Assessment and Management of Acute Respiratory Illness in Childhood

Dr Des Cohen
Paediatric Assessment Triangle
• Acute Assessment using Paediatric Assessment Triangle
• Viral croup
• Bronchiolitis
• Bronchial asthma
Paediatric Assessment Triangle

- Appearance
- Breathing
- Circulation
Appearance

• Colour
  – Pale
  – Cyanosed
• Tone
  – Floppy, weak
• Altered mental status
  – Unfocussed, unresponsive
• Cry
  – Weak, hoarse, stridulous
• Speech
  – Single words or sentences
General Observations

- Heart rate  > 140
- Respiratory rate  > 60
- Pulse oxymetry
  - Oxygen saturation 90 to 93% may suggest hypoxemia
  - <90% suggests significant tissue hypoxemia. Often cyanosed
<table>
<thead>
<tr>
<th>Age group</th>
<th>Respiratory rate</th>
<th>Heart rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Median (1st-99th percentile)</td>
<td>Median (1st-99th percentile)</td>
</tr>
<tr>
<td>0-3 months</td>
<td>43 (25-66)</td>
<td>143 (107-181); term newborn at birth: 127 (90-164)</td>
</tr>
<tr>
<td>3-5 months</td>
<td>41 (24-64)</td>
<td>140 (104-175)</td>
</tr>
<tr>
<td>6-9 months</td>
<td>39 (23-61)</td>
<td>134 (98-168)</td>
</tr>
<tr>
<td>9-12 months</td>
<td>37 (22-58)</td>
<td>128 (93-161)</td>
</tr>
<tr>
<td>12-18 months</td>
<td>35 (21-53)</td>
<td>123 (88-150)</td>
</tr>
<tr>
<td>18-24 months</td>
<td>31 (19-46)</td>
<td>116 (82-149)</td>
</tr>
<tr>
<td>2-3 years</td>
<td>28 (18-38)</td>
<td>110 (76-142)</td>
</tr>
<tr>
<td>3-4 years</td>
<td>25 (17-33)</td>
<td>104 (70-136)</td>
</tr>
<tr>
<td>4-5 years</td>
<td>23 (17-29)</td>
<td>98 (65-131)</td>
</tr>
<tr>
<td>5-8 years</td>
<td>21 (16-27)</td>
<td>91 (59-123)</td>
</tr>
<tr>
<td>8-12 years</td>
<td>19 (14-25)</td>
<td>84 (52-115)</td>
</tr>
<tr>
<td>12-15 years</td>
<td>18 (12-23)</td>
<td>78 (47-108)</td>
</tr>
<tr>
<td>15-18 years</td>
<td>16 (11-22)</td>
<td>73 (43-104)</td>
</tr>
</tbody>
</table>

* The respiratory and heart rates provided are based upon measurements in awake, healthy infants and children at rest. Many clinical findings besides the actual vital sign measurement must be taken into account when determining whether a specific vital sign is normal in an individual patient. Values for heart rate or respiratory rate that fall within normal limits for age may still represent abnormal findings that are caused by underlying disease in a particular infant or child.  

BREATHING

• Airway sounds
  – Stridor, wheeze, grunting

• Positioning
  – Maximize airway opening
    • Sniffing, Tripod position

• Accessory muscle use causes retractions
  – Suprasternal, Intercostal, substernal
  – Head bobbing, nasal flaring

• Respiratory Rate > 60
Child with classic presentation of acute epiglottitis

This four-year-old girl has epiglottitis caused by *Haemophilus influenzae* type b.

(A) She prefers to sit and appears anxious.
(B) The child assumes the characteristic sniffing position to maximize the patency of her airway.

CIRCULATION

• Inadequate perfusion and/or hypoxemia
  – Pallor
  – Cyanosis
  – Cool extremities
  – Poor capillary refill > 3 sec

• Tachycardia
  – Heart Rate >140
<table>
<thead>
<tr>
<th></th>
<th>MILD</th>
<th>MODERATE</th>
<th>SEVERE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Normal</td>
<td>Some irritability</td>
<td>Increasing irritability lethargy, pallor and unresponsiveness</td>
</tr>
<tr>
<td>Resp Rate</td>
<td>Normal</td>
<td>Increased</td>
<td>Increased or markedly decreased as child tires</td>
</tr>
<tr>
<td>Heart rate</td>
<td>N or slight increase</td>
<td>Mild increase</td>
<td>Significant increase or bradycardia</td>
</tr>
<tr>
<td>Signs increase WOB</td>
<td>Minimal or none</td>
<td>Moderate</td>
<td>Marked accessory muscle use with chest retractions</td>
</tr>
<tr>
<td>Oxygenation</td>
<td>Sats &gt; 93%</td>
<td>Sats 90 to 93%</td>
<td>Cyanosis</td>
</tr>
</tbody>
</table>
Assessment and Management

