The Pediatrics for Emergency Physicians Network

Instructor Guide

Session II : Pediatric Respiratory Illness Made Simple

Teaching points to be driven home :

Part I - BASIC APPROACH TO STABLE RESPIRATORY PATIENTS

1. Concept of "THE BIG 6":

1. **TEACHING POINTS:**

   1. **Differential diagnosis of respiratory illness/distress is very broad**
   2. **Treatments are different and need accurate diagnosis**
   3. **Need a systematic approach:**
   4. **Approach "Resp Illness" in kids like we approach "Altered Mental Status" :**
      A. **Spectrum of illness (mild-→ severe)**
      B. **Regardless of severity, differential dx is the same!**
   5. **Regardless of severity, 99% of time dx is one of 6 things (see below):**

6 Most Common Causes of Respiratory Illness in Children ("THE BIG 6") :

Asthma
Bronchiolitis
Pneumonia
URI
Croup
Stuffy nose* ***(infants < 6 mo)**

2. WORKING THRU "THE BIG 6" DIFFERENTIAL:

Pneumonia → BOTTOM LINE: CXR

Croup → Clinical Dx : Barky cough OR Resting stridor

URI → Respiratory symptoms (ie- runny nose, congestion, and/or cough) WITHOUT any other physical findings or abnormalities on exam (ie- no tachypnea, retraction, hypoxia, wheezing, etc)…….Once a patient has ↑RR, wheezing,etc. AND NEEDS TREATMENT, the pt has proceeded BEYOND a URI & another Dx is present!

Stuffy nose → Keep in mind for < 6 mo (especially very young, <4mo)

Physiology: Young infants are obligate nasal breathers; when nose obstructed will not breathe thru mouth & can become significantly SOB-ie- retractions, tachypnea at rest or during feeds. BOTTOM LINE: Keep it in mind

TREATMENT : Nasal suction (Cured!)

Asthma **

Bronchiolitis **

2. ** Asthma OR Bronchiolitis ? → "The 2/2 Rule"

DILLEMA: Both are wheezing illnesses and may clinically appear identical.

QUESTION: WHY DO WE CARE WHETHER IT'S ASTHMA OR BRONCHIOLITIS?
ANSWER: BECAUSE THE TREATMENTS ARE DIFFERENT

Review Treatments, and which work for each condition :
(albuterol/atrovent/racemic epi/steroids/magnesium/CPAP/BiPA)

SO, IN THE ED WHEN A PATIENT ARRIVES IN RESPIRATORY DISTRESS, WE NEED A WORKING DEFINITION OF ASTHMA vs BRONCHIOLITIS (THAT WORKS!) SO WE CAN DECIDE ON THE PROPER TREATMENT :

To differentiate Bronchiolitis from Asthma in the ED,

USE "The 2/2 Rule" :

< 2 yo AND < 2 previous episodes (of wheezing illness) = BRONCHIOLITIS*
***(Conversely, > 2 yo OR ≥ 2 previous episodes (EVEN if <2yo) = ASTHMA)**

THE 2/2 RULE WORKS!! ……IF YOU REMEMBER THE 5 CAVEATS:

Review THE 5 CAVEATS TO THE 2/2 RULE :

1. Don't abandon diagnosis of asthma or bronchiolitis just because pt not wheezing
2. Trial of steroids for sick bronchiolitics
3. Trial of nebulized racemic epinephrine for any pt ≤ 2 years old
4. Many episodes of wheezing in an infant (ie- under 1 yo) is NOT asthma or bronchiolitis
5. Consider diagnosis of PERTUSIS in young infants with bad coughing, whenever the diagnosis of BRONCHIOLITIS is uncertain (ie- no wheezing).

