Croup v3.0: ED Management

Citation Information

Summary of Version Changes

Explanation of Evidence Ratings

Pathophysiology

Inclusion Criteria
- Previously healthy children
- Age 6 months to 6 years

Exclusion Criteria
- Toxic appearance
- Symptoms suggestive of an alternative diagnosis
- Known upper airway abnormality
- Hypotonia or neuromuscular disorder

Consider Bacterial Tracheitis in children who appear toxic or have poor response to racepinephrine.

Severity Assessment (moderate / severe distress)
- Stridor at rest AND one or more of the following:
  - Moderate intercostal retractions
  - Tachypnea
  - Agitation / restlessness / tired appearing
  - Difficulty with talking or feeding

Give Dexamethasone (if not previously given)
- Dosage of 0.6mg/kg Dexamethasone
- Steroids are beneficial for all patients with croup

Evaluate criteria for racemic epinephrine

Observation with Respiratory Assessment Q1 hour
- If worsening or not meeting discharge criteria consider racepinephrine

Severity Assessment (moderate / severe distress)
- Stridor at rest AND one or more of the following:
  - Moderate intercostal retractions (suprasternal retractions are acceptable)
  - Tachypnea
  - Agitation / restlessness / tired appearing
  - Difficulty with talking or feeding

Give Racemic Epinephrine
- Racepinephrine 2.25% inhalation solution (0.5 mL nebulized) diluted in 3 mL NS

AND

Give Dexamethasone (if not previously given)
- Dosage of 0.6mg/kg Dexamethasone

Assess immediate clinical response

Discharge criteria not met

Observation for 2 hr with minimum Q1 hour assessments
- Racepinephrine effect lasts only 2 hours
- If patient worsens, consider repeat racepinephrine and admission

Discharge Criteria
- Minimal stridor at rest (stridor with activity to be expected)
- Minimal retractions
- Able to talk or feed without difficulty
- 2 hours since racepinephrine

To Inpatient Management

Admit Criteria
- Patients with continued stridor at rest AND any symptoms listed in the severity assessment above
- Patients receiving 3 or more doses of racepinephrine
- Patients not otherwise meeting discharge criteria

Patients not otherwise meeting discharge criteria

Consider alternative diagnosis or ICU admission

Off Pathway

Discharge Criteria
- Return for increased work of breathing

Urgent Care Transfer Criteria
- Poor initial response to 1st Racepinephrine
- If 2nd Racepinephrine given
- ALS recommended for all patients
- Can repeat Racepinephrine while awaiting transportation if necessary.
**Inclusion Criteria**
- Previously healthy children
- Age 6 months to 6 years

**Exclusion Criteria**
- Toxic appearance
- Symptoms suggestive of an alternative diagnosis
- Known upper airway abnormality
- Hypotonia or neuromuscular disorder

**Severity Assessment** (moderate / severe distress)
Stridor at rest AND
- One or more of the following:
  - Moderate intercostal retractions (suprasternal retractions are acceptable)
  - Tachypnea
  - Agitation / restlessness / tired appearing
  - Difficulty with talking or feeding

**Give Dexamethasone** (if not previously given)
- Dosage of 0.6mg/kg Dexamethasone

**Give Racemic Epinephrine**
- Racinephrine 2.25% inhalation solution (0.5 mL nebulized) diluted in 3 mL NS
- Can give racepinephrine Q2 hrs; more than 1 additional dose on medical unit requires MD evaluation
- Racepinephrine can be ordered by the physician more frequently than Q2 hrs if the patient is worsening and MD bedside evaluation is in progress

**Give Dexamethasone** (if not previously given)
- Dosage of 0.6mg/kg Dexamethasone

**Observation**
- RN assess symptoms Q2 hr until patient meets discharge criteria
- If patient worsens, consider repeat racepinephrine

**Severity Assessment** (moderate / severe distress)
Stridor at rest AND
- One or more of the following:
  - Moderate intercostal retractions (suprasternal retractions are acceptable)
  - Tachypnea
  - Agitation / restlessness / tired appearing
  - Difficulty with talking or feeding

