**Pediatric ED Asthma Pathway**

**Pathway Goals, Criteria, & Asthma Score**

**Disclaimer:** Pathways are intended as a guide for practitioners and do not indicate an exclusive course of treatment nor serve as a standard of medical care. This pathway should be adapted by medical providers, when indicated, based on their professional judgement and taking into account individual patient and family circumstances.

**PED Pathway Goals:**

- Consistent Use of PED Asthma careset
- Steroid use in 100% of asthma exacerbations
- Administration of bronchodilator & steroids within 15 min of arrival
- ↓ admission rate & LOS (overall & ED)

**Inclusion Criteria:**

- >2 yo with Dx of asthma or recurrent wheezing that improves with Albuterol
- Current exacerbation

**Exclusion Criteria:**

- Chronic lung disease (Cystic fibrosis)
- Cardiac disease requiring baseline medication
- Airway issues (Tracheostomy)
- Sickle Cell Anemia
- Medically complex

### Pediatric Asthma Score

<table>
<thead>
<tr>
<th>Variable</th>
<th>0 points</th>
<th>1 point</th>
<th>2 points</th>
<th>3 points</th>
</tr>
</thead>
<tbody>
<tr>
<td>RR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-3 years</td>
<td>≤ 30</td>
<td>31-34</td>
<td>35-39</td>
<td>≥ 40</td>
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<tr>
<td>4-5 years</td>
<td>≤ 25</td>
<td>26-30</td>
<td>31-35</td>
<td>≥ 36</td>
</tr>
<tr>
<td>6-12 years</td>
<td>≤ 22</td>
<td>23-26</td>
<td>27-30</td>
<td>≥ 31</td>
</tr>
<tr>
<td>&gt;12 years</td>
<td>≤ 18</td>
<td>19-23</td>
<td>24-27</td>
<td>≥ 28</td>
</tr>
<tr>
<td>O2 sat on RA*</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Or Level of respiratory Support</td>
<td></td>
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</tr>
<tr>
<td>≥ 93%</td>
<td>89-92%</td>
<td>85-88%</td>
<td>&lt; 85%</td>
<td>On HFNC/Bipap</td>
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<tr>
<td>&lt;2L NC</td>
<td>2-4L NC</td>
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<tr>
<td>Breath Sounds</td>
<td></td>
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<td></td>
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<tr>
<td>Normal w/ good aeration</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>End expiratory wheezes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diffuse expiratory wheezing</td>
<td></td>
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<td></td>
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<tr>
<td>Biphasic wheezing</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>or ↓ air movement</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Retraction Sites:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subcostal</td>
<td>None</td>
<td>1 site</td>
<td>2 sites</td>
<td>3 sites or 2 + nasal flaring</td>
</tr>
<tr>
<td>Intercostal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supraclavicular</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dyssnea/General appearance</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>&lt; 4 years</td>
<td>Normal feeding, vocalization, &amp; play</td>
<td>1 of the following: Tachypnea w/ activity ↓ activity ↓PO</td>
<td>2 of the following: Tachypnea w/ activity ↓ activity ↓PO</td>
<td>3 of the following: Tachypnea w/ activity ↓ activity ↓PO</td>
</tr>
<tr>
<td>≥ 4 years</td>
<td>Counts to</td>
<td>&gt;9 in 1 breath</td>
<td>7-9 in 1 breath</td>
<td>4-6 in 1 breath</td>
</tr>
</tbody>
</table>

Total Score = 0 - 15

*RA score preferred if safe for patient to be checked on RA. If not, adjust score per level of respiratory support.*
**Pediatric ED Asthma Pathway – Management**

### 1st hour
- **PAS 0-4**
  - PO Dexamethasone
  - Albuterol MDI 4-8 puffs

### 2nd hour
- **PAS 0-4**
  - 1st hr PAS < 4 → discharge if criteria met
  - 1st hr PAS 5-9 → observe 1 hr
  - 1st hr PAS > 9 → observe 2 hrs

### 3rd hour
- **PAS 0-4**
  - Discharge if observation period complete & criteria met

### Discharge Criteria
- O2 > 89% with no retractions
- MDI spacer teaching complete
- Steroids prescribed or completed
- 24-48 hr follow up arranged

### 1st PAS Assessment
Place on O₂ if sat < 90

### 2nd PAS Assessment
15 min after last neb/HFA dose.
If ill-appearing or worsening, rescore & move to 2nd hr treatment

### 3rd PAS Assessment
15 min after last neb/HFA dose.
If ill-appearing or worsening, rescore & move to 3rd hr treatment

### Discharge Criteria
- Use current PAS score to determine the inpatient “STEP” (treatment pathway) & initial neb frequency

### PAS > 12 or AMS
- SWARM, PEDRU pg, start Tx below, & proceed to next page
- Nebs: Albuterol & Ipratropium x 3
- IV Magnesium sulfate
- IV Dexamethasone