---Case illustration : PRACTICAL APPLICATION OF THE CONCEPT OF "THE BIG 6"

Case : 4 yo girl presents to ED with cough and SOB.
Vitals: T 99 RR 44 HR 130 SaO2 89% (RA)

Keeping these "BIG 6" most common diagnoses in mind, we can review this (or a similar) case to see how we can apply this concept to help expedite working through the differential and arrive at the correct diagnosis:

CLINICAL APPROACH: Based on a chief complaint of respiratory illness alone, before even doing any history or exam, we can already narrow down the diagnosis to either ASTHMA or PNEUMONIA (or both-ie- "ASTHMONIA"), by reasoning as follows: Most likely diagnoses (from THE BIG 6):

Since pt is **4 yo** (too old for BRONCHIOLITIS or NASAL STUFFINESS as cause of tachypnea)) and **already tachypneic and hypoxic** (can't be just URI), and we hear **cough isn't barky and no resting stridor** (so not CROUP)……,

…….So, we already have narrowed down the most likely diagnosis to either PNEUMONIA **or** ASTHMA **(or** BOTH!**) , even before starting the H&P!**

3. H&P: THE RAPID PULMONARY SCREENING EXAM

QUESTION:

When you enter the room, how do you approach a respiratory patient?

ANSWER:

Step 1: ABC's + General Appearance

Step 2: Take the RR and HR yourself, and feel the l belly

Step 3: "Rapid PULMONARY Screening Exam" (+ initiate Rx)

Step 4: Full H&P

TEACHING POINTS:

I. Introducing The Rapid Pulmonary Screening Exam:

Recall from the end of Module I the general rule that that ALL pediatric patients get a FULL H&P, but the order of when to do the full H&P varies according to the 2 types of patients:

TYPE 1: Well-appearing/ vitals not extreme: 1.ABC/Appearance→ 2.VS's+ belly → 3. Full H&P
TYPE 2: Sick-looking OR extreme vitals: 1. ABC/Appearance→2.VS+belly→3.RCA*/Resus→ 4. Full H&P
***(RCA=Rapid Cardiopulmonary Assessment)**

While this **IS** the general rule, **RESPIRATORY PATIENTS ARE AN EXCEPTION** to the rule: ALL Patients with a respiratory complaint who are stable {and therefore do not have an indication for a Rapid Cardiopulmonary Assessment}, still require a "Rapid Pulmonary Screening Exam" prior to proceeding to a full H&P:

RAPID PULMONARY SCREENING EXAM : A 40 second exam to assess work of breathing & severity of respiratory distress at initial ED presentation, and repeated serially after each intervention to assess response to treatment. It ALWAYS must Include ALL of the following elements:

RR, HR, O2 Sat; signs of severe distress* ? *(severe distress: ΔMS, grunting , or head-bobbing)

Nasal flaring →ALWAYS indicates at least moderate distress

Upper airway sounds→ 1) Stridor ; 2) TRANSMITTED upper/nasal sounds vs TRUE lung findings

Retractions → 1) Suprasternal ; 2) Intercostal ; 3) Subcostal→Most common in kids

Aeration

I : E

Quality of cough → ? Severe ? Barky

Abnormal breath sounds

II. Commonly asked questions:

WHAT IS THE PURPOSE OF THE RAPID PULMONARY SCREENING EXAM?

1. Establishes baseline severity & decision on initial treatment.
2. Assesses response to ED treatments
3. Helps establish an initial diagnosis
4. When incorporated into routine full H&P, will catch atypical presentations**

NOTE: Only a SINGLE element of the exam may be severe, or at all abnormal. Therefore, accurate assessment (both baseline & repeat) requires always doing ALL the elements of the exam!!

****Optional teaching point:**

****Atypical Presentations of Respiratory Illnesses:**

1. Altered Mental Status {Due to fatigue from work of breathing)
2. Abdominal pain (Due to overlap of muscles of respiration with abdominal muscles)
3. Vomiting (Often is really posttussive vomiting-→Parents won't tell you, unless you ask!
4. Chest Pain (Respiratory muscle fatigue from increased work of breathing)

**** Only attention to ALL elements of the Pulmonary Exam (outlined above) may tip you off to a respiratory etiology in patients who present atypically, because only a single element of the respiratory exam may be abnormal.**

WHY DO EVEN THE MOST COMPLETELY WELL-APPEARING RESPIRATORY PATIENTS STILL REQUIRE A RAPID PULMONARY SCREENING EXAM PRIOR TO THE FULL H&P?

Only a single element of the exam may be abnormal (ie- ONLY retractions, or ONLY tachypnea); and if you miss that one finding, you'll miss the whole diagnosis!

