PEDIATRIC ASTHMA, ED AND INPATIENT, PATHWAY
Updated: March 24, 2023

Clinical pathway summary

PATIENT POPULATION AND DIAGNOSIS: Includes all patients with a primary diagnosis of asthma between the ages of 2 and 18 years of age.

Exclusions:
- Patients admitted for an acute illness other than asthma, such as, a primary diagnosis of bronchiolitis, pneumonia, or croup
- Patients with Chronic Conditions in addition to asthma
  - Primary Lung Diseases (Cystic Fibrosis, restrictive lung disease, lung transplant)
  - Chronic Lung Disease (bronchopulmonary dysplasia)
  - Congenital and/or Acquired Heart Disease
  - Airway Issues (tracheostomy dependent, tracheomalacia)
  - Medically Complex Children (multiple, severe issues)
  - Immunocompromised (chemotherapy, sickle cell, primary immunodeficiency disorders)

APPLICABLE TO: Helen DeVos Children’s Hospital, SH Regional Hospitals

BRIEF DESCRIPTION: Provide management guidelines for patients with primary diagnosis of asthma, utilizing assessment and monitoring to maximize the value of therapy.

Asthma Severity Score
Emergency Department Management
Inpatient Management
Subspecialty Referral and Follow up
Regional ED Observation
Pediatric Critical Care Escalation
Pediatric Critical Care Weaning

OPTIMIZED EPIC ELEMENTS:
- Pediatric Inpatient Asthma Orderset
- Pediatric ED Asthma Orderset
- Flowsheet documentation
- Inpatient referral
- ED referral

LAST REVISED: 3/24/23
Clinical algorithm:

Asthma Management ED Phase I A-C

Use Pediatric ED Asthma Orderset

Supplemental Oxygen should be administered to keep O₂ saturation at or above 90%

**Referral to Allergy Immunology Clinic for patients age ≥5 with ≥2 ED visits needing treatment for asthma symptoms in the past year**
Asthma Management Inpatient Phases II – V

Use Pediatric Inpatient Asthma Orderset

Supplemental Oxygen should be administered to keep $O_2$ saturation at or above 90%

All patients with an Asthma Score greater than 8 should be admitted to HDVCH

**Inpatient Steroid Treatment**
- 5-10 day course depending on severity of exacerbation
- prednisONE / prednisoLONE
  - 2mg/kg/dose daily
- Or
  - Dexamethasone
  - 0.6mg/kg/dose
- Or
  - Methylprednisolone
  - 2mg/kg loading dose via IV
  - Then
  - 1 mg/kg/dose every 12 hours IV
  - Or
  - 2mg/kg/dose daily IV
  - Maximum dose 60mg/day

**ED/Observation Steroid Treatment**
- 0.6mg/Kg (max 16 mg) one further home dose given in 4 mg dexamethasone tabs (round to nearest half tab)

**Family must receive a copy of the Asthma Action Plan for all inpatient discharges**
- Hospitalist completes AAP.
- Additional copies can be printed

**Phase II: AS 9-10**
- **Albuterol** 10mg Continuous NEB
- *(Cardiac Monitoring Required)*
- Asthma Score hourly
- Consider hospitalist/intensivist discussion if no progression after 3 hours at phase 2

**Phase III: AS 5-8**
- **Albuterol** 8 puffs MDI or 5mg NEB every 2 hours
- Asthma score every 2 hours.

**Phase IV: AS 0-4**
- **Albuterol** 8 puffs MDI or 5mg NEB every 4 hours
- Asthma score every 4 hours
- Advance to Phase V after one treatment if score remains less than 5

**Phase V: AS 0-4**
- **Albuterol** 4 puffs MDI or 2.5mg NEB every 4 hours
- Asthma score every 4 hours
- May discharge after one treatment

**Launch PCCU Criteria**
- AS 11-12
- Drowsiness
- Confusion
- Silent chest exam
- May give one Albuterol 15mg NEB continuous on floor with Cardiac Monitoring

**Notify Hospitalist**
- Consider calling an AWARE

**Phase Progression/Regression**
Plan of care is determined and therapy increased or decreased based on AS using scheduled frequency as outlined without the use of PRN therapy.