### PAS 5-12
- SWARM for PAS > 8
- PO Dexamethasone
- Nebs: Albuterol & Ipratropium x 3
- Consider IV Magnesium Sulfate for initial PAS > 10

### PAS 5-7
- Neb: Albuterol 5 mg q15 min (up to 3)

### PAS 8-12
- 3 Albuterol nebs
- Consider IV Magnesium sulfate

### PAS > 12 or AMS
- SWARM, PEDRU pg, start Tx below, & proceed to next page
- Same treatments in “1st hour” for PAS > 12
- Exclude Ipratropium, Magnesium, & steroids if already given

<table>
<thead>
<tr>
<th>PAS</th>
<th>Severity</th>
<th>Admit STEP</th>
<th>Neb frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>13-15</td>
<td>SEVERE</td>
<td>PICU</td>
<td>Continuous</td>
</tr>
<tr>
<td>10-12</td>
<td></td>
<td>STEP A</td>
<td>Continuous</td>
</tr>
<tr>
<td>8-9</td>
<td>MODERATE</td>
<td>STEP B</td>
<td>Q2</td>
</tr>
<tr>
<td>5-7</td>
<td></td>
<td>STEP C</td>
<td>Q3</td>
</tr>
<tr>
<td>0-4</td>
<td>MILD</td>
<td>STEP D</td>
<td>Q4</td>
</tr>
</tbody>
</table>
**APPROACH TO THE ACUTELY SEVERE ASTHMATIC PATIENT (PAS >12)**

- **Concern for respiratory failure or ↓ LOC?**
  - Yes
    - Start BiPAP or HFNC & consider Blood gas + CXR
    - Consider adjuncts:
      - IV Terbutaline
      - SQ Terbutaline or IM epinephrine if near arrest
      - Assess response to therapy q10 min & notify PICU attending
    - Consult table below &/or PICU attending for additional guidance. Transfer to PICU ASAP
  - No
    - Intubate the patient

- **Re-assess following completion of Albuterol, Ipratropium, Magnesium Sulfate, & IV Steroids**
- **PAS < 13**
  - Resume regular pathway
- **PAS > 13**
  - ↓ Work of breathing & improved LOC?
    - Yes
    - Intubate the patient
    - Consult table below &/or PICU attending for additional guidance. Transfer to PICU ASAP
    - No
    - Resume regular pathway
  - No

**Therapeutic Options for patients with insufficient initial response**

<table>
<thead>
<tr>
<th>Agent</th>
<th>Recommended dosages &amp;/or usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albuterol</td>
<td>0.5-1 mg/kg/hr. Suggested continuous albuterol doses range per wt: If &lt; 20 kg → 10-20 mg/hr; 20-30 kg → 20-30 mg/hr, &gt; 30 kg → 20-45 mg/hr (&gt; 30 mg/hr rarely needed). Monitor for hypokalemia.</td>
</tr>
<tr>
<td>Ipratropium</td>
<td>May consider use as an adjunct given q4 in patients on continuous albuterol.</td>
</tr>
<tr>
<td>IV Magnesium</td>
<td>If poor response to bolus dose, consider infusions in dosing table. Mg level = 4 mg/dL. Watch for hypotension</td>
</tr>
<tr>
<td>HFNC/BiPAP</td>
<td>Titrate flows PRN. Start w/Bipap if LOC ↓. Bipap w/ Precedex is an option if child is HDS. Give 1 mcg/kg over 10 min (may repeat x 1), followed by drip of 0.5 – 1 mcg/kg/min. Titrate PRN by 0.1 - 0.2 mcg/kg/min (MAX of 2 mcg/kg/hr)</td>
</tr>
<tr>
<td>Terbutaline</td>
<td>Refer to dosing table. IV preferred but SQ may be used. Monitor HR &amp; BP closely, and potassium q12-24 hrs</td>
</tr>
<tr>
<td>Epinephrine</td>
<td>IM 0.01 mg/kg (max 0.3 mg) q 5 min PRN.</td>
</tr>
<tr>
<td>Ketamine</td>
<td>Bolus dose is 0.5 – 1 mg/kg. Infusion is 5–20 mcg/kg/min. Titrate to effect. Be ready to intubate if needed.</td>
</tr>
<tr>
<td>Aminophylline</td>
<td>Bolus: 6 mg/kg over 30 min. infusion: 0.5–1.2 mg/kg/h. Check level 30 min after infusion &amp; then q12 h. Therapeutic range 10–20 mcg/mL</td>
</tr>
</tbody>
</table>