Similarly, while several elements of the exam may be abnormal, only a single element may be SEVERE (ie- mild tachypnea and retractions BUT only fair aeration); therefore if you fail to assess ALL elements of the exam, you may seriously underestimate severity. This is especially true in babies and children, who often are extremely playful and well-appearing despite severe respiratory distress (ie-poor aeration, extreme tachypnea and retractions, etc) on more objective measurements using the Rapid Pulmonary Screening Exam.

IF THE CORRECT DIAGNOSIS IS ALREADY OBVIOUS FROM THE RAPID PULMONARY SCREENING EXAM, THEN WHY IS IT STILL NECESSARY TO DO A FULL H&P?

Basing your initial impression from the Rapid Pulmonary Screening Exam on the THE BIG 6 will most often lead to an initial diagnosis that is accurate; but this must ALWAYS be confirmed by a FULL H&P, since occasionally a less common diagnosis (ie- a diagnosis outside of THE BIG 6) may be present. A full H&P which is consistent with a BIG 6 diagnosis, and which does not suggest anything else as the cause of the patient's symptoms, serves to confirm that your initial impression was correct.

On the other hand, a much less likely but serious non-respiratory diagnoses may occassionally mimmick a respiratory illness, and the full H&P is the key to not missing it: If something in the history or exam raises concern for another possibility---ie-a wheezing, tachypneic patient {Impression: ?Asthma} who then on full history swallowed an entire bottle of aspirin for a bad headache-------Overdose with CHF?.... …OR the wheezing patient has an uticarial rash ----Anaphylaxis?)……..If the full History or Physical doesn't completely fit the picture of your initial impression, then you need to at least consider rethinking your diagnosis, or perhaps work-up further and rule-out another diagnosis, etc---as you see fit.

So, no matter how straightforward the diagnosis seems to you on your initial Rapid Pulmonary Screening Exam, following up with a FULL H&P is ALWAYS a MUST!

III. DON"T GET THESE 2 CONFUSED:

"THE RAPID PULMONARY SCREENING EXAM"
" THE RAPID CARDIOPULMONARY ASSESSMENT"

RAPID PULMONARY SCREENING EXAM : For ALL stable respiratory patients: A 40 second exam to assess work of breathing & severity of respiratory distress at initial ED presentation, and repeated serially after each intervention to assess for response.

PURPOSE: 1) Assess severity; 2) Provide clues to Dx; 3) Decide initial Rx.

RAPID CARDIOPULMONARY ASSESSMENT: For ALL ill-appearing or potentially sicker pts:** A brief clinical exam to evaluate BOTH 1) Work of breathing (ie- Pulmonary Sreening Exam); AND 2) End-organ perfusion

PURPOSE: To assess for the presence or absence of 2 things:
1) Compensated Shock; 2) Respiratory Failure requiring immediate intubation (or BOTH)

**** Basic Pediatrics Optional Review: 5 Indications for The Rapid Cardiopulmonary Assessment:**

1. **Extreme vitals signs (or hemodynamic Instability)**
2. **Ill-appearance**
3. **Any sign of hypoperfusion**
4. **Abnormal pulse=pressure**
5. **Very young infants**

4. Discharge Criteria for Respiratory Illness

Discussion of the first 5 (out of 6) discharge criteria:

1. **No hypoxia**** → O2 sat level which defines hypoxia varies from institution to institution
2. **No nasal flaring -→** ALWAYS indicates at least moderate distress, even if child looks well!
3. **NOT breathing too hard or too fast→** ie-≤10/min over upper limit nl + mild to no retractions
4. **No general signs of trouble breathing→** 1) active/playful 2) feeding well
5. **Good aeration→**may be only sign of significant distress!

** Infants and children may desaturate and become hypoxic after clinical improvement and no longer in respiratory distress at all (ie- despite not having been hypoxic at all with the initial presentation , when they WERE in distress)----**So ALWAYS re-check the O2 Sat again prior to discharge!**

Rationale: These 5 criteria reflect "Mild" illness. In the absence of reliable predictors of stable respiratory patients at risk for deterioration following ED discharge, these criteria allow for some sliding room, in case a discharged patient does unexpectedly worsen after discharge.

Caveats: 1) Patients must meet ALL 5 of these criteria for discharge.

2) If reliable followup CANNOT be ensured (ie- reliable parents who can recognize signs of distress indicating need to return to ED + available reliable followup within 24-48 hrs), then a patient should be ADMITTED unless completely better (ie- and above discharge DON'T apply).

