Practical Approach to Managing Paediatric Asthma

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“Approaching the patient”

- Check the diagnosis
- Technique & Adherence
- Modify the triggers
- Asthma remission
- Emergency Management
- Medications - Preventers
Definition of childhood asthma

“recurrent wheeze and/or cough”

"Asthma is defined clinically as the combination of variable respiratory symptoms (e.g. wheeze, shortness of breath, cough and chest tightness) and excessive variation in lung function”
(Australian Asthma Handbook 2014)
To wheeze or not to wheeze?

Wheeze is defined as a continuous, high-pitched sound coming from the chest during expiration. It is caused by turbulent air flow due to narrowing of intrathoracic airways and indicates expiratory airflow limitation.

What do parents of wheezy children understand by “wheeze”?

R S Cane, S C Ranganathan, S A McKenzie

Archives of Diseases in Childhood 2000
Differential diagnosis of wheeze/cough in children

- Bronchiolitis
- Suppurative lung disease (e.g. cystic fibrosis)
- Foreign body aspiration
- Congenital malformation causing narrowing of the intrathoracic airways (e.g. tracheomalacia)
- Recurrent aspiration
- Protracted bacterial bronchitis (Chronic wet cough)
Technique & adherence issues
Noncompliance and treatment failure in children with asthma

- 24 children aged 8–12 years, 13 week study, recruited OPD
- Electronic MDI (families not aware) vs diary cards
- Parents report 95.4% vs actual use 58.4%
- Compliance 1/a dosing frequencies
  QID 5.8%, BD 22.2%, OD 46.2%

Milgrom et al JACI 1996
Reminder Asthma Management Program

Adherence 50% !!
Preliminary results

- 31 participants in total recruited so far (14 males, 17 females)
  - Age range 6 to 16 years ($M=10.6$ years, $SD=3.3$ years)
  - 74% of participants have been previously hospitalised for asthma, with 65% having 3 or more admissions
  - A quarter (26%) of participants have been previously admitted to PICU
Mean adherence each month by Group

Adherence (%) vs Month

- Group 1
- Group 2

Adherence values for:
- Month 1: Group 1 - 54.5%, Group 2 - 50.4%
- Month 2: Group 1 - 87.4%, Group 2 - 87.8%
- Month 3: Group 1 - 83.2%
Mean FEV₁ each month by Group

Visit

FEV₁ (%)
Aim for 80% compliance!

Adherence to inhaled corticosteroids: CAMP
Krishnan JA et al JACI 2012
Spacers

- Used with MDIs
- Recommended for use by all patients
- Why?
  - Increase deposition of medication
    - Using an MDI alone – 10-12% deposition
    - Using a spacer and MDI ~ 30% deposition
Breaths/ puff for spacer use

Aerosol Inhalation From Spacers and Valved Holding Chambers Requires Few Tidal Breathes for Children

Schultz et al. Pediatrics 2011

**WHAT THIS STUDY ADDS:** The breathing patterns of young children differ markedly from usual patterns when they use spacers/valved holding chambers. When using these devices, 2 or 3 tidal breaths are adequate for drug delivery in young children.
Improving adherence

- Educate, educate, educate...
- Address barriers
- Family/ carer supervision
- Time medication with routines (e.g. tooth-brushing)
- Ask family to program a reminder in mobile phone!
Asthma triggers

- Respiratory tract infections over 90%
- Change in weather
- Animals – cats, dogs
- Pollens, grasses – worse in spring
- Tobacco smoke
- Exercise
- Different food types
- Anxiety
Modifying triggers

House dust mite control measures in the management of asthma: meta-analysis
Peter C Gøtzsche, Cecilia Hammarquists, Michael Burr

Gotzsche BMJ 1998

Results of a Home-Based Environmental Intervention among Urban Children with Asthma

Morgan NEJM 2004
What practical steps to avoid triggers?

- HDM – regular vacuum, wash linen in hot water, low allergen pillows
- Pets – avoid and keep outside
- Pollen – Listen to pollen counts and refrain from going out, keep windows shut
- Mould – Ventilate/ sun shine to confined areas
Asthma and smoking

PEDIATRICS
OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

Prenatal and Passive Smoke Exposure and Incidence of Asthma and Wheeze: Systematic Review and Meta-analysis
Hannah Burke, Jo Leonard-Bee, Ahmed Hashim, Hembadoon Pine-Abata, Yilu Chen, Derek G. Cook, John R. Britton and Tricia M. McKeever
Pediatrics 2012;129;735; originally published online March 19, 2012;
DOI: 10.1542/peds.2011-2196

The association between tobacco and the risk of asthma, rhinoconjunctivitis and eczema in children and adolescents: analyses from Phase Three of the ISAAC programme
Edwin A Mitchell,1 Richard Beasley,2 Ulrich Keil,3 Stephen Montefort,4 Joseph Odhiambo,5 and the ISAAC Phase Three Study Group*
Role of asthma health practitioners