**RT or RN to notify DR for:**
- All phase transitions
- Failure to advance in phase II after 3 hours continuous albuterol
- Failure to progress after 12 hours all other phases
- Persistent oxygen requirement in Phase IV
- PCCU criteria present

**DR to notify PCCU for:**
- Asthma score over 10
- Failure to advance after 3 hours continuous

**DIRECT ADMISSIONS to floor:**
- **AS 10-12**
  - Albuterol 15 mg with Ipratropium Bromide 1 mg
  - Continuous NEB X1
  - Then follow phase progression

**Supplemental Oxygen** should be administered to keep $O_2$ saturation at or above 90%

**Discharge**

**Subspecialty Consultation / Referral for Outpatient Follow-up**
Consult to Inpatient Respiratory Care Management

- Consult for asthma education or review of Asthma Action Plan if needed.
- Patient will be seen after the Asthma Action Plan has been completed.
- Respiratory Care Managers are available Monday-Friday day shift.

Subspecialty Consultation and Referral

Both the HDVCH Pediatric Pulmonology and Pediatric Allergy/Immunology teams manage patients with asthma. For many patients hospitalized with asthma, subspecialist involvement may be helpful. Here are a few things to consider when deciding whether to seek Pulmonology versus Allergy/Immunology input:

- The Pulmonology Team generally has more inpatient consult availability. Consulting Pulmonology inpatient will allow the patient to be seen in Pulmonology clinic more quickly after discharge in a designated “hospital follow-up” appointment time. If not seen inpatient first, it may be several months before scheduled as a new patient in Pulmonology Clinic.
- The Pediatric Allergy/Immunology team generally has quicker outpatient clinic access and urgent visit slots but much less availability to do inpatient consults (Note: if a patient is admitted and already follows with A/I, please do let them know via PerfectServe as they may want to discuss with the team).
- Thus, if a patient hospitalized due to asthma has other suspected or known pulmonary issues such as Obstructive Sleep Apnea, Dysphagia, chronic cough, Bronchopulmonary Dysplasia or Chronic Lung Disease of Infancy, please consider Pulmonology inpatient consultation.
- If a patient has asthma as well as other atopic conditions such as allergic rhinitis, atopic dermatitis, food allergy, etc. please refer to Allergy/Immunology Clinic at discharge.
- Please also note that the Allergy/Immunology team manages all pediatric patients with severe asthma who require biologic therapy (such as Xolair/omalizumab, Dupixent/dupilumab, Fasenra/benralizumab, Nucala/mepolizumab, and Tezspire/Tezepelumab).
- Pulmonology and Allergy/Immunology work very closely together. If you seek subspecialist team involvement and it is determined later that the patient would benefit from seeing the other subspecialist service, Pulmonology or Allergy/Immunology will facilitate referral to the other clinic.
Pediatric Regional Observation Guidelines – Asthma

Inclusion Criteria
- Children ≥ 2 years with asthma, reactive airway disease
- Stable vital signs
- Insufficient clinical improvement for discharge after Phase I of ED asthma management

Exclusion Criteria
- < 2 years of age
- Unstable vital signs or significant O2 requirement (>2L nasal cannula or > 40% O2 by face mask)
- Need for continuous albuterol or treatments greater than every 2 hours (Strongly consider inpatient admission if respiratory interventions in the ED fail to produce significant improvement after phase I)
- History of significant co-morbidities i.e. extreme prematurity, chronic lung disease, congenital heart disease, CF, significant neuromuscular disease

Observation Interventions
- Respiratory treatments every 2-4 hours
  - Please start with 5 mg Albuterol neb every 2 hours and wean down as condition improves (see phases II-V)
- Asthma education
  - RT to provide spacer/MDI education.
  - Consider time of day, ability of pharmacy to dispense medications, follow up availability prior to discharge
  - Consider HDVCH Allergy/Immunology Referral-especially for >5 yrs with ≥ 2 ED visits in a year
- O2 therapy
- Cardiac and SpO2 monitoring
- Steroids – PO administration is typical; however, consider IV steroids in a sicker child
- IV fluids – Consider IV access in the child who is not taking oral fluids well, is worsening while in observation, or may benefit from fluids depending on amount of albuterol.

Observation Disposition
- Discharge home
  - Child is on room air and stable on current treatments
  - Therapies can be safely and competently delivered at home.
  - Follow up arranged and home needs addressed
- Medications
  - Albuterol MDI
  - Dexamethasone PO, dispensed as 4mg tabs (use ½ tab aliquots)
  - Refill any home mediations as needed
- Admission to the hospital
  - Clinical deterioration – increasing O2 needs, worsening work of breathing
  - Need for more frequent nebs or continuous albuterol – strongly consider inpatient care if child is not showing significant improvement after 4 Q2 hour nebs.
  - Not ready for discharge after 23 hours of treatment.
**Severe Status Asthmaticus (RS 9-12)**
Admitted to the ICU