**Clinic Assessment**
IF 2 INPATIENT DOSES OF RACEPINEPHRINE GIVEN
- Notify MD to evaluate patient and consider RRT
  - Consider alternative diagnosis
  - Consider blood gas
  - Consider RRT (ICU eval)
  - Consider OTO evaluation

**To ED Management**

**Clinical Assessment**

**Discharge Criteria**
- Minimal stridor at rest (stridor with activity to be expected)
- Minimal retractions
- Able to talk or feed without difficulty
- 2 hours since racepinephrine
- No supplemental oxygen for more than 12 hours

**Discharge Instructions**
- Return for increased work of breathing

**Summary of Version Changes**

**Explanation of Evidence Ratings**

**Not Recommended**
(No evidence supporting the use of)
- Viral PCR
- Radiographs
- Repeat Dexamethasone
- Cool Mist

**Recommendations**
1. Consider OTO consultation/referral for direct laryngoscopy in patients with 2 or more episodes of croup and that have a history of intubation and age less than 36 months or who have prolonged severe disease requiring inpatient management.
2. Consider evaluation for GERD and initiation of anti-reflux medications in patients with prolonged or recurrent croup.
3. Consider evaluation and treatment for allergies

**Off Pathway**
Exclusion Criteria

• Toxic Appearance
• Symptoms suggestive of an alternative diagnosis:
  o Poor response to treatment with racemic epinephrine
  o Expiratory wheeze
  o Drooling or difficulty swallowing
  o Prolonged or recurrent stridor
• Known upper airway abnormality
  o Laryngomalacia
  o Tracheomalacia
  o History of vascular ring/sling or tracheoesophageal fistula
• Hypotonia or neuromuscular disorder resulting in hypotonia
  o Trisomy 21
Therapies NOT Indicated in Croup

Not Recommended

**Cool Mist**
- No evidence supporting the use of cool mist for treatment of croup

**Viral FA**
- No evidence that laboratory tests improve croup care

**Radiographs**
- No evidence that radiographs are necessary in croup with typical presentation that responds to therapy

**Repeat Dexamethasone**
- No evidence that repeat doses of dexamethasone improve outcomes

Review of initial evidence in 2012 demonstrated that the following therapies did not enhance the care of patients with croup.
Background Group

- Also known as laryngotracheobronchitis
- Viral illness
- Most common in late fall to early winter
- Results in inflammation and swelling of the upper airway
- Most commonly caused by Parainfluenza virus
- Other causes include:
  - Respiratory syncytial virus
  - Influenza A and B
  - Mycoplasma Pneumonia
  - Other respiratory viruses

Symptoms

- Sudden onset of barking cough
- Inspiratory stridor
- Hoarse voice
- Respiratory distress
- Can be accompanied by fever
- May be abrupt in onset or be preceded by mild URI symptoms

Natural Course

- Symptoms are usually worse at night
- Usually resolve within 48 hours
- Often followed by upper respiratory infection type symptoms
**Bacterial Tracheitis**

- Rapidly progressive
- Requires prompt assessment of airway by otolaryngology and possible intubation in a controlled setting
- Symptoms suggestive of bacterial tracheitis:
  - URI symptoms have been present >24 hours
  - Fever may/may not be present
  - Symptoms do not respond or show incomplete response to racpinephrine
  - CRP and WBC are not predictive for or against bacterial tracheitis
  - Patients may have an oxygen requirement (unusual in croup)

**IMPORTANT Guidance:**

- Bacterial tracheitis can mimic croup initially, but if not identified early can lead to high morbidity and mortality
- Review of serious safety events involving the initiation of the croup pathway demonstrate that a patient that is not responding to racpinephrine needs further physician evaluation to consider alternative diagnoses and escalation of care

![Seattle Children's Hospital - Research - Foundation](WashingtonChildrens.png)
Severity Assessment

In croup, moderate to severe respiratory distress is defined as:

- Stridor at rest
- AND one or more of the following:
  - Moderate intercostal retractions (suprasternal retractions are acceptable)
  - Tachypnea
  - Agitation / Restlessness / Tired appearing
  - Difficulty talking or feeding

Severity Assessment (Cont’d)

