Croup

Inpatient

Nationwide Children's — When your child needs a hospital, everything matters.

Center for Clinical Excellence

Inclusion Criteria:
6 months to 6 years with clinical Signs & Symptoms suggestive of croup, usually including barky cough and inspiratory stridor.

Exclusion Criteria:
- Symptoms suggestive of an alternative diagnosis
- Known upper airway abnormality or recent airway instrumentation (within last 6 months)
- Chronic condition including neuromuscular disorder or hypotonia, chronic lung or heart disease

Differential Diagnosis

Treatments Not Recommended

Racemic epinephrine is **not** necessary for children with isolated, mild stridor at rest.

Verify Diagnosis of Croup

ACT if concern for impending respiratory failure

Croup Symptom Severity Assessment Guide

	Low severity	Moderate severity	High severity
Mental status	Normal	Anxious	Anxious or lethargic
Stridor	Minimal or none at rest	Inspiratory stridor at rest Biphasic stridor with agitation	Biphasic stridor at rest
Work of breathing	Minimal or none	Moderate	Severe
Heart & Respiratory Rates	Normal or slightly elevated	Moderately elevated	Significantly elevated
Oral intake	Normal	Decreased	Unable to feed

Dexamethasone if not received prior to admission

Monitor for recurrent Moderate or High severity symptoms

Racemic epinephrine and Dexamethasone if not received prior to admission or consider repeat dose

Re-assess within 2 hours

Moderate or High severity symptoms?

No

Yes

Red flags
- No/minimal improvement with treatments
- Recurrent croup
- History of prolonged intubation (>7 days)
- Positional stridor

- Notify Resident
- Repeat racemic epinephrine.
- Consider alternative diagnosis

Recurrent moderate or severe distress within 4-8 hours?

Yes

No

- Consider ENT consult or referral
- Consider imaging as indicated
- ACT if indicated

Off Pathway
Individualized management

Alternative diagnosis suspected?

Yes

No

Discharge when meeting criteria:
- Croup symptoms resolved or mild severity for ≥4-8 hrs after last Rac Epi
- O_2 saturation ≥90% on RA
- Tolerating PO fluids
- Follow-up plan established

- Re-assess within 2 hours
- Consider ACT and transfer to ICU for heliox if worsening status despite treatments or requiring racemic epinephrine more frequently than every 2 hours

Definition & Diagnosis

Definition

Croup is a common respiratory illness of the larynx, trachea, and bronchi that leads to **inspiratory** stridor and a barking cough. It is usually caused by a virus.

Diagnostic Criteria

Croup is primarily a clinical diagnosis

Signs & Symptoms

Typical findings include abrupt onset of a barking cough, inspiratory stridor, hoarseness, and sometimes dyspnea and fever. Biphasic stridor, when present, may represent more severe disease.

Diagnostic Timeout

Red flags

- No/minimal improvement with treatments (racemic epinephrine, dexamethasone)
- Recurrent croup
- History of prolonged intubation (>7 days)
- Positional stridor

Signs and symptoms suggestive of an Alternative Diagnosis:

- Age < 6 months or > 6 years
- Expiratory wheeze
- Drooling or difficulty swallowing
- Prolonged or recurrent stridor
- Recurrent croup (2nd episode within 30 days or > 3 episodes in the last 12 months)
- Signs and symptoms of sepsis
- Poor response to treatment
- Asymmetry of respiratory exam
- Non-elective intubation in the past 6 months or history of prolonged intubation (> 7 days)

Differential Diagnosis

Return to Algorithm

Differential Diagnosis

- **Bacterial tracheitis**
  - Signs/symptoms of croup that have markedly worsened, toxic appearing, poor response to racemic epinephrine
- **Epiglottitis**
  - Incomplete immunizations, absence of barky cough and presence of anxiety that is out of proportion to degree of respiratory distress, fever, toxic appearing, drooling, swelling of epiglottis “thumb sign” on lateral radiograph
- **Lower respiratory tract infection**
- **Deep neck space abscesses (peritonsillar abscess, retropharyngeal abscess, parapharyngeal abscess)**
  - Fever, drooling, decreased neck range of motion, lymphadenopathy and varying degrees of toxicity, barky cough absent
- **Foreign body aspiration**
  - History of choking in previously healthy child
- **Subglottic stenosis**
- **Laryngomalacia**
- **Tracheomalacia**
- **Large airway lesions, hemangioma, neoplasm**
  - Chronic course and absence of fever
- **Upper airway abnormality**
  - Ex. vocal cord paralysis, subglottic stenosis, tracheomalacia, vascular ring or TEF
- **Thermal injury/smoke inhalation**
- **Anaphylaxis or Angioedema**
  - Rapid onset without antecedent URI symptoms or fever

