Patient arrives at ED triage with barky cough (historical or present)

Stridor at rest?

NO

Medical team assessment
Administer PO dexamethasone 0.6 mg/kg (consider IM or IV if unable to tolerate PO)

Impending respiratory failure?
Notify MD + Off algorithm:
• Higher level of care required
• Consider alternative diagnoses

Re-assess at 30, 60, 90, 120 mins

Stridor at rest?

YES

Triage RN Assessment
Airway – Breathing – Circulation

Impending respiratory failure?
Notify MD + Off algorithm:
• Higher level of care required
• Consider alternative diagnoses

If not received in the last 24 hours, administer PO dexamethasone 0.6 mg/kg (consider IM or IV if unable to tolerate PO)

Administer racemic epinephrine
*Expect effect within 30 min and for duration of 2 hours

≥2 racemic in ≤2 hours
OR
3rd racemic in 4 hours?

YES

Consider admit per admission considerations

Discharge home once ED discharge criteria met

While awaiting bed placement:
• Place PIV
• Provide supplemental oxygen as indicated

GOAL
Decrease % of admissions that do not receive racemic epinephrine after admission

ADMISSION CONSIDERATIONS
*does not substitute clinical judgment*

• Receives ≥3 racemic epinephrine or requires racemic epinephrine more frequently than Q2 hours x 2 doses in the ED and/or
• Persistent stridor at rest, respiratory distress, tachypnea or
• Inadequate hydration or
• Need for supplemental oxygen or
• Concern for alternative diagnosis

Does not exceed acute care floor care limitations:
• Floor can administer racemic epinephrine Q1 hour x1 only
• Floor cannot start heliox or positive pressure ventilation

DISCHARGE CRITERIA

• Receives ≥1 dexamethasone
• ≥2 hours since last racemic epinephrine treatment (if received)
• ≤2 racemic epinephrine within 4 hours
• Mild or improved croup symptoms (no or minimal stridor and suprasternal or intercostal retractions at rest)
• Able to talk and feed without difficulty
• No supplemental oxygen or hydration requirement

See more evidence-based recommendations

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GOAL
Reduce length of stay: discharge patients without stridor at rest who meet discharge criteria 6 hours after last racemic epinephrine.

DISCHARGE CRITERIA
- ≥6 hours since last racemic epinephrine treatment
- Mild or improved croup symptoms (no or minimal stridor and supra-sternal or intercostal retractions at rest)
- Stable off oxygen
- Able to talk and feed without difficulty
- No IV hydration requirement

GENERAL RECOMMENDATIONS
- Do not routinely order: imaging, antibiotics, viral testing, other laboratory testing
- Do not use cool mist or humidified air
- See more evidence-based recommendations

ENT REFERRAL & CONSULT
Consider ENT referral/consult if:
- recommend if age <1 year, consider if age <3 years
- history of intubation, history of inpatient ENT consult, prematurity, recurrent croup (>2 episodes in a year)
- concerns for foreign body and stridor in the absence of other upper respiratory infections

Patient with croup arrives at acute care unit and is evaluated by RN.

Admit using Croup Order Set

Discharge home once discharge criteria met

Stridor at rest with increasing work of breathing?

No

Yes

RN/RT administers racemic epinephrine and notifies provider
*Expect effect within 30 min and for duration of 2 hours

Impending respiratory failure OR requires racemic epinephrine hourly >1 time?

No

≥4 doses racemic epinephrine given in 8-12 hours?

Yes

Consider alternative diagnosis

Consider repeat dexamethasone if symptoms persist >24 hours after last dose

Reassess stridor as needed and observe for 6 hours

Consider CAT

Consider ENT referral/consult if:
- recommend if age <1 year, consider if age <3 years
- history of intubation, history of inpatient ENT consult, prematurity, recurrent croup (>2 episodes in a year)
- concerns for foreign body and stridor in the absence of other upper respiratory infections

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This guideline is developed based on the best available evidence and local expert consensus for elements of which evidence are inconclusive. Please refer recommendation table below for further details.

**Croup CCG Overview**

**Background:** Croup is a viral illness commonly associated with parainfluenza 1-3. It occurs primarily in late winter but can occur year-round. [1, 2]

**Inclusion:**
- All patients age 6 months to 6 years with primary diagnosis of croup

**Exclusion:**
- Direct admission from outside hospital or Lurie ED into PICU or OR
- Croup as secondary diagnosis in addition to co-diagnostics of pulmonary edema, bronchiolitis, asthma with status asthmaticus, asthma with acute exacerbation, vocal cord paralysis
- Complex chronic conditions, with the exception of mental retardation, epilepsy, chronic respiratory diseases, congenital anomalies for gastrointestinal, renal, and urologic system, chronic renal failure, chronic bladder diseases, and renal conditions requiring devices or technological support

**Outcome measures:**
- Proportion of patients who do not receive additional racemic epinephrine after admission from the ED
- Length of stay in inpatient and observation units (hour method)
- Admission rate

**Process measures:**
- Neck or chest XR use
- Respiratory Viral Panel use
- Antibiotic use
- Total nebulized racemic epinephrine given in the ED before admission
- Time of last racemic epinephrine given to discharge

**Balancing measures:**
- Length of stay (ED)
- Readmission rates within 3 days vs 7 days
- Return to ED within 3 days vs 7 days
- Critical Assessment Team (CAT) call