**Asthma Intubation Guideline**

**Must be supervised by airway physician from PICU, Anesthesia, PED, or main ED**

<table>
<thead>
<tr>
<th>Step</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-intubation</td>
<td>Pre-oxygenate, NS bolus, review airway checklist, notify PICU attending</td>
</tr>
<tr>
<td>Induction meds</td>
<td>Induction: Ketamine 1.5-2 mg/kg followed by Rocuronium 1.2-1.5 mg/kg</td>
</tr>
<tr>
<td>Initial Ventilation</td>
<td>Initially hand-ventilate patient with a slow rate. Watch for hyperinflation, HD instability, &amp; Pneumothorax</td>
</tr>
</tbody>
</table>
| Ventilator Settings      | Mode: PC
  
  | TV: start with 6-8, up to 10ml/kg
  
  | Initial rate: 6-12 breaths per min
  
  | Inspiratory time: 1-1.5 sec
  
  | Expiratory time: 4-9 sec
  
  | I:E ratio 1:3-5
  
  | PEEP: 5
  
  | PIP goal: 25-30 (max of 45 cm H20 )
  
  | Plateau pressure: < 30 cm H20 |
| Ongoing Sedation & Analgesia | Ketamine at 1.2 mg/kg/hr

  | +/- midazolam 0.1-0.2 mg/kg/hr
  
  | Analgesia: Fentanyl 2 mcg/kg/hr
  
  | If continuing NM blockade (not > 48 hrs):
  
  | Cisatracurium 0.1-0.15 mg/kg q 30-60 min |
| Monitoring post intubation | Permissive hypercapnia

  | Plateau Pressures < 30 cm H20
  
  | ABG q 1-2 hrs
  
  | Adequate sedation + analgesia
  
  | Watch for breath stacking |
### ASTHMA GENERAL DOSING TABLE

<table>
<thead>
<tr>
<th>Drug</th>
<th>Kg</th>
<th>Individual Nebs</th>
<th>MDI</th>
<th>Continuous Neb (see below**)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albuterol</td>
<td>0-10</td>
<td>2.5 mg (0.5mL)</td>
<td>4 puffs</td>
<td>10 mg/hr</td>
</tr>
<tr>
<td></td>
<td>&gt; 10</td>
<td>5 mg (1 mL)</td>
<td>8 puffs</td>
<td>20 mg/hr</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Continuous solution takes time, Combine single doses until it arrives</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ipratropium</td>
<td>0-10</td>
<td>250 mcg neb</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; 10</td>
<td>500 mcg neb</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steroid Options</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dexamethasone</td>
<td>0.6 mg/kg</td>
<td>PO/IV</td>
<td>MAX 16 mg</td>
<td></td>
</tr>
<tr>
<td>Methylprednisolone</td>
<td>1-2 mg/kg/day</td>
<td>IV</td>
<td>MAX 60 mg/day</td>
<td></td>
</tr>
<tr>
<td>Prednisone/Prednisolone</td>
<td>1-2 mg/kg/day</td>
<td>PO</td>
<td>MAX 60 mg/day</td>
<td></td>
</tr>
<tr>
<td>IV Magnesium Sulfate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Bolus:</strong> 50 mg/kg (MAX 2 grams) over 20 min with 20 mL/kg NS (MAX 1 L)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Optional Infusion (PICU/ED only):</strong> If persistently severe after bolus dose, may give an infusion of 50 mg/kg over 1hr (MAX 2 gram/hr) up to 3 times.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terbutaline</td>
<td>SQ</td>
<td>10 mcg/kg q20 min x 3 doses</td>
<td>MAX 250 mcg = 0.25 mL</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>4-10 mcg/kg load over 15 min</td>
<td>MAX 750 mcg then infusion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Infusion</td>
<td>0.4 mcg/kg/min, then ↑ by 0.1-0.2 mcg/kg/min PRN q 30 min</td>
<td>MAX 3 mcg/kg/min</td>
<td></td>
</tr>
<tr>
<td>IM Epinephrine</td>
<td>&lt; 30 kg</td>
<td>0.15 mg q 5 min as needed</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>30 kg or &gt;</td>
<td>0.3 mg q 5 min as needed</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Terbutaline Titration Protocol Example**

- **NOTE:** Max dose = 3 mcg/kg/min
- Load with 5 mcg/kg Terbutaline IV
  - Start Drip at 0.2 - 0.4 mcg/kg/min
- Assess PAS & HR q 30 min
  - PAS > 10 x & HR less than max
    - Increase drip by 0.1 mcg/kg/min
  - Plateau Phase
    - Assess PAS q1 hr
      - PAS > 12
        - Start Weaning phase
          - Assess PAS q1 hr
            - PAS < 10
              - Wean drip by 0.1 mcg/kg/min
            - PAS 10-12
              - No change in drip
            - PAS > 12
              - Increase drip by 0.2 mcg/kg/min & suspend wean for 2 hrs
  - PAS < 10
  - PAS > 10 & HR greater than max
    - No change in drip

**HR Maximums**
- Age <3 yo: 200
- Age 3-10 yo: 180
- Age > 10 yo: 160
References

Scoring Tool Modified Quereshi PAS (adapted from tool currently in use on Pediatric Service)


Overview of Asthma Exacerbation Management


Effects of Asthma Pathways for Pediatric Patients


Albuterol and Atovent

References

Steroids


Magnesium Sulfate


Terbutaline


Heliox


Ventilation (noninvasive and invasive)