5. The 6th Discharge Criteria: High-Risk Bronchiolitis

Rationale: "High-risk bronchiolitics" are at risk for EITHER sudden apnea (ie- the very young infants & ex-premies) OR rapid progression to severe illness (the other 3 categories of patients listed below). Therefore, since the discharge criteria listed above would not reliably provide a safe window of opportunity for patients to return to the ED prior to severe deterioration (ie-apnea or severe illness), even in the face of only minor illness, admission of these patients for observation should always be considered, especially the two "At-Risk-For-Sudden-Apnea" groups (ie-- 1) infants < 6-8 weeks old ; and 2) ex-premies).

List of the High-Risk Bronchiolitis Groups:

1. *Very Young Infants (< 6-8 weeks old)
2. *Ex-Premies (<37 weeks) closer to birth (<6mo)
3. Congenital Heart Disease
4. Pulmonary Disease (CLD, BPD, etc)
5. Immunocompromised or Debilitated

**These 2 groups are at risk for sudden, unpredictable apnea (risk is low, probably about 1%)→ therefore should most strongly be considered for admission for observation; For the other 3 groups listed here, the decision to admit (vs very close followup) may be made in consultation with the patient's primary physician or specialty service.

6. ALL 6 Discharge Criteria for *Respiratory Illness:

1. No hypoxia
2. No nasal flaring
3. NOT breathing too hard or too fast
4. No general signs of trouble breathing
5. Good aeration
6. NOT a high-risk bronchiolitic

*Respiratory Illness : Asthma, Bronchiolits, Pneumonia (in otherwise healthy child).

Part II -- APPROACH TO SICKER RESPIRATORY PATIENTS

General outline of the approach to sicker respiratory patients:

STEP 1: DO BOTH Basic Peds + Basic EM: (performed simultaneously)

Basic Peds:

ABC's + Gen Appearance
Do your own vitals (HR,RR) / feel the belly
Rapid Cardiopulmonary Assessment -→ Resuscitate (PALS) as indicated

Basic EM:

Oxygen
Monitors
IV access
d-stick,labs (as indicated)

STEP 2: Establish most likely diagnosis & initiate treatment:

Based on the BIG 6 (as reviewed in Part I above)

STEP 3: Go beyond THE BIG 6 to rule out ALL the less common diagnoses!**

**** The Less Common But Serious Etiologies of Respiratory Distress:**

CARDIAC	UPPER AIRWAY	METABOLIC ACIDOSIS	PNEUMOTHORAX
- CHF	- Foreign body	- DKA	**GERD SEPSIS**
- Myocarditis	- Vascular ring	- Toxic ingestion	**ANAPHYLAXIS**
- CHD	- Epiglottitis	- Sepsis	**PERTUSSIS**

ALL these uncommon but serious diagnoses are ruled-out by doing 3 things:

CXR - helps r/o pneumothorax AND myocarditis (with EKG ; +/- troponin)

Blood gas (VBG) – rules out tachypnea due metabolic acidosis mimicking a respiratory illness.

FULL H&P – will provide clues to any of the other serious diagnoses

NOTE: DON'T miss: SHOCK /SEPSIS/MYOCARDITIS → The 3 most likely to burn you!

Part III – KNOW WHEN TO EXPAND THE DIFFERENTIAL !

Make sure you know the following 4 indications for when to go beyond THE BIG 6 , to also consider all the other less common but serious etiologies:

1) **An ill-appearing or very sick patient -** Good rule of thumb: Anytime you're doing a Rapid Cardiopulmonary Assessment-(ie- The 5 Indications), consider expanding you're differential too.

2) **Your FULL H&P is not consistent with one of THE BIG 6-** Even if pt is stable & not that sick.

3) **A patient is not responding to your ED treatment as expected-** You might have the correct diagnosis and just a sick patient, BUT avoid tunnel vision and at least re-consider your diagnosis.

4) **A deteriorating patient-** Even if initially the patient was improving, once again don't get tunnel vision and "stuck" on your original diagnosis, without at least re-considering (and, if necessary, ruling out) OTHER serious but less common diagnoses.

