Overview of Croup Pathway

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
- Hypoxia 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
  - Steroids are beneficial for all patients with croup

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

AND

Give Dexamethasone:
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  - Dosage of 0.6mg/kg Dexamethasone

Severe Assessment (moderate/severe distress)
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Assess immediate clinical response

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

For children that are not improving with 3 doses of racepinephrine, consider further workup, OTO consultation, and/or evaluation for ICU admission

Give Racepinephrine:
- 2nd Racepinephrine given
  - ALS recommended for all patients
  - Can repeat Racepinephrine while awaiting transportation if necessary

Consider alternative diagnosis or ICU admission

Off Pathway

To Inpatient Management

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

Pathophysiology
- Croup v.2.0: ED Management

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

Summary of Version Changes

Test Your Knowledge

Citation Information

Executive Summary

Test Your Knowledge

Citation Information

Seattle Children's Hospital

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Last Updated: August 2015
Next Expected Review: August 2020
Croup v.2.0: Inpatient Management

**Executive Summary**

**Test Your Knowledge**

**Citation Information**

**Explanation of Evidence Ratings**

**Summary of Version Changes**

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

**Exclusion Criteria**
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- Symptoms suggestive of an alternative diagnosis
- Known upper airway abnormality
- Hypotonia or neuro muscular disorder

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**Give Racemic Epinephrine**
- Racepinephrine 2.25% inhalation solution (0.5 mL nebulized) diluted in 3 mL NS
- Can give racpinephrine Q2 hrs: no more than 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)**
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**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

**Assess immediate clinical response**

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

**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

**To ED Management**

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**Recommendations**
- 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.
- Consider evaluation for GERD and initiation of anti-reflux medications in patients with prolonged or recurrent croup.
- Consider evaluation and treatment for allergies.

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

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**Off Pathway**

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Last Updated: August 2015
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Exclusion Criteria

- Toxic Appearance
- Symptoms suggestive of an alternative diagnosis:
  - Poor response to treatment with racemic epinephrine
  - Expiratory wheeze
  - Drooling or difficulty swallowing
  - Prolonged or recurrent stridor
- Known upper airway abnormality
  - Laryngomalacia
  - Tracheomalacia
  - History of vascular ring/sling or tracheoesophageal fistula
- Hypotonia or neuromuscular disorder resulting in hypotonia
  - Trisomy 21
Review of initial evidence in 2012 demonstrated that the following therapies did not enhance the care of patients with 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
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
Warning Signs: Alternative Diagnoses (Cont’d)

**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 or 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)

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**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
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:

- **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

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 1 Very low quality

Jabbour (2011) found prematurity to also be an associated risk factor. LOE 1 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 Otolaryngology consultation/referral for direct laryngoscopy in patients with 2 or more episodes of croup who are less than 16 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 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: 4☆☆☆☆, (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: 4☆☆☆☆, (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: 4☆☆☆☆, (Russell, 2011)]
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: 3333, (Bjomson, 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: 3333, (Johnson, 2004)]

Severity Assessment (moderate/severe distress)
Stidor at rest AND
1 or more of the following:
- Moderate intercostal retractions (suprasternal retractions are acceptable)
- Tachycardia
- 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 racipinephrine 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.

**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: 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.

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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: ★★★★☆, (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)]

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Severity Assessment (moderate / severe distress)
- Stridor 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: MAR

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: 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: 3, 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.
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
Other Cautions: Respiratory Failure!

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.

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To ED Management

To Inpatient Management
Racemic Epinephrine: Observation in the ED

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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)]
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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)]
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.
Admission Criteria

There is evidence that healthy children with mild croup do not need admission to the hospital.

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

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

Admit Criteria:
- Patients with continued stridor at rest AND any symptoms listed in the severity assessment above.
- Patients receiving 2 doses of racipinephrine.
- Patients not otherwise meeting discharge criteria.
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

Seattle Children's
Hospital • Research • Foundation
Title: Croup Pathway

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Date: August, 2015

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

Example:
Executive Summary

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Objective
Create an evidence-based clinical guideline to improve the care for otherwise healthy children with croup in the urgent care, emergency department, and inpatient medical unit.