Upon presentation and after each intervention the patient should be assessed for:

Focuses on specific symptoms that indicate a need for racemic epinephrine (moderate to severe symptoms):

- Provides a common language to discuss the severity of symptoms among patients
- Based on the Westley Croup Score (Westley 1978)
Two studies attempted to find risk factors significantly associated with moderate to severe operative findings. Both found the following risk factors:

- Inpatient consultation
- History of intubation

*Delany (2015)* also found increased risk associated with *Age < 36 months* and *seasonal allergies*. *LOE 4* Very low quality

*Jabbour (2011)* found prematurity to also be an associated risk factor. *LOE 4* Very low quality

Both studies suggest benefit to performing laryngoscopy in patients with previous intubation and age < 1 year (Jabbour) or < 3 years (Delany) and for patients who require inpatient consultation.

**Recurrent Croup (Cont’d)**

- Two studies demonstrated an association with atopy
  - 38-44% of patients with recurrent croup have a history of atopy.
- 4 studies demonstrated evidence of GERD
  - Identified via laryngoscopy findings
  - Occurrence ranged from 28-87.2% of patients studied.
- Chart review of Seattle Children’s patients with recurrent croup demonstrated an association with:
  - prior intubation (29% in cases vs. 0% in controls)
  - history of asthma (21% in cases vs. 1% in controls)
  - prematurity (14% in cases versus 0.09% in controls).

**Recurrent Croup Recommendations**

**Recommendations:**
1. Consider OTO consultation/referral for direct laryngoscopy in patients with 2 or more episodes of croup who are less than 36 months of age AND have a history of intubation OR for any patient who has prolonged severe disease requiring inpatient management.
2. Consider evaluation for GERD and initiation of anti-reflux medications in patients with prolonged or recurrent croup.
3. Consider evaluation and treatment for allergies.

Otolaryngology evaluation can occur as inpatient or outpatient, depending on the severity of presentation.

Evaluation for GERD and atopy can be conducted by the medical team or PCP.
Dexamethasone

Dexamethasone is recommended for **ALL patients** presenting with croup symptoms.

**Give Dexamethasone (if not previously given)**
- Dosage of 0.6mg/kg Dexamethasone
- Steroids are beneficial for all patients with croup

**FINDINGS:**
- Glucocorticoids are associated with an improved croup score at 6 hours (-1.2 points) and at 12 hours (-1.9 points); NNT for improvement = 5
- Fewer return visits in patients treated with glucocorticoids compared to placebo
- Length of hospital/ED stay was significantly decreased (mean decrease of 12 hours)
- Use of epinephrine is decreased

[LOE: ✭✭✭✭, (Russell, 2011)]

**Dexamethasone Dosage**

A dosage of 0.6 mg/kg of dexamethasone should be given
- Maximum dose of 16mg
- Round dose to nearest 2mg dosage

**Rationale:**

“In the absence of further evidence, a single oral dose of dexamethasone, probably 0.6mg/kg, should be preferred because of its safety, efficacy and cost effectiveness.”

Most of the studies that compared dexamethasone to placebo used the dosage of 0.6mg/kg (12 of 31 trials; N=2032)

There are small studies showing similar therapeutic effect at lower doses, more studies need to be done before changing the dosing recommendation.

[LOE: ✭✭✭✭, (Russell, 2011), (Dobrovoljac, 2012)]

**Glucocorticoid Choice**

Comparisons between steroids:
- **Combination of dexamethasone + budesonide is no better than dexamethasone or budesonide alone**
- **No difference between PO and IM dexamethasone**
- **Dexamethasone and prednisolone are equally effective at 6 and 12 hours, but readmission is more likely with prednisolone**

[LOE: ✭✭✭✭, (Russell, 2011)]
Racemic epinephrine works by causing mucosal vasoconstriction and reduction of subglottic edema.

Nebulized epinephrine is associated with clinically and statistically significant transient reduction of symptoms of croup at 30 minutes post-treatment. (3 studies, 94 children)

Evidence does not favor racemic epinephrine or L-epinephrine, or Intermittent Positive Pressure Breaths (IPPB) over simple nebulization.