The importance of nurse-led home visits in the assessment of children with problematic asthma

M Bracken,1 L Fleming, 2 P Hall, 1 N Van Stiphout, 1 C Bossley, 1 E Biggart, 1 N M Wilson, 1 A Bush 1

Figure 2  Causal factors. More than one factor could be ascribed per child.
Asthma risk factors

- History of atopy – eczema, allergic rhinitis
- Parental history of asthma
- Tobacco smoke exposure
- Respiratory infections in early life

**Current perspectives**

**Do early-life viral infections cause asthma?**

Peter D. Sly, MD, FRACP, DSc, Merci Kusel, MBBS, and Patrick G. Holt, DSc

*Perth, Australia*
Asthma remission

- No gold standard definition
- Rule of thumb:
  - Intermittent asthma – 60 to 70% will by age 10, or adolescence
  - Frequent intermittent/mild persistent asthma – 40 to 50% by adolescence
  - Moderate to severe persistent asthma – 15 to 30% by adolescence, adult life
Management of asthma
Management of acute asthma

- Prednisolone 1mg/kg
- Regular salbutamol
- "Rescue treatment"
- < 6 years – 6 puffs 20 mts for 1 hour
- > 6 years – 12 puffs 20 mts for 1 hour
- Nebulisers/Oxygen if hypoxic
- Ipratropium bromide 8 puffs
- Assess response after 1 hour
A 5- versus 3-day course of oral corticosteroids for children with asthma exacerbations who are not hospitalised: a randomised controlled trial

Anne B Chang, Ronald Clark, Theo P Sloots, David G Stone, Helen L Petsky, Donna Thearle, Anita A Champion, Coralie Wheeler and Jason P Acworth

- 201 children, aged 2-15 years, RCT
- 3d vs 5d oral prednisolone 1mg/kg/d
- Primary outcome “proportion of children without asthma symptoms on day 7”
- 3 days as good as 5 days

MJA 2008, 189: 306-310
Patterns of asthma in children

- Infrequent intermittent ~ 65-75% - no preventers required
- Frequent intermittent ~ 20-25% - role for montelukast
- Persistent ~ 5-10% - preventer required
Management Options – Which Preventers?
Inhaled corticosteroids – 1st line persistent asthma

- Fluticasone (*Flixotide*) 200µg/ day
- Budesonide (*Pulmicort*) 400 µg/ day
- Beclomethasone (*QVAR*) 100 µg/ day
- Ciclesonide (*Alvesco*) 160 µg/ day
Combination preventers (2nd line)

- Seretide (Fluticasone/ Salmeterol)
- Symbicort (Budesonide/Eformoterol)
- Flutiform (Fluticasone/ Eformoterol)
- Breo Ellipta (Fluticasone/ Vilanterol)
Montelukast, Compared With Fluticasone, for Control of Asthma Among 6- to 14-Year-Old Patients With Mild Asthma: The MOSAIC Study

M. Luz Garcia Garcia, MD*; Ulrich Wahn, MD†; Leen Gilles, MSc§; Arlene Swern, PhD§; Carol A. Tozzi, PhD§; and Peter Polos, MD, PhD§

- RT, fluticasone 100ug bd vs montelukast 5mg po daily over 12 months
- Age: 6-14 years
- Mild persistent asthma
- Similar outcomes in both asthma symptom score and lung function

Garcia et al, Pediatr 2005; 116:360-369
A Comparative Study of Inhaled Ciclesonide 160 μg/day and Fluticasone Propionate 176 μg/day in Children With Asthma

- 12 week, RCT
- Aged 6 – 15 years
- Persistent asthma
- Ciclesonide 160 μg vs Fluticasone 100μg BD
Results

Fig. 1. Ciclesonide (CIC) 80 µg BID and fluticasone propionate (FP) 88 µg BID improve FEV₁ over 12 weeks of treatment. Data are least-squares mean ± standard error of the mean for the intention-to-treat analysis. BID, twice daily; FEV₁, forced expiratory volume in 1 sec.
How high can you go with dosing?
Table 2  Doses of fluticasone (μg/day) at which 80% and 90% of the maximum effect is achieved, as derived from a negative exponential model*

<table>
<thead>
<tr>
<th>Outcome measure</th>
<th>80% of maximum effect achieved</th>
<th>90% of maximum effect achieved</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEV₁</td>
<td>146</td>
<td>209</td>
</tr>
<tr>
<td>Morning PEF</td>
<td>172</td>
<td>247</td>
</tr>
<tr>
<td>Evening PEF</td>
<td>175</td>
<td>251</td>
</tr>
<tr>
<td>Use of rescue medication</td>
<td>71</td>
<td>102</td>
</tr>
<tr>
<td>Major exacerbations</td>
<td>108</td>
<td>155</td>
</tr>
<tr>
<td>Night awakenings</td>
<td>135</td>
<td>193</td>
</tr>
</tbody>
</table>

*The effect obtained with 1000 μg/day of fluticasone was considered to be the “maximum effect” for the purposes of this analysis.