Additional objectives:
- Standardize delivery of care
- Use dexamethasone for ALL patients with croup
- Deliver the first dose of inhaled racemic epinephrine in a timely manner
- Identify transfer criteria and discharge readiness in a timely manner
- Eliminate the use of non-proven modalities (e.g. cool mist, radiographs, viral testing)
- Provide recommendations for evaluation of patients with recurrent croup
- Provide additional safety alerts and education for patients with possible bacterial tracheitis

Recommendations
1. Give ALL patients ONE 0.6mg/kg dose of oral dexamethasone to a maximum dose of 16mg regardless of symptom severity
2. Use racemic epinephrine (racedrinephrine) for moderate to severe croup defined as stridor at rest AND one or more of the following symptoms:
   - Moderate intercostal retractions (suprasternal retractions are acceptable)
   - Tachypnea
   - Agitation/restlessness/tired appearing
   - Difficulty with talking or feeding
3. Patients not responding to racemic epinephrine should be re-evaluated by a physician and alternative diagnoses or escalation of care should be considered.
4. Do NOT use cool mist in the emergency department or hospital setting
5. Do NOT routinely use viral testing
6. Do NOT routinely perform radiographs
7. Discharge patients that meet the following criteria
   - Minimal stridor at rest
   - Minimal retractions
   - Able to talk or feed without difficulty
   - 2 hours since racinephrine
   - No supplemental oxygen for more than 12 hours
8. Patients with typical croup will not receive additional doses of steroids.
9. For patients with recurrent croup (2 or more episodes):
   - Consider otolaryngology consultation/referral for direct laryngoscopy for patients age < 3 with a previous history of intubation
executive summary

- Consider evaluation for GERD and initiation of anti-reflux medications
- Consider evaluation and treatment for allergies
10. Consider otolaryngology consultation for patients with severe/prolonged croup that requires inpatient management.

rationale

- Safety: Important safety alerts are imbedded in the algorithm and ordersets to identify patients at high risk of impending respiratory failure, or serious alternative diagnoses. The newest version of the pathway offers recommendations for escalation of care/otolaryngology evaluation for patients who do not respond to racemic epinephrine.
- Quality of care will improve by:
  - Decreasing the time to racemic epinephrine which is a vital treatment for patients with croup and significant respiratory distress
  - Delineating specific times for re-evaluations for patients with croup
  - Having clear indications for racemic epinephrine and defined observation times.
- Delivery of care will be improved by providing the emergency department with tools to expedite appropriate croup care.
- Engagement: is grounded in the fact that the pathway has been developed by RNs, RTs, and MDs. All involved groups in the emergency department and inpatient unit had multiple opportunities during its development to provide feedback and suggestions.
- Patient/Family Satisfaction: will be addressed by implementing clinical standard work that will assure the highest quality of care. This work makes it clear to families what the discharge criteria are and provides guidelines for safe discharge as early as possible.
- Costs: will be reduced by eliminating the use of unnecessary testing and prolonged hospitalization.

evidence

We initially performed a filtered search of the literature that included systematic reviews, meta-analyses, and published guidelines from 1996-2011. This search yielded 99 publications which were reviewed by title and abstract and reduced to 50 pertinent publications. The full text of each of these 50 publications were reviewed by one physician and one nurse and categorized by type and by clinical question addressed. Three guidelines were identified which were then evaluated using the AGREE II tool to determine the quality of the guidelines. All three were reviewed independently by 4 reviewers and accepted for use with modifications.

The three guidelines were:

- Diagnosis and management of croup. (2008). Toward Optimized Practice (Referred to as “Alberta”) - developed by an Alberta Clinical Practice Working Group as part of the Alberta Medical Association in Alberta, Canada.
- Croup. (2008). CKS (Formerly PRODIGY) (Referred to as “CKS”) - published by CKS, which was initially commissioned by the National Institute for Health and Clinical Excellence (NICE) in Great Britain.
Executive Summary


Additionally we reviewed the comprehensive Cochrane reviews below:

In 2015 we repeated our initial literature search to determine “what is the best treatment for croup,” and expanded our search to include recommendations for the management of recurrent croup and clinical characteristics of bacterial tracheitis. 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. 94 records were screened and 68 were discarded as not relevant to the clinical question. 17 articles were eventually summarized and included as basis for our recommendations.

Our 2015 review did not change our initial recommendations from 2011, but led to additional recommendations for escalation of care, cautions for alternative diagnoses and recommendations for further evaluation in patients with recurrent croup.

Implementation Items
- Revised two algorithms: One for Emergency Department/Urgent Care and one for inpatient management of croup.
- Revised the Croup Learning Center training module to include information about alternative diagnoses and recurrent croup. Module includes test questions and explanations.
- Developed a new croup Power Plan:
  o ED Croup Initial and Subsequent
  o Inpatient Croup Admit and Subsequent
Executive Summary

Metrics Plan
1. Monitor the number of ED and inpatient discharges with croup diagnosis. (Quarterly)
2. Inpatient and ED median length of stay (Quarterly)
3. Pathway/orderset usage rate as a percentage of croup discharges (Quarterly)
4. Percentage of patients with discharge diagnosis of croup receiving dexamethasone (Quarterly)
5. Median time to first dose of racemic epinephrine in the emergency department. (Quarterly)
6. Readmission within 7 days of discharge from ED or inpatient unit (Quarterly)

PDCA Plan
The CSW owner and committee will follow metrics, continue to review medical literature, and make alterations to the pathway as needed.