• Croup
• Bronchiolitis
• Acute Asthma
VIRAL CROUP

Assessment and Management
VIRAL CROUP (LTB)

• Common childhood upper airway disorder caused by viral infection resulting in inflammation and varying degrees of upper airway obstruction

• Clinical diagnosis

• Classical symptoms include barking cough, stridor, hoarse voice and respiratory distress
Risk factors for severe croup

• Pre existing narrowing of upper airway
  – Downs Syndrome
  – Subglottic stenosis
• Previous admissions for severe croup
• <6 months of age
<table>
<thead>
<tr>
<th></th>
<th>MILD</th>
<th>MODERATE</th>
<th>SEVERE</th>
<th>LIFE THREAT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>APPEARANCE</strong></td>
<td>Normal mental state</td>
<td>Anxious, tired</td>
<td>Agitated, exhausted, pale</td>
<td>Confused, drowsy</td>
</tr>
<tr>
<td><strong>STRIDOR</strong></td>
<td>Stridor only when crying</td>
<td>Stridor at rest</td>
<td>Stridor at rest</td>
<td>Stridor at rest</td>
</tr>
<tr>
<td><strong>BREATHING</strong></td>
<td>NIL</td>
<td>MILD</td>
<td>MARKED</td>
<td>MAXIMAL</td>
</tr>
<tr>
<td>accessory muscle use</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>retractions or tug</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>HEART RATE</strong></td>
<td>Normal</td>
<td>Increased</td>
<td>Markedly increased</td>
<td>Markedly increased or falling</td>
</tr>
<tr>
<td><strong>OXYGEN SATURATIONS</strong></td>
<td></td>
<td></td>
<td>Hypoxemia is a late sign of</td>
<td>Cyanosed</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>significant upper airway</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>obstruction</td>
<td></td>
</tr>
</tbody>
</table>
Investigations

• NPA, X-Ray and Blood tests NOT usually indicated
• May distress child and worsen symptoms
• CLINICAL DIAGNOSIS
DD for Croup

- Inhaled foreign body
- Epiglottitis
- Bacterial tracheitis
- Retropharyngeal abscess
MANAGEMENT

• Allow child to adopt position of comfort
• Corticosteroids
• Nebulised adrenaline
• Oxygen
Corticosteroids

- Oral Prednisolone 1mg/kg 12hourly up to 4 doses. Takes 1 hour to work
- Oral Dexamethasone 0.3mg/kg
- Nebulised Budesonide 2mg if cannot take a steroid orally or if vomiting. Usually effective in 30 minutes
Nebulised Adrenaline

- 1:1000 0.5ml/kg undiluted
- Use Oxygen to drive nebuliser if available
- Rapid onset of action
- Lasts approx 2 hours. May be safely repeated
- Safe to administer at surgery while awaiting ambulance transfer
Treatment by Severity

• **MILD**
  – ? Steroid
  – Home with info sheet

• **MODERATE**
  – Prednisolone 1mg/kg
  – Reassess after 1 hour
  – Home if good response i.e. no significant airway obstruction
  – ? further doses of steroid
  – Hospitalise if poor response to treatment
Management

• **SEVERE**
  – Oxygen if sats < 90%
  – Nebulised adrenaline
  – Prednisolone
  – Hospital by ambulance
3: Presentation with croup: two typical case scenarios

Scenario 1: A child with mild croup presents to a general practitioner at 10 am

“James”, a 20-month-old boy, is brought to a GP with a barking cough, slight fever and hoarse voice. He has had a restless night. There is a family history of croup but this is James’s first episode of croup and his mother is anxious. There is no significant past medical history. On examination, James is playful, smiling and interactive. He has a typical “seal bark” cough but no audible stridor. His chest is clear on auscultation, there is no tracheal tug or chest-wall recession, and his respiratory rate is normal. He has mild croup and needs no immediate treatment. His mother asks whether James will get worse tonight. The GP replies that it is possible, and discusses with James’s mother the arguments for and against giving a single dose of oral corticosteroid.
FOR Corticosteroid

