

Treatment of Pediatric Acute Asthma Exacerbation

Purpose & Background

Acute asthma exacerbations can be defined as episodes of progressive shortness of breath, characterized by coughing, wheezing, and/or chest tightness which may result in respiratory distress. The scope of this guideline is primarily focused on the treatment that occurs in the emergency department setting. The guideline does not take into consideration adjunctive treatments that may be considered for patients with severe asthma exacerbations or impending respiratory failure.

[Treatment Algorithm for Acute Asthma Exacerbation in the Emergency Department](#)

Diagnostic Evaluation: Assessment

❖ Patient History of Present Illness:

- Time of onset of exacerbation and trigger (if known)
- Treatment given for asthma exacerbation prior to arrival to ED/hospital setting including time of last dose
- Daily asthma controller medications prescribed and last taken
- Severity of underlying asthma
- Presence of environmental or viral triggers and/or exposures
- Asthma exacerbation and admission history:
 - History of intubation for asthma (ever)
 - Number of ED visits in the last year
 - Number of hospitalizations in the last year

INCLUSION CRITERIA

- a. Patients \geq 2 years of age with a diagnosis of asthma or history of episodic wheezing that is responsive to bronchodilator therapy

EXCLUSION CRITERIA

- a. Patients with other underlying chronic lung disease, bronchiolitis, bacterial pneumonia, cardiac conditions, or complex neurological disorders

❖ Physical Exam

- Vital signs, including respiratory rate and pulse oximetry
- Focus on findings concerning for [impending respiratory failure](#)

❖ Clinical Assessment Tools

- The [Clinical Asthma Score](#) (CAS) is the asthma scoring tool that Rainbow Babies & Children's Hospital uses across the continuum of care.

❖ Diagnostic Studies – consider [laboratory](#) or [radiologic](#) studies as indicated

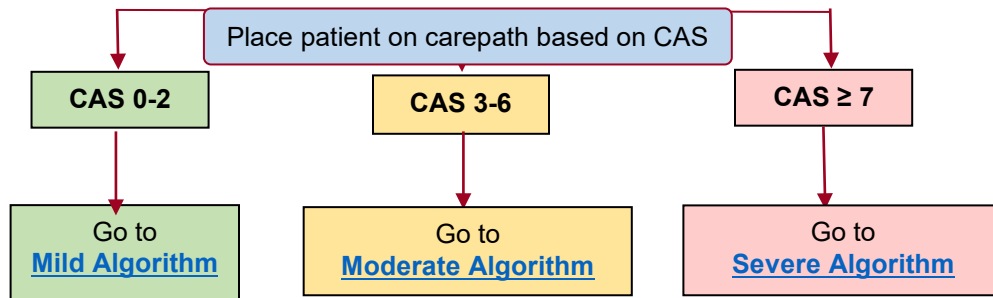
Treatment Algorithm for Acute Asthma Exacerbation in the Emergency Department

Child presents to Emergency Department for Management of Acute Asthma Exacerbation

Inclusion: Age \geq 2yo with respiratory symptoms & known history of wheezing/albuterol use/asthma

