DIFFERENTIALS

Acute presentation of ear pain (otalgia), discharge (otorrhoea) +- fever. AOM diagnosis is strengthened by the presence of a bulging tympanic membrane, air-fluid level behind the tympanic membrane, tympanic membrane perforation and/or discharge in the ear canal (although discharge only occurs in AOM if there is a tympanic perforation). Presence of fluctuant post auricular swelling and/or protrusion of the pinna suggest possible mastoiditis.

Otitis media has similar symptoms to acute otitis externa but important to differentiate between the two because AOM can lead to intracranial complications (See table 1 for feature distinguishing AOM from otitis externa).

***RED FLAGS**:

URGENT senior review and ENT input if:

- Signs of extra-cranial complications:
  - Features of mastoiditis
- Signs of intracranial infection including:
  - Drowsiness
  - Meningism / irritability
  - Unusually severe headache requiring opioids
  - Features of raised intracranial pressure including headache/vomiting
  - New squint / diplopia / deteriorating vision
  - New limb weakness / coordination issues
  - Pain beyond the ear, extensive headache or facial pain
- Haemodynamic instability / sepsis (may require urgent source control) or signs of toxic shock syndrome (shock, mucosal erythema, rash, GI symptoms)

If signs of intracranial infection or mastoiditis, consider urgent neuro-otological imaging (CT +/- MRI)

INVESTIGATIONS

Evaluate severity of infection:
MILD = systemically well
MODERATE = systemically unwell including fever, tachycardia and tachypnoea
SEVERE = presence of any red flags*

If MILD infection#, no investigations required.
If MODERATE / SEVERE infection, for FBC, CRP and blood culture +- ear swab if discharge/pus in canal.
If SEVERE infection, for urgent senior review and ENT input. If mastoiditis, consider contrast CT and petrous bones or if intracranial complications suspected, consider MRI brain/petrous bones $.

MANAGEMENT

MILD infection – only consider antibiotics if symptoms for ≥4 days, otorrhoea (not due to otitis externa), immunosuppression or AOM in a child <6 months of age.[1] If aged 6/12mths-2 years, start Abx if bilateral AOM or if symptoms score>8#[5]

If mild infection requiring antimicrobial therapy, only consider IVAbx if:
- Oral Abs not tolerated/absorbed

MODERATE infection – consider initial management with IVAbx as per local empirical antibiotic guidelines.
If persisting fever/no clinical improvement despite 48 hours antibiotics, arrange ENT review.
If development of red flags, for urgent ENT review and consider urgent neuro-otological imaging (contrast CT or MRI)$

SEVERE infection – start IVAbx as per local empirical antibiotic guidelines
Urgent ENT review and consideration of neuro-otological imaging (contrast CT or MRI)

$If neuro-otologial imaging performed, ENT review of imaging findings:
- AOM but no intracranial complication - consider continuing IV antibiotics +/- grommet
- Acute mastoiditis – drainage of mastoid +/- grommet if clinical or radiological evidence of subperiosteal access or other red flag
- Acute ongoing simultaneous ENT infection may require grommet insertion +/- cortical mastoidectomy. See BSO Guideline.

Management of Intracranial complications depends on type and often requires ENT and neurosurgical input[7]:
- Intracranial abscess may require urgent drainage depending on site, site and symptoms
- Intracranial sinus thrombosis may need neurology input for consideration of anticoagulation

Optimise analgesia
Oral antibiotics as per local/national guidelines.[1]
If AOM in a child with tympanostomy tubes, treat with non-ototoxic topical Abx.[4]
Total duration of treatment 5-7 days[1-3]
Provide verbal and written safety netting information
If no improvement despite ≥72 hours of adequate oral Abx, consider 2nd line oral Ab therapy as per local/national guidelines.[1]

Consider ambulation[8] on IVAbx from ED / children's assessment unit (admission avoidance or reduced inpatient stay) unless:
- Clinical risk factors: haemodynamically unstable, risk of dehydration, requirement for drainage
- Social / caregiver risk factors**

Ensure robust clinical governance systems and documentation in place for children being ambulated
Daily review required and provide verbal and written safety netting information

IV to oral switch when:
- Clinically improving +- improving inflammatory markers
- Apyrexial
- If source control (mastoidectomy), then consider early IV to oral switch.[6]
- Total duration of treatment (IV+oral)=5-7 days (10 days if mastoiditis). Seek specialist advice if intracranial infection.

CLINICAL SIGNS	Otitis Externa	Otitis Media
Ear pain	Yes	Yes, often improved when discharge commences
Discharge	Scanty	Mod/severe Mucopurulent
Hearing	Later onset muffled	Early onset
Preceding URTI	No	Often
Tender ear canal	Yes, very	No
Periauricular swelling	Yes in severe secondary to soft tissue cellulitis	No unless mastoiditis
Canal swelling	Yes	No
Ear drum	Can be difficult to visualise due to canal debris	Red bulging, oedematous, perforated with mucopus pulsating through
Associated with intracranial complications	No (unless immuno-compromised)	Yes

Table 1. Distinguishing AOM and otitis externa.

#Severity scoring for AOM in children aged 6 months to 2 years (1 point for each of the following):

- fever (38-38.9 degrees = score of 1; >39 degrees = score of 2)
- tugging ears
- crying more
- irritability
- difficulty sleeping
- less playful
- eating less

** Social/caregiver risk factors

Selection involves consideration of patient-specific criteria, such as ability to understand and consent to OPAT, likelihood of compliance, appropriate home circumstances, ability to attend for OPAT, support from family members and safety of visiting healthcare staff

- Is the home/outpatient environment adequate to support care and safe for all?
- Are there any child protection concerns?
- Is there agreement between families and clinicians regarding treatment and understanding about the commitment required for ambulation/OPAT?
- Are the families able to recognise potential complications and have the means to escalate concerns (e.g. telephone) and return to hospital if needed (e.g. transport)?

REFERENCES

1) NICE guideline otitis media (acute):antimicrobial prescribing https://www.nice.org.uk/guidance/ng91.
2) Venekamp, R. P., *et al*. Antibiotics for acute otitis media in children. The Cochrane database of systematic reviews(6): CD000219.
3) Venekamp RP, Damoiseaux RA, Schilder AG. Acute otitis media in children. *BMJ Clin Evid*. 2014;2014:0301. Published 2014 Sep 16.
4) van Dongen TM, van der Heijden GJ, Venekamp RP, Rovers MM, Schilder AG. A trial of treatment for acute otorrhea in children with tympanostomy tubes. N Engl J Med. 2014;370(8):723-733.
5) Hoberman A, Paradise JL, Rockette HE *et al*. Treatment of acute otitis media in children under 2 years of age. N Engl J Med. 2011; 364(2): 105-15.
6) Moore JA, Wei JL, Smith HJ *et al.* Treatment of pediatric suppurative mastoiditis: is peripherally inserted central catheter (PICC) antibiotic therapy necessary? Otolaryngol Head Neck Surg 2006; 135: 106–10.
7) Lording A, Patel S, Whitney A. Intracranial complication of ear, nose and throat infections in childhood. Journal of ENT Masterclass 2017; 10 (1): 64-70.
8) Patel S, Abrahamson E, Goldring S *et al*. Good practice recommendations for paediatric outpatient parenteral antibiotic therapy (p-OPAT) in the UK: a consensus statement. *J Antimicrob Chemother* 2015;70, 360-373.

