Reducing unnecessary antibiotic use in respiratory tract infections in children

-a secondary care perspective

Dr Conor Doherty
(Consultant in paediatric infectious diseases and immunology GGC)
• Current recommendations
• Changing epidemiology of RTI’s
• Risks of not giving antibiotics
• Spotting the child who need antibiotics
Respiratory tract infections - antibiotic prescribing

Implementing NICE guidance

2008
NGC69 Recommendations: Antibiotic prescribing options - 1

A no antibiotic prescribing strategy or a delayed antibiotic prescribing strategy should be agreed for most patients with the following conditions:

- Acute otitis media
- Acute sore throat/acute pharyngitis/acute tonsillitis
- Common cold
- Acute rhinosinusitis
- Acute cough/acute bronchitis
NGC69 Recommendations: Antibiotic prescribing options - 2

Immediate antibiotic prescribing and/or further investigation/management should only be offered to adults and children in the following situations:

– If the patient is systemically very unwell
– If the patient has symptoms and signs of serious illness and/or complications
– If the patient is at high risk of serious complications because of pre-existing comorbidity
NCG 69 Recommendations: Antibiotic prescribing options - 3

Depending on clinical assessment of severity, patients in the following subgroups can also be considered for immediate antibiotics:

- Children younger than 2 years with bilateral acute otitis media
- Children with otorrhoea who have acute otitis media
- Patients with acute sore throat/acute pharyngitis/acute tonsillitis when three or more Centor criteria are present
NCG 69 Recommendations:
When no antibiotic prescribing is agreed

Offer patients:

– Reassurance that antibiotics are not needed immediately

– Signs of worsening

– A clinical review if the condition worsens or becomes prolonged
The changing epidemiology
Finland: changes in infectious diseases mortality over 3 decades

(Pediatr Infect Dis J 2013;32: e355–e359)


Streptococcus Pneumonia

- Capsule - major virulence factor
- Over 90 different capsular types have been characterised
- Prior to PCV 80% of invasive infections in children were caused by eight to ten capsular types

- Most freq cause of bacteraemia (community acq) and meningitis
- Major cause of morbidity/mortality
- Particularly problematic in under 2’s, immunocompromised, asplenics
Streptococcus Pneumonia

Health Protection England Data

Cumulative weekly number of reports of Invasive Pneumococcal Disease due to any of the thirteen serotypes in Prevenar™: Children aged <2 years in England and Wales by epidemiological year July-June (2006 - to date)

Introduction of Prevenar™
GREEN LINE Week 36 2006

Introduction of Prevenar13™
RUST LINE Week 13 2010
Impact of pneumococcal conjugate vaccines on childhood otitis media in the United Kingdom

Vaccine 33 (2015) 5072–5079
Risks of not giving antibiotics

Current Opinion in Infectious Disease 2010, 23: 242-8

• AOM and mastoiditis risk

Antibiotics halved the risk of mastoiditis. General practitioners would need to treat 4831 otitis media episodes with antibiotics to prevent 1 child from developing mastoiditis. (Ped 2009 123(2):424-30)

• Tonsillitis and peritonsillar abscess

Risk of 3.9/10000 vs 4.9 per 10,000 if not given antibiotics i.e. Not giving antibiotics would result in 1 additional case per 10,000 children with tonsillitis (BMJ 2007; 335:982)

• URTI and pneumonia

Risk of pneumonia of children treated with antibiotics for URTI was 5.7 per 10,000 vs 8.8 per 10,000 for those not treated i.e. Not prescribing antibiotics for those presenting with URTI’s would result in additional 3.1 cases of pneumonia per 10,000 (BMJ 2007; 335:982)
Spotting the vulnerable child

- The very young
- The unimmunised
- Immunocompromised
- Significant co-morbidities
The very young ( < 3 months)