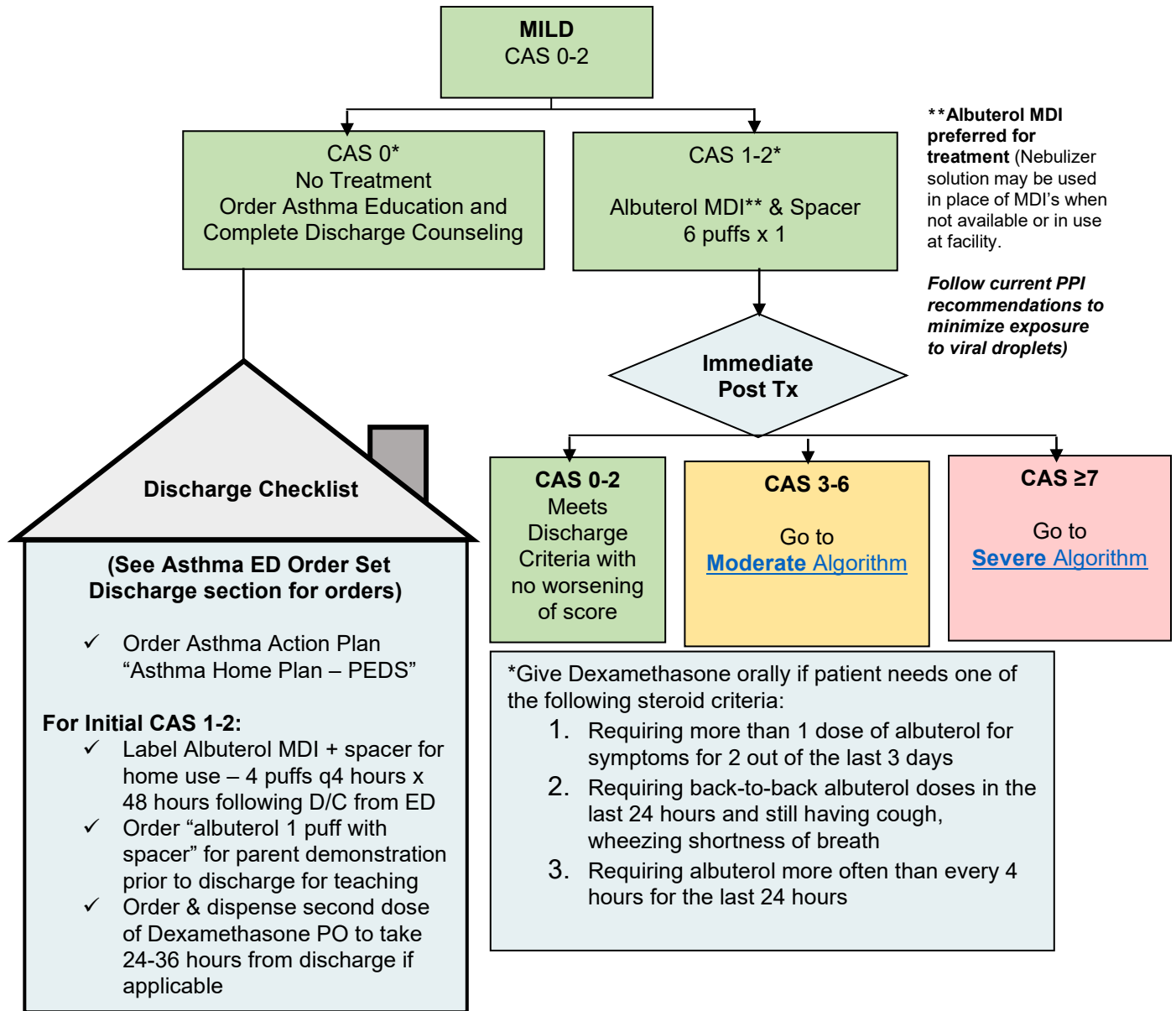
Assess patient using Rainbow Clinical Asthma Score (CAS)

Clinical Asthma Score (CAS)			
	0 – None/Mild	1 – Moderate	2-Severe
Wheeze	None or end expiratory wheezes	Inspiratory and/or expiratory wheezes	Breath sounds becoming inaudible
Accessory Muscle Usage	None	Intercostal and/or tracheosternal	Intercostal and/or tracheosternal muscles PLUS use of sternocleidomastoid muscles
Air Exchange	Equal all lobes	Decreased in some lobes	Decreased in all lobes
Oxygenation	SpO ₂ \geq 94% on room air	SpO ₂ < 94% on room air OR SpO ₂ \geq 94% on supplemental O ₂	SpO ₂ < 94% on supplemental O ₂
Respiratory Rate	1-5 yrs < 30 bpm 6-14 yrs < 25 bpm \geq 15 yrs < 20 bpm	1-5 yrs < 30-35 bpm 6-14 yrs < 25-30 bpm \geq 15 yrs < 20-25 bpm	1-5 yrs > 35 bpm 6-14 yrs > 30 bpm \geq 15 yrs \geq 25 bpm



Medication Dosing Overview
(See Asthma PEDS ED Order Set)

