Respiratory infections in childhood

To use antibiotics or not?

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Respiratory tract infections are the most common infections of childhood but are, in the main, caused by common viruses and result in a relatively benign course. The great majority can be managed by simple, supportive measures. Recourse to antibiotics is often unnecessary and, indeed, encourages antibiotic resistance that is fast becoming the greatest microbiological challenge of the 21st century. This article will outline the key features of common childhood respiratory infections and indicate the appropriateness, or otherwise, of antibiotics for each individual infection.

Introduction

Respiratory tract infections constitute the greatest 'illness burden' in childhood, virtually affecting all age groups but especially infants and pre-school children. They account for up to 30% of general practice consultations [1] and, worldwide, they result in 15 million deaths per annum in those below the age of five years. [2] Although most children will have between 2-4 upper respiratory tract infections per year, the vast majority of these will have a viral aetiology and are self-limiting. Nevertheless, they constitute a significant workload in primary practice and have important implications for pharmaco-prescribing. Others such as otitis media and pustular tonsillitis, though generally benign, may lead to secondary complications and, finally, a small minority such as epiglottitis and pneumonia may be serious from the outset. The crux of good medical practice is to differentiate between the benign and the potentially problematic, and intervene appropriately. In practice, this will translate into simple supportive measures in the great majority and aggressive intervention, including antibiotics, in just a few. This article will attempt to outline the clinical and identifying features of the more common respiratory infections affecting children beyond the neonatal period, and will provide simple guidelines for their management.

Respiratory infections

Types of respiratory infections

Respiratory infections can be conveniently divided into upper and lower infections, and may be caused by viral, bacterial and other organisms as shown in Table 1.

Upper respiratory tract infections

Nasopharyngitis

This constitutes the common cold, presenting with the coryzal syndrome of snuffles (rhinorrhoea), sneezing, cough and a low-grade fever. Involvement of the glottic area results in 'laryngitis' with pain and a hoarse voice. The vast majority (>75%) of infections are viral and self-limiting after 3-5 days. [3] Simple measures including paracetamol for temperature control and attention to regular fluid intake are indicated (Table 2). Oral decongestants/ antitussive medications with or without nasal decongestant drops are of doubtful value though they commonly result in behavioural problems. Antibiotics are grossly over prescribed in this setting, in Malta and elsewhere, and are only indicated if: (i) symptoms persist beyond 5-7 days; (ii) there is a marked purulent nasal discharge (may imply secondary streptococcal infection), and (iii) with signs of systemic deterioration with or without complications (e.g. otitis media or pneumonia).

Sinusitis

Sinusitis is uncommon in preschool children when the facial sinuses are

Table 1: Causes of respiratory tract infections		
Respiratory infections	**Upper tract**	**Lower tract**
Viral causes	rhinoviruses adenoviruses influenza A+B parainfluenza respiratory syncytial virus Ebstein-Barr virus coxsackie A+B echoviruses	influenza A+B respiratory syncytial virus cytomegalovirus human immuno- deficency virus measles virus* varicella*
Bacterial causes	streptococci spp. *S. pneumoniae* *H. influenzae* staphylococci spp.	*S. pneumoniae* streptococci spp. staphylococci spp. *H. influenzae* *B. pertussis* klebsiella spp.** pseudomonas spp.**
Other causes	mycoplasma	mycoplasma *P. carinii** fungal spp.*

* especially in the immunosuppressed patient.
** especially with underlying respiratory disease (e.g. cystic fibrosis).

still relatively underdeveloped. Children with sinusitis generally present with fever, headache, local tenderness, nasal stuffiness and catarrh that may be purulent. The majority are viral but secondary bacterial infection occurs in about 2-5%.[4] The latter include pneumococci, streptococci, Haemophilus and sometimes staphylococci. In the latter situations, antibiotics (beta lactam ± clavulanic acid, or a cephalosporin or macrolide[4]) are also indicated, together with analgesics, antipyretics and general supportive measures (Table 2).

Tonsillitis

Acute tonsillitis is very common, generally resulting in more systemic upset than nasopharyngitis with pain, higher fever, catarrh and cough, usually associated with cervical lymphadenopathy. Most are due to viruses but around 30-40% may be bacterial (usually streptococcal), when a pustular or exudative appearance may be more marked. The latter is, however, not diagnostic for bacterial versus viral tonsillitis and it is therefore reasonable to prescribe antibiotics for 5-7 days if the child is systemically unwell with pus on the tonsils. Conversely, the absence of pus does not exclude some bacterial infections and, again if systemic upset is present, antibiotics such as beta lactams, cephalosporins or, if allergic, a macrolide could be used (Table 2).

