Pediatric Respiratory Emergencies

ILENE CLAUDIUS
HARBOR-UCLA MEDICAL CENTER
IACLAUDIUS@GMAIL.COM

Bronchiolitis

- 800,000 infants treated/y in US
- Duration: Median 15d, 25% last ≥21d
- Presentation
  - 2-4 days
  - Low grade fever
  - Nasal congestion
  - Cough
  - Tachypnea
  - Respiratory distress

Bronchiolitis: How NOT to Diagnose

- Don't test
  - RSV accounts for 50-80%
  - Some patients + for 10 weeks
  - 6-30% have co-infections
  - How will it change your management?
- CXR not necessary
  - Consider for hypoxia, grunting, persistent focal crackles, temp >39
  - Unnecessary antibiotics

Bronchiolitis: Management Updates (2014 AAP, 2019 JID Review)

- No bronchodilators
  - No change in ox-sat, LOS, admission, duration
  - Recurrent wheezers may benefit
- No hypertonic saline in ED
  - AAP recommends for >72h inpatient stay
  - Inpatient use also in question
- No steroids
  - Do not reduce LOS
  - Do not alter long-term outcomes
- No antibiotics
  - 1.2% develop secondary infection
- In spite of this drugs used in 58.3%

Bronchiolitis: Management Updates

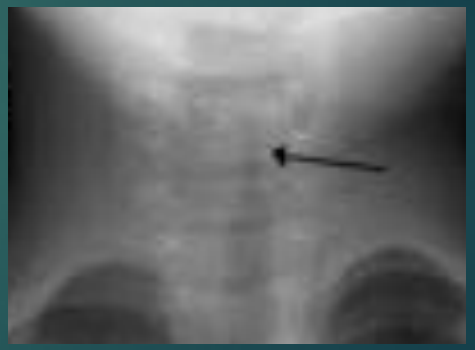
- Nasal saline (0.9%)
  - Sats improved 5-50min after use
- Oxygen if saturation falls to 90%
  - 90-95% across guidelines, majority 92%
  - Continuous p-ox not mandatory
  - Desats unlikely relevant
    - 118 kids sent home on p-ox
    - 43% had desaturations lasting ≥3m
    - No sig difference in bounceback or admission
- IVF

Bronchiolitis Updates: Admit

- <1 month or <48 weeks PCA
- Apnea
  - 21% infants < 2 weeks old
- Dehydrated with PO
- RR >60-70
- Oxygen sats <90%
- Poor follow-up
- Borderline with risk factors

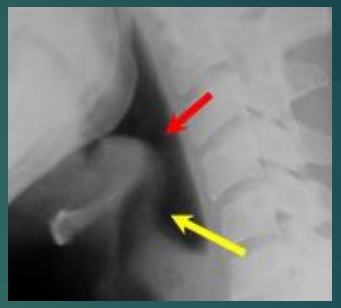
Croup

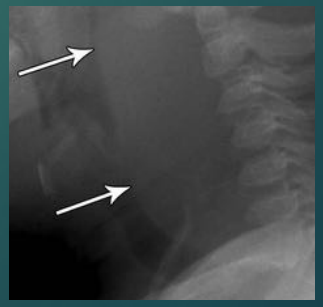
- 1-2 d prodrome: serous nasal discharge, elevated temperature, sore throat, anorexia and/or malaise.
- #1 cause stridor 6 mo to 6 years
- 7-14 days
  - 75% barky cough (obstruction) gone in 72h
  - <5% more than 5 days
- Worse at night
- Viral: parainfluenza and rhinovirus
- No labs or CXR necessary
  - Influenza A can cause severe case
  - Steeple sign (subglottic edema) ~limited sens/spec



Croup: Mimics

- Physical airway anomalies
- Epiglottitis
  - XR: thumb sign
- Bacterial Tracheitis
- Retropharyngeal abscess
  - 5% with stridor
  - Paravertebral soft tissue width should be less than width of vertebral body
- Upper airway foreign body





Croup: Rating

- Mild: No stridor or distress at rest
- Moderate
  - Stridor at rest
  - Mild tachypnea and retractions
- Severe
  - Stridor at rest
  - Tachypnea, retractions
  - +/- mental status changes
  - +/- hypoxemia

Croup: Treatment

- Cool mist little utility
- **Dexamethasone** IM, IV, PO
  - 0.15-0.6mg/kg as single dose; Oral = parenteral
  - Improve sx for 2-24 hours
  - Decreases ED returns >50%
- Inhaled **racemic epinephrine** 2.25%
  - 0.25 mL <20kg ; 0.5 mL >20kg
  - Lasts 90m-3h
  - Rare case reports of VT after 3 doses
- **Heliox** may be beneficial short-term (60-90 min) for moderate to severe croup

