The treatment of URTIs and otitis media in children

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Despite the majority of infections being viral and self-limiting, children are still frequently prescribed antibiotics for upper respiratory tract infections (URTIs) and acute otitis media. This article discusses how to assess whether an antibiotic is appropriate and when referral to secondary care may be necessary.

The term upper respiratory tract infection (URTI) refers to infection of the upper respiratory tract, which includes the nasal passages, pharynx, larynx, trachea and sinuses. URTIs, which encompass the common cold, acute pharyngitis, laryngitis, tonsillitis and sinusitis, are extremely commonly in children and account for a substantial proportion of primary care consultations within the UK. The majority of URTIs are caused by several families of viruses including: rhinovirus, coronavirus, parainfluenza, respiratory syncytial virus (RSV), adenovirus, human metapneumovirus and influenza, and are usually self-limiting.

Symptomatic URTI with cough in school children typically occurs around 7–10 times per year.

Acute otitis media (AOM), defined by NICE as middle ear effusion associated with acute onset of symptoms and signs of middle ear inflammation, occurs frequently in children as a complication of URTI when inflammation of the upper airway extends from the nasopharynx to the ear through the Eustachian tube.

Children are predisposed to AOM due to the shorter length of their Eustachian tubes, which are more horizontal and more prone to obstruction by enlarged adenoids. Approximately 10% of children will have had an episode of AOM by three months of age, and by three years of age, approximately 50–85% will have experienced at least one episode.

Diagnosis and assessment

Differentiating acute bacterial URTIs from viral can be challenging since 20–40% of children diagnosed with acute sinusitis based on clinical criteria likely have a viral URTI. NICE recommends that all children presenting to primary care with a history suggestive of an URTI or AOM should be offered a full clinical assessment.

Where possible, clinicians should attempt to determine a specific diagnosis; see Table 1, taken from the British Thoracic Society’s guidance for the assessment and management of cough in children. Children under three months of age presenting with fever should be referred to hospital for assessment...
by a paediatrician as per the NICE feverish illness in children guidance (see Table 2). The Centor clinical predictor tool was originally developed for use in adults and consists of four criteria: presence of fever, tender anterior cervical lymph node, tonsillar exudate and absence of cough. The presence of three or four of these clinical signs indicates a 40–60% chance of group A Streptococcus infection and hence the patient may benefit from antibiotic treatment. In clinical practice, the Centor criteria can be an ineffective predictor of bacterial tonsillitis in children and is rarely used. In children, the presence of fever and tonsillar exudate alone is a strong indicator of bacterial tonsillitis. Although NICE does not advocate routine use of throat swabs, they can be useful to exclude a diagnosis of bacterial tonsillitis in children and reduce inappropriate prescribing of antibiotics.

Public Health England (PHE)’s 2016 guidance on managing common infections in primary care now recommends the use of the Fever PAIN score. The Fever PAIN score was derived from a cohort study including 1760 adults and children aged three years and over, which concluded that use of the score resulted in more rapid symptom resolution and reduced prescribing of antibiotics. The score consists of five items: fever during previous 24 hours, purulence, attend surgery rapidly (less than three days), very inflamed tonsils and no cough/coryza. Fever PAIN score of 0–1: only 13-18% have Streptococcus, close to background carriage, therefore a no antibiotic strategy is appropriate with discussion.

| Question                                                                 | Features                                                                 | Likely common diagnosis                                                                 |
|--------------------------------------------------------------------------|--------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| Is this an upper respiratory tract infection?                            | Coryzal symptoms                                                          | Simple cold with cough suggesting presence of some degree of tracheitis and/or bronchitis |
| Is this a croup syndrome?                                                | Stridor with associated ‘barking’ or ‘croupy cough’; in milder cases only barking cough may be present | Viral croup Recurrent spasmodic croup                                                    |
| Are there any features to suggest a lower respiratory tract illness?    | Tachypnoea, respiratory distress with increased work of breathing, chest signs (crackles/wheeze) and fever | Pneumonia Bronchiolitis                                                                   |
| Is there anything to suggest an inhaled foreign body?                   | Very sudden onset or witnessed choking episode                            | Inhaled foreign body                                                                     |
| Is there anything to suggest acute pollinosis?                          | Cough with other features of ‘hay fever’ in pollen season; this cough is often described as a ‘clearing the throat’ cough | Allergic rhinitis cough True coughing may suggest allergic tracheobronchial inflammation |
| Is there anything to suggest that this is presentation of a chronic respiratory disorder? | Failure to thrive, finger clubbing, overinflated chest, chest deformity, features of atopy | Asthma Cystic fibrosis Immune deficiencies Tuberculosis Interstitial lung disease Retained inhaled foreign body |