- Will reduce even mild symptoms
- Will reduce risk of hospital attendance or readmission
- Safe as a single dose
- Relatively easy to administer
AGAINST corticosteroid

• Mild symptoms do not require treatment
• Before the popularisation of corticosteroids the risk of hospitalisation was low (approx 1 in 80)
• Reduction in reattendance within a week after a single dose of OCS given in an ED is small. Need to treat 12 children to prevent one reattendance
• No RCT’s on interventions for croup in a primary care setting
Summary of important points

- Croup is characterised by a barking cough, stridor with or without the presence of respiratory distress
- Assessment of A, B, C focusing on airway is paramount in managing croup
- Take care not to cause the child undue distress
- Mild/moderate croup -- give prednisolone 1mg/kg and review in 1 hour
- Severe or life threatening croup -- give oxygen, 4ml of 1:1000 adrenaline via nebuliser and send to hospital by ambulance
Bronchiolitis

- Viral lower respiratory tract infection
- Children under 12 months age.
- 12 to 24 months overlap with possible asthma
- Present with increased WOB ? apnoea
- Widespread wheeze and crackles
- Reduced oxygen saturations
- Decreased feeding
- Peak severity day 3 to 4 of illness with resolution over 7 to 10 days
- May cough for weeks
Assessment of Severity

• Basic Observations
  – RR > 60
  – HR > 140
  – O2 sats < 93% = hypoxia
  – Temp > 38.5 may indicate toxicity

• General Appearance
  – Alert and Interactive OR Lethargic and Tired

• Feeding

• Hydration

• Degree of Respiratory Difficulty

• Oxygenation
<table>
<thead>
<tr>
<th></th>
<th>MILD</th>
<th>MODERATE</th>
<th>SEVERE</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPEARANCE</td>
<td>Normal</td>
<td>Some irritability</td>
<td>Increasing irritability Lethargy, fatigue</td>
</tr>
<tr>
<td>RESPIRATORY EFFORT</td>
<td>Mild chest wall retractions</td>
<td>Moderate retractions, tug, flaring</td>
<td>Marked retractions, tug grunting</td>
</tr>
<tr>
<td>RESPIRATORY RATE</td>
<td>Normal</td>
<td>Slight increase RR &gt;60</td>
<td>Marked increase RR &gt;70</td>
</tr>
<tr>
<td>FEEDING</td>
<td>Normal</td>
<td>50 to 75%</td>
<td>&lt; 50%</td>
</tr>
<tr>
<td>OXYGEN SATS</td>
<td>&gt;93%. No oxygen requirement</td>
<td>90 to 93%. Mild hypoxemia which is corrected by oxygen</td>
<td>&lt;90%. May not be corrected by oxygen</td>
</tr>
<tr>
<td>APNOEA</td>
<td>None</td>
<td>Brief episodes</td>
<td>Increasing or prolonged</td>
</tr>
</tbody>
</table>
Apnea in infants <4 months
Sharp, dry cough
Cyanosis or pallor
Hyperinflation of the chest:
- sternum prominent
- liver displaced downwards
Subcostal and intercostal recession
Auscultation:
- fine end-inspiratory crackles
- prolonged expiration
Investigation

• Generally not helpful
• Chest x-ray if diagnostic uncertainty
  – Localised signs on auscultation
  – Heart murmur with signs of CCF
• NPA
  – ? Severe cases for infection control
• FBC, Cultures if toxic
Treatment

• Supportive
  – Oxygenation
  – Hydration
  – Minimal handling

• Nebulised hypertonic saline (3%) or adrenaline may improve clinical scores and decrease length of hospital stay

• Do Not Use
  – Bronchodilators
  – Antibiotics
  – Oral Corticosteroids
Management

• MILD
  – No Investigation
  – Home
  – More frequent, smaller feeds
  – Saline nose drops
  – Advise re course of illness and provide info sheet
  – Review in 2 to 3 days

• MODERATE and SEVERE disease will require hospital admission
  – Oxygenation
  – Hydration
Indications for Hospitalisation

- Appearance – Lethargic. Poor feeding <50% usual feeds. Dehydration
- Moderate to severe resp distress
  - Nasal flaring, retractions, RR >70/min, cyanosis
  - Apnoea
  - Hypoxemia O2 Saturations < 93%
- Unable to be cared for at home
- PLUS -- consider risk factors for potentially more severe disease
Risk Factors for Severe Disease

