

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 on day two) and self-limiting but can be severe and rarely, life-threatening.
- 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} Onset may be abrupt, and is more common at night. The illness is typically mild and self-limiting but can be severe and rarely, life-threatening.^{1,4,5}

Croup usually develops as part of a concurrent coryzal illness. Many viruses can cause croup, the most common of which are Parainfluenza and RSV, but also includes influenza and Covid-19.^{2,5,6,10} 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} Spasmodic croup can occur in the absence of acute viral illness, but assessment and treatment is identical.^{2,7}

Croup results from inflammation of the upper airway, including the larynx and trachea. Inflammation of the laryngeal and tracheal mucosa leads to hyperaemia and oedema⁸. As the subglottic region is surrounded by a firm cartilaginous ring, this swelling encroaches on the internal diameter of the airway, resulting in substantial narrowing.^{2,7} Airway narrowing leads to increased airflow resistance, turbulent airflow producing inspiratory stridor, and increased work of breathing.

Children with severe croup develop paradoxical breathing (asynchronous chest wall and abdominal movement).^{2,9,10} This paradoxical breathing results in progressive fatigue and deterioration in ventilation.



If untreated, respiratory failure with resulting hypoxia and hypercapnia may eventually progress to respiratory arrest.^{2, 9, 10}

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. Detailed examination, in particular examination of the throat, is not recommended as distress may exacerbate symptoms.¹¹

Several conditions can result in acute onset stridor and respiratory distress.¹³ Consider alternative diagnoses, especially in children outside the typical age range (6 to 36 months). In young children, always consider foreign body inhalation.

Differential diagnosis of acute onset stridor and respiratory distress

Toxic appearance	Non-toxic appearance
<ul style="list-style-type: none"> Bacterial tracheitis Epiglottitis Retropharyngeal abscess Peritonsillar abscess (quinsy) Anaphylaxis 	<ul style="list-style-type: none"> Croup Angioneurotic oedema (eg hereditary angioedema) Laryngeal foreign body Subglottic haemangioma

^{10, 14}

Once confident in the diagnosis of croup, an accurate assessment of severity guides treatment.

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 also be expiratory)	Stridor at rest, although may be quieter
No or mild respiratory distress* at rest	Moderate respiratory distress	Severe respiratory distress	Exhausted, poor respiratory effort
Normal SpO ₂ [#] , no cyanosis	Normal SpO ₂ , no cyanosis	SpO ₂ ≤ 93% or cyanosis	SpO ₂ ≤ 93% or cyanosis
Alert	Little or no agitation	Fatigue, agitation or distress	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 Cherry¹³



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^{11,14}

- prematurity³
- 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.^{10, 14} Lateral X-ray of the neck is not routinely required as rarely alters management.¹⁴ 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.¹⁴

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. These interventions have been shown to reduce the need for, and duration of endotracheal intubation, length of stay, and representation rates to emergency services.¹⁵⁻²⁰
- Nursing the child upright on carer's lap

Corticosteroids

Recommended for all children with croup.²¹

Oral corticosteroids take approximately 30 minutes to lessen respiratory distress,²² and if not tolerated, can be more reliably given via a nebuliser.¹⁶ While not fully understood, corticosteroids are thought to reduce airway oedema through an anti-inflammatory effect.²⁰

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

- less pain and distress for the child
- inexpensive and readily available
- quicker to administer



Corticosteroid dosing for the treatment of croup

Dexamethasone (Oral/IM/IV)	<p>Mild-moderate croup: 0.15-0.3mg/kg^{20, 23}, maximum 12mg²³</p> <ul style="list-style-type: none"> Some uncertainty remains about optimal dexamethasone dosing in croup.^{20, 23} 0.15 mg/kg is an effective dose in most cases. 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. <p>Severe or life-threatening: 0.6mg/kg (oral/IV/IM), maximum 12mg.</p> <ul style="list-style-type: none"> 0.6 mg/kg may be used in more severe cases²³. Adverse effects of higher doses are uncommon.²⁰ <p>Preferred corticosteroid as associated with lower representation rate, shorter course, less vomiting and fewer school days missed.^{20, 24-27}</p> <p>Oral suspension is not widely available. Dexamethasone 0.5mg and 4mg tablets are available but they are not easily dispersed in water to give in a partial dose. Doses that can be rounded to full tablet size can however be crushed and dispersed in water²⁸. Dexamethasone injection can be given orally and is tasteless. If IV stock is in shortage, please give liquid suspension.</p>
Prednisolone (Oral)	<p>Day 1: 1mg/kg/day Day 2: 1mg/kg/day in the evening</p>

Nebulised Budesonide

Consider for a child who repeatedly vomits the oral medication.

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

Nebulised Adrenaline

Consider as first-line treatment in any child with persisting inspiratory stridor (at rest) and marked chest wall retractions. Adrenaline generally improves symptoms rapidly, and 'buys time' for corticosteroids to take effect.