Treatment effect disappears after two hours.

There is no evidence, on average, to suggest that there was an increase or worsening of croup score, as compared to the pre-treatment or baseline in the group treated with epinephrine.

[LOE: 3☆☆☆☆, (Bjornson, 2013)]

Racemic Epinephrine: Who should receive it?

Children with severe respiratory distress (indicated by marked sternal wall indwelling and agitation) [LOE: E (Expert Opinion), (Toward Optimized Practice, 2008)]

Children with severe or life threatening croup
[LOE: Guideline, (Mazza, 2008)]

Compared with placebo or no treatment nebulized adrenaline is more effective in the short-term at reducing symptom severity at 10-30 minutes in children with moderate to severe croup. [LOE: 3☆☆☆☆, (Johnson, 2004)]

Severity Assessment (moderate/severe distress)
- Systolic at rest AND
- one or more of the following:
- Moderate intercostal retractions
- (suprasternal retractions are acceptable)
- Tachypnea
- Agitation/restlessness/tired appearing
- Difficulty with talking or feeding

= Moderate/Severe

Racemic Epinephrine: Ordering

Note that racemic epinephrine is ordered under the name:
- racepinephrine (racepinephrine 2.25% inhalation solution)

Additional doses of racepinephrine can be ordered in the ED Croup subsequent and Inpatient Croup subsequent phases of the Croup Power Plan.
Racemic Epinephrine: MAR

Severity Assessment for racemic epinephrine in Croup

Note that racemic epinephrine is ordered under the name:

- *racepinephrine* (racepinephrine 2.25% inhalation solution)

Racepinephrine is given to patients with stridor at rest AND symptoms of moderate to severe respiratory distress as determined by the severity assessment.

Racemic Epinephrine: Inpatient Management

Racemic epinephrine can be given every 2 hours to patients who meet severity criteria.

We strongly recommend that patients be re-evaluated by MD if requiring more than **ONE** additional dose of racemic epinephrine after admission.

Racemic epinephrine can be given more frequently than Q2 hours, but should be done cautiously in conjunction with ongoing MD evaluation.

**Give** *Racemic Epinephrine*
- Racepinephrine 2.25% inhalation solution (0.5 mL nebulized) diluted in 3 mL NS
- Can give *racepinephrine Q2 hrs*; more than 1 additional dose on medical unit requires MD evaluation
- Racepinephrine can be ordered by the physician more frequently than Q2 hrs if the patient is worsening and MD bedside evaluation is in progress

**Give** *Dexamethasone*
(if not previously given)
- Dosage of 0.6mg/kg Dexamethasone
We have added an important safety step to help identify patients who may be at high risk for deterioration or alternative diagnoses.

Racemic Epinephrine: Inpatient Management *NEW*

Clinical Assessment
IF 2 INPATIENT DOSES OF RACEPINEPHRINE GIVEN
- Notify MD to evaluate patient and consider RRT
  - Consider alternative diagnosis
  - Consider blood gas
  - Consider RRT (ICU eval)
  - Consider OTO evaluation

Racemic Epinephrine: Cautions!

Most patients with croup demonstrate rapid and significant improvement of symptoms with administration of racemic epinephrine.

Consider further workup and removal from the croup clinical pathway if your patient does not show improvement with administration to racemic epinephrine.

Consider BACTERIAL TRACHEITIS in children who appear toxic or have poor response to racepinephrine.
Racemic epinephrine can be given every 2 hours to patients who meet severity criteria.

We strongly recommend that patients be re-evaluated by MD if requiring more than ONE additional dose of racemic epinephrine after admission.

Racemic epinephrine can be given more frequently than Q2 hours, but should be done cautiously in conjunction with ongoing MD evaluation.

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- Racepinephrine 2.25% inhalation solution (0.5 mL nebulized) diluted in 3 mL NS
- Can give racpinephrine Q2 hrs; more than 1 additional dose on medical unit requires MD evaluation
- Racepinephrine can be ordered by the physician more frequently than Q2 hrs if the patient is worsening and MD bedside evaluation is in progress

**Give Dexamethasone** (if not previously given)
- Dosage of 0.6mg/kg Dexamethasone
We have added an important safety step to help identify patients who may be at high risk for deterioration or alternative diagnoses.