Table 1. Questions to be addressed to arrive at a specific diagnosis of acute cough

Patients unable to tolerate oral medications or those with complications such as acute epiglottitis should be referred to hospital.

A diagnosis of AOM is usually made clinically where symptoms may include pain (ear tugging in young children), fever, irritability, and problems feeding and sleeping. Otoscopic appearances typical of AOM include bulging tympanic membrane, with loss of normal landmarks, red or yellow in colour, and poor mobility. NICE guidance recommends admission for paediatric assessment of all children under three months of age with a temperature of 38°C or more and children with suspected acute complications of AOM such as meningitis, mastoiditis or facial nerve paralysis.

Treatment options

There is currently no national clinical guideline in the UK relating to antibiotic prescribing in primary care for URTIs that are likely to be self-limiting. The main emphasis of management is symptom relief of fever, nasal congestion and coughing.
Children <2 years of age with difficulty breathing, stridor/hoarse voice, drooling, or signs of epiglottitis or diphtheria: following symptoms suggestive of these conditions:

- Severe suppurative complications (e.g., peritonsillar abscess or cellulitis, parapharyngeal abscess, retropharyngeal abscess, mastoiditis or Lemierre syndrome)
- Stridor or breathing difficulties
- Suspected Kawasaki disease
- Dehydration or reluctance to take fluids
- Severe suppurative complications (e.g., peritonsillar abscess or cellulitis, parapharyngeal abscess, retropharyngeal abscess, mastoiditis or Lemierre syndrome)

**Immediate antibiotic prescription**

- Children who are systemically unwell
- Children presenting with the following symptoms suggestive of epiglottitis or diphtheria: fever/chills, severe sore throat, stridor/hoarse voice, drooling, difficulty breathing

Table 2. Criteria for referral or immediate antibiotic prescription[^9^-^11]

**Antipyretics and analgesics**

Although the safety profiles of antipyretics and analgesics such as paracetamol and ibuprofen are good and the side-effects minimal, NICE recommends that these agents should only be used in children to reduce fever that is associated with pain or distress, and stress the importance of avoiding unnecessary use of these agents in children with self-limiting viral illness[^10].

Parents and carers should be advised that paracetamol or ibuprofen alone may be used if the child appears to be distressed or in pain; use of paracetamol and ibuprofen in combination is not recommended, since the clinical benefit is considered to be too small. Parents and carers may be advised to switch to the alternative medication if the child’s distress is not alleviated.[^16]

Clinicians should ensure parents and carers have a clear understanding of the dosage and frequency of administration of these products and that counselling on the appropriate measuring device (e.g., spoon or oral syringe) is provided.

**Over-the-counter cough and cold preparations**

Following initial concerns raised in the USA, in 2009 the Medicines and Healthcare products Regulatory Agency (MHRA) conducted a review of the risks and benefits associated with the use of over-the-counter (OTC) cough and cold medications in children under 12 years of age. The review found no robust evidence to support the use of the medications listed below in children under six years of age. Given that these medications can cause side-effects such as allergic reactions, effects on sleep and hallucinations, the balance of risk versus benefit was not shown to be favourable and the advice is that these medications should no longer be used in children under six years of age:[^17]

- Nasal decongestants (pseudoephedrine, ephedrine, phenylephrine, oxymetazoline and xylometazoline)
- Antihistamines (diphenhydramine, chlorphenamine, brompheniramine, promethazine, triprolidine and doxylamine)
- Antitussives (dextromethorphan and pholcodine)
- Expectorants (guaifenesin and ipecacuanha).