Cellulitis pathway for children presenting to hospital

(for periorbital/orbital cellulitis, see separate pathway)

DIFFERENTIALS

Presentation of cellulitis: Erythematous, hot, tender spreading rash. May be associated with swelling and systemic features

Consider differentials:
- Allergic/contact dermatitis: if itchy and non-tender, cellulitis unlikely
- Impetigo: well defined lesions, often crusting/discharging, systemically well
- Staph scalded skin syndrome: blistering, exfoliative rash; more common in neonates and young children
- Necrotising fasciitis: serious infection, rapidly progressing, red/purple colour, extreme pain often disproportionate to the extent of the rash

INVESTIGATIONS

Cellulitis is diagnosed clinically; investigations are rarely useful in the child presenting with uncomplicated cellulitis#.[1]
- Consider odontogram in children presenting with facial or submandibular cellulitis; >50% of facial cellulitis is of odontogenic origin and may require tooth extraction
- Send skin swab for MC+S if skin broken, esp. if risk of unusual organism

Features of complex cellulitis include:
- Severe infection (see Melbourne ASSET score)
- Significant immunosuppression
- Associated with VZV
- Post-burn

ASSESSING SEVERITY

All children with cellulitis require treatment with systemic antibiotics. The severity of infection determines the route of administration (IV versus oral). Consider using Melbourne ASSET score to stratify severity of infection

Melbourne ASSET score:[2]
Area: <1% BSA=0; ≥1% BSA=1 (size of child's palm = 1%)
Systemic features: No=0, Yes=1
Swelling: None=0, Mild=1, Mod/severe=2
Eye: Not involved=0, Involved=1
Tenderness: None=0, Mild=1, Mod/severe=2

MANAGEMENT

MILD/MOD if score <4.
Treat with oral antibiotics

In MILD infection, only consider IVAbx if:
- Oral Abx not tolerated or absorbed
- Worsening of cellulitis despite adequate oral Abx
- Associated with VZV
- Post-burn
- Facial cellulitis
- Significant immunosuppression

SEVERE if score ≥4
Initial management with IVAbx

Choice of oral Abx as per local / national guidelines
Total duration of treatment 5-7 days[3-6]
Provide verbal and written safety netting information

Consider ambulation[6] on IVAbx from ED / children's assessment unit (admission avoidance or reduced inpatient stay) unless:
- Clinical risk factors: haemodynamically unstable or evidence of toxin mediated disease
- Social / caregiver risk factors**
- Lower threshold for admission if severe immunosuppression

Choice of IVAbx as per local / national guidelines

Ensure robust clinical governance systems and documentation in place for children being ambulated
Daily review required and provide verbal and written safety netting information

IV to oral switch when:
- Clinically improving and apyrexial +- improving inflammatory markers
- Total duration of treatment (IV+oral) =5-7 days[3-6]

If clinically deteriorating despite IVAbx, consider:
- Deep seated infection requiring source control; consider imaging / surgical review
- Resistant organism – check risk factors and microbiology results
- Non-infective pathology

** Social/caregiver risk factors:

Selection involves consideration of patient-specific criteria, such as ability to understand and consent to OPAT, likelihood of compliance, appropriate home circumstances, ability to attend for OPAT, support from family members and safety of visiting healthcare staff

- Is the home/outpatient environment adequate to support care and safe for all?
- Are there any child protection concerns?
- Is there agreement between families and clinicians regarding treatment and understanding about the commitment required for ambulation/OPAT?
- Are the families able to recognise potential complications and have the means to escalate concerns (e.g. telephone) and return to hospital if needed (e.g. transport)?

REFERENCES

1. Malone JR, Durica SR, Thompson DM *et al*. Blood cultures in the evaluation of uncomplicated skin and soft tissue infections. Pediatrics. 2013 Sep;132(3):454-9.
2. Ibrahim LF, Hopper SM, Donath S *et al*. Development and Validation of a Cellulitis Risk Score: The Melbourne ASSET Score. Pediatrics. 2019 Feb;143(2):e20181420.
3. Ibrahim LF, Hopper SM, Orsini F *et al.* Efficacy and safety of intravenous ceftriaxone at home versus intravenous flucloxacillin in hospital for children with cellulitis (CHOICE): a single-centre, open-label, randomised, controlled, non-inferiority trial. Lancet Infect Dis. 2019 May;19(5):477-486.Hepburn MJ et al. Arch Intern Med 2004.
4. NICE guideline: Cellulitis and erysipelas: antimicrobial prescribing [NG141] 2019.
5. McMullan BJ, Andresen D, Blyth CC, *et al*; ANZPID-ASAP group. Antibiotic duration and timing of the switch from intravenous to oral route for bacterial infections in children: systematic review and guidelines. Lancet Infect Dis. 2016 Aug;16(8):e139-52.
6. Patel S, Abrahamson E, Goldring S *et al*. Good practice recommendations for paediatric outpatient parenteral antibiotic therapy (p-OPAT) in the UK: a consensus statement. *J Antimicrob Chemother* 2015;70, 360-373.

INFANT <90 DAYS OF AGE WITH FEVER AND NO SOURCE PATHWAY FOR CHILDREN PRESENTING TO HOSPITAL

DIAGNOSIS

- Temperature ≥38°C measured by axillary thermometer
- If within 24 – 48hrs of 8 week immunisations and appears well, consider period of observation +/- urinalysis if systemically well[1,2]

DIFFERENTIALS

- Urinary tract infection (10 - 20%)
- Bacteraemia (4%) including Group B Strep, *E. coli* etc.
- Bacterial meningitis (0.5%)
- Enterovirus infection/meningitis
- Herpes simplex virus infection
- Respiratory virus infection
- Post-immunisation fever

INVESTIGATIONS

- FBC, CRP & blood culture
- Urinalysis and MC&S (in out catheter preferred collection method because clean catch urine is associated with >25% contamination rate). [3,11]
- Lumbar puncture (LP) if <28 days[10] or clinical concerns for bacterial meningitis and no contraindications*
- Only perform CXR or stool culture if indicated by clinical presentation.
- Consider performing nasal swabs for respiratory viruses [4], rectal swab for enterovirus and parechovirus. In babies under 4 weeks of age, consider neonatal HSV (eye/rectal/throat swabs +- blood +- CSF for HSV PCR)

*Contraindications to LP
Signs suggestive of raised ICP
Shock
Extensive or spreading purpura
Recent seizures
Coagulation abnormalities
Local superficial infection at puncture site
Respiratory insufficiency

ASSESSING SEVERITY [5-9]

Low risk
- >28 days of age and
- Inflammatory markers not raised (CRP<20mg/L)[8] and
- Not unwell appearing and
- Negative urinalysis

Moderate risk
- Age >28 days and Not unwell appearing and
- either inflammatory markers raised (CRP≥20mg/L)[8] and/or positive urinalysis

High Risk
- Infants ≤28 days of age or
- Unwell appearing or
- Comorbidities high risk for serious bacterial infection (immunosuppression, congenital malformations, indwelling devices etc.)

MANAGEMENT [5-9]

Low Risk
- Empirical antibiotics not necessary unless there are specific clinical concerns
- Consider a period of observation to ensure the child remains well
- Discharge with written safety net information

Moderate Risk
- Treat with empirical IV antibiotics as per local/national guidelines whilst awaiting blood and urine cultures. Blood cultures can be reviewed at 24-36 hours (from time of loading onto machine).
- Perform an LP if meningism/irritability (unless contraindications).
- If UTI diagnosed, see UTI pathway. Upper UTI not commonly associated with concomitant meningitis in babies >28 days of age[10]. Perform LP if clinical concerns (meningism / persisting irritability).
- If the child is clinically well, consider ambulating[14] with written safety net advice and clear plans for follow up if no social risk factors**
- If no focus of infection is identified and the child remained well, consider stopping antibiotics at 24 – 48hrs if blood cultures remain negative.[12,13] If strong index of suspicion of invasive bacterial infection (i.e. markedly elevated CRP) and no alternative diagnosis, consider empirical 5 day IVAbx course.

If specific focus of infection confirmed, see relevant guideline for duration of antibiotics and timing of step down from IV to oral therapy.

