Critical Levels
Pediatric Respiratory Illnesses
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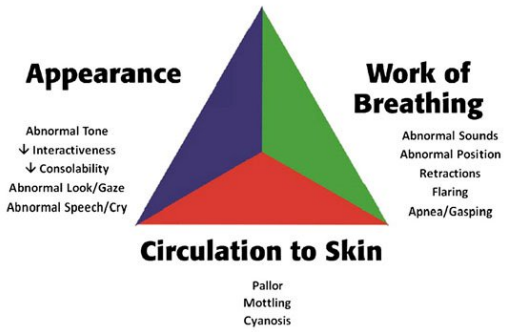
BACKGROUND

Respiratory complaints are the #2 reason for pediatric transport by the paramedics, making up 17.5% of all transports to CHEO (behind neuro), and is also the 2nd most common reason parents transport their own children to CHEO.

Of all the CTAS 1 patients brought to CHEO by paramedics, 20% of those were for respiratory concerns – less than neuro, but more than trauma. As for patients arriving without paramedics – respiratory complaints are the number 1 reason a child would CTAS 1, making up 50% of that cohort.

GENERAL PEDIATRIC RESPIRATORY ASSESSMENT



Respiratory pathologies are the most common ED complaint, other than fever, and the most likely reason why children may deteriorate rapidly – thus it's taken seriously.

First part of assessment is the patient assessment triangle (PAT) – appearance, breathing, colour. This assessment becomes easier with experience, but when you're newer or a little less experienced, you need to be more deliberate in your assessment.

The PAT + vital signs will ultimately frame management, treatment, and transport decision/priority. There are many other online resources available with respect to the PAT.

WOB: nasal flaring, tracheal tug, scalene retractions, abdominal muscle use. Any or all will be present. Positioning of the patient is also important (actively moving vs. sitting up right vs. tripod or sniffing)

Colour: Pallor, cyanosis, mottling, pink

Age Appropriate Respiratory Rates

Age	RR
0-3 months	30-60
3-6 months	30-60
6-12 months	25-45
1-3 yr	20-30
6 yr	16-24
10 yr	14-20

CROUP (LARYNGOTRACHEOBRONCHITIS)

Typically, is an inflammatory viral (no antibiotics) infection impacting primarily the upper airways (larynx, trachea). Since it involves the upper airway, stridor is a common presentation. Stridor is mostly inspiratory, due to pressures exerted during inspiration. Stridor is increased turbulent flow through a partially obstructed airway. As air is forced through a narrow airway, there's an increase in speed & decrease in pressure (Bernoulli's Principle) → a decrease in lateral pressure against walls of airway, which causes the walls to vibrate → stridor

Be careful not to miss some big troublesome differential diagnoses: foreign body aspiration, retropharyngeal or peritonsillar abscess, epiglottis, neck space infections.

Croup usually impacts the young kids (3 months – 6-8 years old), but can affect the older kids. Symptoms usually occur at night, with some seasonal variation. Traditionally, croup usually has a seasonal variation, but in practice this isn't necessarily true – it occurs year-round. The worst part of the illness is around night 2-3, but can last a week.

History/Physical Assessment

The typical croup story is the child who is well, goes to sleep, and wakes up with a seal bark cough or stridor or hoarse voice. Some preceding URTI symptoms and/or fever, but not always.

Signs/Symptoms:
- +/- barky cough
- +/- stridor
- +/- increased work of breathing (nasal flaring, retractions, etc.)
- URTI symptoms
- no lower adventitious airway sounds (wheeze/crackles) on auscultation

Vital Signs:
- +/- fever
- Might be tachycardic

- Normal to elevated respiratory rates
- Normal blood pressures
- O2 saturations tend to be normal, but low saturations in croup is concerning

Treatment

Treatment is usually a dose of oral steroid (dexamethasone), which decreases hospital visits, admissions, and invasive treatments. Exposure to cold air is also often beneficial.

If patients are severely ill or short of breath, inhaled epinephrine can be used. The desired effects are due to the alpha agonist properties, which help decrease secretions and increase the diameter of the airway. Very few kids need epi though. Having said that, it's often better to err on the side of caution if they need it.

Generally, the sick child who needs epi is the one with stridor at rest and who are having trouble breathing (clinical findings of increased work of breathing).

Salbutamol does not work. Salbutamol works on the lower airways, and croup is not a disease of the lower airways.

BRONCHIOLITIS

A common viral illness, with hallmark symptoms of wheezing. Generally, bronchiolitis is wheezing in any child under 2 years of age (though many consider it <1 year of age).

Working definition: 0-12 months, viral induced wheeze, with some seasonal variation. Respiratory Syncytial Virus (RSV), the main cause of bronchiolitis tends to come November-March/April, but can creep through in October and occasionally in the summer.

Anatomy/Physiology

Bronchiolitis is an upper and lower respiratory tract infection, caused by a virus.

Since nasal passages account for 50% of total airway resistance, increased nasal mucus production may cause upper airway obstruction due to small nasal passages in infants. This can cause respiratory distress as infants are obligate nasal breathers. Moreover, these young children can't clear their noses. If a child's nose is blocked, they will prioritize breathing over feeding, which is fine, until the kids get dehydrated.

Acute inflammation in the airways, edema, & necrosis of epithelial cells lining small airways, bronchospasm, and increased mucus production → increase in airway resistance & development of lower airway obstructions (wheezing) → increased WOB.