- | | |
|---|---|
| <ul style="list-style-type: none"> ▪ Albuterol MDI (90 mcg/inh) 6 puffs ▪ Albuterol/Ipratropium Nebulizer (2.5 mg/0.5 mg/per dose) ▪ Albuterol Continuous Nebulizer 15 mg/hour ▪ Administer Supplemental Oxygen to Achieve SpO₂ > 93% ▪ Magnesium sulfate 50mg/kg IV piggyback x1 over 20 minutes (max dose 2000 mg) ▪ Normal Saline IV bolus 20mL/kg over 1 hour max (max 1000 mL) | <ul style="list-style-type: none"> ▪ Ipratropium MDI (17 mcg/inh) 6 puffs ▪ Methylprednisolone IV push 2mg/kg (max 60 mg) ▪ Dexamethasone oral x 1 dose per 24 hours <ul style="list-style-type: none"> ○ 0-8 kg = 4 mg ○ 8.1 – 15 kg = 8 mg ○ 15.1 – 20 kg = 12 mg ○ \geq 20 kg = 16 mg |
|---|---|



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MODERATE
CAS 3-6

Within the 1st 60 minutes

Dexamethasone PO (give within first 20 mins) +
Albuterol MDI & Spacer 6 puffs x 3 treatments +
Ipratropium MDI & Spacer 6 puffs x 3 treatments
OR
Albuterol 2.5mg/Ipratropium 0.5mg/3ml Neb Soln (Duoneb) x 3 treatments** (order q10 min in EMR to complete in 1 hour)

**MDI preferred for treatment, begin MDI demonstration and teach-back with family (Nebulizer solution may be used in place of MDIs when not available or in use at facility).

Follow current PPI recommendations to minimize exposure to viral droplets)

Immediate Post Tx

2nd Hour

CAS 0-4
Observe for 60 minutes

CAS ≥ 5
Continuous **Albuterol at 15 mg/hour** for 1 hour & **Magnesium IVPB** + Normal Saline bolus

Immediate Post Tx

CAS 0-2
Meets Discharge Criteria

CAS 3-4
Albuterol MDI** & spacer 6 puffs q2 hrs – begin 2 hrs after last dose of Albuterol
Admit to Floor

CAS ≥ 5
Continuous Albuterol at 15 mg/hour x 1 hour & Magnesium IVPB + Normal Saline bolus

CAS 0-4
Albuterol MDI** & spacer 6 puffs q2 hrs – begin 2 hrs after last dose of albuterol
Admit to Floor

CAS ≥ 5
2nd hour Continuous Albuterol
Admit to PICU

3rd Hour

Discharge Checklist

(See Asthma ED Order Set Discharge Section for Orders)

- ✓ Order Asthma Action Plan "Asthma Home Plan – PEDS"

For Initial CAS 1-2:

- ✓ Label Albuterol MDI + spacer for home use – 4 puffs q4 hours x 48 hours following D/C from ED
- ✓ Order "albuterol 1 puff with spacer" for parent demonstration prior to discharge for teaching
- ✓ Order & dispense second dose of Dexamethasone PO to take 24-36 hours from discharge if applicable