High Risk

Full septic screen should be considered in any child ≤28 days with fever ≥38°C, unless contraindications for LP. Cultures should be sent prior to commencement of Abx although Abx should not be delayed in the unwell child. Treat with empirical IV antibiotics as per local/national guidelines whilst awaiting culture and sensitivities

- **If unwell looking**, resuscitate according to APLS guidelines, treat with empirical IV antibiotics as per local/national guidelines. Perform an LP if no contraindications. Consider aciclovir if ≤28 days and requiring fluid boluses or CSF pleocytotis (if LP performed). Admit to hospital.
- **If UTI diagnosed**, see UTI pathway. Upper UTI not commonly associated with concomitant meningitis in babies >28 days of age. Perform LP if confirmed UTI in baby ≤28 days or if clinical concerns (meningism / persisting irritability).
- If **meningitis diagnosed,** see meningitis pathway.

If the child is clinically well, consider ambulating with written safety net advice and clear plans for follow up if no social risk factors**:
- If no focus for infection found, and no alternative diagnosis, consider empirical treatment with 5 days of IVAbx if strong index of suspicion of invasive bacterial infection (i.e. markedly elevated CRP, unwell at presentation). If low index of suspicion, stop antibiotics at 24 – 48hrs [10, 11] if blood cultures remain negative.

Other specific foci of infection (i.e. upper UTI, meningitis etc)
- See relevant guideline for duration of antibiotics and timing of step down from IV to oral therapy.

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- Is the home/outpatient environment adequate to support care and safe for all?
- Are there any child protection concerns?
- Is there agreement between families and clinicians regarding treatment and understanding about the commitment required for ambulation/OPAT?
- Are the families able to recognise potential complications and have the means to escalate concerns (e.g. telephone) and return to hospital if needed (e.g. transport)?

REFERENCES

1. Campbell G, Bland RM, Hendry SJ. Fever after meningococcal B immunisation: A case series. *J Paediatr Child* Health. 2019 Aug;55(8):932-937
2. Murdoch H, Wallace L, Bishop J, Robertson C, Claire Cameron J. Risk of hospitalisation with fever following MenB vaccination: self-controlled case series analysis. *Arch Dis Child.* 2017 Oct;102(10):894-898.
3. Tosif S, Baker A, Oakley E, Donath S, Babl FE. Contamination rates of different urine collection methods for the diagnosis of urinary tract infections in young children: An observational cohort study. *J Paediatr Child Health* 2012;48:659–64.
4. Nicholson, E. G., Avadhanula, V., Ferlic-Stark, L., Patel, K., Gincoo, K. E., & Piedra, P. A. (2018). The Risk of Serious Bacterial Infection in Febrile Infants 0-90 Days of Life with a Respiratory Viral Infection. *The Pediatric Infectious Disease Journal*, *38*(4), 1.
5. National Institute for Health and Care Excellence. (2013). *Fever in under 5s: assessment and initial management*. https://www.nice.org.uk/guidance/cg160/resources/fever-in-under-5s-assessment-and-initial-management-pdf-35109685049029
6. Martinez, E., Mintegi, S., Vilar, B., Martinez, M. J., Lopez, A., Catediano, E., & Gomez, B. (2015). Prevalence and Predictors of Bacterial Meningitis in Young Infants With Fever Without a Source. *The Pediatric Infectious Disease Journal*, *34*(5), 494–498.
7. Mintegi, S., Gomez, B., Martinez-Virumbrales, L., Morientes, O., & Benito, J. (2017). Outpatient management of selected young febrile infants without antibiotics. *Archives of Disease in Childhood*, *102*(3), 244–249.
8. Gomez, B., Mintegi, S., Bressan, S., Da Dalt, L., Gervaix, A., & Lacroix, L. (2016). Validation of the "step-by-step" approach in the management of young febrile infants. *Pediatrics*, *138*(2), e20154381–e20154381.
9. Kuppermann, N., Dayan, P. S., Levine, D. A., Vitale, M., Tzimenatos, L., Tunik, M. G., Saunders, M., Ruddy, R. M., Roosevelt, G., Rogers, A. J., Powell, E. C., Nigrovic, L. E., Muenzer, J., Linakis, J. G., Grisanti, K., Jaffe, D. M., Hoyle, J. D., Greenberg, R., Gattu, R., … Mahajan, P. (2019). A Clinical Prediction Rule to Identify Febrile Infants 60 Days and Younger at Low Risk for Serious Bacterial Infections. *JAMA Pediatrics*, *173*(4), 342–351.
10. Nugent, J., Childers, M., Singh-Miller, N., Howard, R., Allard, R., & Eberly, M. (2019). Risk of Meningitis in Infants Aged 29 to 90 Days with Urinary Tract Infection: A Systematic Review and Meta-Analysis. *The Journal of Pediatrics*.
11. Tzimenatos, L., Mahajan, P., Dayan, P. S., Vitale, M., Linakis, J. G., Blumberg, S., Borgialli, D., Ruddy, R. M., Van Buren, J., Ramilo, O., & Kuppermann, N. (2018). Accuracy of the Urinalysis for Urinary Tract Infections in Febrile Infants 60 Days and Younger. *Pediatrics*, *141*(2), e20173068.
12. Theodosiou AA, Mashumba F, Flatt A. Excluding Clinically Significant Bacteremia by 24 Hours in Otherwise Well Febrile Children Younger Than 16 Years. P*ediatr Infect Dis J* 2019;38:e203–8.
13. Biondi EA, Mischler M, Jerardi KE, Statile AM, French J, Evans R, et al. Blood culture time to positivity in febrile infants with bacteremia. *JAMA Pediatr* 2014;168:844–9.
14. Patel S, Abrahamson E, Goldring S et al. Good practice recommendations for paediatric outpatient parenteral antibiotic therapy (p-OPAT) in the UK: a consensus statement. *J Antimicrob Chemother* 2015;70, 360-373.

CHILDREN WITH A FEVER AND PETECHIAL RASH OR PURPURA PRESENTING TO HOSPITAL

PRESENTING FEATURES

Non blanching rash
(any size or formation)

RED FLAGS:
- Appears unwell / haemodynamically unstable
- Rash developing within department
- Purpura (>2mm)

DIFFERENTIALS
- Viral infections such as enterovirus
- Idiopathic thrombocytopaenic purpura (ITP) - will need blood tests to confirm or refute
- Henoch-Schonlein Purpura (HSP) - is a clinical diagnosis with rash normally buttocks and below +/- abdominal pain
- Non accidental injury
- Haematological malignancy

ASSESSING SEVERITY

Yes

Potential evolving Meningococcal Disease or Disseminated Intravascular Coagulation secondary to sepsis

Prompt medical assessment and senior review

[Consider HSP if purpura alone and well appearing]

No

Clear mechanical cause e.g. forceful vomiting, coughing or trauma resulting in a rash in SVC distribution

Yes

INVESTIGATIONS

Blood Tests including FBC, U&Es, Clotting, Meningococcal PCR, CRP, Blood Culture and Blood Gas.

No

Blood Tests may include FBC, U&Es, Clotting, CRP, Blood Culture

Abnormal bloods (inc. CRP≥20mg/L)[2] or clinical deterioration

Normal bloods (inc. CRP<20mg/L)[2]

MANAGEMENT

Oxygen as Required. Escalation of care depending on haemodynamic status.
IV 3rd generation cephalosporin (as per local guidance).

If bloods suggest alternative diagnosis (i.e. ITP, HSP etc), manage as per local protocols.
Consider early ambulation[2] on IVAbx from ED / children's assessment unit (admission avoidance) after 4 hours observation unless:
- Clinical risk factors: haemodynamically unstable
- Social / caregiver risk factors**

Ensure robust clinical governance systems and documentation in place for children being ambulated
Provide verbal and written safety netting information
Review Abx at 36-48 hours. If invasive bacterial infection unlikely / alternative diagnosis, stop Abx. If presumed invasive bacterial infection but cultures+-PCRs –ve, stop Abx after 5 days if clinical improvement and improvement in CRP.