Croup: Treatment & Dispo

- Mild: steroids →home (85%)
- Moderate: steroids + rac epi
  - If well 2-3 hours after epi, can dispo home
  - Most admit for ≥2 doses racemic epi
    - 66% of these patient got more RE in hospital
    - 14% of pts asymptomatic at admission got more RE
- Severe
  - PICU
  - Predict difficult intubation (small ETT)
  - Extubation failure in 6.5%

Recurrence

- 5% of children get recurrent croup
- Spasmodic croup: boys, 5-8y
- Concerns
  - Physical airway anomaly (eg sublottic stenosis)
  - GERD
- Of patients getting bronchoscopy
  - 11.5% with surgical anomaly
  - 61.7% any anomaly
  - GERD 53-56%

GINA 2019: Asthma Updates

- *No treatment in adolescents and adults with short acting bronchodilators alone*
- *All adults and adolescents with asthma should receive either symptom-driven (in mild asthma) or daily inhaled corticosteroid (ICS)-containing treatment*
- SABA over-use assoc w/ risk of asthma-related death
- AE of SABA alone: reduced bronchodilator response, increased airway hyperresponsiveness, exercise-induced bronchoconstriction and allergic responses, and increased inflammation

Box 3-5A

Adults & adolescents 12+ years

Personalized asthma management:
Assess, Adjust, Review response

Confirmation of diagnosis if necessary
Symptom control & modifiable risk factors (including lung function)
Comorbidities
Inhaler technique & adherence
Patient goals

Symptoms
Exacerbations
Side-effects
Lung function
Patient satisfaction

Treatment of modifiable risk factors & comorbidities
Non-pharmacological strategies
Education & skills training
Asthma medications

Asthma medication options:
Adjust treatment up and down for individual patient needs

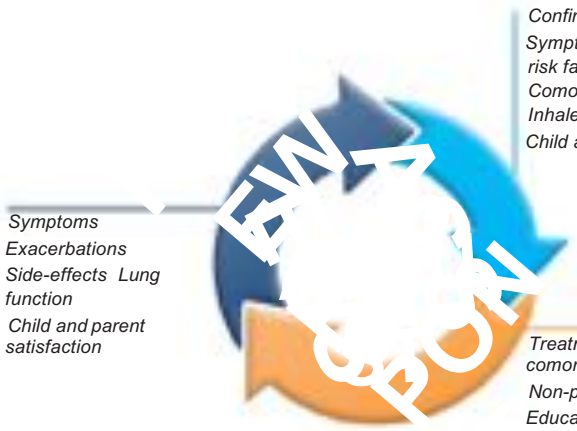
	STEP 1	STEP 2	STEP 3	STEP 4	STEP 5
PREFERRED CONTROLLER to prevent exacerbations and control symptoms	As-needed low dose ICS-formoterol *	Daily low dose inhaled corticosteroid (ICS), or as-needed low dose ICS-formoterol *	Low dose ICS-LABA	Medium dose ICS-LABA	High dose ICS-LABA Refer for phenotypic assessment ± add-on therapy, e.g.tiotropium, anti-IgE, anti-IL5/5R, anti-IL4R
Other controller options	*Low dose ICS taken whenever SABA is taken †*	*Leukotriene receptor antagonist (LTRA), or low dose ICS taken whenever SABA taken †*	*Medium dose ICS, or low dose ICS+LTRA #*	*High dose ICS, add-on tiotropium, or add-on LTRA #*	*Add low dose OCS, but consider side-effects*
PREFERRED RELIEVER	As-needed low dose ICS-formoterol *		As-needed low dose ICS-formoterol for patients prescribed maintenance and reliever therapy ‡		
Other reliever option	*As-needed short-acting β_2 -agonist (SABA)*				

* Off-label; data only with budesonide-formoterol (bud-form)
† Off-label; separate or combination ICS and SABA inhalers
‡ Low-dose ICS-form is the reliever for patients prescribed bud-form or BDP-form maintenance and reliever therapy
# Consider adding HDM SLIT for sensitized patients with allergic rhinitis and FEV$_1$ >70% predicted

Box 3-5B

Children 6-11 years

Personalized asthma management:
Assess, Adjust, Review response



Confirmation of diagnosis if necessary
Symptom control & modifiable risk factors (including lung function)
Comorbidities
Inhaler technique & adherence
Child and parent goals

Symptoms
Exacerbations
Side-effects Lung function
Child and parent satisfaction

Treatment of modifiable risk factors & comorbidities
Non-pharmacological strategies
Education & skills training
Asthma medications

Asthma medication options:
Adjust treatment up and down for individual child's needs