Pregnancy and immunity
• Immune system functionally immunodeficient at birth
• Move from sterile environment to pathogenic
• ‘immunosuppressive’ environment of womb moving to ‘dampened’ responsiveness to avoid inflammatory responses to benign/harmless ag’s
• Increased susceptibility to pathogens and reduced responses to vaccines in neonates

Transfer of protection
• Immunoglobulin – IgG – predom in third trimester
• Breast-feeding
Maternal and child undernutrition: global and regional exposures and health consequences

Robert E Black, Lindsay H Allen, Zulfiqar A Bhutta, Laura E Caulfield, Mercedes de Onis, Majid Ezzati, Colin Mathers, Juan Rivera, for the Maternal and Child Undernutrition Study Group

<table>
<thead>
<tr>
<th>Outcome</th>
<th>0-5 months</th>
<th>6-23 months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Predominant breastfeeding</td>
<td>Partial breastfeeding</td>
</tr>
<tr>
<td>All cause mortality</td>
<td>1.48 (1.13–1.92)²⁴ ¹⁸ ³⁴ ³⁹</td>
<td>2.85 (1.59–5.10)²⁴ ¹⁸ ³⁴ ³⁹</td>
</tr>
<tr>
<td>Diarrhoea mortality</td>
<td>2.28 (0.85–6.11)²⁴ ¹⁸</td>
<td>4.62 (1.81–11.77)²⁴ ¹⁸</td>
</tr>
<tr>
<td>Pneumonia mortality</td>
<td>1.75 (0.48–6.43)²⁴ ³³</td>
<td>2.49 (1.03–6.04)²⁴ ¹¹</td>
</tr>
<tr>
<td>Diarrhoea incidence</td>
<td>1.26 (0.81–1.95)²</td>
<td>3.04 (1.32–7.00)²</td>
</tr>
<tr>
<td>Pneumonia incidence</td>
<td>1.79 (1.29–2.48)²</td>
<td>2.48 (0.23–27.15)²</td>
</tr>
</tbody>
</table>

Data are point estimate (95% CI), references.

Table 4: Relative risk of suboptimum breastfeeding (compared with exclusive breastfeeding from 0 to 5 months and any breastfeeding from 6 to 23 months)
<table>
<thead>
<tr>
<th>Age Group</th>
<th>Respiratory Rate</th>
<th>Heart Rate</th>
<th>Systolic Blood Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newborn</td>
<td>30 - 50</td>
<td>120 - 160</td>
<td>50 - 70</td>
</tr>
<tr>
<td>Infant (1-12 months)</td>
<td>20 - 30</td>
<td>80 - 140</td>
<td>70 - 100</td>
</tr>
<tr>
<td>Toddler (1-3 yrs.)</td>
<td>20 - 30</td>
<td>80 - 130</td>
<td>80 - 110</td>
</tr>
<tr>
<td>Preschooler (3-5 yrs.)</td>
<td>20 - 30</td>
<td>80 - 120</td>
<td>80 - 110</td>
</tr>
<tr>
<td>School Age (6-12 yrs.)</td>
<td>20 - 30</td>
<td>70 - 110</td>
<td>80 - 120</td>
</tr>
<tr>
<td>Adolescent (13+ yrs.)</td>
<td>12 - 20</td>
<td>55 - 105</td>
<td>110 - 120</td>
</tr>
</tbody>
</table>

Severity scoring and children

pneumonia.wmv
Development and internal validation of a clinical rule to improve antibiotic use in children presenting to primary care with acute respiratory tract infection and cough: a prognostic cohort study

- 8394 children aged between 3 months and 16 years presenting with acute cough

- Outcome was hospital admission within 30 days (n=78) not confirmed bacterial infection (27% of all discharge summaries were suggestive of possible bacterial cause)

No evidence of assoc between hosp admission and prescription of antibiotics 32% vs 37%

