

Pediatric Severe Asthma Exacerbation Algorithm



For Children Aged ≥ 12 months

Recognition

- Pediatric Respiratory Assessment Measure (PRAM) score ≥ 8
- Increased work of breathing (WOB), cough, wheeze, or silent chest (Note: child may not have asthma diagnosis/previous wheeze)
- Caution: Decreased level of consciousness (LOC), lethargy, cyanosis, decreasing respiratory effort and/or rising PCO_2 indicates **impending respiratory failure**



Initial Management

- Continuous cardiorespiratory monitoring, resuscitation area/call for help if concern for impending respiratory failure
- Administer O_2 to maintain $SpO_2 >92\%$ ($>90\%^*$)
- Administer salbutamol + ipratropium q20 min x 3 treatments via MDI **OR** with minimally interrupted/continuous nebulization x 1 hour (see dosing table below)
- Administer corticosteroid after first dose of bronchodilator. Oral route preferred, IV route if impending respiratory failure.
- Assess perfusion, if hypoperfused administer NS or RL 20 mL/kg IV/IO and repeat prn
- Administer magnesium sulfate IV if impending respiratory failure
- Measure POCT glucose if decreased LOC
- Administer **IM** epinephrine if concern for anaphylaxis (e.g., acute respiratory distress following food/medication ingestion or insect sting)

*at higher altitude

PRAM Scoring Table				
SIGNS	0	1	2	3
Suprasternal indrawing	Absent		Present	
Scalene contractions	Absent		Present	
Wheezing	Absent	Expiratory only	Inspiratory +/-expiratory	Audible wheeze/silent chest/minimal air entry
Air entry	Normal	Decreased at bases	Widespread decrease	Absent/minimal
O_2 saturation in room air	$>94\%$ ($>93\%^*$)	92–94% (90–93%*)	$<92\%$ ($<90\%^*$)	

*at higher altitude

Reassess vital signs, SpO_2 , WOB, perfusion, LOC, and PRAM score after 1st hour of initial management

Improving, PRAM < 8

- See [TREKK Bottom Line Recommendations for Asthma](#)
- Ongoing bronchodilator treatment with salbutamol prn

Persistent Severe Distress, PRAM ≥ 8

- Continuous nebulized salbutamol
 - IV fluid as needed to maintain perfusion
 - Administer magnesium sulfate IV if not already given
 - CXR/POCUS to assess for barotrauma
 - Consider measuring blood gas and electrolytes
- Alert Pediatric Referral Centre**
- For persistent decreased/worsening LOC, cyanosis, decreased respiratory effort:**
- Stepwise ventilatory support:
 1. Administer high flow O_2 if available
 2. CPAP (min 5 cm H_2O , max 10 cm H_2O)
 3. Transition to BiPAP if required (PEEP min 5 cm H_2O , min delta P of 5)

CAUTION!

- Intubation is high risk and rarely required
- Consider cardiogenic shock if deterioration post IV fluid
- Consider pneumothorax if deterioration or failure to improve

	Drug	Dose	Considerations
Bronchodilator	Salbutamol	Less than 20 kg: MDI (100 mcg/puff) 5 puffs OR 2.5 mg nebulized Greater than or equal to 20 kg: MDI 10 puffs OR 5 mg nebulized q20min x 3 consecutive treatments	For MDI: alternate between salbutamol and ipratropium doses For nebulizers: mix salbutamol and ipratropium doses together. If large volume nebulizer available, give all together via continuous nebulization to minimize interruptions between doses in first hour.
	Ipratropium	All weights: MDI (20 mcg/puff) 4 puffs OR 250 mcg nebulized q20min x 3 consecutive treatments	After first hour of treatment (initial three doses of salbutamol + ipratropium), ongoing MDI or nebulized therapy is salbutamol only.
Steroid	Dexamethasone	0.6 mg/kg/dose (MAX 12 mg/dose) PO/IV	
	Hydrocortisone sodium succinate	8 mg/kg/dose (MAX 400 mg/dose) IV	No evidence of advantage over PO steroid. Hydrocortisone has less hypersensitivity reactions compared to methylprednisolone. Methylprednisolone 40 mg vials are contraindicated in patients with cow's milk protein allergy.
	Methylprednisolone sodium succinate	2 mg/kg/dose (MAX 80 mg/dose) IV	
Other	Magnesium sulfate	50 mg/kg/dose (MAX 2000 mg/dose) IV over at least 20 min	May cause hypotension. Maintain euolemia. Consider NS/RL bolus prn. Check BP q5min during infusion, then q30min x 2. Rare cause of apnea, hypotonia, paralysis.
	Epinephrine	0.01 mg/kg/dose (MIN 0.1 mg/dose; MAX 0.5 mg/dose) IM	Administer IM epinephrine if anaphylaxis suspected. Use 1 mg/mL concentration of epinephrine, administer IM in anterolateral thigh.