4th Hour

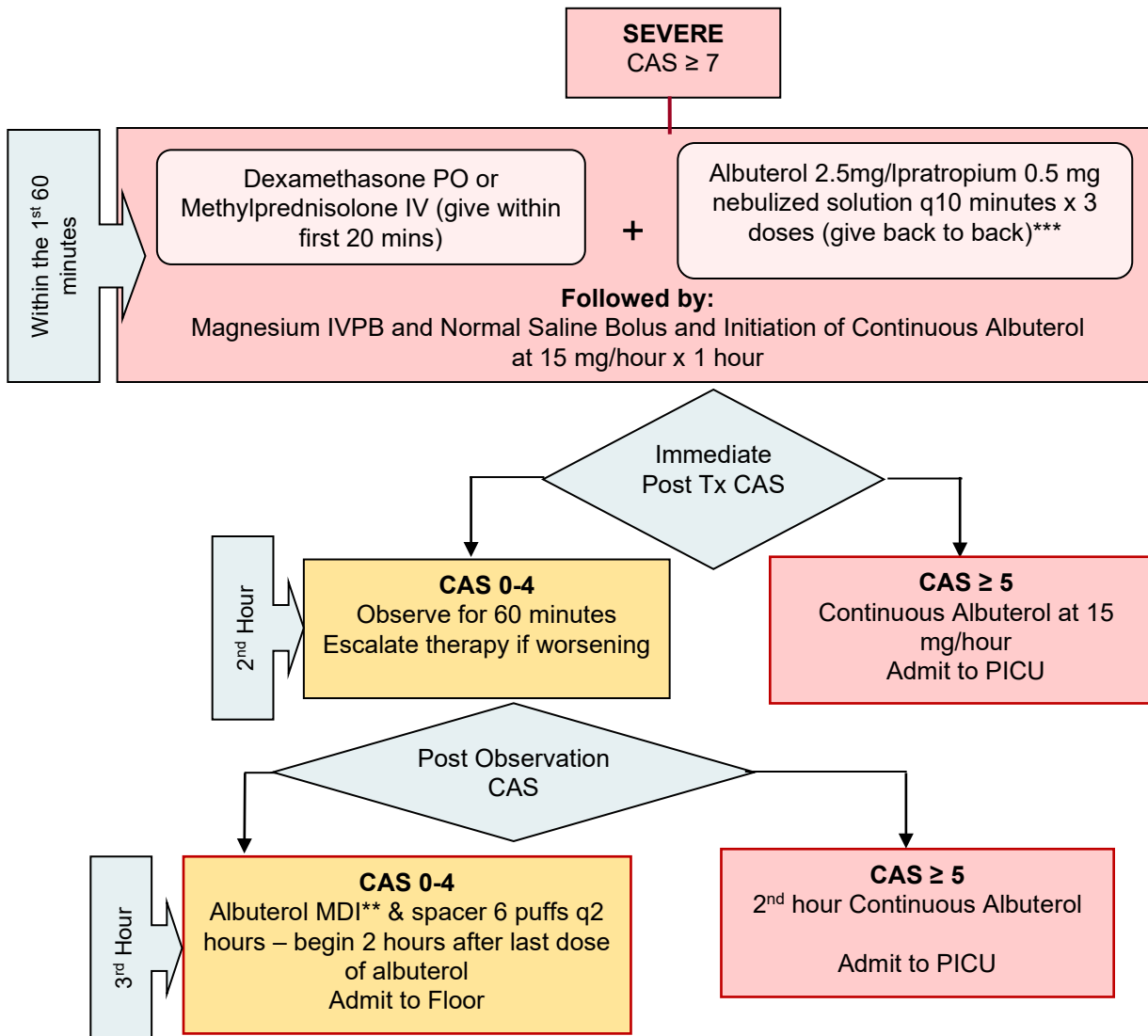
CAS 0-4
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2nd hour Continuous Albuterol
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Medication Dosing Overview (See Asthma PEDS ED Order Set)

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- Albuterol Continuous Nebulizer 15 mg/hour
- Administer Supplemental Oxygen to Achieve SpO₂ > 93%
- Magnesium sulfate 50mg/kg IV piggyback x1 over 20 minutes (max dose 2000 mg)
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[Back to Start of Algorithm](#)



***All #3 Albuterol 2.5mg/Ipratropium 0.5mg (Duoneb) doses can be mixed in nebulizer and give as a continuous dose over 30 minutes

**MDI preferred for treatment, begin MDI demonstration and teach-back with family (Nebulizer solution may be used in place of MDI's when not available or in use at facility. Follow current PPI recommendations to minimize exposure to viral droplets)

Medication Dosing Overview (See Asthma PEDS ED Order Set)	
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Table 1: Exam findings concerning for impending respiratory failure

Single word dyspnea
Acute change in mental status
Significant accessory muscle use
Silent chest
Oxygen Saturation < 92%

Table 2: Clinical Asthma Score (CAS)

	0 – None/Mild	1 – Moderate	2 – Severe
Wheeze	None or end expiratory wheezes	Inspiratory and/or expiratory wheezes	Breath sounds becoming inaudible
Accessory Muscle Usage	None	Intercostal and/or tracheosternal	Intercostal and/or tracheosternal muscles PLUS use of sternocleidomastoid muscles
Air Exchange	Equal all lobes	Decreased in some lobes	Decreased in all lobes
Oxygenation	SpO2 ≥94% on room air	SpO2 < 94% on room air OR SpO2 ≥ 94% on supplemental O2	SpO2 <94% on supplemental O2
Respiratory Rate	1-5 yrs: <30 bpm 6-14 yrs: <25 bpm ≥15 yrs: <20 bpm	1-5 yrs: 30-35 bpm 6-14 yrs: 25-30 bpm ≥15 yrs: 20-25 bpm	1-5 yrs: >35 bpm 6-14 yrs: >30 bpm ≥15 yrs: >25 bpm