Products for children aged 6 to 12 years of age containing these ingredients are still available for purchase from pharmacies, with clearer advice on the packaging. Following this, in 2010 the MHRA also reviewed the use of OTC cough and cold medications containing codeine for use in children. These medications are no longer recommended for use in children and young people under the age of 18 years.[^18]

For younger children, saline nose drops can loosen dried nasal secretions and relieve congestion. Parents and carers can also be advised to try ticking the child’s nose with a cotton bud to cause sneezing to clear the nose. Although advice to use steam inhalation is still occasionally given in primary care, there is no evidence of effectiveness and reports of mild thermal injury are well documented. This treatment option should therefore be discouraged.[^19] Parents and carers should be advised to ensure their child rests and remains adequately hydrated.

**Antibiotic prescribing**

It is estimated that 90% of URTIs are self-limiting and caused by viruses, hence antibiotic use remains contentious.[^20] Despite little evidence of benefit, antibiotic prescribing for children with uncomplicated URTIs remains widespread in the UK, with approximately 33% of childhood consultations for URTI resulting in an antibiotic prescription.[^21][^22]

Unnecessary antibiotic prescribing contributes to the increasing burden of antimicrobial resistance, which is a major public health concern. Parents’ or carers’ concerns and expectations should be determined and addressed, and clinicians should consider the risks versus benefits of antibiotic prescribing. The NICE guidance on the prescribing of antibiotics for respiratory tract infections concludes that there is good evidence that antibiotics are of limited efficacy in treating the majority of URTIs and AOM in adults and children.[^8] Delayed prescription of antibiotics is recommended in international guidance; NICE and PHE currently recommend using a strategy of either no antibiotic prescribing or delayed antibiotic prescribing for the management of uncomplicated sore throat and other URTIs.
in children over three months of age once the child has had a thorough clinical examination of the tonsils.\textsuperscript{9,21}

Unnecessary antibiotic prescribing within primary care is partly due to the inability to exclude bacterial infection. Rapid point-of-care (POC) tests that can be performed within the duration of a GP consultation could assist clinicians with the decision to prescribe antibiotics in the future. Rapid antigen tests that detect the presence of \textit{Group A Streptococcus} antigen on a throat swab are currently available but they have poor sensitivity and hence have little impact on prescribing decisions.\textsuperscript{11}

Where antibiotic treatment is deemed necessary for suspected bacterial tonsillitis, NICE and PHE recommend treatment with a 10-day course of phenoxymethylpenicillin. For children with a true penicillin hypersensitivity, treatment with a five-day course of clarithromycin or erythromycin is recommended. Macrolides have a broader spectrum of activity than phenoxymethylpenicillin and thus are more likely to drive the emergence of bacterial resistance.\textsuperscript{11,13,23} Phenoxymethylpenicillin remains the antibiotic of choice for suspected bacterial tonsillitis, based on a combination of its proven efficacy, narrow spectrum, safety and cost effectiveness.\textsuperscript{11,13} Phenoxymethylpenicillin is available in a child-friendly suspension formulation (125mg/5ml or 250mg/5ml) and tablet formulation (250mg) for those children who are able to swallow. Dosage frequency is four times a day, ideally on an empty stomach. Phenoxymethylpenicillin is not particularly palatable, making compliance in children difficult. Amoxicillin and other broad-spectrum antibiotics are not recommended for empiric treatment of sore throats in children; however, if adherence to phenoxymethylpenicillin is likely to be an issue, these alternatives may be considered, providing there is no possibility of glandular fever.\textsuperscript{11} Antibiotic dosing recommendations are outlined in Table 3.