Adrenaline is thought to work by reducing bronchial and tracheal epithelial vascular permeability thereby decreasing airway oedema, increasing the airway radius and improving airflow.^{8, 29, 30} Symptoms usually improve significantly within minutes, and the duration of effect is up to two hours.^{2, 3, 29, 30}

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 in 10 minutes if there is inadequate response. ³⁷
Monitoring	Clinical observations every 15 minutes for the first hour.



A period of observation is required after nebulised adrenaline, to ensure recurrence of symptoms does not occur. Multiple studies have demonstrated low rates of recurrence of symptoms requiring intervention outside of a 2-3 hour period post adrenaline administration.^{3, 31-34} 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. 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 while getting expert help for an anticipated difficult airway.

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^{1, 19, 35}
- cough suppressants^{10, 37}
- heliox – evidence is limited, and does not support routine use.³⁶ Individual clinicians may consider its use in refractory cases of 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)



	Less than 1 year	1-4 years	5-11 years
	<ul style="list-style-type: none"> RR >50 HR <90 or >170 sBP <65 SpO2 <93% in oxygen or <85% in air GCS ≤12 	<ul style="list-style-type: none"> RR >40 HR <80 or >160 sBP <70 SpO2 <93% in oxygen or <85% in air GCS ≤12 	<ul style="list-style-type: none"> RR >40 HR <70 or >150 sBP <75 SpO2 <93% in oxygen or <85% in air GCS ≤12
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: <ul style="list-style-type: none"> 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 : <ul style="list-style-type: none"> 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.		



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



Reason for contact	Who to contact
Advice (including management, disposition or follow-up)	Follow local practice. Options: <ul style="list-style-type: none"> onsite/local paediatric service Queensland Children's Hospital experts via Children's Advice and Transport Coordination Hub (CATCH) on 13 CATCH (13 22 82) (24-hour service) local and regional paediatric videoconference support via Telehealth Emergency Management Support Unit TEMSU (access via QH intranet) on 1800 11 44 14 (24-hour service)
Referral	First point of call is the onsite/local paediatric service

Inter-hospital transfers

Do I need a critical transfer?	<ul style="list-style-type: none"> discuss with onsite/local paediatric service view Queensland Paediatric Transport Triage Tool
Request a non-critical inter-hospital transfer	<ul style="list-style-type: none"> contact onsite/local paediatric service contact RSQ on 1300 799 127 for aeromedical transfers contact Children's Advice and Transport Coordination Hub (CATCH) on 13 CATCH (13 22 82) for transfers to Queensland Children's Hospital
Non-critical transfer forms	<ul style="list-style-type: none"> QH Inter-hospital transfer request form (access via QH intranet) aeromedical stepdown (access via QH intranet) commercial aeromedical transfers: <ul style="list-style-type: none"> Qantas Virgin Jetstar

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 30 minutes post oral corticosteroids) ³⁷
- 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

- No specific follow up required.
- Children should return to an emergency department if recurrence of stridor at rest, or increased work of breathing.



- Covid-19 testing should only occur once stridor and respiratory distress has resolved.

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 <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/recurrent or worsening symptoms) after 12 hours of care.

Related documents

- [Croup factsheet](#)

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Guideline approval

Document ID	CHQ-GDL-60004	Version no.	3.0	Approval date	01/02/2023
Executive sponsor	Executive Director Medical Services			Effective date	01/02/2023
Author/custodian	Queensland Emergency Care Children Working Group			Review date	01/02/2027
Supersedes	2.0				
Applicable to	Queensland Health medical and nursing staff				
Document source	Internal (QHEPS) + External				
Authorisation	Executive Director Clinical Services				
Keywords	Paediatric, laryngotracheobronchitis, upper airway obstruction, emergency, guideline, croup, children, CHQ-GDL-60004				
Accreditation references	NSQHS Standards: 1, 4, 8				

