Croup - Emergency management in children

Purpose

This document provides clinical guidance for all staff involved in the care and management of a child presenting to an Emergency Department (ED) with symptoms suggestive of croup in Queensland. This guideline has been developed by senior ED clinicians and Paediatricians across Queensland, with input from PICU and ENT staff, Queensland Children’s Hospital, Brisbane. It has been endorsed for use across Queensland by the Queensland Emergency Care of Children Working Group in partnership with the Queensland Emergency Department Strategic Advisory Panel and the Healthcare Improvement Unit, Clinical Excellence Queensland.

Key points

- Croup is a common cause of airway obstruction in young children.
- Symptoms are usually mild to moderate (worse at night and peak on day two to three) and self-limiting but can be severe and rarely, life-threatening.
- Exercise care to avoid distressing a child with croup as this may exacerbate symptoms.
- Treatment includes corticosteroids and, in moderate to severe cases, nebulised Adrenaline.

Introduction

Croup (acute laryngotracheobronchitis) is a clinical syndrome characterised by barking cough, inspiratory stridor and hoarseness of voice with or without respiratory distress.\(^1,2\) It is a common cause of upper airway obstruction in young children.\(^3,4\) Illness is typically mild and self-limiting but can be severe and rarely, life-threatening.\(^4\)

Croup results from inflammation of the upper airway, including the larynx, trachea, and bronchi. Viral invasion of the laryngeal mucosa leads to inflammation, hyperaemia, and oedema. This may subsequently result in narrowing of the subglottic region.\(^5\) Children then compensate for this narrowing by changing their work of breathing.

In children with severe croup, as the narrowing progresses their increased work of breathing becomes counter-productive. Airflow through the upper airway becomes turbulent (producing stridor) and their compliant chest wall begins to cave in during inspiration.\(^6-8\) This results in paradoxical breathing, and consequently the child becomes fatigued. If untreated, these events may lead to hypoxia and hypercapnea, which may eventually result in respiratory failure and arrest.\(^5-8\)

Croup usually develops over a few days with a concurrent coryzal illness. Many viruses may cause croup, the most common of which are Parainfluenza and RSV.\(^1,2,4,9,10\) The airway obstruction symptoms of croup are classically worse at night and peak on the second or third night of the illness. Symptoms usually resolve within 48 hours but occasionally persist for up to a week.\(^1,2,11,12\)
Assessment

**ALERT** – Children with croup should be made as comfortable as possible. Take special care not to distress the child as this may exacerbate symptoms.

Several conditions can result in acute onset stridor and respiratory distress. Croup commonly affects children between 6 and 36 months. It is rare in children more than six years. Consider alternative diagnoses, especially in children outside the typical age range. In young children always consider foreign body inhalation.

### Differential diagnosis of acute onset stridor and respiratory distress

<table>
<thead>
<tr>
<th>Toxic appearance</th>
<th>Non-toxic appearance</th>
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Adapted from NSW Department of Health Clinical Practice Guidelines and Royal Children’s Hospital, Melbourne

Once confident in the diagnosis of croup, an accurate assessment (mild, moderate, severe and life-threatening) of severity is important to guide treatment. Croup severity scores used in hospital-based clinical research studies are of limited value in clinical practice. The initial assessment of a child presenting with croup should be based on the Alberta Medical Association Guideline as outlined in the table below (developed as a clinical adaption of the research-based Westley Croup score). Throat examination is not recommended as distress may exacerbate symptoms.

### Assessment of severity of croup

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<thead>
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<th>Severe</th>
<th>Life-threatening</th>
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*Signs of respiratory distress include accessory muscle use, abdominal breathing, intercostal recession, subcostal recession and tracheal tug. Oxygen saturations using pulse oximetry, commonly referred to as “sats”

Adapted from Alberta Medical Association Guideline as referenced in Cherry

Consider seeking senior emergency/paediatric advice as per local practice for a child with moderate to severe croup.

Seek senior emergency/paediatric advice as per local practice for a child with moderate to severe croup who is not responding to treatment.

Seek urgent senior assistance onsite (such as critical care, ENT, Anaesthetics) to manage airway for child with life-threatening croup. Contact paediatric critical care (onsite or via Retrieval Services Queensland (RSQ)).
Risk factors for severe croup

- age less than six months
- underlying structural upper airway condition e.g. tracheomalacia, subglottic stenosis
- history of previous severe croup
- unplanned representation to ED within 24 hours of first croup presentation
- trisomy 21

Investigations

Investigations (including blood tests, NPA, CXR) are usually not indicated and may unnecessarily distress the child and worsen symptoms. Lateral X-ray of the neck is not routinely required as rarely alters management.\(^{17}\) Although subglottic narrowing, radio-opaque foreign bodies and supraglottic swelling may be apparent on radiographic imaging of the airway, the risk of the procedure generally outweighs any benefits, as the neck extension required may precipitate sudden severe obstruction.\(^{17}\)

Management

Refer to Appendix 1 for a summary of the emergency management and medications for children presenting with symptoms of croup.