Where antibiotic treatment is deemed necessary for suspected AOM, NICE and PHE recommend treatment with a five-day course of amoxicillin. For children with a true penicillin hypersensitivity, treatment is with a five-day course of clarithromycin or erythromycin.\textsuperscript{4,13,23} Amoxicillin is effective against the likely bacterial pathogens involved in AOM, including \textit{Haemophilus influenzae}, \textit{Streptococcus pneumoniae}, \textit{Streptococcus pyogenes}, and \textit{Moraxella catarrhalis}.\textsuperscript{4} Macrolides have less activity against \textit{H. influenzae} than amoxicillin.\textsuperscript{4} Azithromycin may be associated with greater development of resistance than the other macrolides, owing to its greater half-life, and is therefore not recommended despite the possibility of increased adherence with its once-daily regimen.\textsuperscript{21} Amoxicillin is available as a child-friendly suspension formulation (125mg/5ml or 250mg/5ml) and capsule formulation (250mg or 500mg) for those children who are able to swallow. Dosage frequency is three times daily (with or without food), which allows for doses to be administered at home for children attending nursery or school. Amoxicillin is generally well tolerated by children, with diarrhoea, nausea and vomiting being the most common side-effects along with skin rash. The suspension is also fairly palatable. Antibiotic dosing recommendations are outlined in Table 3.

Although clarithromycin suspension is twice the price of erythromycin suspension, it is still often considered the preferred macrolide for treatment in children with confirmed penicillin allergy owing mainly to its reduced side-effect profile and reduced dosage frequency. Like amoxicillin, clarithromycin is also available as a child-friendly suspension formulation (125mg/5ml or 250mg/5ml) and tablet formulation (250mg or 500mg) for those children who are able to swallow. Dosage frequency is twice daily, making clarithromycin a more practical option than erythromycin, which has a dosage frequency of four times daily. Clinicians should be aware of potential drug interactions and take care when prescribing macrolides.

Most antibiotic suspensions will require storage in the refrigerator once reconstituted, and parents and carers should

| Antibiotic | Neonate 7–28 days | Child 1 month – 1 year | Child 1–6 years | Child 6–12 years | Child 12–18 years |
|------------|-------------------|-----------------------|----------------|-----------------|-----------------|
| Phenoxymethylpenicillin | 30mg/kg 3 times daily | 125mg 3 times daily | 250mg 3 times daily | 500mg 3 times daily, increased if necessary in severe infections up to 1g 3 times daily |
| Amoxicillin | 7.5mg/kg twice daily | 125mg 4 times daily | 250mg 4 times daily | 500mg 4 times daily, increased if necessary in severe infections up to 1g 4 times daily |
| Clarithromycin | 7.5mg/kg twice daily | 125mg 4 times daily | 250mg 4 times daily | 500mg 4 times daily, increased if necessary in severe infections up to 1g 4 times daily |
| Erythromycin | 12.5mg/kg 4 times daily | 125mg 4 times daily | 250mg 4 times daily | 500mg 4 times daily, increased if necessary in severe infections up to 1g 4 times daily |

Table 3. Antibiotic dosing recommendations\textsuperscript{11,23}
be advised to shake the bottle before giving each dose and to space doses as evenly as possible throughout the child’s waking day. Clinicians should ensure parents and carers are given advice on the natural history of the illness and they should be reminded of the importance of ensuring all antibiotic doses are given and the course is completed. Antibiotic liquids can be administered using either the measuring spoon provided or an oral syringe. For babies, parents and carers should be advised to administer doses down the side of the cheek and avoid mixing doses with feeds, as in the event that the whole dose is not taken, this may result in only a proportion of the dose being administered. For children attending nursery/school, a twice daily or three-times daily antibiotic regimen may be preferable to avoid needing to administer a dose during the nursery/school period. Administration of medicines in nurseries/schools can be complex and if medications are required to be administered, they will need to be in their original containers and clearly labelled with the child’s name and administration instructions.

Summary

URTIs are common in childhood but are usually viral and self-limiting. The mainstay of management is symptom relief with simple analgesics. There is no evidence of benefit for the use of OTC cough and cold preparations and these should not be recommended. Despite the predominantly viral cause, children are frequently prescribed antibiotics for the treatment of URTIs and AOM. Inappropriate prescribing of antibiotics contributes to the increasing prevalence of antimicrobial resistance, which is recognised as a major threat to public health. NICE and PHE recommend three antibiotic prescribing strategies for children presenting to primary care with symptoms of an uncomplicated URTI or AOM: no prescribing, delayed prescribing and immediate prescribing. The prescribing strategy should be decided based on the child’s clinical presentation and should take into account any risk factors. Where the decision is made not to prescribe antibiotics, parents and carers should be offered reassurance that antibiotics are not required as they are unlikely to make a difference and may potentially cause side-effects. They should be advised to return if symptoms worsen or become prolonged.