FEV₁=forced expiratory volume in one second; PEF=peak expiratory flow.
### Maximum effective dose of fluticasone

<table>
<thead>
<tr>
<th>Outcome measure</th>
<th>( R^2 )</th>
<th>Dose of peak effect</th>
<th>Mean change (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( FEV_1 ) (L)</td>
<td>35%</td>
<td>568</td>
<td>0.62 (0.24 to 1.00)</td>
</tr>
<tr>
<td>Morning PEF (L/min)</td>
<td>48%</td>
<td>600</td>
<td>44 (19.5 to 68.5)</td>
</tr>
<tr>
<td>Evening PEF (L/min)</td>
<td>49%</td>
<td>590</td>
<td>52 (8.6 to 95.0)</td>
</tr>
<tr>
<td>( \beta ) agonist use (puffs/day)</td>
<td>35%</td>
<td>560</td>
<td>-1.98 (-3.00 to -0.93)</td>
</tr>
</tbody>
</table>

\( FEV_1 \)=forced expiratory volume in one second; PEF=peak expiratory flow.
“Effect of Long-Term Treatment with Inhaled Budesonide on Adult Height in Children with Asthma”

- Prospective study over 10 years
- 142 budesonide, 51 healthy sibs, 18 controls
- Mean asthma age 3.4 years (range 1-10)
- Duration of BUD 9.2 yrs
- Mean daily BUD 412mcg/day

Agertoft & Pederson NEJM
2000; 343:1064-1069
<table>
<thead>
<tr>
<th>GROUP</th>
<th>NO.</th>
<th>MEASURED ADULT HEIGHT</th>
<th>TARGET ADULT HEIGHT</th>
<th>DIFFERENCE BETWEEN MEASURED AND TARGET ADULT HEIGHTS (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Budesonide</td>
<td>142</td>
<td>173.2±9.5</td>
<td>172.9±7.5</td>
<td>+0.3 (-0.6 to +1.2)</td>
</tr>
<tr>
<td>Girls</td>
<td>56</td>
<td>164.6±6.0</td>
<td>164.8±3.0</td>
<td>-0.2 (-1.6 to +1.0)</td>
</tr>
<tr>
<td>Boys</td>
<td>86</td>
<td>178.8±6.8</td>
<td>178.1±4.3</td>
<td>+0.7 (-0.5 to +1.9)</td>
</tr>
<tr>
<td>Controls</td>
<td>18</td>
<td>173.9±10.1</td>
<td>174.1±8.2</td>
<td>-0.2 (-2.4 to +2.1)</td>
</tr>
<tr>
<td>Siblings</td>
<td>51</td>
<td>172.3±9.5</td>
<td>171.4±8.7</td>
<td>+0.9 (-0.4 to +2.2)</td>
</tr>
<tr>
<td>Girls</td>
<td>27</td>
<td>165.8±5.6</td>
<td>165.2±8.7</td>
<td>+0.6 (-1.2 to +2.3)</td>
</tr>
<tr>
<td>Boys</td>
<td>24</td>
<td>179.8±7.2</td>
<td>178.5±4.9</td>
<td>+1.3 (-0.7 to +3.3)</td>
</tr>
</tbody>
</table>

*Patients in the budesonide group had been treated with inhaled budesonide for an average of 9.2 years. Patients in the control group had never been treated with inhaled corticosteroids. The members of the third group were healthy siblings of patients in the budesonide group and had attained adult height. Plus-minus values are means ±SD. CI denotes confidence interval.
943 subjects

Age range 5-13 years

Budesonide group had a final height of 1 cm less than placebo
Step-up Therapy for Children with Uncontrolled Asthma Receiving Inhaled Corticosteroids

# Preventive therapy in children: The 2016 approach

<table>
<thead>
<tr>
<th>Frequent episodic asthma</th>
<th>Montelukast</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mild persistent asthma</strong></td>
<td>Montelukast or Low dose ICS (FP/BD/CIC 100mcg/day)</td>
</tr>
<tr>
<td><strong>Moderate asthma</strong></td>
<td>Increase ICS (FP/BD/CIC 200mcg/day) or Add long-acting $\beta_2$ agonist or Add montelukast</td>
</tr>
<tr>
<td>If not controlled...</td>
<td>Further increase dose ICS (max ICS 500mcg/day)</td>
</tr>
<tr>
<td><strong>Severe asthma</strong></td>
<td></td>
</tr>
</tbody>
</table>
Take Home Messages

1. Ensure the diagnosis is indeed asthma and not something else
2. Check technique and adherence.
3. ICS is the cornerstone of therapy. Titrate the dose to maximise efficacy and minimise adverse effects