BOTTOM LINE RECOMMENDATIONS:

Asthma

Asthma is the most common chronic disease in children. Acute exacerbations of asthma are one of the most common reasons for children to seek emergency care and require urgent hospitalization. Up to two-thirds of children with asthma who seek emergency care can be classified as having **mild** respiratory distress, between 2 and 5% have **severe** respiratory distress, and the remainder have **moderate** respiratory distress.

OVERVIEW OF MANAGEMENT

» Evidence-based management of children with acute asthma exacerbations (including repeated doses of salbutamol and ipratropium, and oral corticosteroids in the first 60 minutes of care) reduces hospitalization rates substantially.

NOTE: *While Canadian pediatric emergency departments (EDs) have similar approaches to treating children with asthma, there are some regional differences. Depending on where in Canada you practice, please see the following clinical pathways for more detailed guidance including dosing of bronchodilators:*

Quebec (Sainte-Justine) *Ontario* *Alberta* *British Columbia*

CLASSIFYING ASTHMA SEVERITY

» Use of a standardized, validated clinical score (the Pediatric Respiratory Assessment Measure or PRAM) to classify the severity of respiratory distress in children with asthma exacerbations results in improved use of evidence-based medications and lower rates of hospitalization.[1,2]

» Cut-off scores for categorizing patients as having mild, moderate, or severe respiratory distress differ between provincial pathways. *See pathways listed above for specific details.*

MILD

» Salbutamol should be delivered with metered dose inhalers (MDIs) and spacers rather than nebulization.[3]

» While oral corticosteroids are frequently administered to children with mild respiratory distress, clear evidence of benefit in those with mild symptoms is lacking.

MODERATE

» Treat with salbutamol delivered via MDI and spacers every 20 minutes, for a total of three doses.

» Methods for adjusting the dose of salbutamol for children of different ages vary between pediatric emergency departments. Some adjust based on age in years and others adjust based on broad weight cut-offs. *See provincial pathways listed above for specific adjustments.*

» Administration of **oral corticosteroids** just before or immediately after initiating bronchodilator therapy substantially decreases respiratory distress within 2-6 hours of treatment and substantially decreases hospitalization rates.

» **Oral dexamethasone** or **prednisone/prednisolone** are likely to be comparably effective;[4] in some studies, dexamethasone was reported to result in substantially lower rates of vomiting.

- **Liquid parenteral form of dexamethasone** administered orally is used preferentially in most Canadian pediatric emergency departments.
- **Standard dosing:** dexamethasone 0.15 to 0.3 mg/kg, or prednisone/prednisolone 1-2 mg/kg. *See provincial pathways above for specific dosing and maximum doses.*

» Multiple doses of **ipratropium** (two or three) added to salbutamol aerosols and oral corticosteroids in the first 60 minutes of treatment yield greater improvement and lower hospitalization rates.[5] *See provincial pathways for specific dosing*.

- Benefits appear to be greatest in those with severe respiratory distress; it is less certain in those children with moderate distress.

SEVERE

» There is good evidence that patients with severe respiratory distress improve more rapidly when **bronchodilators** are delivered continuously **via aerosol** over 60 to 180 minutes as compared with intermittently (i.e.: every 20 minutes).[6] Some provincial pathways suggest use of continuous nebulization in place of intermittent MDI and spacers for children with severe respiratory distress.

» Although delivery via MDIs/spacers is more efficient than nebulization, it is much more convenient to deliver aerosols continuously via nebulization than via MDIs/spacers.

» **Large volume nebulizers**[7] allow administration of bronchodilators continuously over 60 or more minutes, and should be used in preference to standard-sized nebulizers, which can only accommodate doses administered over shorter times.

- Mix: three 5 mg (child weight >20 kg) or 2.5 mg (child weight <20 kg) salbutamol nebules with three 250 mcg ipratropium nebules and enough normal saline to make a total volume of 20 ml.
- Nebulize over 60 minutes at 8L/min.

» **Magnesium Sulfate:** Children with severe initial respiratory distress who do **not** respond to repeated or continuous bronchodilators and early corticosteroids have been shown to have greater subsequent improvement if treated with intravenous magnesium sulfate (in addition to repeated or continuous bronchodilator therapy). While the dose studied has varied, **40 mg/kg** appears to be as effective as higher doses.[8, 9]

CRITERIA FOR SAFE DISCHARGE HOME

» General consensus among Canadian pediatric emergency physicians for safe discharge includes:

- No significant intercostal and/or suprasternal indrawing at least 1 to 2 hours after the last bronchodilator treatment;
- Good air movement on auscultation with at most mild expiratory wheezes; and
- Oxygen saturations on room air greater than 90%.
- The above equates to PRAM score ≤ 3.

CRITERIA FOR HOSPITAL ADMISSION OR PROLONGED OBSERVATION

» Continue therapy as per provincial pathway for those not yet ready for discharge.

» Consider admission to hospital if persistent moderate/severe respiratory distress more than 4-6 hours after corticosteroids given.

» Consult PICU/transport team regarding transfer is persistent severe respiratory distress after initial 1-2 hours of therapy.

This summary is based on:

1) Ducharme FM, Chalut D, Plotnick L, Savdie C, Kudirka D, Zhang X, Meng L, McGillvary D. The pediatric respiratory assessment measure: A valid clinical score for assessing acute asthma severity from toddlers to teenagers. *J Pediatr*. 2008 Apr; 152(4):476-80.
2) Chalut DS et al. The preschool respiratory assessment measure (PRAM): a responsive index of acute asthma severity. *J Pediatr*. 2000 Dec; 137(6): 762-8.
3) Cates CJ, Crilly JA, Rowe BH. Holding chambers (spacers) versus nebulisers for beta-agonist treatment of acute asthma. *Cochrane Database Syst Rev.* 2013 Sep 13;(9):CD000052. doi: 10.1002/14651858.CD000052.pub3.
4) Keeney GE et al. Dexamethasone for acute asthma exacerbations in children: A meta-analysis. *Pediatrics.* 2014 Mar 1;133(3):493-9.
5) Griffiths B, Ducharme FM. Combined inhaled anticholinergics and short-acting beta2-agonists for initial treatment of acute asthma in children. *Cochrane Database Syst Rev.* 2013 Aug 21;(8):CD000060. doi: 10.1002/14651858.CD000060.pub2.
6) Camargo CA Jr et al. Continuous versus intermittent beta-agonists in the treatment of acute asthma. *Cochrane Database Syst Rev.* 2003;(4):CD001115.
7) Order information for MiniHEART Hi-Flo®, Westmed HEART Continuous Nebulizers (large-volume nebulizer used in RCTs)
8) Cheuk DK, Chau TC, Lee SL. A meta-analysis on intravenous magnesium sulphate for treating acute asthma. *Arch Dis Child.* 2005 Jan;74-7.
9) Griffiths B, Kew KM. Intravenous magnesium sulfate for treating children with acute asthma in the emergency department. *Cochrane Database Syst Rev.* 2016; (4):CD011050.