References

1. Fahey T, et al. Systematic review of the treatment of upper respiratory tract infection. Arch Dis Child 1998;79:225–30.
2. Cotton MF, et al. Management of upper respiratory tract infections in children. S Afr Fam Pract 2004;50(2):6–12.
3. Shields MD, et al. British Thoracic Society guidelines: Recommendations for the assessment and management of cough in children. Thorax 2008;63(Suppl. 3):i11–i15.
4. National Institute for Health and Care Excellence. Clinical Knowledge Summaries. Otitis media – acute. July 2015. Available from: https://cks.nice.org.uk/otitis-media-acute
5. Kalu SU, et al. Clinical spectrum of acute otitis media complicating upper respiratory tract viral infection. Pediatr Infect Dis J 2011;30(2):95–9.
6. Forgione S, et al. Management of acute otitis media. Paediatr Child Health 2009;14(7):457–60.
7. Venekamp RP et al. Antibiotics for acute otitis media in children. Cochrane Database Syst Rev 2015;6:CD000219.
8. Shaikh N, et al. Signs and symptoms that differentiate acute sinusitis from viral upper respiratory tract infection. Pediatr Infect Dis J 2013;32(10):1061–5.
9. National Institute for Health and Clinical Excellence. Respiratory tract infections (self-limiting): prescribing antibiotics. CG69. July 2008. Available from: https://www.nice.org.uk/guidance/cg69
10. National Institute for Health and Care Excellence. Fever in under 5s: assessment and initial management. CG160. May 2013. Available from: https://www.nice.org.uk/guidance/cg160
11. National Institute for Health and Care Excellence. Clinical Knowledge Summaries. Sore throat – acute. July 2015. Available from: https://cks.nice.org.uk/sore-throat-acute
12. Roggen I, et al. Center criteria in children in a paediatric emergency department: for what it is worth. BMJ 2013;3(3):e002712.
13. Public Health England. Management of infection guidance for primary care for consultation and local adaptation. May 2016. Available from: https://www.gov.uk/government/publications/managing-common-infections-guidance-for-primary-care
14. Fever PAIN clinical score. https://ctu1.phc.ox.ac.uk/feverpain/index.php [Accessed 20 January 2017]
15. Scottish Intercollegiate Guidelines Network (SIGN). Diagnosis and management of childhood otitis media in primary care – A national clinical guideline. SIGN 66. Edinburgh: SIGN, February 2003. Available from: http://www.sign.ac.uk/pdf/sign66.pdf
16. National Institute for Health and Care Excellence. Clinical Knowledge Summaries. Feverish children – management. September 2013. Available from: https://cks.nice.org.uk/feverish-children-management
17. Medicines and Healthcare products Regulatory Agency (MHRA). Over-the-counter cough and cold medicines for children. April 2009. Available from: https://www.gov.uk/drug-safety-update/over-the-counter-cough-and-cold-medicines-for-children
18. Medicines and Healthcare products Regulatory Agency (MHRA). Codeine for cough and cold: restricted use in children. April 2015. Available from: https://www.gov.uk/drug-safety-update/codeine-for-cough-and-cold-restricted-use-in-children
19. Little P, et al. Ibuprofen, paracetamol, and steam for patients with respiratory tract infections in primary care: pragmatic randomised factorial trial. BMJ 2013;347:f6041.
20. Kutty N. Treating children without antibiotics in primary healthcare. Oman Med J 2011;26(5):303–5.
21. Little P, et al. Delayed antibiotic prescribing for respiratory tract infections in primary care: pragmatic, factorial, randomised control trial. BMJ 2014;348:g1606.
22. Easton G, Saxena S. Antibiotic prescribing for upper respiratory tract infections in children: how can we improve? London J Prim Care 2010;3(1):37–41.
23. British Medical Association and Royal Pharmaceutical Society. British National Formulary for Children. September 2016–17. https://www.bnf.org/

Declaration of interests

None to declare.

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