Statewide Paediatric Guideline

Emergency

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, Lady Cilento Children's Hospital, Brisbane. It has been endorsed for use across Queensland by the Statewide Emergency Care of Children Working Group in partnership with the Queensland Emergency Department Strategic Advisory Panel and the Healthcare Improvement Unit, Clinical Excellence Division.

Key points

- Croup is a common cause of airway obstruction in young children.
- Symptoms are usually mild-moderate (worse at night and peak on day 2-3) and self-limiting but can be severe and rarely, life-threatening.
- Care should be taken 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, accounting for approximately 2.3% of ED presentations in Australia and New Zealand.[3,4] Although croup is usually a mild and self-limiting illness, significant upper airway obstruction, respiratory distress, and rarely death, can occur.[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.[6-8]

Typical viral croup 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, and clinicians should take special care during assessment and treatment not to distress the child as this may cause substantial worsening of symptoms.

Children with a variety of conditions may present with acute onset stridor and respiratory distress and may have a range of associated symptoms and varying levels of severity.[13] The first step in any assessment is to consider the differential diagnosis of an acute episode of stridor (see table below).

Croup mostly affects children between 6 and 36 months, although it may occur in older children or infants as young as 3 months.[10] It is rare beyond 6 years of age.[5,14] Alternative causes of upper airway obstruction should be considered and excluded in all children presenting with symptoms of upper airway obstruction but particularly those outside the typical age range. Always consider the possibility of foreign body inhalation in young children.

Differential diagnosis of acute onset stridor and respiratory distress	
Toxic appearance*	**Non-toxic appearance**
• Bacterial tracheitis • Epiglottitis • Retropharyngeal abscess • Peritonsillar abscess (quinsy)	• Spasmodic croup • Angioneurotic oedema • Laryngeal foreign body • Subglottic haemangioma

***** Child who looks unwell and has reduced interaction with their environment[14]

Adapted from NSW Department of Health Clinical Practice Guidelines[15] and Royal Children's Hospital, Melbourne[16]

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.[17] 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).[15,18] Throat examination is not recommended as distress may exacerbate symptoms.

Assessment of severity of croup			
Mild	**Moderate**	**Severe**	**Life -threatening**
Occasional barking cough No audible stridor at rest	Frequent barking cough Audible stridor at rest	Persistent stridor at rest (may be expiratory)	Audible stridor may be quieter
No or mild respiratory distress* at rest	Moderate respiratory distress	Severe respiratory distress	Exhausted, poor respiratory effort
Normal SpO2 # No cyanosis	Normal SpO2 No cyanosis	SpO2 ≤93% or cyanosis	SpO2 ≤93% or cyanosis
Alert	Little or no agitation	Fatigue or altered mental state	Lethargy or decreased level of consciousness

*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[17]

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

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

Contact paediatric critical care specialist (onsite or via RSQ) for a child with life-threatening croup. Urgent onsite assistance to manage airway may include ICU/ENT/Anaesthetics.

Risk factors for severe croup include:

- age < 6 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 upset the child and worsen symptoms. Lateral X-ray of the neck is not routinely required and seldom provides information that affects 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 neck extension required for the procedure may precipitate sudden severe obstruction.[17]

Management

Refer to Appendix 1 and 2 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). Care should be taken to avoid causing distress in the child as this can exacerbate symptoms.

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

Corticosteroids take approximately 30 minutes to lessen respiratory distress,[27] more quickly if given by nebuliser.[19,22] The precise mechanism by which corticosteroids exert their effect is not fully known. It is presumed to be based on vasoconstrictive actions in the upper airway followed by the 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[2,21,28]

Steroid dosing for the treatment of croup	
Steroid	**Dose**
Dexamethasone (PO/IM)	0.15-0.3 mg/kg May use up to 0.6 mg/kg if repeat doses required or to ensure the desired dose in child who is resistant to taking oral medicine. Preferred corticosteroid as associated with lower representation rate.[30, 31] Not available at all hospitals and community pharmacies.
Prednisolone (PO)	Day 1: 1mg/kg/day Day 2: 1mg/kg/day in evening[29]

Nebulised budesonide

Nebulised budesonide may be considered if the child repeatedly vomits the oral medication.

Budesonide (NEB) dosing for the treatment of croup	
Dose	2mg nebulised with oxygen.
Side effects	Facial irritation – cover child's eyes while administering and wash face afterwards[32]

Nebulised adrenaline

Contact paediatric critical care specialist (onsite or via RSQ) for a child who fails to respond to nebulised adrenaline.