- Since it's not smooth muscle reactivity, it doesn't respond to salbutamol

Bronchiolitis can have a wide range of sounds on auscultation. Patients can present with wheezing, crackles, transmitted upper airway sounds, or clear lungs. This makes it a challenging diagnosis.

Bronchiolitis is a clinical diagnosis – based on the history and signs/symptoms.

Signs/Symptoms/Vital Signs:

- WOB (nasal flaring, tracheal tug, suprasternal retractions, intercostal indrawing, abdominal breathing)
- +/- cyanosis
- We want saturations >90%
- Normal HR → tachycardia
- Tachypnea
- Most kids will have normal sats
- If they've had poor feeding & dehydration, a blood glucose may be appropriate
- Dehydration
    - Tachycardia
    - Sunken fontanelle
    - Tears/moist mucus membranes
    - Cap refill
    - LOC
    - Urine output (how many wet diapers)

Treatment:

- The #1 treatment is nasal suctioning
- Inhaled epi *might* help, but there is conflicting evidence
- Give oxygen PRN
- <u>Ventolin will not work</u>

ASTHMA

Asthma is a chronic disease, characterized by episodic and reversible airflow obstruction due to bronchial smooth muscle and hyperreactivity (in response to a trigger), that is responsive to bronchodilator treatment.

Most common triggers are a viral upper respiratory tract infection, environmental allergens, exercise, cold weather.

Signs/Symptoms:

- Bronchoconstriction
- WOB can often be elevated
    - Overall appearance: can be active or nonactive. A very sick kid may be doing nothing except breathing.
    - Lower respiratory tract findings (intercostal indrawing, abdominal breathing)
    - Color: can be pink to cyanosed

- Usually will be tachypneic
- Can be hypoxic
- “Shark fin” appearance on EtCO2

Big Red Flags:

- How sick that kid has been
    - Previous ICU admissions
    - Previous intubations
    - Previous hospital admissions
- How responsive the child is to Ventolin
- How frequently they come to the ED

PRAM (Pediatric Respiratory Assessment Measure)

- Standardized, validated clinical score to classify the severity of respiratory distress in children with asthma exacerbations
- Good inter-rater reliability, and good prognosticator for illness severity. The score also dictates treatment.
- **THE HIGHER THE SCORE, THE SICKER THE PATIENT (1-12)**
- Patch to the ED at the higher limit of the scores

Severity	PRAM Score
Mild	1-3
Moderate	4-7
Severe/Life-Threatening	8-12

SIGNS	0	1	2	3
Suprasternal indrawing	Absent		Present	
Scalene retractions	Absent		Present	
Wheezing	Absent	Expiratory only	Expiratory +/- inspiratory	Audible wheeze/silent chest/minimal air entry
Air entry	Normal	Decreased at bases	Widespread decrease	Absent/minimal
Room Air O2 Saturation	>94%	92-94%	<92%	

Severity-Based Initial Management

Mild Asthma (PRAM 1-3)
- Salbutamol MDI x 1 treatment, reassess in 60 min

Moderate Asthma (PRAM 4-7)
- Salbutamol MDI q 20 minutes x 3 treatments
- Dexamethasone **0.6 mg/kg/dose (MAX 12 mg)** within 60 minutes

Severe Asthma (PRAM 8-12)
- 3 consecutive treatments of: Salbutamol (MDI or neb) + Ipratropium (MDI or neb)
- Dexamethasone **0.6 mg/kg/dose (MAX 12 mg) within 60 minutes**

Impending Respiratory Failure
(PRAM 12 + lethargy, cyanosis, decreasing respiratory effort, and/or rising pCO_2)
- Add Magnesium sulfate 50 mg/kg IV over 20-30 min (MAX 2000 mg /dose)
- Hydrocortisone 8 mg/kg IV if po steroid not tolerated (MAX 400 mg/dose)

MDI vs. Nebulizer

- Salbutamol should be delivered by MDI (with spacer) rather than nebulization (nebulizers are for kids who can't generate a proper tidal volume)
- Kids use MDIs at home, so they're more comfortable with them
- From an infection control point of view, MDIs are also safer

Severe Asthmatic

- Worrisome patient
- Follow medical directives
- Ventolin is still our main-stay
- IM Epi for apneic patients (with BVM)
    - If unable to generate tidal volume, you get the B-agonism without the alpha side effects
- In the ED, they'll be treating with IV magnesium sulfate, IV steroid, ketamine
- AVOID INTUBATION
- Normally we spend more time in inspiration than expiration, but the severe asthmatic is the converse – so they need to expire properly.

Bronchiolitis	Asthma
<12-24 months	>12 months
Nov-April	Any season
URTI prodrome	+/- URTI
Wheeze, crackles	Wheeze, cough
+/- fever	+/- fever
No response to Ventolin	Responds to Ventolin

ADDITIONAL RESOURCES

TREKK Asthma Resources
https://trekk.ca/resources?utf8=%E2%9C%93&tag_id=D001249&external_resource_type=All

TREKK Bronchiolitis Recourses
https://trekk.ca/resources?utf8=%E2%9C%93&tag_id=D001988&external_resource_type=All

TREKK Croup Resources
https://trekk.ca/resources?utf8=%E2%9C%93&tag_id=D003440&external_resource_type=All

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