- Prematurity (gestational age < 37 weeks)
- Age < 6 weeks
- Chronic lung disease eg BPD, CF
- Anatomic defect of the airways
- Congenital heart disease
- Neurologic disease
- Immunodeficiency
Key Points

• Majority of cases are mild and readily managed in general practice
• Only 1 to 2% require hospitalisation
• Oxygenation and maintenance of hydration form the mainstay of treatment
• 10% of hospitalised infants will require ICU admission for respiratory support
Bronchial Asthma
ASTHMA

• Chronic inflammatory disease of the lower airways characterised by reversible airway obstruction and bronchospasm

• Exacerbations in children are often triggered by viral infections

• In children < 12 months of age with wheeze consider diagnosis of Bronchiolitis especially if widespread crackles
Pathology of Asthma

Normal airway

Asthmatic airway

Asthmatic airway during attack

Relaxed smooth muscles

Wall inflamed and thickened

Tightened smooth muscles

Air trapped in alveoli
Clinical Evaluation

- Assessment of severity. How sick is the child?
- Which drugs to use
- Optimal dosing and delivery
Assessment of severity

• Brief focused history
• Focused examination
History

• Time onset exacerbation
• Current medication and allergies
• Recent use of beta2 agonists
• Risk factors for severe disease
  – Frequent ED visits
  – Hospital and ICU admissions
  – Rapid progression
  – Recurrent use OCS
Examination

• **Appearance**
  – Level of consciousness, agitation, anxiety

• **Breathing**
  – wheeze, air entry, accessory muscle use and retractions

• **Circulation**
  – Vital signs
  – Pulse oxymetry
<table>
<thead>
<tr>
<th>Assessed severity</th>
<th>MILD</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altered consciousness</td>
<td>No</td>
<td>No</td>
<td>Agitated</td>
</tr>
<tr>
<td>Accessory muscle use</td>
<td>No</td>
<td>Minimal</td>
<td>Moderate</td>
</tr>
<tr>
<td>Oxymetry</td>
<td>&gt;94%</td>
<td>90 to 94%</td>
<td>&lt;90%</td>
</tr>
<tr>
<td>Talks in</td>
<td>Sentences</td>
<td>Phrases</td>
<td>Words</td>
</tr>
<tr>
<td>Wheeze</td>
<td>Variable</td>
<td>Moderate to Loud</td>
<td>Often quiet</td>
</tr>
<tr>
<td>Pulse Rate</td>
<td>Normal</td>
<td>Mild to moderate tachycardia</td>
<td>Moderate to marked tachycardia</td>
</tr>
<tr>
<td>Central Cyanosis</td>
<td>No</td>
<td>No</td>
<td>Likely</td>
</tr>
</tbody>
</table>
Early Signs and Symptoms of Acute Exacerbations

- Increasing wheeze and dyspnoea
- Increase cough esp. night-time
- Increasing bronchodilator requirement
- Decreased exercise tolerance
- Impairment of daily activities eg. Feeding
Investigations

- **Chest x-ray**
  - Rarely of value
  - Consider if
    - Severe disease
    - Temp >39C
    - Focal auscultatory findings? Pneumonia? FB

- **Peak Flow**
  - > age 6

- **ABG**
  - Not very helpful.
  - Pain, stress
  - Increasing CO2 levels
Treatment goals

• Rapid reversal bronchospasm
  – Inhaled bronchodilator
  – Systemic corticosteroids
• Correct hypoxemia. Maintain O2 sats > 92%
• Intensify baseline therapy to prevent recurrence
Bronchodilators

- Inhaled beta 2 agonist
  - Mainstay of acute treatment
  - Nebuliser vs MDI-S
    - < 5 years  2.5 mg nebuliser equiv to 6 puffs salbutamol via MDI-S.
    - > 5 years  5.0mg = 12 puffs
    - Favour nebuliser for more severe exacerbations
- Ipratropium (Atrovent) combined with beta2 agonist in moderate to severe asthma
- IV Magnesium SO4 if other bronchodilators fail
  - Decrease smooth muscle contraction as well as histamine and acetyl choline release
- Aminophylline IV
(A) Girl using a nebulizer with a mask.
(B) Boy using a metered-dose inhaler with spacer.