Immediate treatment with nebulised adrenaline should be considered in any child with persisting inspiratory stridor (at rest) and marked chest wall retractions (moderate to severe croup). Adrenaline is thought to reduce bronchial and tracheal epithelial vascular permeability thereby decreasing airway oedema, resulting in an increase in the airway radius and improved airflow.[2,19]

Nebulised adrenaline is associated with significant transient reduction of symptoms of croup 30 minutes post-treatment.[34] The duration of effect is approximately 2 hours.[1,2,33,34]

Adrenaline (NEB) dosing for the treatment of croup	
Dose	5 mL of undiluted 1:1000 adrenaline nebulised with oxygen. Dose may be repeated if there is inadequate response.[29]
Monitoring	Clinical observations every 15 minutes for the first hour.

Historically, children were admitted for 24 hours after an initial dose of nebulised adrenaline. However, 2 retrospective cohort studies and combined data from 5 prospective clinical trials in croup patients treated with adrenaline and dexamethasone (or budesonide) and observed for 2-4 hours, found that fewer than 5% of children discharged home returned within 72 hours (with only 6/253 requiring admission).[23,35-38] There were no reported adverse events. Based on this evidence and allowing a margin of safety, discharge may be considered 3 hours after nebulised adrenaline providing the child has tolerated an effective dose of systemic steroids and symptoms (stridor and/or respiratory distress) have not persisted or recurred. If a repeat dose of adrenaline is required the 3 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.

Other Treatments

Supplemental oxygen therapy is not routinely recommended. It may be considered in children with severe viral croup who have significant oxygen desaturation (SpO2 < 93%), however this must be administered with care to avoid further distressing the child. Oxygen may be administered without distressing the child via a 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.[14] For life-threatening croup, administer high flow oxygen at 15 L/min via non-rebreather mask.

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

Treatments which are **NOT** recommended for acute croup include:

- antibiotics
- steam inhalations[38,39] (as insufficient evidence to support use and carry risk of scalds and burns in young children)[40]
- 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.

When to escalate care

Follow your local facility escalation protocols for children of concern. Transfer is recommended if the child requires care beyond the level of comfort of the treating hospital. Clinicians can contact the services outlined below to escalate the care of a paediatric patient.

Service	Reason for contact by clinician	Contact
Local Paediatric service	For specialist paediatric advice and assistance with local transfers as per local arrangements.	As per local arrangements
Children's Advice and Transport Coordination Hub (CATCH)	For access to specialist paediatric advice and assistance with inter-hospital transfer of non-critical patients into and out of Lady Cilento Children's Hospital. For assistance with decision making regarding safe and appropriate inter-hospital transfer of children in Queensland. For QH staff, click here for the QH Inter-hospital transfer request form (access via intranet).	(07) 3068 4510 24 hours CATCH website
Telehealth Emergency Management Support Unit (TEMSU)	For access to generalist and specialist acute support and advice via videoconferencing, as per locally agreed pathways, in regional, rural and remote areas in Queensland.	TEMSU QHEPS website 24 hours
Retrieval Services Queensland (RSQ)	For access to telehealth support for, and to notify of, critically unwell patients requiring retrieval in Queensland. For any patients potentially requiring aeromedical retrieval or transfer in Queensland.	RSQ QHEPS website 24 hours

When to consider discharge

Most children with appropriately diagnosed croup will be discharged from the ED.

Discharge is recommended for children with croup who meet the following criteria:

- no respiratory distress or stridor at rest post treatment (minimum 3 hours post nebulised adrenaline or 1-hour post oral steroids)
- croup remains the primary diagnosis after consideration of differential diagnoses
- parents have:
    - access to further doses of any required prescribed medication
    - received education regarding the condition and are comfortable with what to do if symptoms recur (provide Croup factsheet)
    - access to transport or emergency services

Follow-up

- with General Practitioner in 1 -2 days

When to consider admission

Facilities without a Short Stay Unit (SSU)

Admission is recommended for children with croup who have persistent or recurrent symptoms (stridor and/or respiratory distress) despite treatment at 3 hours.