Clinical Assessment IF 2 INPATIENT DOSES OF RACEPINEPHRINE GIVEN

- Notify MD to evaluate patient and consider RRT
- Consider alternative diagnosis
- Consider blood gas
- Consider RRT (ICU eval)
- Consider OTO evaluation
**Racemic Epinephrine (racepinephrine)**

Racemic epinephrine works by causing mucosal vasoconstriction and reduction of subglottic edema.

*Nebulized epinephrine is associated with clinically and statistically significant transient reduction of symptoms of croup at 30 minutes post-treatment.* (3 studies, 94 children)

*Evidence does not favor racemic epinephrine or L-epinephrine, or Intermittent Positive Pressure Breaths (IPPB) over simple nebulization.*

*Treatment effect disappears after two hours.*

*There is no evidence, on average, to suggest that there was an increase or worsening of croup score, as compared to the pre-treatment or baseline in the group treated with epinephrine.*

[LOE: 2222, (Bjornson, 2013)]

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**Racemic Epinephrine: Who should receive it?**

*Children with severe respiratory distress (indicated by marked sternal wall indwelling and agitation)* [LOE: E (Expert Opinion), (Toward Optimized Practice, 2008)]

*Children with severe or life threatening croup* [LOE: Guideline, (Mazza, 2008)]

*Compared with placebo or no treatment nebulized adrenaline is more effective in the short-term at reducing symptom severity at 10-30 minutes in children with moderate to severe croup.* [LOE: 2222, (Johnson, 2004)]

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**Severity Assessment (moderate / severe distress)**

Sindt or at rest AND

- One or more of the following:
  - Moderate intercostal retractions
  - (suprasternal retractions are acceptable)
  - Tachycardia
  - Agitation / restlessness / tired appearing
  - Difficulty with talking or feeding

= Moderate/Severe

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**Racemic Epinephrine: Ordering**

Note that racemic epinephrine is ordered under the name:

- **racepinephrine** (racepinephrine 2.25% inhalation solution)

Additional doses of racepinephrine can be ordered in the ED Croup subsequent and Inpatient Croup subsequent phases of the Croup Power Plan.
Racemic Epinephrine: MAR

Note that racemic epinephrine is ordered under the name:

- **racepinephrine** (racepinephrine 2.25% inhalation solution)

Racpinephrine is given to patients with stridor at rest AND symptoms of moderate to severe respiratory distress as determined by the severity assessment.

Racemic Epinephrine: Observation in the ED

**Observation for 2 hr with minimum Q1 hour assessments**
- Racepinephrine effect lasts only 2 hours
- If patient worsens, consider repeat racepinephrine and admission

*Treatment effect disappears after two hours.*

There is no evidence, on average, to suggest that there was an increase or worsening of croup score, as compared to the pre-treatment or baseline in the group treated with epinephrine. [LOE: ★★★ O, (Bjornson, 2013)]

Racemic Epinephrine: Cautions!

Most patients with croup demonstrate rapid and significant improvement of symptoms with administration of racemic epinephrine.

Consider further workup and removal from the croup clinical pathway if your patient does not show improvement with administration to racemic epinephrine.

![Consider BACTERIAL TRACHEITIS in children who appear toxic or have poor response to racepinephrine](logo.png)
Re-evaluation and Readiness for Discharge

RN will assess severity symptoms upon transfer to the medical unit.

If racemic epinephrine given, observe patients hourly for 2 hours.

Assess discharge readiness every 2 hours after arrival to floor.

Patient can be discharged as soon as discharge criteria are met.

