

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 with 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.
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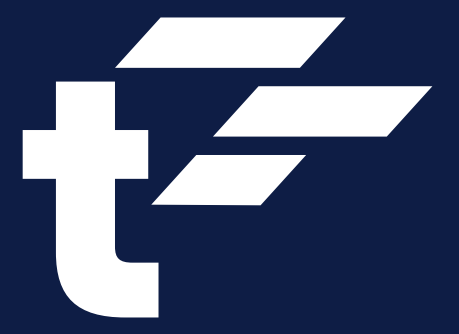
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	SUGGESTED DISCHARGE MEDICATIONS		
	DRUG	DOSE	CONSIDERATIONS
RELIEVER (BETA AGONIST)	Salbutamol MDI (100 mcg/puff) (Ventolin®)	2-4 puffs q4h for 24 hours, and then 2 puffs q4h PRN	Prescribe a reliever for ALL patients with asthma. Prescribe a spacer 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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