Complex chronic condition is defined as “any medical condition that can be reasonably expected to last at least 12 months (unless death intervenes) and to involve either several different organ systems or 1 organ system severely enough to require specialty pediatric care and probably some period of hospitalization in a tertiary care center”. [3]

---

**Recommendation Table (see final page for grading details)**

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Strength of recommendation</th>
<th>Quality of evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Give PO dexamethasone (0.6 mg/kg) instead of prednisolone to all patients with croup; give IM or IV if patient can't tolerate PO [4-12]. Consider repeat dose if no improvement is noted after 24 hours.</td>
<td>Strong, consensus for repeat dose</td>
<td>Low to moderate</td>
</tr>
<tr>
<td>Give inhaled racemic epinephrine for patients with moderate to severe croup symptoms [9, 12, 13]</td>
<td>Strong</td>
<td>High</td>
</tr>
<tr>
<td>Observe patient for ≥2 hours after last racemic epinephrine administration in the ED [12, 14]</td>
<td>Strong</td>
<td>Moderate</td>
</tr>
<tr>
<td>Do not admit all patients requiring multidose epinephrine [15-17]. Consider symptoms besides absolute number of racemic epinephrine received [15, 17-21]</td>
<td>Strong, consensus</td>
<td>Low to moderate</td>
</tr>
<tr>
<td>Discharge patient admitted with croup ≥6 hours after the last dose of racemic epinephrine [18]</td>
<td>Strong, consensus</td>
<td>Moderate</td>
</tr>
<tr>
<td>Emphasize follow up visits within the first week after discharge [22]</td>
<td>Weak</td>
<td>Moderate</td>
</tr>
<tr>
<td>Do not use humidified air or cool mist [9, 11, 12, 23, 24]</td>
<td>Strong</td>
<td>Low to moderate</td>
</tr>
</tbody>
</table>

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Rating the Quality of Evidence using GRADE

Assign priori ranking
- Randomized controlled trial (RCT): HIGH
- Observation study (OS): LOW

Determine factors for upgrade or downgrade

Downgrade for:
- Design limitations
- Inconsistency of results
- Indirectness of evidence
- Imprecision
- Publication bias

Upgrade for:
- Large consistent effect
- Dose response
- Confounders only reducing size of effect

Assign final grade per number of upgrade or downgrade

<table>
<thead>
<tr>
<th>Grade</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>• RCT</td>
</tr>
<tr>
<td></td>
<td>• OS with ≥ 3 downgrades</td>
</tr>
<tr>
<td>Moderate</td>
<td>• RCT with ≥ 1 downgrades</td>
</tr>
<tr>
<td></td>
<td>• OS with ≥ 1 downgrades</td>
</tr>
<tr>
<td>Low</td>
<td>• RCT with 2 downgrades</td>
</tr>
<tr>
<td></td>
<td>• OS</td>
</tr>
<tr>
<td>Very Low</td>
<td>• RCT with 1 downgrade</td>
</tr>
<tr>
<td></td>
<td>• OS with 1 downgrade</td>
</tr>
<tr>
<td></td>
<td>• Case series/case report</td>
</tr>
</tbody>
</table>

Determine factors impacting recommendations
- Balance of desirable and undesirable effects
- Cost-effectiveness
- Preference of patients

Make recommendations
- Strong
- vs
- Weak

What does our rating mean to our readers?

<table>
<thead>
<tr>
<th>Rating</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>We are very confident that the effect in the study reflects the actual effect</td>
</tr>
<tr>
<td>Moderate</td>
<td>We are quite confident that the effect in the study is close to the true effect, but it is also possible it is substantially different</td>
</tr>
<tr>
<td>Low</td>
<td>The true effect may differ significantly from the estimate</td>
</tr>
<tr>
<td>Very Low</td>
<td>The true effect is likely to be substantially different from the estimated effect</td>
</tr>
</tbody>
</table>

References

Design limitations
- Lack of blinding - members involved in study are aware of which arm the patient is allocated
- Lack of allocation concealment – enrolled patients are aware of which group the next enrolled patient will be allocated
- Large losses to follow up
- Incorrect analysis of Intention to treat (ITT)
- Stopped early for benefit
- Selective reporting of measured outcomes (e.g. no effect outcomes) – incomplete or absent reporting of some outcomes and not others on the basis of the results

Inconsistency of results
- Wide variation of treatment effect across studies
- Population varied
- Interventions varied
- Outcomes varied

Indirectness of evidence
- Head-to-head comparison in correct population
- Indirect comparisons
- Different populations – indirectness in population
- Different interventions – interventions delivered differently in different settings
- Different outcomes measured – time differences, use of surrogate outcomes in place of patient important outcomes
- Comparisons not applicable to questions/outcome

Imprecision
- Sample size lower than calculated optimal size
- Total # of events <300
- 95% CI includes negligible effect and appreciable benefit of harm
- Wide confidence interval
- Confidence interval not reported

Publication bias
- Studies with ‘negative’ findings remain unpublished

Large consistent effect
- Effect cannot be accounted for by bias common to the study; usually when relative risk are > 5 or < 2

Dose response
- when the result is proportional to the degree of exposure

Confounding only reduce size of effect
- when all possible confounders would only diminish the observed effect. It is likely that the actual effect is larger than the data suggests