Discharge Criteria: Inpatient

- Minimal stridor at rest (stridor with activity to be expected)
- Minimal retractions
- Able to talk or feed without difficulty
- 2 hours since racinephrine
- No supplemental oxygen for more than 12 hours
One in 4,500 children (1 in 170 hospitalized children) with croup are intubated

[LOE: E (Expert Opinion), (Toward Optimized Practice, 2008)]

Hypoxemia is uncommon in otherwise healthy children with croup and should be viewed as a warning sign of possible respiratory failure

**Signs of impending respiratory failure**
- Poor respiratory effort
- Stridor may be present or decreased
- Listless or decreased LOC
- Cyanosis / Hypoxemia

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To ED Management  
To Inpatient Management
Racemic Epinephrine: Observation in the ED

Observation for 2 hr with minimum Q1 hour assessments
- Racepinephrine effect lasts only 2 hours
- If patient worsens, consider repeat racepinephrine and admission

Treatment effect disappears after two hours.

There is no evidence, on average, to suggest that there was an increase or worsening of croup score, as compared to the pre-treatment or baseline in the group treated with epinephrine. [LOE: ★★★ O, (Bjornson, 2013)]
RN will assess severity symptoms upon transfer to the medical unit.

If racemic epinephrine given, observe patients hourly for 2 hours.

Assess discharge readiness every 2 hours after arrival to floor.

Patient can be discharged as soon as discharge criteria are met.
Discharge Criteria

- Minimal stridor at rest (stridor with activity to be expected)
- Minimal retractions
- Able to talk or feed without difficulty
- 2 hours since racepinephrine

Discharge Criteria: Emergency Department (Cont’d)

Study of children (n=527) admitted to hospital with stridor and/or sternal retractions at rest showed that only 1% of those who had resting stridor but no sternal retractions (N=305) had worsening respiratory distress after admission. (Wagner 1986)

A child with croup who received adrenaline and steroids may be discharged after 3 hours observation if they are free of stridor and intercostal retractions at rest and are clinically well. [LOE: Guideline, (Mazza, 2008)]

Criteria for ED discharge:

- Presence of mild symptoms either on initial evaluation or after a period of observation
- Children should not be discharged earlier than 2 hours after the administration of adrenaline
- Parents should be able to return for care if symptoms worsen [LOE: E (Expert Opinion), (Toward Optimized Practice, 2008)]
Transfer Criteria from Urgent Care to ED

Urgent Care Transfer Criteria
- Poor initial response to 1st Racepinephrine
- If 2nd Racepinephrine given
- ALS recommended for all patients. Can repeat Racepinephrine while awaiting transportation if necessary.

We recommend transfer to the ED of all croup patients who are not initially responding to epinephrine due to risk of decompensation and all patients who meet admission criteria.

Due to possible respiratory compromise in transit, ALS is recommended.
There is evidence that healthy children with mild croup do not need admission to hospital.

There is no evidence that stratifies the risk/benefits of whom to admit in moderate category.

There is consensus that patients with severe croup should be admitted.

Local data shows that patients receiving 3 or more doses of racpinephrine have a more severe course/presentation and may benefit from admission.
Discharge Instructions

For patients being discharged from the emergency room, discharge instructions will be provided from FirstNET.

**Call your Primary Health-Care Provider or return to the Emergency Department if your child:**

- Breathing becomes more difficult or does not improve with moist air treatments and calming techniques as listed above
- Has stridor at rest when calm and is working hard to breathe
- Has trouble swallowing or is drooling a lot
- Is not able to take liquids
- Shows signs of dehydration:
  - dry mouth
  - no tears when crying
  - urinates less than 3 times in 24 hours
- Is too fussy or cannot be calmed
- Is too sleepy
- **Seems sicker**

**Call 9-1-1 if your child:**

- Is having a hard time breathing
- Lips or face look blue

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Title: Croup Pathway

Date: August, 2015

Retrieval Website: http://www.seattlechildrens.org/pdf/croup-pathway.pdf

Example:

CSW Croup Team:

Pathway Owner, Inpatient Medicine
Pathway Owner, ED/UC Pathway Owner
ED CNS
UC CNS
Medical Unit CNS
PIT Pharmacist
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Medicine is an ever-changing science. As new research and clinical experience broaden our knowledge, changes in treatment and drug therapy are required.

The authors have checked with sources believed to be reliable in their efforts to provide information that is complete and generally in accord with the standards accepted at the time of publication.