There is no definitive treatment for the viruses that cause croup. Therapy is aimed at decreasing airway oedema and providing supportive care (respiratory support and maintenance of hydration).

Recommended management includes:

- the appropriate use of corticosteroids and nebulised Adrenaline.\(^{19-24}\) These interventions have been shown to reduce the need for, and duration of endotracheal intubation, length of stay, and representation rates to emergency services.\(^{19,20,22,25,26}\)
- nursing the child upright on carer’s lap

Corticosteroids

Recommended for children with mild to moderate croup.

Corticosteroids take approximately 30 minutes to lessen respiratory distress,\(^{27}\) more quickly if given via a nebuliser.\(^{19,22}\) While not fully understood, corticosteroids are thought to vasoconstrict the upper airway and exert a systemic anti-inflammatory effect.

Oral administration is recommended whenever possible. Advantages of oral over other methods include:

- less pain and distress for the child
- inexpensive and readily available
- easy to administer\(^{2,21,26}\)
Corticosteroid dosing for the treatment of croup

<table>
<thead>
<tr>
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<th>Notes</th>
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<tr>
<td>Dexamethasone</td>
<td>0.15-0.3 mg/kg</td>
<td>0.15 mg/kg has shown to be an effective dose but in practice clinicians may opt for a higher dose to ensure the desired dose is ingested in a child who is vomiting/having difficulty taking oral medicine. Preferred corticosteroid as associated with lower representation rate. 29, 30 Not available at all hospitals and community pharmacies.</td>
</tr>
<tr>
<td>Prednisolone</td>
<td>0.3 mg/kg</td>
<td>Day 1: 1 mg/kg/day&lt;br&gt;Day 2: 1 mg/kg/day in evening 31</td>
</tr>
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Nebulised Budesonide

Consider for a child who repeatedly vomits the oral medication.

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<td><strong>Dose</strong></td>
</tr>
<tr>
<td><strong>Side effects</strong></td>
</tr>
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</table>

Nebulised Adrenaline

Consider as first-line treatment in any child with persisting inspiratory stridor (at rest) and marked chest wall retractions.

Adrenaline is thought to reduce bronchial and tracheal epithelial vascular permeability thereby decreasing airway oedema, increasing the airway radius and improving airflow. 2, 19 Symptoms usually improve significantly within 30 minutes. 33 The duration of effect is approximately two hours. 1, 2, 33, 34

<table>
<thead>
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<tr>
<td><strong>Monitoring</strong></td>
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</table>

Historically, children were admitted for 24 hours after an initial dose of nebulised Adrenaline. However, two retrospective cohort studies and combined data from five prospective clinical trials in croup patients treated with Adrenaline and Dexamethasone (or Budesonide) and observed for two to four hours, found that fewer than 5% of discharged children returned within 72 hours (with only 6 of 253 requiring admission). 23, 35-38 No adverse events were reported. Based on this evidence and allowing a margin of safety, discharge may be considered three hours after nebulised Adrenaline providing the child has tolerated an effective dose of corticosteroids and symptoms (stridor and/or respiratory distress) have not persisted or recurred. If a repeat dose of Adrenaline is required the three hours must be taken from the time of the second dose. 39 In practice, the decision to discharge will also depend on non-clinical factors including the time of day and the family’s proximity to hospital.

Seek urgent paediatric critical care advice (onsite or via RSQ) for a child who fails to respond to two doses of nebulised Adrenaline.
Oxygen

**ALERT – Oxygen desaturation may herald an impending complete upper airway obstruction.**

Administer high flow oxygen at 15 L/min via non-rebreather mask to children with life-threatening croup.

Consider supplemental oxygen for children with severe croup and SpO2 less than 93% providing it can be administered without distressing the child. This can be done using plastic tubing with the opening held within a few centimetres of the nose and mouth (blow-by oxygen) at minimum of 10 L/min flow rate.

Treatments NOT recommended

- antibiotics
- steam inhalations - insufficient evidence to support use and associated with risk of scalds in young children
- heliox treatment (RCT evidence (n=91) to suggest a significant improvement in croup scores at 60 minutes but not after 120 minutes). However, individual clinicians may consider its use in refractory cases of moderate or severe croup

Escalation and advice outside of ED

Clinicians can contact the services below to escalate the care of a paediatric patient as per local practices. Transfer is recommended if the child requires a higher level of care.