Pediatric Referral Centre Discussion

- Airway management
- Difficult vascular access
- Persistent/severe respiratory distress or impending respiratory failure
- Concern for underlying cardiac problem
- Pneumothorax or other barotrauma

[View suggested discharge medications below](#)



Scan or click the QR code to learn more, to see a list of key references, and development team members.

Disclaimer: The purpose of this document is to provide emergency healthcare professionals an approach to the assessment and management of Severe Pediatric Asthma. The TREKK Network is not liable for any damages, claims, liabilities, costs or obligations arising from the use of this document, including loss or damages arising from any claims made by a third party.

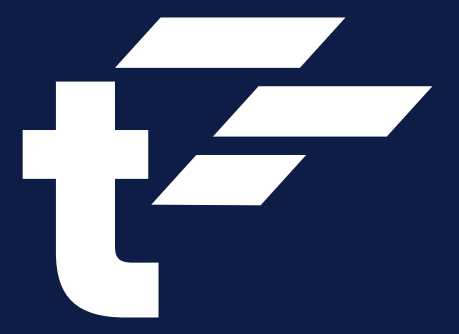


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	SUGGESTED DISCHARGE MEDICATIONS		
	DRUG	DOSE	CONSIDERATIONS
RELIEVER (BETA AGONIST)	Salbutamol MDI (100 mcg/puff) (Ventolin®)	2-4 puffs q4h for 24 hours, and then 2 puffs q4h PRN	Prescribe a reliever for ALL patients with asthma. Prescribe a spacer for use with ALL MDIs.
	Budesonide/Formoterol DPI (Symbicort®)*	Age ≥ 12 years Rapid symptom relief: 1 inhalation PRN. If symptoms persist repeat dose. MAX 8 inhalations per 24 hours. See below for ICS maintenance dosing.	Age < 12 years: salbutamol Age ≥ 12 years: salbutamol OR if patient is already on budesonide/formoterol, they could be discharged with it <i>instead</i> of salbutamol.
CONTROLLER (INHALED CORTICOSTEROID/ICS)	Fluticasone Propionate MDI (Flovent®)	Age (yr) Low/Starting Dose 1-5 50 mcg BID 6-11 100 mcg BID ≥ 12 125 mcg BID	All children presenting with a PRAM >4 should go home on scheduled low/starting dose ICS until follow up. Consider low/starting dose ICS in children with PRAM ≤3 who are at higher risk for severe exacerbations. [§]
	Ciclesonide MDI (Alvesco®)	Age (yr) Low/Starting Dose 1-5 100 mcg once daily ≥ 6 200 mcg once daily	Only move to medium dose after ensuring good technique, adherence and trigger control on low dose ICS. Minimum duration: 3 months. Ensure follow up with primary care (ideally within 7 days of exacerbation). If primary care not available, consider referral to pediatrics/asthma clinic.
	Budesonide/Formoterol DPI (Symbicort®)*	Age ≥ 12 years if already prescribed. Low Dose 200 mcg BID in <i>addition</i> to its use as a reliever as above. MAX 8 inhalations/day.	
ORAL STEROID	Dexamethasone	0.6 mg/kg/dose (MAX 12 mg/dose) PO once daily x 1 day (OPTIONAL for patients requiring 2 day course including dose given in ED)	A 1-2 day course of dexamethasone OR a 5 day course of prednisone/prednisolone should be prescribed for ALL moderate or severe exacerbations (PRAM >4). Dexamethasone is preferred due to better tolerance.
	Prednisone or Prednisolone	1 mg/kg/dose (MAX 60 mg/dose) PO once daily x 4 days for 5 days total therapy	If suspension unavailable, tablets can be halved/quartered and crushed then added to small amount of food.

*Symbicort: ICS budesonide 100 mcg or 200 mcg/inhalation + long-acting beta-agonist with fast onset formoterol 6 mcg/inhalation

§Higher risk for severe exacerbations includes ANY of: 1) history of severe exacerbation requiring systemic steroids, ED visit or hospitalization; 2) asthma not well-controlled[#]; 3) overuse of reliever medication (> 2 inhalers/year); or 4) current smoker.

#Well-controlled asthma defined as ALL of the following: 1) daytime symptoms < 2 days/week; 2) nighttime symptoms < 1 night/week; 3) normal physical activity; 4) mild (no ED visit/hospitalization) and infrequent (frequency does not impair quality of life) exacerbations; 5) no school absence due to asthma; and 6) < 2 reliever doses/week.



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