However, in view of the possibility of human error or changes in medical sciences, neither the authors nor Seattle Children’s Healthcare System nor any other party who has been involved in the preparation or publication of this work warrants that the information contained herein is in every respect accurate or complete, and they are not responsible for any errors or omissions or for the results obtained from the use of such information.

Readers should confirm the information contained herein with other sources and are encouraged to consult with their health care provider before making any health care decision.
Summary of Version Changes

- **Version 1.0 (12/19/2011):** Go live
- **Version 1.1 (05/31/2012):** Updated Viral FA to Viral PCR. Correction to Alternative Diagnosis slide: upset changed to onset
- **Version 2.0 (08/19/2015):** Scheduled review update (see executive summary for significant changes)
- **Version 3.0 (02/04/2019):** Removed “Patients receiving 2 doses of racepinephrine” from admission criteria
This pathway was developed through local consensus based on published evidence and expert opinion as part of Clinical Standard Work at Seattle Children’s. Pathway teams include representatives from Medical, Subspecialty, and/or Surgical Services, Nursing, Pharmacy, Clinical Effectiveness, and other services as appropriate.

When possible, we used the GRADE method of rating evidence quality. Evidence is first assessed as to whether it is from randomized trial or cohort studies. The rating is then adjusted in the following manner (from: Guyatt G et al. J Clin Epidemiol. 2011;4:383-94.):

- Quality ratings are *downgraded* if studies:
  - Have serious limitations
  - Have inconsistent results
  - If evidence does not directly address clinical questions
  - If estimates are imprecise OR
  - If it is felt that there is substantial publication bias

- Quality ratings are *upgraded* if it is felt that:
  - The effect size is large
  - If studies are designed in a way that confounding would likely underreport the magnitude of the effect OR
  - If a dose-response gradient is evident

Guideline – Recommendation is from a published guideline that used methodology deemed acceptable by the team.

Expert Opinion – Our expert opinion is based on available evidence that does not meet GRADE criteria (for example, case-control studies).

**Quality of Evidence:**
- ⭐⭐⭐⭐ High quality
- ⭐⭐⭐⭐ Moderate quality
- ⭐⭐⭐ Low quality
- ⭐⭐⭐⭐⭐ Very low quality

Guideline
Expert Opinion
Literature Search Strategy

Search Methods, *Croup*, Clinical Standard Work

Studies were identified by searching electronic databases using search strategies developed and executed by a medical librarian, Jackie Morton. The searches for croup and recurrent stridor were performed in February 2015 and the search for tracheitis was performed in March 2015. The following databases were searched – on the Ovid platform: Medline, Cochrane Database of Systematic Reviews; elsewhere – Embase, Clinical Evidence, National Guideline Clearinghouse, TRIP and Cincinnati Children’s Evidence-Based Care Guidelines. Clinical questions regarding croup were searched from March 2012 to date or the closest date range available in the respective databases. Clinical questions regarding recurrent stridor and tracheitis were searched from 2005 to date.

Retrieval was limited to humans ages 0 – 12 and English language. In Medline and Embase, appropriate Medical Subject Headings (MeSH) and Emtree headings were used respectively, along with text words, and the search strategy was adapted for other databases using their controlled vocabularies, where available, along with text words. Concepts searched were croup, recurrent stridor or tracheitis. All retrieval was further limited to certain evidence categories, such as relevant publication types, Clinical Queries filters for diagnosis and therapy, index terms for study types and other similar limits.

Jackie Morton, MLS
June 26, 2015

Identification

- 93 records identified through database searching
- 1 additional records identified through other sources

Screening

- 94 records after duplicates removed

Eligibility

- 94 records screened
- 68 records excluded

- 26 records assessed for eligibility

Included

- 9 full-text articles excluded,
  4 did not answer clinical question
- 5 did not meet quality threshold

- 17 studies included in pathway

Flow diagram adapted from Moher D et al. *BMJ* 2009;339:bmj.b2535


17. Shargorodsky, Josef; “Bacterial Tracheitis: A Therapeutic Approach” Laryngoscope; 120; December 2010; 2498-2501


**Guidelines and Reviews**

Croup. (2008). CKS (Formerly PRODIGY)

Diagnosis and management of croup. (2008). Toward Optimized Practice