- Continuous Albuterol increase as clinically indicated
- Provide Oxygen via Facemask
- Start NPPV or HFNC as clinically indicated (increased work breathing)
- Methylprednisolone, Magnesium Sulfate Q4-6 hrs PRN, Atrovent Q6 hrs

Reassess Respiratory Score Q15 min x 4 then Q1hr

- RS 1-4: Wean Continuous Albuterol
- RS 5-8: Consider Terbutaline or Aminophylline
  - Consider heliox if FiO2 requirements <40%
- RS 9-12: Consider Intubation and Mechanical Ventilation if altered mental status, severe distress, hypercarbia hypoxia and tissue hypoxia

Follow Weaning Pathway

Reassess Respiratory Score Q15 min x 4, then Q1hr

Consider initiating or titrating NPPV or HFNC

Escalation Medications:
- Continuous Albuterol (NEB):
  - INH: 5-20 mg/hr
  - Increase as indicated (max 40 mg/hr)
- Methylprednisolone (IV):
  - IV Bolus: 2 mg/kg (max 60mg), IV:
  - 1mg/kg q6-q12 hours (max 125mg/day)
- Magnesium Sulfate (IV):
  - IV: 50-75mg/kg (max 2g) over 20 min
  - Q4-6 hrs PRN
  - Consider a 20 ml/kg IV bolus of Normal Saline
- Terbutaline (IV):
  - IV Bolus: 10mcg/kg over 5-10 min, Cont IV 0.2-10mcg/kg/min, increase by 0.2mcg/kg Q30 min PRN
- Aminophylline (IV):
  - IV Bolus: 5.7mg/kg over 30 min in D5Q, Cont IV: 0.5-1 mg/kg/hr, obtain level 30 min after bolus and 12-24 hours after initiating continuous infusion (goal plasma level: 5-15 mg/mL)

Once intubated on maximum escalation therapies, consider the following: ketamine sedation, inhalational gases, consult for V-V ECMO
**PCCU Management – Weaning**

Assess Respiratory Score Q1hr

- **RS 1-4:** Stop Aminophylline/ Wean Terbutaline by 50% Q1 x 2 then turn off
- **RS 5-8:** Continue Aminophylline or Terbutaline
- **RS 9-12:** Revert to Escalation Pathway VS Q15 min

Wean NPPV and HFNC as clinically indicated. Wean heliox as clinically indicated.

Assess respiratory Score Q1hr

- **RS 1-4:** Wean Continuous Albuterol
- **RS 5-8:** Continuous Albuterol
- **RS 9-12:** Revert to Escalation Pathway VS Q15 min

Transfer to floor criteria:
- RS 1-4 with albuterol 5mg Q2 x 2 treatments. Otherwise follow inpatient discharge criteria.
- Reminder to consult Pulmonology and Respiratory Care Management for outpatient management.

Weaning Medications:

- **Albuterol:**
  - Wean by 5 mg/hr Q2hrs until 5 mg/hr for 2 hrs then stop if RS<4 and use intermittent albuterol 5mg Q2hrs

- **Methylprednisolone:**
  - IV: 1mg/kg q6-q12 hours, may be switched to Prednisone if off BiPAP and on PO
  - Terbutaline:
    - Wean by 50% Q1hr x 2 then turn off
    - Aminophylline:
      - Stop if ready to wean
Clinical pathways clinical approach

TREATMENT AND MANAGEMENT:

Asthma Distress Score (Ages 2-18 years)

<table>
<thead>
<tr>
<th>Scoring</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
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<tbody>
<tr>
<td>Respiratory Rate</td>
<td>18-26</td>
<td>27-34</td>
<td>35-39</td>
<td>Greater than 39</td>
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<tr>
<td>2-3 years</td>
<td>16-24</td>
<td>25-30</td>
<td>31-35</td>
<td>Greater than 35</td>
</tr>
<tr>
<td>4-5 years</td>
<td>14-20</td>
<td>21-26</td>
<td>27-30</td>
<td>Greater than 30</td>
</tr>
<tr>
<td>6-12 years</td>
<td>12-18</td>
<td>19-23</td>
<td>24-27</td>
<td>Greater than 27</td>
</tr>
<tr>
<td>12-18 years</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Auscultation

- Normal breath sounds with good aeration
- End Expiratory wheezes only
- Expiratory wheezes throughout
- Inspiratory & Expiratory wheezes to diminished throughout

Retractions

- None
- Mild – Subcostal or Intercostal
- Moderate – 2 of the following Subcostal Intercostal Suprasternal or Nasal flaring
- Severe - 3 of the following Subcostal Intercostal Suprasternal or Nasal flaring or head bobbing

Dyspnea

- Normal vocalization and activity
- Decreased vocalization, agitated or coughing
- Minimal vocalization, short cry, decreased activity
- Unable to speak, grunting, confused or drowsy

Total Score

- 0-4 Mild
- 5-8 Moderate
- 9-10 Severe
- Greater than 10 Status
1. **Purpose**
   Provide management guidelines for patients with primary diagnosis of asthma, utilizing assessment and monitoring to maximize the value of therapy.