Otitis

Otitis externa presents with a sero-purulent discharge and erythema of the external canal with little in the way of systemic upset. In the majority, local cleansing and topical antibiotic drops will suffice.

Otitis media commonly complicates acute tonsillitis or nasopharnygitis and results in acute pain, high fever, nausea and vomiting and general irritability. Ear pulling or rubbing is not a particularly reliable sign, especially in toddlers. Inspection of the tympanic membrane during otostopy is resisted due to pain but will demonstrate dullness/redness of the

Table 2: Respiratory tract infections in childhood: aetiology and need for intervention				
Infection	**Incidence**	**Aetiology**	**Morbidity**	**Intervention**
Upper				
Nasopharyngitis	very common	V>>B	minimal	supportive ±Ab**
Sinusitis	very common	V>>>B	mild	supportive±Ab
Tonsillitis	common	V>>B	mild	supportive±Ab
Otitis externa	common	V=B	minimal	supportive±Ab
Otitis media	common	V=B	moderate	supportive+Ab
Laryngobronchitis	common	V>B	moderate/severe	supportive/intensive
Epiglottitis	very rare	B	severe	intensive+Ab
Lower				
Tracheitis	uncommon	B>V	moderate/severe	supportive/intensive+Ab
Pneumonia (lobar)	less common	B>>V	moderate/severe	supportive/intensive+Ab
Bronchopneumonia*	less common	B=V	moderate/severe	supportive/intensive+Ab
Empyema	rare	B	severe	intensive+Ab

Ab=antibiotics; V=viral; B=bacterial (including mycoplasma).
*includes RSV bronchiolitis.
**Supportive measures include paracetamol for temperature, attention to regular fluid intake, oral decongestants/antitussives ± nasal decongestant drops.

drum sometimes with vesicles. Fluid and air bubbles may be visible behind the drum that may perforate spontaneously to release pus.
Up to 50% of cases are caused by *S. pneumoniae* and other bacteria which infect the upper airway (Table 1). Supportive measures, adequate analgesia and a short 5-day course of antibiotics (beta lactam or macrolide) are indicated (Table 2), although reports of antibiotic resistance are increasing.[5]

Laryngotracheobronchitis

Commonly known as '**croup**', larnygotracheobronchitis is a common condition affecting children between the ages of 6 months to 4 years and is usually caused by parainfluenza, influenza and RSV viruses. A mildly febrile, coryzal prodrome of 1-3 days is followed by a deterioration with a barking/hacking cough, hoarseness and stridor. Significant airway swelling may lead to obstruction with hypoxia causing irritability, distress and eventually exhaustion. Most cases resolve before reaching this stage and may be treated with paracetamol and fluids. A short 3-day course of oral or rectal steroids may help to reduce the upper airway oedema.[6] Simple decongestants/antitussives may offer some relief but humidifiers and humidification tents have not been shown to be effective. Those with signs of respiratory embarrassment should be referred to hospital with urgency where nebulised adrenaline may buy time until the airway can be secured (Table 2).

Epiglottitis

This serious infection, caused by *H. influenzae,* is now extremely rare since the advent of the Hib vaccine. Children would present with a short, rapidly deteriorating history with general 'toxicity', fever, stridor and increasing respiratory compromise. The ill looking stridulous child, drooling at the mouth and assuming a position with forward neck extension should raise alarm bells and prompt urgent referral to hospital. Nebulised adrenaline and oxygen are the mainstay of initial therapy pending intubation (by the most experienced operator available), followed by intravenous fluids and a third generation cephalosporin (Table 2).

Lower respiratory tract infections

Lower respiratory tract infections (LRTIs) are less common but more likely to result in serious complications when compared with URTIs (Table 3). Furthermore, they are more likely to be caused by bacterial agents and the indication for adding antibiotics to the treatment regimen is clearly greater.

Tracheitis

Severe tracheitis is a rare, serious infection involving the main airway in childhood that results in generalised debility, copious pus in the trachea and airway compromise. Staphylococci are often to blame and treatment entails respiratory support, intravenous fluids and anti-staph antibiotics (flucloxacillin, aminoglycosides).

Pneumonia

A **lobar pneumonia** complicating an URTI should be suspected when the symptoms do not subside after a week or so, particularly in those with persistent lethargy, high, swinging fevers and a productive cough. Clinical focal signs may be difficult to illicit, especially in young children and, whenever there is any doubt, this would be an indication for a 'screening' chest X-ray. Most are due to *S. pneumoniae*, followed by mycoplasma and other bacteria (streptococci, staphylococci, Haemophilus, etc). It is difficult to differentiate between bacterial pneumonias and 'atypicals' due to mycoplasma and, for this reason, current guidelines dictate that all cases where either agent may be responsible are treated with dual antibiotics including a beta lactam or cephalosporin and a macrolide for at least 10 days, half of which is administered intravenously. [7] Physiotherapy, fluids and antipyretics complete the treatment regimen. Staphylococcal and streptococcal pneumonias may be complicated by lung abscesses, air leaks, effusions, empyemas or pneumatocoeles and may require surgical drainage. Recurrent, refractory or unusual pneumonias may indicate an underlying disorder affecting the respiratory tract such as cystic fibrosis, immune or congenital defect.