	STEP 1	STEP 2	STEP 3	STEP 4	STEP 5
PREFERRED CONTROLLER to prevent exacerbations and control symptoms		Daily low dose inhaled corticosteroid (ICS) (see table of ICS dose ranges for children)	Low dose ICS-LABA, or medium dose ICS	Medium dose ICS-LABA Refer for expert advice	Refer for phenotypic assessment ± add-on therapy, e.g. anti-IgE
Other controller options	*Low dose ICS taken whenever SABA taken*; or daily low dose ICS*	*Leukotriene receptor antagonist (LTRA), or low dose ICS taken whenever SABA taken**	*Low dose ICS+LTRA*	*High dose ICS-LABA, or add-on tiotropium, or add-on LTRA*	*Add-on anti-IL5, or add-on low dose OCS, but consider side-effects*
RELIEVER	*As-needed short-acting β_2 -agonist (SABA)*				

* Off-label; separate ICS and SABA inhalers; only one study in children

GINA options for home escalation

- ICS:
  - 4x dose decreased severe exacerbations in adults
  - 500– 1600mcg BDP-HFA for 7-14 days = short course of OCS
  - 5x dose did not decrease severe exacerbations in kids
- LABA: Patients with mild asthma exacerbation on chronic low dose ICS-formoterol can increase use as needed
  - Decreases severe exacerbation requiring OCS by 2/3 compared to SABA only
  - Up to 12 puffs (72 mcg) per day

Asthma Updates: B-agonists

- Mild to moderate asthma
  - Use of an MDI may decrease ED LOS and cost
  - MDI efficacy equivalent to nebs (~6 puffs)
- Severe asthma
  - Every 20 min nebulized treatment (0.15-0.3 mg/kg)
  - Continuous B-agonists may be more effective
- Ipratropium bromide 250-500 mcg x 3
- Albuterol increases lactate
- New drug of abuse: 1/3 teens use w/out Rx

Asthma Updates: Steroids

- Start within 1h of presenting
  - 30 min delay => 20% increased odds of admission
- Prednisone/ Prednisolone PO (1-2 mg/kg)
  - Duration 12-36 hours
  - Bad taste
- Dexamethasone PO (0.6 mg/kg)
  - Duration 36-72 hours
  - 1-2 doses of dex = 3-5 days prednisone
  - Less vomiting with dex, No increase relapse rate
  - If admitted, shorter LOS and decreased cost with dex
  - No change in readmit rates
- Methylprednisolone IV (1-2mg/kg/dose)
  - Reserved for severe (PICU) cases

Asthma Updates: Standard IV Magnesium

- Smooth muscle relaxer via Ca-blk
- Acute asthma not responsive to B-agonists and steroids
- 25-75 mg/kg (max 2 g) over 20 min
- Cochrane 2016: May decrease admission in moderate to severe
- SE: hypotension

CXR

- <2% of patients with asthma exacerbations have pneumonia
- Typically
  - Febrile
  - >5 years
  - Hypoxic
- Yet 1/3 of patients get CXR

The Sick Asthmatic

- Oxygen: Keep saturations >92%
- Permissive hypercapnia (to 70 mHg)
- B-agonists~ higher dose → hypokalemia
- Ipratropium bromide
- Steroids
- Magnesium
- Epi: 0.01 mg/kg (max 0.3-0.5 mg) IM of 1:1000 q20m X 3
- Bipap

The Sick Asthmatic

- Heliox 70:30
  - No use in mild to moderate
  - Decreased hospitalization in severe asthma (OR .49)
- IV aminophylline and salbutamol controversial
  - Shown to have effect on avoiding intubation
  - Substantial SE (emesis, arrhythmias)
- Ketamine
  - Onset 60 seconds
  - Block pulmonary NMDA receptors → decrease edema and bronchoconstriction
  - Controversial efficacy and dose
- Inhaled anesthetics, ECMO

BVM

- Difficult pediatric intubation rate: 0.25-0.32%
- Difficult BVM: 0.02%
- JAMA 2000 pediatric prehospital care study
  - Medic BVM vs. intubation
  - No differences in
    - Survival
    - Neurological outcome
    - Hospital LOS
    - Complications
  - A few subgroups favored BVM
- Consider OGT/NGT

HFNC

- Starting rate
  - Infant 8 L/min
  - Child 10 L/min
  - L/min = weight (kg) +1
- Clinical improvement within 60-90 min
- Possible mechanisms
  - Dead space washout from nasopharynx
  - Reduction UA resistance/ splinting open
  - Recruit alveoli with + distending pressure
    - 2.5 L/min → 8 cm H_2O
    - Lose efficacy with small nasal cannula or open mouth

HFNC: Literature

- Comparable to CPAP
- Bronchiolitis
  - Reduce intubation/escalation (23% vs 12%, NEJM)
  - Ease WOB
  - Decrease PICU transfer and PICU LOS
  - Cost savings over standard care for hospitalized bronchiolitics

Further Reading

- Silver A, Nazif J. Bronchiolitis. Pediatrics in Review. 2019; 40(11):568-576.
- Ortiz-Alvarez, O. Acute management of croup in the emergency department. Paediatric Child Health. 2017; 22(3):166-169.
- Patel S, Teach S. Asthma. Pediatrics in Review. 2019; 40(11):549-567.