CLINICAL GUIDELINE | CROUP

(Age 3 months–8 years)

Children's MINNESOTA

Aim: To reduce unwarranted resource utilization and decrease admissions for patients with suspected croup.

Patient with clinically suspected croup? (Note 1)

- No → Consider alternate etiology, off-guideline
- Yes → Give Dexamethasone, 0.6 mg/kg PO x 1 if none/insufficient dose received in preceding 24 hours (max dose 12 mg)

Consider watch/wait prescription in patients with very mild symptoms

Increased work of breathing (WOB: retractions or tachypnea for age) or stridor at rest?
**Hypoxia requires emergent evaluation, manage off-guideline*

- No → **Assess for discharge**
  - Single dose of dexamethasone is sufficient for most patients (Note 6).
  - Viral/blood tests, X-ray not routinely indicated
- Yes → Give racemic epinephrine (RE) 0.5 mg

Symptoms improved?

- Yes → Monitor up to 2 hours for need for repeat RE doses* (if given for WOB/stridor) (Note 2)

If in clinic and unable to monitor, discuss home monitoring vs. ED referral with family. (Notes 2, 5)

Additional RE needed for WOB/stridor at rest? (Note 3)

- Yes → Repeat RE. See Note 4 for influenza testing. Monitor up to 2 additional hrs#

Additional RE needed for WOB/ stridor at rest?

- Yes → **Admit for monitoring** (Note 4, 5)
  - If increased WOB or stridor at rest:
    - Give additional RE dose (Nursing/RT: please notify provider if giving)
    - Consider additional steroid dose (Note 6) if >24 hr since previous dose.
    - Revisit differential diagnosis
    - Consider additional workup & ENT consult if acute critical airway obstruction, need for repeated RE after admission, toxic appearance, recurrent croup in an infant or risk factors for subglottic stenosis, subglottic cyst or airway hemangioma.
  - *Hypoxia or lack of response to RE indicate need for additional urgent evaluation, off-guideline (Note 3).*
  - Assess for discharge if no RE in ≥ 6 hours (Notes 2, 5)
    - Single dose of dexamethasone is sufficient for most patients (Note 6).
- No → **Assess for discharge** (Note 5)
  - Single dose of dexamethasone is sufficient for most patients (Note 6)
  - Viral/blood tests, X-rays not routinely indicated (Note 3)

- No → **Further management off-guideline.**

Poor response to treatment with RE is concerning for an alternate diagnosis such as bacterial tracheitis or foreign body. Patient should have further workup, off-guideline. (Notes 1, 3)

EXCLUSION GUIDELINES

Patients **excluded** from this guideline:

- History of airway anomalies (e.g., laryngomalacia) or airway surgeries
- Multiple previous "croup" episodes requiring hospitalization
- Critically ill children
- Suspected *lower* respiratory tract infection (bronchiolitis/ pneumonia)
- *Hypoxia is extremely concerning in patients with croup. Patients with O2 sats < 92% on room air should be emergently evaluated and treated off-guideline

#Consider admitting for monitoring if ≥ 3 doses of RE including any adequate outside facility doses. See note 5 for additional admission considerations.

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NOTE 1: Presenting signs/symptoms and differential diagnosis.

- Croup typically presents with stridor, barky cough. May be accompanied by fever, runny nose.
- Differential diagnosis includes foreign body, bacterial tracheitis, epiglottitis, airway tumor, laryngomalacia, tracheomalacia.
- If patient meets inclusion criteria for "ED Protocol Dexamethasone for Stridor" and does not meet any exclusion criteria, the dose of dexamethasone may be given in triage before assessment by the provider.

NOTE 2: Children's MN Study about interventions after croup admission

Consider admission if patient has received total of 3 or more doses in preceding 24 hours, including at outside facility. See note 4 for other admission considerations.

A 2019 study at Children's Minnesota (Hester, et al) found increased rate of needing inpatient racemic epinephrine (RE) with increased total RE doses (at clinic/OSH/ ED) in patients after ED management:

If 1 RE: 0.5% If 2 RE: 12.1% If ≥3 RE: 23.5%

Limiting to only admitted patients *(Note: patients initially admitted to ICU were excluded from study):*

If 1 RE: 16.3% If 2 RE: 16.9% If ≥3 RE: 29.3%

Average cost of monitoring (without additional intervention) vs. discharge from ED was 3.1 times higher.

A second 2019 study (Asmundsson, et al, included patients at Children's Minnesota) also found a low rate of interventions (22.6%) after admission from the ED in patients with croup.

NOTE 3: Response to racemic epinephrine.

Patients who respond as expected to racemic epinephrine and steroids do not routinely require X-rays or lab testing. However, poor response to treatment with RE is concerning for an alternate diagnosis such as foreign body or tracheitis; these patients should be managed off-guideline with further workup. Obtain lateral neck X-ray if stridor/WOB does not at least temporarily improve with racemic epinephrine or patient does not demonstrate sustained improvement following 3 RE nebs over a relatively short period of time.