Observe for 4 hours since time of presentation.
Home with clear safety netting advice if bloods and observations reveal no abnormality or concern.
Always discuss with senior if any uncertainty.

Home with clear safety netting advice.
Always discuss with senior if any uncertainty.

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- Is the home/outpatient environment adequate to support care and safe for all?
- Are there any child protection concerns?
- Is there agreement between families and clinicians regarding treatment and understanding about the commitment required for ambulation/OPAT?
- Are the families able to recognise potential complications and have the means to escalate concerns (e.g. telephone) and return to hospital if needed (e.g. transport)?

REFERENCES

1. Waterfield T, Maney J, Fairley D *et al.* Validating clinical practice guidelines for the management of children with non-blanching rashes in the United Kingdom (a PERUKI study). *Lancet Child & Adol* 2020 Accepted for Publication.
2. Patel S, Abrahamson E, Goldring S *et al.* Good practice recommendations for paediatric outpatient parenteral antibiotic therapy (p-OPAT) in the UK: a consensus statement. *J Antimicrob Chemother* 2015;70, 360-373.

Cervical lymphadenitis / LN abscess pathway for children presenting to hospital

DIFFERENTIALS

Acute presentation of unilateral, red, hot, tender neck lump. Often associated with fever.

RED FLAGS:

- Stertor or stridor suggesting airway obstruction
- Difficulty swallowing/drooling
- Muffled speech
- Torticollis (can occur in minor infections but potential sign of retropharyngeal infection)
- Severe respiratory distress
- Haemodynamic instability / sepsis (may require urgent source control)

URGENT senior review and ENT input

Differentials:

1) Infection
   - Bacterial lymphadenitis / LN abscess (more common in children <6 years of age)
   - EBV / CMV infection
   - Bartonella (Cat scratch)
   - Mumps re parotitis
   - TB / non-tuberculous mycobacteria (usually painless, non-tender)
   - Infected congenital cyst such as branchial cyst or lymphangioma
2) Malignancy
3) Kawasaki disease
4) Severe eczema is the commonest cause of generalised lymphadenopathy
5) Sternocleidomastoid tumour in

INVESTIGATIONS

#Evaluating severity of infection:
MILD = systemically well
MODERATE = previous antibiotic failure, systemically unwell or clinical signs suggestive of LN abscess (fluctuant mass).
SEVERE = presence of any red flags

If MILD infection, no investigations required.
If MODERATE / SEVERE infection, for FBC, CRP and blood culture +- throat swab
Consider USS if clinical signs suggestive of LN abscess.
Urgent imaging (USS neck) if severe infection. If retropharyngeal infection suspected, consider urgent CT neck.[2]
In severe cases, ensure airway secure before imaging.

MANAGEMENT

MILD infection – manage with oral antibiotics as per local/national guidelines.

In MILD infection, consider IVAbx if:
- Oral Abx not tolerated/absorbed
- No improvement despite ≥48 hours of adequate oral Abx prescribed in 1° care (source control may be required – consider USS)
- Significant immunosuppression

Choice of antibiotic as per local empirical antibiotic guidelines

MODERATE infection – initially manage with IVAbx as per local empirical antibiotic guidelines. If clinical deterioration despite 24 hours IVAbx or persisting fever/no clinical improvement despite 48 hours IVAbx, arrange urgent USS. If collection, for ENT review and consider incision and drainage. Conservative treatment can be considered in children with small collections (<2.2cm) if no red flag features present.[1,2]
If development of red flags, for urgent ENT review and consider urgent CT neck.[2] Ensure airway secure before imaging.

SEVERE infection – start IVAbx as per local empirical antibiotic guidelines
- Urgent ENT review and consideration of source control (operative management)
- If airway is compromised by swelling, consider emergency measures to secure it
- If evidence of toxin mediated disease, consider adding an antitoxin antibiotic (i.e. clindamycin) and lower threshold for urgent drainage (source control).

Choice of oral Abx as per local guidelines
Total duration of treatment = 7 days
Provide verbal and written safety netting information

Consider ambulation[4] on IVAbx from ED / children's assessment unit (admission avoidance) unless:
- Clinical risk factors: haemodynamically unstable, requirement for drainage
- Social / caregiver risk factors**

Ensure robust clinical governance systems and documentation in place for children being ambulated
Daily review required and provide verbal and written safety netting information
IV to oral switch when:
- Clinically improving +- improving inflammatory markers
- Apyrexial
- If source control (I+D), then early IV to oral switch recommended.
- Total duration of treatment (IV+oral)= 7 days

If clinically deteriorating or remains pyrexial despite antibiotics, consider:
-- Deep seated infection requiring source control; ENT review +- imaging (USS)
- Resistant organism – check risk factors and microbiology results
- Non-infective pathology or unusual infection (consider differentials)

** Social/caregiver risk factors:

Selection involves consideration of patient-specific criteria, such as ability to understand and consent to OPAT, likelihood of compliance, appropriate home circumstances, ability to attend for OPAT, support from family members and safety of visiting healthcare staff

- Is the home/outpatient environment adequate to support care and safe for all?
- Are there any child protection concerns?
- Is there agreement between families and clinicians regarding treatment and understanding about the commitment required for ambulation/OPAT?
- Are the families able to recognise potential complications and have the means to escalate concerns (e.g. telephone) and return to hospital if needed (e.g. transport)?

REFERENCES

1. Luu TM, Chevalier I, Gauthier M, *et al.* Acute adenitis in children: clinical course and factors predictive of surgical drainage. *J Paediatr Child Health*. 2005;41(5-6):273-277. doi:10.1111/j.1440-1754.2005.00610.x
2. Georget E, Gauthier A, Brugel L, *et al.* Acute cervical lymphadenitis and infections of the retropharyngeal and parapharyngeal spaces in children. *BMC Ear Nose Throat Disord*. 2014;14:8. Published 2014 Sep 5. doi:10.1186/1472-6815-14-8.
3. McMullan BJ, Andresen D, Blyth CC, *et al.* Antibiotic duration and timing of the switch from intravenous to oral route for bacterial infections in children: systematic review and guidelines. *Lancet Infect Dis*. 2016;16(8):e139-e152. doi:10.1016/S1473-3099(16)30024-X.
4. Patel S, Abrahamson E, Goldring S *et al.* Good practice recommendations for paediatric outpatient parenteral antibiotic therapy (p-OPAT) in the UK: a consensus statement. *J Antimicrob Chemother* 2015;70, 360-373.

Management of children aged ≥3 months with confirmed meningitis

Confirmed meningitis:
CSF WCC>5
+/- raised CSF protein
+/- low CSF glucose

Immediate empiric antibiotics IV as per local guidelines[1,2]
- Ensure dose maximised for CNS infection
- Dexamethasone if:
  - Purulent CSF
  - CSF WCC>1000
  - Bacteria seen on Gram stain
  - Not indicated if meningococcal disease suspected

INDICATIONS FOR URGENT NEUROIMAGING:
- Reduced GCS
- Symptoms / signs of raised intracranial pressure
- Focal neurology
- Seizures

Confirmed bacterial cause (culture or PCR)
Note: caution with false positive results with BioFire® array panel – esp. pneumococcus.[3] Send sample for confirmatory testing.

No bacterial pathogen identified

Test for viral meningitis (enterovirus / parechovirus can be associated with polymorphonuclear cell predominant CSF pleocytosis)
Consider TB meningitis if lymphocyte predominant CSF, markedly raised protein and low glucose.