Return to Algorithm

Recommended Treatments

Dexamethasone

- Dose: 0.6 mg/kg, max 16 mg PO, IV, IM should be administered by the least invasive route possible. Emerging evidence suggests that a single dose of 0.15 mg/kg of dexamethasone may be as effective as the standard (0.6 mg/kg) dose. (Aregbesola Alex et al. 2023). Use provider clinical judgment and shared decision making with parent/guardian.
- There is no **evidence to support repeated dexamethasone doses in patients who respond well to initial therapy**. There is no difference in incidence of symptom rebound in critically ill patients based on cumulative dexamethasone dose, and redosing may be associated with a longer LOS (Tyler et al. 2019, 2022). Can consider repeat dose if there are ongoing symptoms requiring hospitalization and additional treatments. No dosage guidelines exist for repeat dexamethasone in croup, consider expert consultation if providing repeat doses.

Racemic epinephrine

- Dose: 0.5 mL of a 2.25% solution diluted to 3 mL total volume with normal saline should be given to all patients with moderate-severe croup.
    - Onset: 10-30 minutes
    - Can be repeated after 20 minutes if symptoms persist
    - Duration: 1-2 hours

Heliox

- A mixture of helium (70-80%) and oxygen (20-30%) that promotes laminar flow of air rather than turbulent flow. When administered via a non-rebreather mask heliox can decrease the work of breathing in children with severe symptoms.
- Use of heliox is limited in children with hypoxia because of the low fractional concentration of oxygen in the gas mixture.

Return to Algorithm

ENT Evaluation

- **Consider ENT consultation if:**
  - Ongoing symptoms requiring prolonged admission and/or repeat dexamethasone
  - History of prolonged intubation (>7 days)

- **Consider ENT referral if:**
  - Recurrent croup (2nd episode within 30 days or > 3 episodes in the last 12 months)
  - Atypical croup (crescendo onset, age > 6 years)

Return to Algorithm

Treatments Not Routinely Recommended

- **Radiographs:** not indicated in the vast majority of children with croup (Petrocheilou 2014). Imaging may be indicated in the evaluation for **alternate diagnosis**, including foreign body.

- **Viral testing:** not necessary for diagnosis or management (Smith 2018)

- **Cool mist:** no benefit (Scolnik 2006)

- **Prednisolone**: Dexamethasone reduces readmissions/return visits compared to prednisolone (Aregbesola 2023)

Return to Algorithm

References

1. Aregbesola A, Tam CM, Kothari A, Le ML, Ragheb M, Klassen TP. Glucocorticoids for croup in children. *Cochrane Database Syst Rev*. 2023;1(1):CD001955. Published 2023 Jan 10. doi:10.1002/14651858.CD001955.pub5

2. Bagwell T, Hollingsworth A, Thompson T, et al. Management of Croup in the Emergency Department: The Role of Multidose Nebulized Epinephrine. *Pediatr Emerg Care*. 2020;36(7):e387-e392. doi:10.1097/PEC.0000000000001276

3. Bjornson, Candice et al. "Cochrane Review: Nebulized Epinephrine for Croup in Children." Evidence-Based Child Health: A Cochrane Review Journal, vol. 7, no. 4, 2012, pp. 1311-54. DOI: 10.1002/14651858.CD006619.pub3

4. Bjornson CL, Johnson DW. Croup-treatment update. *Pediatr Emerg Care*. 2005;21(12):863-873. doi:10.1097/01.pec.0000190225.04986.e0

5. Cherry JD. Clinical practice. Croup. *N Engl J Med*. 2008;358(4):384-391. doi:10.1056/NEJMcp072022

6. Cooper T, Kuruvilla G, Persad R, El-Hakim H. Atypical croup: association with airway lesions, atopy, and esophagitis. *Otolaryngol Head Neck Surg*. 2012;147(2):209-214. doi:10.1177/0194599812447758