Bronchopneumonia presents with a similar clinical picture but produces diffuse crepitations throughout both lung fields, confirmed by patchy non-focal changes on X-ray. Infecting causes include bacterial and atypical organisms (as per lobar pneumonias), as well as opportunistic organisms such as fungal species, certain viruses (measles and varicella) and pneumocystis carinii. The latter are almost invariably seen in children with an immune defect or those undergoing immunosuppressive therapy (e.g. cancer chemotherapy).

Table 3: Complications of URTI and LRTIs

Complication	URTI	LRTI
General	Fever, debility, poor feeding	Fever, debility, poor feeding
Secondary infection	Otitis media *Mastoiditis* *Retropharyngeal abscess* *Meningitis* *Septicaemia*	Lung abscess Septicaemia *Empyema*
Others	Febrile convulsions Chronic otitis media *Airway compromise* *Glomerulonephritis* *Rheumatic fever*	Febrile convulsions Pleural effusions Air leaks *Pneumatocoeles* *Bronchiectasis*

Complications in italics are rare.

Table 4: Recommendations for antibiotic usage in URTI and LRTIs		
Infection	**Most common organism**	**First line antibiotic**
Upper		
Nasopharyngitis	75% viral;	Nil
	20% Gp A strep	Penicillin V or clarithromycin
Sinusitis	95% viral;	Nil
	2% *S. pneumoniae, H. influenzae*	Amoxycillin & clavulanic acid; macrolide; cephalosporin
Tonsillitis	60% viral	Nil
	40% *S. pneumoniae*, streptococci, *H. influenzae*	Beta lactam, cephalosporin, macrolide
Otitis media	50% viral;	Nil
	50% *S. pneumoniae*, streptococci, *H. influenzae*	Beta lactam, cephalosporin, macrolide
Laryngobronchitis	parainfluenza, influenza, RSV	Nil
Epiglottitis	95% *H. influenzae*	3rd generation cephalosporin
Lower		
Tracheitis	*S. aureus,* streptococci	Flucloxacillin, vancomycin, aminoglycoside
Pneumonia	*S. pneumoniae*, mycoplasma	Beta lactam or cephalosprin + macrolide
Bronchiolitis	RSV	Nil
Pertussis	*B. pertussis*	Macrolide

Bronchiolitis is a specific, generalised bronchopneumonia usually due to RSV infection in 70% of cases, which affects infants and pre-school children particularly during late autumn to early spring. Children present with a minimal fever but have a 'spluttering' cough, copious catarrh and increasing respiratory distress often with widespread wheezing. Oxygen and ventilatory support is required in those with significant respiratory compromise - the majority may benefit from bronchodilatation therapy, as well as supportive measures, with or without simple decongestants. Steroids have been shown to confer some benefit in those who are severely ill and require ventilation, whereas antibiotics are only indicated for secondary bacterial super-infection. [8]

Pertussis

Concerns with pertussis vaccines in the 1970s led to inadequate uptake of this vaccine and suboptimal herd immunity. As a result, pertussis is still prevalent and may cause a severe generalised pneumonia, especially in young infants yet to be immunised. Apart from general supportive measures, antibiotics effective against Bordetella pertussis such as macrolides are prescribed since they may shorten the period of excretion and risk to others. [9] There is little evidence that they alter the course of the primary illness.

Empyema

This arises when a pleural effusion, generally associated with an underlying lobar pneumonia, becomes secondarily infected to form a large collection of pus between the lung and chest wall. The empyema may become loculated and will require prolonged anti-staph. and anti-strep. intravenous antibiotics, plus repeated chest drains and/or surgical interventions before resolution.

Conclusion

In summary, most URTIs are viral in origin and simply require supportive therapy without antibiotics. Indeed, widespread inappropriate prescribing in this situation has contributed significantly to the development of antibiotic resistance and is irresponsible. When antibiotics are indicated, they should be used in accordance with guidelines that are evidence-based. Guidelines for antibiotic usage should target the most likely pathogen, take into account current resistance patterns and the results of well-conducted clinical trials, as well as the safety profile, ease of administration and patient tolerance of the antibiotic in question. On this basis, Table 4 outlines the current recommendations for the use of antibiotics in the more common respiratory tract infections of childhood.

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