MANAGEMENT

- No oral step down: total course IV
- Consider PICC or Midline IV access early, if antibiotic duration likely to be >5 days
- Suggested antibiotic duration for uncomplicated cases[4]:
  - *N. meningitidis* 5-7 days
  - *S. pneumoniae* 10-14 days
  - *H. influenzae* (capsulate) 7-10 days
  - *E. coli* 21 days

Complications of meningitis occur most frequently by days 2–3 and are rare after days 3–4. Fever lasts 5–9 days in 13% of patients. Consider ambulating management if the patient is seizure free and apyrexial for ≥24 h. Be cautious about discharging a child with meningitis before day 5 and if abnormal neurology persists[5-8]

Consider ambulation[5] on IVAbx unless:
- Clinical risk factors: haemodynamically unstable, risk of dehydration
- Social / caregiver risk factors**

Ensure robust clinical governance systems and documentation in place for children being ambulated
Daily review required and provide verbal and written safety netting information

Seek ID/Micro advice if:
- Unusual pathogen (including TB meningitis)
- Infection associated with implantable device
- Clinical/epidemiological features suggestive of TB or imported infection
- Failure to respond to empiric therapy or onset of secondary fever

Causative pathogen not identified, but still considered likely bacterial meningitis:
- Antibiotic duration 10 days[4] (consider stopping antibiotics at 5 days if rapid recovery). Total course IV – no oral step down.
- Consider PICC or Midline IV access early, if antibiotic duration likely to be >5 days

Viral pathogen identified from CSF and clinical picture consistent with viral meningitis:
- Stop antibiotics (if no concomitant bacterial infection)

** Social/caregiver risk factors:

Selection involves consideration of patient-specific criteria, such as ability to understand and consent to OPAT, likelihood of compliance, appropriate home circumstances, ability to attend for OPAT, support from family members and safety of visiting healthcare staff.

- Is the home/outpatient environment adequate to support care and safe for all?
- Are there any child protection concerns?
- Is there agreement between families and clinicians regarding treatment and understanding about the commitment required for ambulation/OPAT?
- Are the families able to recognise potential complications and have the means to escalate concerns (e.g. telephone) and return to hospital if needed (e.g. transport)?

REFERENCES

1. Kim KS. Acute bacterial meningitis in infants and children. *Lancet Infect Dis.* 2010 Jan;10(1):32-42.
2. Sigfrid L, Perfect C, Rojek A, *et al.* A systematic review of clinical guidelines on the management of acute, community-acquired CNS infections. *BMC Med.* 2019 Sep 6;17(1):170.
3. Tansarli GS, Chapin KC. Diagnostic test accuracy of the BioFire® FilmArray® meningitis/encephalitis panel: a systematic review and meta-analysis. *Clin Microbiol Infect.* 2020 Mar;26(3):281-290.
4. NICE guideline: Meningitis (bacterial) and meningococcal septicaemia in under 16s: recognition, diagnosis and management [CG102]. 2010.
5. Patel S, Abrahamson E, Goldring S *et al.* Good practice recommendations for paediatric outpatient parenteral antibiotic therapy (p-OPAT) in the UK: a consensus statement. *J Antimicrob Chemother* 2015;70, 360-373
6. Lin TY, Nelson JD, McCracken GH Jr. Fever during treatment for bacterial meningitis. *Pediatr Infect Dis* 1984; 3: 319–22.
7. Waler JA, Rathore MH. Outpatient management of pediatric bacterial meningitis. *Pediatr Infect Dis* J 1995; 14: 89–92.
8. Marcy MS. Outpatient management of bacterial meningitis. *Pediatr Infect Dis J* 1989; 8: 258–60.

PRE-SEPTAL AND POSTSEPTAL (ORBITAL) CELLULITIS PATHWAY FOR CHILDREN PRESENTING TO HOSPITAL

DIAGNOSIS

- Unilateral eyelid oedema and erythema
- Unilateral eye pain or tenderness

Consider differentials*

***DIFFERENTIALS**

- Neonatal; consider gonorrhoea/ chlamydial infections
- Bilateral findings and/or painless swelling; consider allergic reaction
- Hordeolum (stye)
- Acute blepharitis
- Conjunctivitis
- Angioneurotic oedema
- Insect bite
- Cavernous sinus thrombosis
- If swelling exclusively below eye, consider facial cellulitis or dacrocyctitis. If swelling at cheek level, consider dental origin.

ASSESSING SEVERITY

FACTORS ASSOCIATED WITH INCREASED DISEASE SEVERITY

- Clinical suspicion of orbital cellulitis (see below) or unable to assess eye due to swelling
- Pyrexia
- Immunocompromised
- Worsening despite 36-48 hours of oral antibiotics
- Age >9 years
- If features of sepsis, for urgent senior input / paediatric input

FACTORS ASSOCIATED WITH MILDER DISEASE SEVERITY

- Younger children
- Normal eye assessment
- History of insect bite or mild trauma

CLINICAL SIGNS	POSTSEPTAL (ORBITAL)	PRESEPTAL
Proptosis	Yes	No
Double vision	Yes	No
Eye movements	Painful & restricted	Normal
Vision (acuity, fields, colour)	Worse in severe	Normal
Relative Afferent Pupillary Defect	Yes in severe	Absent i.e. normal
Severe or persistent headache	Yes in severe	No

INVESTIGATIONS

- For MILD preseptal cellulitis, no investigations required.
- FBC, CRP & blood culture
- Endonasal swab
- If clinical suggestion of postseptal (orbital) cellulitis, for senior review and neuroimaging[3] *

***INDICATION FOR IMAGING (AFTER STARTING EMPIRIC ANTIBIOTIC THERAPY)**

Contrast enhanced CT orbit, sinuses and brain if:

- CNS involvement / focal neurology / meningism
- Unable to examine eye/open eyelids
- Clinical signs of postseptal (orbital) cellulitis
- Clinical progression despite 24 hours treatment or no improvement after 48 hours
- Continued pyrexia after 48 hours IV antibiotics

MANAGEMENT

PRESEPTAL CELLULITIS

MILD preseptal cellulitis can be managed with oral antibiotics +- topical decongestant.[1] Provide verbal and written safety netting information. 7 day total antibiotic course.[1]

If significant periorbital swelling or fever, or unable to tolerate/absorb oral Abx, start IVAbx +- topical decongestant as per local empirical antimicrobial guidelines. Daily review whilst on IVAbx[2] – if no improvement after 48 hours, consider neuroimaging. Consider early ambulation[9] on IVAbx from ED / SSU / PAU (admission avoidance) unless:

- Clinical risk factors: haemodynamically unstable, acutely worsening eye signs or concerns about postseptal (orbital) cellulitis
- Social / caregiver risk factors**

Ensure robust clinical governance systems and documentation in place for children being ambulated. Provide verbal and written safety netting information and suggest daily photos taken by parents.

IV to oral switch when clinically improving and apyrexial. Total antibiotic course (IV+oral) = 7 days.[1]

POSTSEPTAL (ORBITAL) CELLULITIS

- If no orbital collection on neuroimaging, manage as pre-septal cellulitis (see above)
- Involve ENT and ophthalmology +- maxfax teams as per local pathways[4] - ENT team for consideration of surgical drainage, ophthalmology for ongoing visual assessment.
- Commence IVAbx and topical decongestants as per local empirical antimicrobial guidelines. If immunocompromised, discuss with microbiology.
- Drainage generally indicated for larger, non-medial subperiosoteal or orbital collections, age >9 years, significant proptosis and restricted eye movements. Small collections can be managed conservatively.[5-8]
- 4 hourly eye & neuro-observations with head of bed elevation.
- Daily ophthalmology review and suggest daily photos taken by parents.
- If no improvement after 48 hours, consider repeat neuroimaging.
- If clinically stable and no risk factors**, consider ambulation[9] on IVAbx. IV to oral switch when clinically improving and apyrexial. Total antibiotic course (IV+oral) = 7-10 days.[1] If CNS complications, prolonged IVAbx course will be required; discuss with paediatric ID/microbiology.
- Provide verbal and written safety netting information

** Social/caregiver risk factors:

Selection involves consideration of patient-specific criteria, such as ability to understand and consent to OPAT, likelihood of compliance, appropriate home circumstances, ability to attend for OPAT, support from family members and safety of visiting healthcare staff.