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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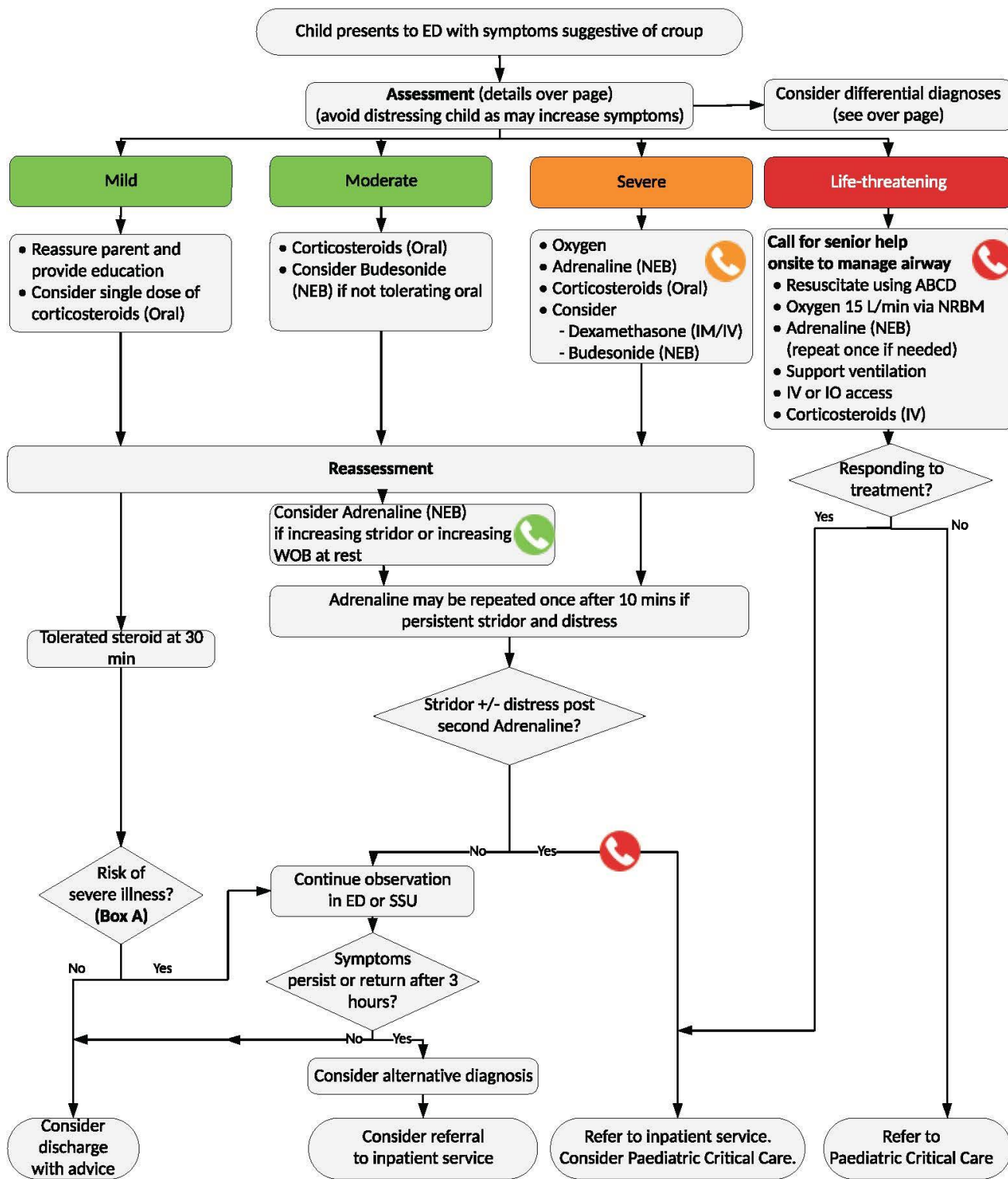
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CHQ-GDL-60004 Croup – Emergency management in children





Box A: Risk factors for severe croup

- age less than 6 months or prematurity
- 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			
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
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Normal SpO ₂ [#] , no cyanosis	Normal SpO ₂ , no cyanosis	SpO ₂ ≤ 93% or cyanosis	SpO ₂ ≤ 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"

Differential diagnosis of acute onset stridor and respiratory distress	
Toxic appearance	Non-toxic appearance
<ul style="list-style-type: none"> Bacterial tracheitis Epiglottitis Retropharyngeal abscess Peritonsillar abscess (quinsy) 	<ul style="list-style-type: none"> Spasmodic croup Angioneurotic oedema Laryngeal foreign body Subglottic haemangioma

Corticosteroid dosing for the treatment of croup	
Dexamethasone (Oral/IM/IV)	<p>Mild-moderate croup: 0.15-0.3mg/kg^{20, 23}, maximum 12mg²³</p> <ul style="list-style-type: none"> Some uncertainty remains about optimal dexamethasone dosing in croup.^{20, 23} 0.15 mg/kg is an effective dose in most cases. 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. <p>Severe or life-threatening: 0.6mg/kg (oral/IV/IM), maximum 12mg.</p> <ul style="list-style-type: none"> 0.6 mg/kg may be used in more severe cases²³. Adverse effects of higher doses are uncommon.²⁰ <p>Preferred corticosteroid as associated with lower representation rate, shorter course, less vomiting and fewer school days missed.^{20, 24-27}</p> <p>Oral suspension is not widely available. Dexamethasone 0.5mg and 4mg tablets are available but they are not easily dispersed in water to give in a partial dose. Doses that can be rounded to full tablet size can however be crushed and dispersed in water²⁸. Dexamethasone injection can be given orally and is tasteless. If IV stock is in shortage, please give liquid suspension.</p>
Prednisolone (Oral)	<p>Day 1: 1mg/kg/day</p> <p>Day 2: 1mg/kg/day in the evening</p>

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

For more information refer to [CHQ-GDL-60004 - Croup – Emergency management in children](#)



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.

For more information refer to [CHQ-GDL-60004 - Croup – Emergency management in children](#)