**Child is critically unwell or rapidly deteriorating**

Includes the following children (as a guide):

- poor respiratory effort or exhausted
- SpO2 ≤ 93% or cyanotic
- lethargic or decreased level of consciousness
- more than two doses of nebulised Adrenaline with any of:
  - ongoing stridor and moderate or severe respiratory distress
  - signs of fatigue
- physiological triggers based on age (see table below)

<table>
<thead>
<tr>
<th>Less than 1 year</th>
<th>1-4 years</th>
<th>5-11 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>RR &gt;50</td>
<td>RR &gt;40</td>
<td>RR &gt;40</td>
</tr>
<tr>
<td>HR &lt;90 or &gt;170</td>
<td>HR &lt;80 or &gt;160</td>
<td>HR &lt;70 or &gt;150</td>
</tr>
<tr>
<td>sBP &lt;65</td>
<td>sBP &lt;70</td>
<td>sBP &lt;75</td>
</tr>
<tr>
<td>SpO2 &lt;93% in oxygen or &lt;85% in air</td>
<td>SpO2 &lt;93% in oxygen or &lt;85% in air</td>
<td>SpO2 &lt;93% in oxygen or &lt;85% in air</td>
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<tr>
<td>GCS ≤12</td>
<td>GCS ≤12</td>
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</tbody>
</table>
### Reason for contact | Who to contact
--- | ---
For immediate onsite assistance including airway management (anticipate difficult airway) | The most senior resources available onsite at the time as per local practices. Options may include:
- paediatric critical care
- critical care
- anaesthetics
- ENT
- paediatrics
- Senior Medical Officer (or similar)

Paediatric critical care advice and assistance | Onsite or via Retrieval Services Queensland (RSQ). If no onsite paediatric critical care service contact RSQ on 1300 799 127:
- for access to paediatric critical care telephone advice
- to coordinate the retrieval of a critically unwell child

RSQ (access via QH intranet)

Notify early of child potentially requiring transfer.
Consider early involvement of local paediatric/critical care service.
In the event of retrieval, inform your local paediatric service.

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#### Non-critical child

**May include the following children:**

- moderate to severe disease
- mild to moderate disease with risk factors for severe disease including:
  - aged less than six months
  - underlying structural upper airway condition e.g. tracheomalacia, subglottic stenosis
  - history of previous severe croup
  - unplanned representation to ED within 24 hours of first croup presentation
  - trisomy 21
- other significant clinical concern not already described

#### Advice (including management, disposition or follow-up) | Who to contact
--- | ---
| Follow local practice. Options: | 
- onsite/local paediatric service
- Queensland Children’s Hospital experts via [Children’s Advice and Transport Coordination Hub (CATCH)](https://www.childrenshospital.org.au/services/advice-support) on 13 CATCH (13 22 82) (24-hour service)
- Queensland Health experts via Telehealth Emergency Management Support Unit (TEMSU) on 1800 11 44 14 (24-hour service) [TEMSU](https://www.health.qld.gov.au/telehealth-emergency-management-support-unit) (access via QH intranet)

Referral | First point of call is the onsite/local paediatric service
**Inter-hospital transfers**

| **Do I need a critical transfer?** | • discuss with onsite/local paediatric service  
| • view Queensland Paediatric Transport Triage Tool |

| **Request a non-critical inter-hospital transfer** | • contact onsite/local paediatric service  
| • view the [QH Inter-hospital transfer request form](#) (access via QH intranet)  
| • for transfers to Queensland Children’s Hospital, contact [Children's Advice and Transport Coordination Hub (CATCH)](#) on 13 CATCH (13 22 82) (24-hour service)  
| • aeromedical non-critical patient transfer forms:  
| o [Qantas](#)  
| o [Virgin](#)  
| o [Jetstar](#)  
| o [non-critical RSQ transfer](#) (access via QH intranet) |

**When to consider discharge from ED**

Most children with croup will be safely discharged from the ED.

Discharge is recommended for children who meet the following criteria:

- no respiratory distress or stridor at rest post-treatment (minimum three hours post administration of nebulised Adrenaline or one hour post oral corticosteroids)
- croup remains the primary diagnosis after consideration of differential diagnoses
- parent/caregiver has:
  - access to further doses of any required prescribed medication
  - received education and are comfortable with what to do if symptoms recur (provide [Croup factsheet](#))
  - access to transport or emergency services in the event of deterioration

**Follow-up**

- with General Practitioner in one to two days

**When to consider admission**

**Facilities without a Short Stay Unit (SSU)**

Admission is recommended for children with persistent or recurrent symptoms (stridor and/or respiratory distress) despite treatment at three hours.