- Is the home/outpatient environment adequate to support care and safe for all?
- Are there any child protection concerns?
- Is there agreement between families and clinicians regarding treatment and understanding about the commitment required for ambulation/OPAT?
- Are the families able to recognise potential complications and have the means to escalate concerns (e.g. telephone) and return to hospital if needed (e.g. transport)?

REFERENCES

1. McMullan B *et al.* Antibiotic duration and timing of the switch from intravenous to oral route for bacterial infections in children: systematic review and guidelines. *Lancet ID* 2016; 16(8):139-152
2. Tritt A, Kay-Rivest E, Paradis T, Duval M. Daily outpatient intravenous antibiotic therapy for the management of paediatric periorbital cellulitis, a retrospective case series. *Clin Otolayrngol* 2019; 44(3):273–278.
3. Crosbie RA, Nairn J, Kubba H. Management of paediatric periorbital cellulitis: Our experience of 243 children managed according to a standardised protocol 2012-2015. *Int J Pediatr Otorhinolaryngol* 2016; 87:134–8.
4. Amin N, Syed I, Osborne S. Assessment and management of orbital cellulitis. *Br J Hosp Med (Lond)* 2016; 77(4):216–20.
5. Cossack MT, Herretes SP, Cham A, Sniegowski MC, Lyon DB. Radiographic Course of Medically Managed Pediatric Orbital Subperiosteal Abscesses. *J Pediatr Ophthalmol Strabismus* 2018; 55(6):387–392.
6. Le TD, Liu ES, Adatia FA, Buncic JR, Blaser S. The effect of adding orbital computed tomography findings to the Chandler criteria for classifying pediatric orbital cellulitis in predicting which patients will require surgical intervention. JAAPOS. 2014; 18:271–277.
7. Quintanilla-Dieck L, Chinnadurai S, Goudy SL, Virgin FW. Characteristics of superior orbital subperiosteal abscesses in children. *Laryngoscope* 2017; 127(3):735–740.
8. Wan Y, Shi G, Wang H. Treatment of Orbital Complications Following Acute Rhinosinusitis in Children. *Balkan Med J* 2016; 33(4):401–406.
9. Patel S, Abrahamson E, Goldring S *et al*. Good practice recommendations for paediatric outpatient parenteral antibiotic therapy (p-OPAT) in the UK: a consensus statement. *J Antimicrob Chemother* 2015; 70, 360-373

COMMUNITY ACQUIRED PNEUMONIA (CAP) AND EMPYEMA PATHWAY FOR CHILDREN PRESENTING TO HOSPITAL

DIAGNOSIS

Clinical features consistent with CAP include
Cough, fever, breathlessness, tachypnoea, chest recession, crackles /wheeze on auscultation.
Consider differentials*

***DIFFERENTIALS:**
- **Bronchiolitis**
- **Viral induced wheeze**
- **Acute exacerbation of asthma**
- **Croup**
- **Inhaled foreign body**
- **Pertussis**
- **Pneumothorax**
- **Metabolic acidosis e.g. DKA**

ASSESSING SEVERITY

Decision making about antimicrobial therapy, investigation and need for admission is influenced by severity of illness. Features of severe disease# include:
- Significant tachypnoea*
- Significant tachycardia*
- Severe respiratory distress (significant recession (age <12 months), nasal flaring, grunting)
- Apnoeas (ages <12 months)
- Hypoxia (sustained O2 sats ≤92% in room air)
- Cyanosis
- Signs of severe dehydration
- Capillary Refill Time >2 secs

If features of sepsis, for urgent senior input / paediatric input

***Parameters for significant tachycardia / tachypnoea:**
Age <6 months: RR>70, HR>170
Age 6-12 months: RR>70, HR>170
Age 1 year to < 3 years: RR>50, HR>150
Age 3 year to 5 years: RR>50, HR>140
Age 5 year to 14 years: RR>50, HR>120
Age 14 years to 17 years: RR>50, HR>100

INVESTIGATIONS

If no features of severe disease, no investigations routinely indicated.

If features of SEVERE respiratory distress:
- FBC, U&E, creatinine, CRP & blood culture
- Consider respiratory viral testing if diagnosis of bronchiolitis considered
- Consider performing a CXR (AP film), especially if hypoxia or significant respiratory distress. Also consider if no improvement in symptoms despite ≥48 hours of adequate oral Ab therapy.

MANAGEMENT

MILD SEVERITY: child < 5 years with absence of persistent/recurrent fever over preceding 24-48 hours, no respiratory distress and no tachypnoea. **Presence of generalised wheeze makes viral aetiology far more likely.**

→ No antibiotics required
Provide verbal and written safety netting information (under 12 months, ≥12 months)

MODERATE SEVERITY: persistent/recurrent fever over preceding 24-48 hours, respiratory distress and/or tachypnoea

→ Manage with oral antibiotics as per local or national guidelines.[1-7] Total Axb course = 5 days.[1,3]
Provide verbal and written safety netting information (under 12 months, ≥12 months)

Consider IVAbx if:
- Oral Abx not tolerated/absorbed
- No improvement despite ≥48 hours of adequate oral Abx therapy prescribed in 1° care
- Significant immunosuppression, chronic lung or heart disease

SEVERE disease # and/or presence of empyema

Observe in hospital and start antibiotics as per local guidelines.
- consider IV Abx if unable to tolerate orals or complicated pneumonia (empyema/necrotising pneumonia) or significantly immunosuppression

During periods when influenza is known to be circulating locally, consider empirical antiviral therapy in children with risk factors for severe influenza whilst awaiting respiratory virus results (in children requiring PICU/PHDU support, consider empirical antiviral treatment even in children without risk factors whilst awaiting respiratory virus results).
Perform X-Ray and proceed to a chest ultrasound scan if radiological or clinical evidence of effusion. Consider possible complicated pneumonia (including empyema and necrotising pneumonia) if no significant response to antibiotic therapy after 48 hours.
If empyema present, initially manage conservatively unless life threatening respiratory distress or evidence of toxic shock syndrome. If no clinical improvement within 48 hours of IVAbx, repeat USS and consider drainage.
IV to oral switch when clinically improving +/- improving inflammatory markers +/- removal of chest drain (see BTS guidelines https://thorax.bmj.com/content/60/suppl_1/i1).[10, 12]
Total duration of Abs 5 days (unless complicated pneumonia - empyema or necrotising pneumonia – minimum 14 days Abx course).[8,11] Provide verbal and written safety netting information on discharge (under 12 months, ≥12 months)

→ Consider ambulation[13] on IVAbx unless:
- Clinical risk factors: O_2 requirement, haemodynamically unstable, risk of dehydration, need for source control
- Social / caregiver risk factors**

Ensure robust clinical governance systems in place for children being ambulated and appropriate documentation. Daily review required. IV to oral switch when clinically improving +- improving inflammatory markers.
Total Abx course (IV+oral)=5 days[1,3]

→ If no improvement despite 48 hours Abx, consider complicated pneumonia# or alternative non-infective diagnosis.

** Social/caregiver risk factors:

Selection involves consideration of patient-specific criteria, such as ability to understand and consent to OPAT, likelihood of compliance, appropriate home circumstances, ability to attend for OPAT, support from family members and safety of visiting healthcare staff

- Is the home/outpatient environment adequate to support care and safe for all?
- Are there any child protection concerns?