Part IV – APPENDIX: OPTIONAL (USEFUL) INFORMATION

1) "MAKING THE DISCHARGE CRITERIA WORK FOR YOU":

Since our Discharge Criteria for Respiratory Illness reflect "MILD" illness (SEE above, PART I, Section 4: "Discharge Criteria for Respiratory Illness"), they are useful for MORE than just discharging the patient, and can also help you make other important clinical decisions:

Albuterol alone OR Albuterol + Atrovent: Clinical studies show that moderate to severe asthmatics benefit from the addition of nebulized atrovent to albuterol. If your asthmatic patient already fits these discharge criteria on presentation, then that patient is a mild asthmatic and will not likely benefit from the addition of atrovent.

Steroids OR no steroids: Again, while clinical studies show that less asthmatics will bounce back to the ED if given steroids, the principle benefit is in moderate to severe asthma. So a mild asthmatic, namely one who presents to the ED already fitting the discharge criteria, does not need steroids.**

**CAVEAT: In addition to knowing that (based on clinical studies in the ED) mild asthmatics don't generally benefit from steroids, from a pathophysiologic standpoint there are 2 phases to asthma :
EARLY PHASE- Acute bronchospasm, which usually responds to bronchodilators alone, like albuterol.
LATE PHASE- Left untreated, after 4-12 hours the initial (EARLY PHASE) asthma attack characterized primarily by bronchospasm , will progress to a leukotrine-mediated more intense inflammatory response (LATE PHASE) characterized by airway edema, mucous plugging, etc which responds more to the addition of steroids.

So if an asthmatic patient presents with mild asthma but still fails to improve with albuterol alone in the ED , and further history reveals that he/she has been having asthma symptoms for a prolonged period, the mild exacerbation still may represent LATE PHASE asthma and warrant steroids.

In summary, when deciding on steroids, consider BOTH the data from clinical studies that in the ED the moderate to severe asthmatic benefits from steroid treatment, in addition to considering the duration of symptoms and response to albuterol for a milder asthmatic in the ED.

Reducing ED length of stay: A patient who presents with a mild asthma exacerbation (as defined by the discharge criteria) may need bronchodilator treatment initiated in the ED, or perhaps an addition to the treatment they're already on, but they don't need to stick around in the ED for lots of treatments----Following their full H&P, a good plan, and reliable followup, they can be on their way.

2. UNDERSTANDING ATYPICAL PRESENTATIONS OF PEDIATRIC RESPIRATORY ILLNESS/DISTRESS:

1. **Altered Mental Status/Lethargy:** Due to fatigue from work of breathing
2. **Abdominal Pain:** From overlap of muscles of respiration with abdominal muscles
3. **Vomiting:** Often really posttussive vomiting-→Parents won't tell you, unless you ask!
4. **Chest Pain:** Respiratory muscle fatigue from increased work of breathing

TAKE-HOME POINT: A HARD RESPIRATORY FINDING (ie- retractions, tachypnea, etc) ON YOUR FULL H&P INDICATES THAT, DESPITE THE PRESENTING COMPLAINT AND SYMPTOMS, THE DIAGNOSIS IS MOST LIKELY RESPIRATORY.

3. WHY DO PEDIATRIC ASTHMA/BRONCHIOLITIS PATIENTS BECOME HYPOXIC AFTER TREATMENT, EVEN THOUGH CLINICALLY IMPROVED?

The answer is not really known, but 2 theoretical possibilities are:

1) The patient is actually sicker than our clinical assessment reveals: Sometimes an examiner thinks aeration is "good" in an asthmatic child breathing 60 or 80 breaths/minute---But if an asthmatic child needs to be breathing at 60 or 80 to ventilate effectively, the aeration probably isn't as good as we think by our assessment. …..Similarly, the hypoxic patient who otherwise seems clinically well to us may actually be less well than our exam detects.

2) **Blunting of the "Physiologic Compensatory Hypoxic Vasonstriction Response" to V/Q mismatch:** In an effort to compensate for an asthma exacerbation, the physiologic response at the alveolar level is to vasoconstrict in areas of Poor Ventilation/Good Perfusion, shunting blood to alveoli with better ventilation. While beta-agonists such as albuterol are bronchodilators, to a certain extent vasodilatation may also occur and the

net effect may be a balance of clinical improvement from bronchodilatation and reduced work of breathing **PLUS** blunting of the compensatory vasoconstriction which results in some worsening of V/Q mismatch.

********* END MODULE II (Respiratory) *********