2. **Responsibilities**
   Physicians, Advanced Practice Providers (APP), Licensed Respiratory Therapists (LRT), Registered Nurses (RN)

3. **Guideline**
   A. Includes all patients with a primary diagnosis of asthma between the ages of 2 and 18 years of age.

   B. Patients who do not fall under this guideline include:
      - Patients admitted for an acute illness other than asthma, such as, a primary diagnosis of bronchiolitis, pneumonia, or croup, do not fall under this guideline.
      - Patients with Chronic Conditions in addition to asthma
         - Primary Lung Diseases (Cystic Fibrosis, restrictive lung disease, lung transplant)
         - Chronic Lung Disease (bronchopulmonary dysplasia)
         - Congenital and/or Acquired Heart Disease
         - Airway Issues (tracheostomy dependent, tracheomalacia)
         - Medically Complex Children (multiple, severe issues)
         - Immunocompromised (chemotherapy, sickle cell, primary immunodeficiency disorders)

   C. **Assessment**
      i. All interventions contained in this guideline must have a provider order.
      ii. Patients meeting the inclusion criteria will be assessed using the **Asthma Score (AS)** to determine severity of symptoms.
      iii. Asthma score will determine treatment plan and orders placed
      iv. Supplemental oxygen should be administered to keep saturation greater than or equal to 90%
         a. Continuous therapy monitoring requirements
         b. Patients in ED phases require continuous pulse oximetry to monitor heart rate during continuous therapy and for one hour post treatment completion.
         c. Patients in admission phases require a cardiac monitor during continuous therapy and for one hour post treatment.

   NOTE: Albuterol doses of 8 puffs via Metered Dose Inhaler (MDI) and 5mg via nebulizer can be interchanged. The route of delivery is determined on a case by case basis considering patient presentation, ability, tolerance, and home therapy. MDI therapy is preferred for admitted patients with adequate technique. All MDI medications will be delivered with a spacer; a spacer mask can be utilized in conjunction if patient unable to maintain an adequate seal with a mouthpiece. Nebulizers should be given via mouthpiece. Masks will be used if the patient unable to maintain an adequate seal with a mouthpiece. All Continuous treatments will be delivered via mask.

   D. **Emergency Department Management Plan of care** is determined and modified based on the **Asthma Score** see Pediatric ED Asthma Order set.
      i. **Phase IA Initial Assessment**
         a. Asthma Score 0 to 5
            1) Administer Albuterol 8 puffs via MDI or 5mg nebulization
            2) Administer Dexamethasone 0.6mg/kg once oral (16mg max)
         b. Asthma Score 6-12
1) Administer Albuterol 15mg with Ipratropium Bromide 1mg via continuous nebulization over one hour
2) Administer Dexamethasone 0.6mg/kg once oral (16mg max)

ii. Phase IB Reassess 20 minutes after initial therapy
   a. Asthma Score 0 to 4
      1) Discharge if criteria met
      2) If initial score was greater than 5 observe for one hour prior to discharge
   b. Asthma Score 5 to 8
      1) Administer Albuterol 8 puffs via MDI or 5mg via nebulizer
   c. Asthma Score 9 to 12
      1) Administer Albuterol 15mg via continuous nebulization over one hour
      2) Add Ipratropium Bromide 1mg if not already given
      3) Consider Magnesium Sulfate 50mg/kg IV once (max 2 grams)
      4) Consider Patient Admission Status (See Appendix B)
      5) Regional Hospitals: patient must transfer to HDVCH if asthma score remains above 8 after next round of therapy. Continue Care; Consider Transfer.
      6) PCCU admission criteria regardless of Asthma Score: Drowsiness, Confusion, Silent Chest exam, PEFR less than 25% predicted