7. Johnson DW. Croup. *BMJ Clin Evid*. 2014;2014:0321. Published 2014 Sep 29.

8. Moraa I, Sturman N, McGuire TM, van Driel ML. Heliox for croup in children. *Cochrane Database Syst Rev*. 2021;8(8):CD006822. Published 2021 Aug 16. doi:10.1002/14651858.CD006822.pub6

9. Petrocheilou A, Tanou K, Kalampouka E, Malakasioti G, Giannios C, Kaditis AG. Viral croup: diagnosis and a treatment algorithm. *Pediatr Pulmonol*. 2014;49(5):421-429. doi:10.1002/ppul.22993

10. Rudinsky SL, Sharieff GQ, Law W, Kanegaye JT. Inpatient Treatment after Multi-Dose Racemic Epinephrine for Croup in the Emergency Department. *J Emerg Med*. 2015;49(4):408-414. doi:10.1016/j.jemermed.2015.05.031

11. Smith DK, McDermott AJ, Sullivan JF. Croup: Diagnosis and Management. *Am Fam Physician*. 2018;97(9):575-580.

12. Tyler A, Bryan MA, Zhou C, et al. Variation in Dexamethasone Dosing and Use Outcomes for Inpatient Croup. *Hosp Pediatr*. 2022;12(1):22-29. doi:10.1542/hpeds.2021-005854

13. Tyler A, Anderson L, Moss A, Graham J, Dempsey A, Carpenter T. Predictors of Symptom Rebound in Critically Ill Patients With Croup. *Hosp Pediatr*. 2019;9(6):447-454. doi:10.1542/hpeds.2018-0195

14. Udoh I, Heegeman D, Ravi S. Retrospective Evaluation of Return Rates in Pediatric Patients Treated With Inhaled Racemic Epinephrine for Croup. *WMJ*. 2022;121(1):26-29.

15. Jim Edward Weber, Carl R. Chudnofsky, John G. Younger, G. Luke Larkin, Michael Boczar, Mark D. Wilkerson, George Y. Zuriekat, Brian Nolan, David M. Eicke; A Randomized Comparison of Helium–Oxygen Mixture (Heliox) and Racemic Epinephrine for the Treatment of Moderate to Severe Croup. *Pediatrics* June 2001; 107 (6): e96. 10.1542/peds.107.6.e96

Return to Algorithm

Metrics

Goal

- To efficiently monitor and manage patients admitted with croup.

Metrics:

Process measures:

- Order set utilization
- Dexamethasone dosing

Outcome measures:

- Inpatient LOS
- Number of dexamethasone and racemic epinephrine doses

Balancing measure:

- 72hr ED/UC return rate
- Readmissions
- Emergent transfers/escalation

Return to Algorithm

Team & Process

Pathway Development Team

Leader(s):

Hospital Pediatrics:

Katie Stone, MD

Gerd McGwire, MD, PhD

Members:

ENT:

Amy Manning MD, MS

ID:

Guliz Erdem, MD

Clinical Pathways Program: **Include involved only*

Medical Director – Hospital Pediatrics:

Gerd McGwire, MD, PhD

Medical Director – Clinical Informatics & Emergency Medicine:

Laura Rust, MD, MPH

Business & Development Manager:

Rekha Voruganti, MBOE, LSSBB

Program Coordinators:

Tara Dinh, BS

Clinical Pathway Approved:

Associate Chief Medical Officer, Center for Clinical Excellence:

Ryan Bode, MD, MBOE

Advisory Committee Date: *August, 2024*

Origination Date: *October, 2024*

Next Revision Date: *October, 2027*

Clinical Pathway Development

This clinical pathway was developed using the process described in the NCH Clinical Pathway Development Manual Version 6, 2022. Clinical Pathways at Nationwide Children's Hospital (NCH) are standards which provide general guidance to clinicians. Patient choice, clinician judgment, and other relevant factors in diagnosing and treating patients remain central to the selection of diagnostic tests and therapy. The ordering provider assumes all risks associates with care decisions. NCH assumes no responsibility for any adverse consequences, errors, or omissions that may arise from the use or reliance on these guidelines. NCH's clinical pathways are reviewed periodically for consistency with new evidence; however, new developments may not be represented, and NCH makes no guarantees, representations, or warranties with respect to the information provided in this clinical pathway.

For more information about our pathways and program please contact:
ClinicalPathwaysProgram@NationwideChildrens.org

Return to Algorithm