  Is there agreement between families and clinicians regarding treatment and understanding about the commitment required for ambulation/OPAT?
- Are the families able to recognise potential complications and have the means to escalate concerns (e.g. telephone) and return to hospital if needed (e.g. transport)?

REFERENCES

1) NICE guideline: Pneumonia (community-acquired): antimicrobial prescribing [NG138]. 2019.
2) Haider BA, Saeed MA, Bhutta ZA. Short-course versus long-course antibiotic therapy for non-severe community-acquired pneumonia in children aged 2 months to 59 months. *Cochrane Database Syst Rev* 2008; **2:** CD005976.
3) Greenberg *et al*. Short-course Antibiotic Treatment for Community-acquired Alveolar Pneumonia in Ambulatory Children. *Pediatr Infect Dis J* 2014;33:136–142.
4) Atkinson M, Lakhanpaul M, Smyth A, *et al.* Comparison of oral amoxicillin and intravenous benzyl penicillin for community acquired pneumonia in children (PIVOT trial): a multicentre pragmatic randomised controlled equivalence trial. *Thorax* 2007; **62:** 1102–06.
5) Addo-Yobo E, Chisaka N, Hassan M, *et al.* Oral amoxicillin versus injectable penicillin for severe pneumonia in children aged 3 to 59 months: a randomised multicentre equivalency study. *Lancet* 2004; **364:** 1141–48.
6) Hazir T, Fox LM, Nisar YB, *et al.* Ambulatory short-course high-dose oral amoxicillin for treatment of severe pneumonia in children: a randomised equivalency trial. *Lancet* 2008; **371:** 49–56.
7) Lodha R, Kabra SK, Pandey RM. Antibiotics for community-acquired pneumonia in children. *Cochrane Database Syst Rev* 2013; **6:** CD004874.
8) Kusher Oral Antibiotics for Treating Children With Community-Acquired Pneumonia Complicated by Empyema. *Clin Pediatr.* 2019; 58: 1401-1408.
9) Shah *et al.* Intravenous Versus Oral Antibiotics for Post discharge Treatment of Complicated Pneumonia. *Pediatr* 2016; 138 (6).
10) Balfour-Lynn IM, Abrahamson E, Cohen G, et al. BTS guidelines for the management of pleural infection in children. *Thorax* 2005; 60:i1-i21.
11) Stockmann *et al*. Comparative Effectiveness of Oral Versus Outpatient Parenteral Antibiotic Therapy for Empyema. *Hosp Pediatr* 2015; 5 (12): 605-12.
12) Segerer *et al.* Therapy of 645 Children With Parapneumonic Effusion and Empyema—A German Nationwide Surveillance Study. *Pediatr Pulmonol* 2017; 52: 540-547.
13) Patel S, Abrahamson E, Goldring S *et al.* Good practice recommendations for paediatric outpatient parenteral antibiotic therapy (p-OPAT) in the UK: a consensus statement. *J Antimicrob Chemother* 2015;70, 360-373.

Pyelonephritis (PN) / upper UTI pathway for children presenting to hospital

DIAGNOSIS

It can be difficult to differentiate upper from lower UTI especially in younger children. However features suggestive of PN include fever, malaise, vomiting, poor feeding, irritability, loin pain and renal tenderness.[1]

Consider differentials:
1) Lower UTI - dysuria, frequency, urgency and incontinence with a low grade or absent fever
2) Vulvitis/balanitis, dehydration - dysuria without fever
3) Other sepsis https://www.nice.org.uk/guidance/ng143/resources/fever-in-under-5s-assessment-and-initial-management-pdf-66141778137541
4) T1DM- urinary frequency

INVESTIGATIONS

i) For infants and children who are **not toilet trained**: urine cultures should ideally be obtained by TUBC or SPA (data suggest 26% of clean catch urine specimens are contaminated*)[2]
DO NOT send bag urines for culture due to even higher risk of contamination.[2]*
ii) For **toilet trained** children send **correctly performed** clean voided urine samples

Other – blood pressure, electrolytes , CRP and blood culture; LP if <1 month old and consider LP in older children if signs of meningitis.[3,4,5]***
Arrange urgent inpatient renal tract USS if poor urine flow, abdominal or bladder mass, raised creatinine, sepsis, failure to respond to treatment with suitable antibiotics within 48 hours, or infection with non-*E. coli* organisms.[6]

Management

Evidence suggests enteral therapy as effective as initial IV therapy followed by oral switch[7]

Empiric antimicrobial therapy should be initiated immediately after appropriate urine collection (**do not delay IV antibiotics if sepsis suspected**[6])

Initial enteral treatment if [7]
- >3 months old AND clinically stable and not septic
- able to tolerate and absorb enteral antibiotics

Initial IV therapy if: [4 5 6 7]
- sepsis
- <3 months old (pending blood ± CSF culture results)
- ill appearance
- unable to tolerate or absorb enteral antibiotics

Consider initial IV therapy if:
- costovertebral angle tenderness
- Significant immunosuppression
- known urologic abnormality

Choice of oral Abx as per local/national guidelines
Consider risk factors for aminoglycoside toxicity ****
Total duration of antibiotics 7-10 days[6, 7]
Choice of Abx as per local/national guidelines[6]
Provide verbal and written safety netting information

Consider ambulation[8] on IVAbx from ED / children's assessment unit (admission avoidance) unless:
- Clinical risk factors: haemodynamically unstable, unable to tolerate fluids
- Social / caregiver risk factors**

Ensure robust clinical governance systems and documentation in place for children being ambulated
Daily review required and provide verbal and written safety netting information
IV to oral switch (pending blood and urine cultures) when:
- Clinically improving +- improving inflammatory markers
- Apyrexial
- Total duration of treatment (IV+oral) = 7-10 days[6]

If clinically deteriorating or remains pyrexial despite antibiotics, consider:
-- Deep seated infection requiring source control: consider imaging (USS)
- Resistant organism – check risk factors and microbiology results
- Non-infective pathology or unusual infection (consider differentials)

*Urine sample **contamination rates** in children <2 years[2] :

SPA - suprapubic aspiration-1%
TUBC- 12%

Clean catch urine - 26%

***Concomitant UTI and meningitis is uncommon in infants and children 5 weeks old and older.[3]

Bacteraemia in UTI is inversely related to age with most cases under 6 months.[4] [5]

**** Conditions that predispose to aminoglycoside toxicity (BNFc)

1. chronic renal failure or deteriorating renal function
2. chronic liver disease
3. severe cholestasis
4. significant conductive hearing problems
5. vestibular symptoms

** Social/caregiver risk factors:

Selection involves consideration of patient-specific criteria, such as ability to understand and consent to OPAT, likelihood of compliance, appropriate home circumstances, ability to attend for OPAT, support from family members and safety of visiting healthcare staff.

- Is the home/outpatient environment adequate to support care and safe for all?
- Are there any child protection concerns?
- Is there agreement between families and clinicians regarding treatment and understanding about the commitment required for ambulation/OPAT?
- Are the families able to recognise potential complications and have the means to escalate concerns (e.g. telephone) and return to hospital if needed (e.g. transport)?