Revision History
Date Approved: August, 2015
Next Review Date: August, 2020

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Self-Assessment

• Completion qualifies you for 1 hour of Category II CME credit. If you are taking this self-assessment as a part of required departmental training at Seattle Children’s Hospital, you MUST logon to Learning Center.

1. The croup pathway is designed for previously healthy children ages:
   a. 1 month to 6 years
   b. 6 months to 5 years
   c. 12 months to 12 years
   d. Newborn to 18 years

2. Symptoms of croup can include all of the following EXCEPT:
   a. Fever
   b. Inspiratory Stridor
   c. Respiratory Distress
   d. Wheezing

3. A 3 year old presents with 5 days of URI symptoms, high fever and worsening stridor and respiratory distress over the past 12 hours. You should consider:
   a. Consulting otolaryngology immediately
   b. Consulting otolaryngology and PICU if patient does not improve with racpinephrine.
   c. Giving a dose of decadron and re-evaluating in 3 hours to see if patient still has stridor.
   d. Trialing a dose of albuterol before placing patient on the croup pathway

4. Which of the following patients with suspected croup should receive dexamethasone?
   a. A patient with barking cough and no respiratory distress
   b. A patient with inspiratory stridor that is audible with agitation
   c. A patient with inspiratory stridor at rest, significant tachypnea and retractions
   d. All of the above

5. Which of the following patients with suspected croup should receive racemic epinephrine (racepinephrine)?
   a. A patient with a barking cough and fever
   b. A patient with a barking cough and slight suprasternal retractions
   c. A patient with inspiratory stridor at rest and no other signs of increased work of breathing
   d. A patient with inspiratory stridor at rest and significant intercostal retractions

6. True or false: All patients with bacterial tracheitis have high fevers and elevated white blood cell counts?

7. Patients with suspected croup should get:
   a. Cool mist treatment
   b. Lateral neck soft tissue x-rays
   c. Oral steroids
   d. Respiratory PCR

8. Which of the following patients should be referred for otolaryngology consultation?
   a. A 13 month old ex-30 weeker with a history of intubation at birth who is admitted with croup for the third time.
   b. A four-year-old healthy child who is admitted on the croup pathway but has persistent inspiratory stridor and intercostal retractions on hospital day #4.
   c. A two-year-old ex-28 weeker who was intubated at birth and presents with his 4th croup admission. He just received his 5th racemic epinephrine treatment in 24 hours.
   d. All of the above

9. Discharge criteria include all of the following EXCEPT:
   a. Able to talk or feed without difficulty
   b. Minimal retractions
   c. No stridor for two hours
   d. Two hours since last racepinephrine treatment
Question #1: Answer: b. Inclusion criteria for the croup pathway are: age 6 months to 6 years and previously healthy. Exclusion criteria include patients with upper airway abnormalities, toxic appearance, symptoms suggestive of an alternative diagnosis, hypotonia and neuromuscular disorders.

Question #2: Answer: d. Croup is generally characterized by bary cough, inspiratory stridor, hoarse voice, respiratory distress, fever and URI symptoms. Wheezing is not a symptom of croup and suggests an alternative diagnosis.

Question #3: Answer: b. the patient above is demonstrating symptoms that could be consistent with bacterial tracheitis. Symptoms include: URI symptoms that have been present > 24 hours, fever, and stridor. Patient with bacterial tracheitis often do not respond to or have an incomplete response to racpinephrine. This patient should be treated with racpinephrine, but closely monitored for response and if condition does not improve with racpinephrine escalation of care is appropriate.

Question #4: Answer: d. All patients with croup should receive a single dose of steroids.

Question #5: Answer: d. the decision to give racemic epinephrine is based on a severity assessment that includes stridor at rest and one or more of the following: Moderate intercostal retractions, significant tachypnea, agitation/restlessness/tired appearing, and difficulty with talking or feeding. Inspiratory stridor at rest without other signs of significant respiratory distress does not necessitate racemic epinephrine, observation is appropriate.

Question #6: Answer: False. Cohort studies looking at children with bacterial tracheitis have shown that patients with bacterial tracheitis may or may not have fever. They have also demonstrated that CRP and WBC count are not predictive for or against bacterial tracheitis.

Question #7: Answer: c. None of the above therapies except oral steroids are recommended for patients with croup meeting the inclusion criteria for the croup pathway.

Question #8: Answer: d. Otolaryngology consultation/referral for direct laryngoscopy is recommended for patients who present with 2 or more episodes of croup AND are less than 36 months old and have a history of intubation OR for any patient with severe prolonged disease requiring inpatient management.

Question #9: Answer: c. Stridor with activity is to be expected in patients with croup. Patients with minimal stridor at rest that have remained stable and who don’t show other significant signs of respiratory distress can be discharged home.
Medical Disclaimer

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 (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)
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

94 records screened

68 records excluded

Eligibility

26 records assessed for eligibility

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

Included

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