Corticosteroids

• Prednisolone
  – 2mg/kg (max 60mg) first dose po followed by 1mg/kg once or twice daily for 3 to 10 days
• Effect noticeable within 1 to 2 hours
• IV Methylprednisolone for more severe cases
Rx MILD Exacerbation

• Salbutamol by spacer – once and review after 20 minutes
  – GOOD response
    • Send home on prn B2 agonist.
    • ? OCS if episode has persisted over several days
    • Written Asthma plan
  – POOR response treat as Moderate
Rx MODERATE Exacerbation

- O2 if O2 sat < 92%
- Salbutamol every 20 minutes for 1 hour and then review
- OCS 1mg/kg daily for 1 to 3 days
- ? Send to hospital ED
Rx SEVERE Exacerbation

- Hospitalise
- Oxygen
- Salbutamol every 20 mins
- ? Atrovent
  - 4 puffs <6 years old, 8 puffs > 6 years
- OCS (Give IV if vomiting)
Rx CRITICAL Exacerbation

• Clinical
  – Confused, maximal work of breathing, marked tachycardia, unable to talk, SILENT chest
• O2
• Continuous nebulised salbutamol
• IV methylprednisolone
• IV Magnesium sulphate
• IV Aminophylline
• Respiratory support
Preschool Wheezers

• Are these children asthmatic?
Preschool Recurrent Wheezing

• Recurrent wheeze affects up to 1/3 of preschool children
• Only 20% go on to have wheeze that persists into later childhood
• Can we identify these?
• How do we manage them?
Wheezing phenotypes

- Tucson Study (1995) cohort 800 children birth to age 6 years
  - Non atopic recurrent wheezers
    - Smoking during pregnancy, narrower airways, daycare attendance
  - Atopic recurrent wheezers
    - Can begin in infancy.
    - Increase in prevalence with increasing age
    - Personal and family history of atopy.
    - Decreased lung function
    - “Classical” asthma phenotype. Probably will persist into adulthood
Wheezing phenotypes

• ERS classification. *Symptom based* phenotypes
  – Episodic viral wheezers
    • Discreet episodes of wheeze. Absence of wheeze in between episodes
    • Usually associated with viral respiratory tract infections
  – Multi-trigger wheezers.
    • Wheezing episodes with and between viral infections
    • Triggers include viruses, exercise, allergen and cigarette smoke exposure
  – BUT phenotypes may change in time
Management preschool wheezers

• Optimal management yet to be determined due to heterogeneity of phenotypes
• View in different context to older school aged counterparts
• Individualize therapy for individual patients
  – Severity symptoms
  – Prior response to treatment
  – Risk factors for Asthma
• Change Rx if desired response not seen
Asthma risk factors

• Atopy
  – Allergic Rhinitis
  – Eczema
  – Positive allergy testing

• Parental asthma
Management preschool wheezers

**ACUTE**

- Bronchodilators
- Oral Corticosteroids
  - GINA, BTS guidelines recommend use of OCS for treatment of acute asthma episodes in children
  - Recent studies however have shown that the pattern of response is different in recurrent preschool wheezers
  - Very little if any benefit from initiating OCS at the start of viral induced wheezing episodes in most pre-schoolers (both patient and doctor initiated)
  - **Use** if severe acute exacerbations or in those preschoolers with risk factors suggesting classical asthma phenotype
  - **Avoid widespread OCS use in this age group**
Management preschool wheezers

• LTRA eg Singulair
  – Intermittent LTRA given for 7 days or more at the onset of viral infections has modest effect on symptoms
Management preschool wheezers

• **Prevention**
  
  – ICS
  
  • Standard doses given daily are effective especially in children with clinical diagnosis of asthma or significant risk factors
  
  • Does **not** alter natural history of underlying disease process
  
  • Majority studies show minimal effect on growth velocity. Children <3 years of age at greater risk
  
  – LTRA
  
  • Daily dosing may play a role in this group of children
Long Acting beta 2 Agonists

• Increasing use despite stabilisation asthma rates and **despite**
  – Modest effectiveness
  – Increased risk of severe exacerbations
  – ? Pro-inflammatory action
Label changes for LABA’s

• Only use in conjunction with asthma controller e.g. ICS. Never as stand alone Rx
• Only use when low to medium dose ICS not effective
• Only use as fixed dose combination product containing LABA and ICS e.g. Seretide, Symbicort