REFERENCES

1. Lambert H, Coulthard M. *The Child with urinary tract infection.* In: Webb N and Postlethwaite R, editors. Clinical Paediatric Nephrology. 3rd ed. Oxford University Press; 2003.p.197-227.
2. Tosif S, Baker A, Oakley E, *et al.* Contamination rates of different urine collection methods for the diagnosis of urinary tract infections in young children: an observational cohort study. J *Paediatr Child Health* 2012;48(8):659-664.
3. Tebruegge M, Pantazidou A, Clifford V *et al.* The Age-Related Risk of Co-Existing Meningitis in Children with Urinary Tract Infection. *PLoS ONE* 2011;6(11):e26576.
4. Bachur R, Caputo GL. Bacteremia and meningitis among infants with urinary tract infections. *Pediatr Emerg Care* 1995;11:280-4.
5. Pitetti RD, Choi S. Utility of blood cultures in febrile children with UTI. *Am J Emerg Med* 2002;20:271-4.
6. https://www.nice.org.uk/guidance/cg54/resources/urinary-tract-infection-in-under-16s-diagnosis-and-management-pdf-975507490501.
7. Strohmeier Y, Hodson EM, Willis NS *et al*. Antibiotics for acute pyelonephritis in children. Cochrane Database Syst Rev. 2014.
8. Patel S, Abrahamson E, Goldring S *et al.* Good practice recommendations for paediatric outpatient parenteral antibiotic therapy (p-OPAT) in the UK: a consensus statement. *J Antimicrob Chemother* 2015 Feb;70(2):360-73.

Tonsillitis and peritonsillar abscess (quinsy) pathway for children presenting to hospital

DIFFERENTIALS

Acute presentation of inflamed tonsils.
Presence of fever, progressive worsening of symptoms, deviated uvula and trismus suggest possible peritonsillar abscess (quinsy).
Presence of fever, stridor, difficulty swallowing, drooling or torticollis suggest possible deep neck space infection.
Organisms causing tonsillitis include Gp A streptococcus, *Fusobacterium*, EBV and CMV. EBV generally presents non-specifically in younger children and with tonsillitis in children aged 10 years and over.
Non-infectious differentials include acute leukaemia.

RED FLAGS:
- Stertor or stridor suggesting airway obstruction
- Difficulty swallowing/drooling
- Muffled speech
- Torticollis (can occur in minor infections but potential sign of deep neck space infection)
- Severe respiratory distress
- Haemodynamic instability / sepsis (may require urgent source control) or signs of toxic shock syndrome (shock, mucosal erythema, rash, GI symptoms)

URGENT senior review and ENT input

INVESTIGATIONS

Evaluating severity of infection:
MILD = systemically well
MODERATE = systemically unwell (fever, tachycardia and tachypnoea)
SEVERE = presence of any red flags

If MILD infection, no investigations required.
If MODERATE / SEVERE infection#, for FBC, CRP and blood culture, EBV testing (Monospot in child ≥ 5 years, EBV serology in younger child if EBV considered)[2] +- throat swab. If abdominal pain, check LFTs and examine for hepatosplenomegaly.
If peritonsillar abscess (quinsy), ENT team may decide on early aspiration in older children.

If red flags present, urgent senior review and ENT input. Ensure airway secure before imaging performed.

MANAGEMENT

MILD infection – only treat with antibiotics if FeverPAIN * score 4 or 5 or Centor * score 3 or 4[1]

In MILD infection requiring antimicrobial therapy, only consider IVAbx if:
- Oral Abx not tolerated / absorbed

MODERATE infection – consider initial management with IVAbx as per local empirical antibiotic guidelines.

If clinical deterioration despite 24 hours Abx or persisting fever/no clinical improvement despite 48 hours Abx, consider quinsy or retropharyngeal abscess. Arrange ENT review for consideration of imaging +- surgical management (source control).[4-7]

If development of red flags, for urgent ENT review. Ensure airway secure before imaging performed.

SEVERE infection – start IVAbx as per local empirical antibiotic guidelines. Consider stat dose steroids (IV dexamethasone 0.15mg/kg) if signs of airway obstruction.
- Urgent ENT review and consideration of source control (operative management)[8]
- If airway is compromised by swelling, consider emergency measures to secure it including extending supraglottis, nebulaised adrenaline and non-invasive ventilation/nasopharyngeal airway.
- If evidence of toxin mediated disease, consider adding an antitoxin antibiotic (i.e. clindamycin) and lower threshold for urgent drainage (source control).

Important to optimise analgesia.
Oral antibiotics as per local/national guidelines.[1] Total duration of treatment 7 days.[1]
If organomegaly secondary to EBV, advise against contact sports for 4 weeks.
Provide verbal and written safety netting information
If no improvement despite ≥72 hours of adequate oral Abx, consider 2nd line oral Abx therapy as per local guidelines.

Consider ambulation[9] on IVAbx from ED / children's assessment unit (admission avoidance or reduced inpatient stay) unless:
- Clinical risk factors: haemodynamically unstable, risk of dehydration, requirement for drainage
- Social / caregiver risk factors**

Ensure robust clinical governance systems and documentation in place for children being ambulated
Daily review required and provide verbal and written safety netting information

IV to oral switch when:
- Clinically improving +- improving inflammatory markers
- Apyrexial
- If source control (I+D) of peritonsillar abscess, then early IV to oral switch recommended.[3]
- Total duration of treatment (IV+oral) = 7 days (10 days if peritonsillar abscess or retropharyngeal abscess)

If clinically deteriorating or remains pyrexial despite antibiotics, consider:
- Deep seated infection requiring source control; ENT review +- imaging
- Resistant organism – check risk factors and microbiology results
- Non-infective pathology or unusual infection (consider differentials)

*FeverPAIN score
• Fever, purulence, attend within 3 days or less, severely Inflamed tonsils, no cough or coryza
1 point for each

Centor score
• Tonsillar exudate, tender anterior cervical lymphadenopathy or lymphadenitis, history of fever (>38°C), no cough
1 point for each

** Social/caregiver risk factors:

Selection involves consideration of patient-specific criteria, such as ability to understand and consent to OPAT, likelihood of compliance, appropriate home circumstances, ability to attend for OPAT, support from family members and safety of visiting healthcare staff.

- Is the home/outpatient environment adequate to support care and safe for all?
- Are there any child protection concerns?
- Is there agreement between families and clinicians regarding treatment and understanding about the commitment required for ambulation/OPAT?
- Are the families able to recognise potential complications and have the means to escalate concerns (e.g. telephone) and return to hospital if needed (e.g. transport)?

REFERENCES

1) NICE guideline sore throat (acute): antimicrobial prescribing [NG84]Published date: 26 January 2018 . https://www.nice.org.uk/guidance/ng84.
2) Marshall-Andon T, Heinz P. How to use the Monospot and other heterophile antibody tests. Archives of Disease in Childhood - *Education and Practice* 2017;102:188-193.
3) Sexton DG, Babin RW. Peritonsillar abscess: a comparison of a conservative and a more aggressive management protocol. *Int J Pediatr Otorhinolaryngol* 1987; **14:** 129–32.
4) Lamkin RH, Portt J. An outpatient medical treatment protocol for peritonsillar abscess. *Ear Nose Throat J* 2006; **85:** 658–60.
5) Al-Sabah B, Bin Salleen H, Hagr A, Choi-Rosen J, Manoukian JJ, Tewfi k TL. Retropharyngeal abscess in children: 10-year study. *J Otolaryngol* 2004; **33:** 352–55.
6) McClay JE, Murray AD, Booth T. Intravenous antibiotic therapy for deep neck abscesses defined by computed tomography. *Arch Otolaryngol Head Neck Surg* 2003; **129:** 1207–12.
7) Page C, Biet A, Zaatar R, Strunski V. Parapharyngeal abscess: diagnosis and treatment. *Eur Arch Otorhinolaryngol* 2008; **265:** 681–66.
8) Kirse DJ, Roberson DW. Surgical management of retropharyngeal space infections in children. *Laryngoscope* 2001; **111:** 1413–22.
9) Patel S, Abrahamson E, Goldring S *et al*. Good practice recommendations for paediatric outpatient parenteral antibiotic therapy (p-OPAT) in the UK: a consensus statement. *J Antimicrob Chemother* 2015;70, 360-373.