NOTE 4: Influenza testing considerations.

During influenza season, recommend testing for influenza in children who have received ≥2 racemic epinephrine doses, as this small subset may qualify for antiviral treatment per CDC recommendations (i.e. if admitted).

NOTE 5: Admission considerations.

- There is insufficient evidence to suggest that all patients must be admitted after 2 doses of racemic epinephrine, a common dogma. See Note 2.
- Patients who are critically ill, needing emergent airway intubation, hypoxia or toxic appearance should be admitted and managed off-guideline.
- Suggest shared decision making approach with families using best local evidence (see Note 2) to discuss risks vs. benefits of discharge vs. monitoring in hospital in patients for whom their symptoms have resolved/improved after ED management.
- Consider admitting for monitoring if: ≥ 3 doses of RE, ≥ 2 doses RE and ongoing increased work of breathing or previous history of severe croup requiring inpatient interventions, other indication for admission (e.g., dehydration and failure of PO challenge), barriers to outpatient care, high parental anxiety.

Additional notes on page 3

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NOTE 6: Dexamethasone notes.

Studies are ongoing to determine ideal dexamethasone per-dose dosing:

- 2019 RCT compared 0.6 mg/kg vs. 0.15 mg/kg dexamethasone and found no significant difference in Westley croup scoring 1 hour after dose. Experts at Children's MN feel this study does not provide sufficient evidence to support changing to lower dose as it does not evaluate other key end-points such as need for additional treatments, length of ED/hospital stay. It was insufficiently powered to detect significant differences in ED revisits/readmissions (which were 17.8% in the 0.6 mg/kg and 19.5% in the 0.15 mg/kg groups).
- A 2018 Cochrane review on steroids in croup noted "Uncertainty remains with regard to the optimal type, dose, and mode of administration of glucocorticoids for reducing croup symptoms in children."
    - They found no significant difference in revisits between oral dexamethasone vs. IM dexamethasone.
    - They found that "children treated with 0.60 mg/kg dexamethasone experienced significantly greater reductions in croup score after two hours (MD -0.15, 95% CI -0.29 to -0.01; P = 0.04; 1 RCT; 41 children; low-certainty evidence; Analysis 13.1) and six hours (MD -0.33, 95% CI -0.50 to -0.16; P < 0.001; I^2 = 4%; 3 RCTs; 178 children; moderate certainty evidence; Analysis 13.2) compared to those treated with 0.15 mg/kg dexamethasone."
- 2023 Cochrane review on steroids in croup
    - "There was likely little to no difference between prednisolone and dexamethasone for reduction in croup score at six-hour post-baseline score (SMD 0.21, 95% CI -0.21 to 0.62; 1 RCT, 99 children; moderate-certainty evidence). However, dexamethasone probably reduced the return visits or (re)admissions for croup by almost half (risk ratio (RR) 0.55, 95% CI 0.28 to 1.11; 4 RCTs, 1537 children; moderate-certainty evidence), and showed a 28% reduction in the use of supplemental glucocorticoids as an additional treatment (RR 0.72, 95% CI 0.53 to 0.97; 2 RCTs, 926 children)."
    - "A smaller dose of 0.15 mg/kg of dexamethasone may be as effective as the standard dose of 0.60 mg/kg. More RCTs are needed to strengthen the evidence for effectiveness of low-dose dexamethasone at 0.15 mg/kg to treat croup."

Number of dexamethasone doses:

- Numerous studies suggest that a single dose of dexamethasone is sufficient for patients treated in the outpatient setting.
- There are fewer studies surrounding number of steroid doses for patients hospitalized for croup.
    - A 2021 observational study (Tyler et. al.) of 5 US children's hospitals found significant inter-hospital variation in number of dexamethasone doses given. Among 234 hospitalized children, 145 (62%) received one dose and 89 (38%) received >1 dose. Of those receiving >1 dose, 62 (70%) received 2 doses, 19 (21%) received 3 doses, 8 (9%) received ≥4 doses. Patient characteristics including severity on presentation did not differ statistically across dexamethasone dosing regimen groups. There was no statistically significant association between number of dexamethasone doses and same-cause 30-day reutilization (OR: 0.87, 95% CI: 0.26, 2.95).

Summary of dexamethasone notes: The recommendations in this clinical guideline for a *single dose of dexamethasone 0.6 mg/kg in most cases* is supported by existing evidence.

- Future studies may support either lower dosing (e.g., 0.3 mg/kg) or provide additional clarification around ideal number of doses for patients hospitalized with croup.
- Factors that may be considered prior to providing an additional dose of dexamethasone (24 or more hours after initial dose) for hospitalized children may include: ongoing symptoms (note, this may also indicate need for additional workup), barriers to quick health care access, previous croup episodes, caregiver and provider preference. Potential side effects and costs should also be taken into account.

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