Consider admission for the following children:

- high risk of severe illness. This includes:
  - age less than six months
  - underlying structural upper airway condition
  - history of previous severe croup
  - trisomy 21
  - unplanned representation to ED within 24 hours following diagnosis of croup at first presentation
• persistent symptoms (e.g. respiratory distress or stridor at rest) three hours after treatment
• inadequate fluid intake
• social circumstances that make discharge potentially unsafe

Facilities with a Short Stay Unit (SSU)

Consider admission to a SSU for children who are responding to treatment but require a period of observation prior to meeting the criteria for discharge.

When to consider admission to inpatient ward from SSU

Consider admission to an inpatient service for children who are failing to improve (persistent/recurring or worsening symptoms) after 12 hours of care.

Related documents

Factsheet

• Croup factsheet

References

21. Geelhoed GC, Macdonald WB. Oral dexamethasone in the treatment of croup: 0.15 mg/kg versus 0.3 mg/kg versus 0.6 mg/kg. Pediatric Pulmonology. 1995; 20 (6): 362-368.

Guideline approval

<table>
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<th>CHQ-GDL-60004</th>
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<td>26/9/19</td>
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<tr>
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<tr>
<td>Accreditation references</td>
<td>NSQHS Standards (1-10): 1, 3, 8</td>
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Disclaimer
This guideline is intended as a guide and provided for information purposes only. The information has been prepared using a multidisciplinary approach with reference to the best information and evidence available at the time of preparation. No assurance is given that the information is entirely complete, current, or accurate in every respect. We recommend hospitals follow their usual practice for endorsement locally including presenting it to their local Medicines Advisory Committee (or equivalent) prior to use.

The guideline is not a substitute for clinical judgement, knowledge and expertise, or medical advice. Variation from the guideline, taking into account individual circumstances may be appropriate.

This guideline does not address all elements of standard practice and accepts that individual clinicians are responsible for:

- Providing care within the context of locally available resources, expertise, and scope of practice
- Supporting consumer rights and informed decision making in partnership with healthcare practitioners including the right to decline intervention or ongoing management
- Advising consumers of their choices in an environment that is culturally appropriate and which enables comfortable and confidential discussion. This includes the use of interpreter services where necessary
- Ensuring informed consent is obtained prior to delivering care
- Meeting all legislative requirements and professional standards
- Applying standard precautions, and additional precautions as necessary, when delivering care
- Documenting all care in accordance with mandatory and local requirements

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For copyright permissions beyond the scope of this licence contact: Queensland Emergency Care of Children working group, Children’s Health Queensland Hospital and Health Service, email QPEC@health.qld.gov.au.
Child presents to ED with symptoms suggestive of croup

Assessment (details over page)
(avoid distressing child as may increase symptoms)

Consider differential diagnoses (see over page)

Mild
- Reassure parent and provide education
- Consider single dose of corticosteroids (Oral)

Moderate
- Corticosteroids (Oral)
- Consider NEB if not tolerating oral

Severe
- Oxygen
- Adrenaline (NEB)
- Corticosteroids (Oral)
- Consider - Dexamethasone (IM/IV)
  - Budesonide (NEB)

Life-threatening
- Call for senior help onsite to manage airway
- Resuscitate using ABCD
- Oxygen 15 L/min via NRBM
- Adrenaline (NEB)
  (repeat once if needed)
- Support ventilation
- IV or IO access
- Corticosteroids (IV)

Reassessment

No symptoms at 1 hour

Risk of severe illness? (Box A)

Continue observation in ED or SSU

Symptoms persist or return after 3 hours?

Consider alternative diagnosis

Consider referral to inpatient service

Refer to inpatient service. Consider Paediatric Critical Care.

Refer to Paediatric Critical Care

Box A: Risk factors for severe croup
- age less than 6 months
- underlying structural upper airway condition
- history of previous severe croup
- unplanned representation within 24 hours
- trisomy 21

Abbreviations
WOB = Work of Breathing  NRBM = Non-rebreather mask

Consider seeking senior emergency/paediatric advice as per local practices
Seek senior emergency/paediatric advice as per local practices
Onsite assistance with airway may include ICU/ENT /Anaesthetics. Call Retrieval Services Queensland (RSQ) on 1300 799 127 if no paediatric critical care facility on site
### Croup – Emergency management in children – Medications

#### Assessment of severity of croup

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#### Corticosteroid dosing for the treatment of croup

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<td>Dexamethasone (IV)</td>
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<tr>
<td>Prednisolone (Oral)</td>
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#### Budesonide (NEB) dosing for the treatment of croup

| Dose | 2 mg nebulised with oxygen. |
| Side effects | Facial irritation – cover child’s eyes while administering, wash face afterwards |

#### Adrenaline (NEB) dosing for the treatment of croup

| Dose | 5 mL of undiluted 1:1000 Adrenaline nebulised with oxygen as a single dose. Dose may be repeated if there is inadequate response. |
| Monitoring | Clinical observations every 15 minutes for the first hour. |