Consider admission for the following children with croup:

- those at high risk of severe illness. This includes:
    - age < 6 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
- persistence of symptoms (e.g. respiratory distress or stridor at rest) 3 hours after treatment
- inadequate fluid intake
- children with social circumstances that make discharge potentially unsafe

Facilities with a Short Stay Unit (SSU)

Consider admission to an 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

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Guideline approval

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Disclaimer

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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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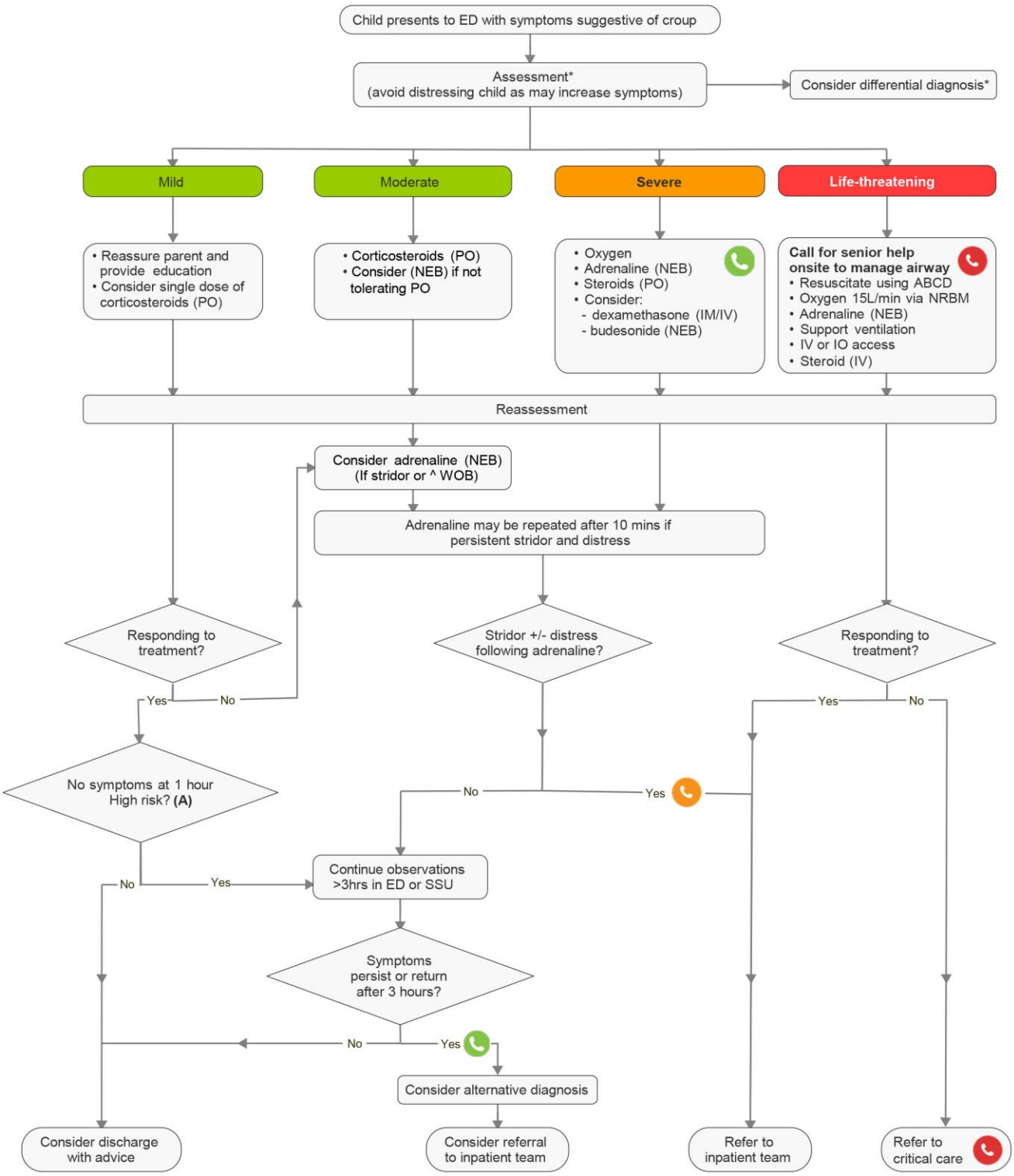
Croup - Emergency Management in Children - Flowchart



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

see over page

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

Onsite assistance with airway may include ICU / ENT / Anaesthetics
Call RSQ if no paediatric critical care facility on site

Seek senior emergency/paediatric advice as per local protocols

Consider seeking senior emergency/paediatric advice as per local protocols

For more information refer to the *Statewide Paediatric Guideline: Croup - Emergency Management in Children*

Croup – Emergency Management in Children – Assessment and Medications

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