iii. Phase IC Reassess 20 minutes after second round of therapy
   a. Asthma Score 0 to 4
      1) Discharge if criteria is met
      2) If initial score was greater than 5 observe for one hour prior to discharge
      3) Emergency Department Discharge: Prescribe additional dose of Dexamethasone to be taken 24 hours after discharge. Use 4 mg tablets rounded to the nearest ½ tab (max 16mg,) Tablets should be crushed for children unable to swallow pills.
   b. Asthma Score 5 to 8
      1) Admit patient using Phase III guidelines while continuing care in ED
      2) Administer Albuterol 8 puffs via MDI or 5mg via nebulizer
      3) Patients can be directly admitted to a general HDVCH floor if a regional hospital does not accept pediatric admissions.
   c. Asthma Score 9-12
      1) Administer Albuterol 15mg via continuous nebulization over one hour
      2) Add Ipratropium Bromide 1mg if not already given
   d. Asthma Score 9 or 10
      1) HDVCH: Admit patient using Phase II guidelines while continuing care in ED
      2) Regional Hospitals: Admit to HDVCH ED while continuing care in ED
   e. Asthma Score 11 to 12
      1) Admit to HDVCH PCCU while continuing care in ED
      2) PCCU admission criteria regardless of Asthma Score: Drowsiness, Confusion, Silent Chest exam, PEFR less than 25% predicted

4. Admission: Treatment Frequency and Dosage: All patients with an Asthma Score greater than 8 should be admitted to HDVCH. Plan of care is determined and therapy increased or decreased based on Asthma Score using scheduled frequency as outlined without the use of PRN therapy. See: Pediatric Inpatient Asthma Order set.

A. Inpatient Steroid Treatment options for 5 to 10 day course depending on severity of exacerbation.
   i. PredniSONE / PrednisoLONE 2mg/kg/dose oral daily
   ii. Methylprednisolone 2mg/kg loading dose via IV
   iii. Methylprednisolone 1mg/kg/dose every 12 hours intravenous
   iv. Methylprednisolone 0.5mg/kg/dose every 6 hours intravenous
v. Methylprednisolone 1mg/kg/dose every 6 hours intravenous for very severe status asthmaticus (no maximum dose)

vi. Maximum dose:
- Less than 12 years of age = 60 mg/day
- Greater than or equal to 12 years of age: max = 80 mg/day

B. Severe: Asthma Score greater than 10
   i. Administer Albuterol 15 mg continuous nebulization
   ii. For direct admissions add 1mg Ipratropium Bromide
   iii. PCCU transfer if the Asthma Score remains greater than 10 after one hour of therapy.
   iv. PCCU criteria regardless of Asthma Score: Drowsiness, Confusion, Silent Chest exam, PEFR less than 25% of predicted

C. Moderate/Severe: Asthma Score of 9 to 10
   i. Phase II: Administer Albuterol 10 mg continuous nebulization
      a. Provider (HDVCH Hospitalist or Senior Resident) must notify PCCU attending if Asthma Score remains 9 to 10 after 3 hours on continuous albuterol treatment.

D. Moderate: Asthma Score of 5 to 8
   i. Phase III: Administer Albuterol 5mg every two hours
      a. Transition to Albuterol 8 puffs MDI every two hours for patients with adequate technique.

E. Mild: Asthma Score 0 to 4
   i. Phase IV: Administer Albuterol 8 puffs MDI or 5mg Neb every 4 hours
      a. Advance to phase V if score remains less than 5 after one treatment
   ii. Phase V: Administer Albuterol 4 puffs MDI or 2.5 mg every 4 hours
   iii. Maintain home therapy (if admitted for reasons other than exacerbation)

F. Discharge when Asthma Score 0 to 4
   i. May discharge after first treatment in phase V
   ii. Family must receive a copy of the Asthma Action Plan at discharge.

G. RT to Notify Provider for: (at HDVCH contact Hospitalist or Senior Resident)
   i. All phase transitions
   ii. Failure to advance from phase II after 3 hours on continuous Albuterol
   iii. Failure to progress after 12 hours in all other phases
   iv. Persistent oxygen requirement in phase IV.
   v. PCCU criteria present
   vi. Physician orders written outside of Pediatric Asthma Management Guideline.

6. Provider Communication
   A. Regional Hospitals should notify HDVCH for patients with an Asthma Score greater than 8
   B. HDVCH Hospitalists or Senior Resident to notify PCCU Intensivist when:
      i. Asthma Score greater than 10
      ii. Failure to advance from phase II after 3 hours on continuous Albuterol
      iii. PCCU criteria present

7. Documentation
   A. Asthma Score (How to document) (How to find it for providers: wrench in “Asthma Distress Score”)
   B. Medications administered
   C. Response to therapy
   D. Asthma Action Plan (for admitted patients)
Pathway information

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CLINICAL PRACTICE COUNCIL (CPC): Children's

CPC APPROVAL DATE: February 28, 2023

OTHER TEAM(S) IMPACTED: Respiratory Therapy, Respiratory Therapy Care Management

References


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