Laboratory Studies

1. Consider RFP if:
 - a. Patient has known renal insufficiency and magnesium sulfate infusion is warranted
 - b. Patient requires multiple hours of continuous albuterol inhalation
2. Consider blood gas when exam findings are concerning for impending respiratory failure

Radiologic Studies

Chest radiograph should not be obtained during initial management of acute asthma exacerbation

- ❖ A low level of evidence supports the use of chest radiograph in limited situations, including:
 - Hypoxemia (SpO2 < 92%) and focal pulmonary exam findings not responsive to asthma therapy or
 - Concern for pneumothorax, pneumomediastinum, or cardiac abnormalities

Steroid Selection and Route

- ❖ In the Emergency Department, for mild-moderate acute asthma exacerbations, evidence supports the use of dexamethasone over prednisolone due to no difference in outcomes, improved tolerability, and cost-effectiveness; *high level of evidence*
- ❖ In the non-ICU setting, for mild-moderate acute asthma exacerbations, evidence supports the use of a 2-day course of dexamethasone as a non-inferior alternative to prednisolone. Dexamethasone is associated with decreased length of stay, improved tolerability and compliance, and is cost-effective; *low level of evidence*.

Route of Albuterol Administration in Severe Asthma in ED and Non-Intensive care unit (ICU) setting

- ❖ Evidence supports the safety of continuous nebulized short-acting bronchodilators in the ED and ICU setting for severe asthma exacerbations; *very low level of evidence*

Albuterol nebulizer versus metered-dose inhaler (MDI) with spacer-valved holding device (VHD) in ED for Mild/Moderate Exacerbations

- ❖ Evidence supports administering short-acting bronchodilators by MDI with a spacer/VHD rather than via nebulizer in patients with mild-moderate exacerbations due to efficacy and decreased ED LOS; *high level of evidence*

Role of Intravenous Magnesium Sulfate for Asthma Exacerbations in the ED

- ❖ Evidence supports the safety and effectiveness of intravenous magnesium sulfate in the Emergency Department for severe asthma exacerbations due to decreased odds of hospital admission and improvement in respiratory function; *high level of evidence*
 - Reformulated ED Carepath not constructed to include the option for patient initially placed on severe algorithm to be discharged. However, using magnesium sulfate for all severe asthmatics may result in decreased ICU admission. Area for future study

Discharge Education

- ❖ Evidence supports discharging all patients and families with an asthma action care plan, *high level of evidence*
 - Recommended the use of consistent scripting for asthma teaching at discharge across inpatient and ED that is consistent with care plan, *expert consensus*
 - Recommend using teach back method with inhalers and spacers and if possible to allow family to administer one dose of beta-agonist via MDI prior to discharge if possible, *expert consensus*

How Was This Guideline Developed?

- ❖ This guidance document was developed by a multi-disciplinary group of caregivers participating in the Asthma Clinical Effectiveness Team (CET) which was led by pulmonary services. The final recommendations in this document reflect the decisions of the Asthma CET with consideration to the best available evidence, expert opinion, and patient/family preferences.
- ❖ Primary literature considered for this guideline was published prior to February 2020. The literature search strategy was focused on initial medication treatments. The evidence levels were assigned based on the overall strength of the body of published literature.
- ❖ The 2007 NHLBI and 2020 GINA guidelines as well as publically available treatment algorithms from peer children's hospitals were also reviewed and referenced.

Disclaimer: Practice recommendations are based upon the evidence available at the time the clinical practice guidance was developed. Clinical practice guidelines (including summaries and pathways) do not set out the standard of care and are not intended to be used to dictate a course of care. Each physician/practitioner must use his/her independent judgement in the management of any specific patient and is responsible, in consultation with the patient and/or the patient's family to make the ultimate judgement regarding care.

If you have questions about this guideline, any other RBC clinical practice guidelines or about the guideline development process please contact the Rainbow Evidence Practice Program at RainbowEBPprogram@uhhospitals.org