<table>
<thead>
<tr>
<th>Data source</th>
<th>Odds ratio</th>
<th>95% CI</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current asthma‡</td>
<td>Notes review</td>
<td>3.93</td>
<td>2.20-7.03</td>
</tr>
<tr>
<td>Inter and substernal recession</td>
<td>Clinician</td>
<td>3.82</td>
<td>2.23-6.62</td>
</tr>
<tr>
<td>Age of child (&lt;2 years)</td>
<td>Parent</td>
<td>3.42</td>
<td>2.12-5.58</td>
</tr>
<tr>
<td>Illness duration (&lt;4 days)</td>
<td>Parent</td>
<td>2.77</td>
<td>1.77-4.35</td>
</tr>
<tr>
<td>Moderate-to-severe vomiting in the last 24 h§</td>
<td>Parent</td>
<td>2.56</td>
<td>1.54-4.31</td>
</tr>
<tr>
<td>Wheeze</td>
<td>Clinician</td>
<td>2.16</td>
<td>1.28-3.60</td>
</tr>
<tr>
<td>Body temperature &gt;37.8°C or parent-reported severe fever in the last 24 h</td>
<td>Clinician or parent</td>
<td>1.99</td>
<td>1.22-3.25</td>
</tr>
</tbody>
</table>

*Model includes 8340 (99.4%) of 8394 cohort participants; the original model intercept coefficient was -6.65 (95% CI -7.21 to -6.10), suggesting that the probability of hospital admission for children with no predictors was 0.14%. †Odds ratios calculated using shrunken estimates from the bootstrap internal validation calibration slope. §Defined as present if asthma in medical notes and asthma drugs issued in the previous 12 months. $Including after cough.

Table 2: Final multivariable* predictors of hospitalisation (all p<0.01)
Mnemonic **STARWAVE** distinguished 3 hospital admission strata:

- **S**: Short duration i.e. < 3 days
- **T**: Temperature i.e. T > 37.8 or parent reported severe fever in last 24hrs
- **A**: Age i.e. < 24 months
- **R**: Recession
- **W**: Wheeze
- **A**: Asthma
- **V**: Vomiting

If antibiotic prescription in low risk group halved, remained static in the mid risk group and increased to 90% in the high risk group then overall there would be a 10% drop in prescribing.

- ≤ 1 point: 0.3% chance of admission
- 2-3 points: 1.5% chance of admission
- ≥ 4 points: 12% chance of admission
Bronchiolitis

1 in 3 under 1’s will develop clinical bronchiolitis

2-3% of all infants will require hospitalisation

Clinical diagnosis: coryzal illness followed by persistent cough, tachypnoea, chest recession & wheeze or crackles
NG9 (2015) Bronchiolitis

Do not use any of the following to treat bronchiolitis in children:

- antibiotics
- hypertonic saline
- adrenaline (nebulised)
- salbutamol
- montelukast
- ipratropium bromide
- systemic or inhaled corticosteroids

Red Flags

- worsening work of breathing (for example grunting, nasal flaring, marked chest recession)
- fluid intake is 50–75% % of normal or no wet nappy for 12 hours
- apnoea or cyanosis
- exhaustion (for example, not responding normally to social cues, wakes only with prolonged stimulation)
NG9 (2015) Bronchiolitis
Safety netting

When caring for your child at home, you need to know these important signs and if they may be getting worse so you can get help as quickly as you can:

• breathing becoming harder work – this may mean they're making an 'effort noise' every time they breathe out (often called grunting), flaring their nostrils, their chest might 'suck in' between the ribs, or they may use their stomach to breathe
• not taking in enough feeds (half to three quarters of normal, or no wet nappy for 12 hours) – these are signs they might be dehydrated
• pauses in their breathing for more than 10 seconds (apnoea)
• skin inside the lips or under the tongue turning blue (cyanosis)
• exhaustion (not responding as they usually would, sleepy, irritable, floppy, hard to wake up).
Antibiotics and RTI’s in children

To give

.. Or not to give

- Allergies/ Side effects/ Cost
- Not protective of complics
- Cycle of expectation
- Clinically ineffective

- Severity of presentation
- Co-morbidities
- Fear of clinical status changing rapidly