**Purpose**

This procedure provides clinical practice guidelines to guide clinicians involved in the emergency management of children with acute croup.

**Scope**

This guideline relates to all staff involved in the care and management of children with acute croup.

**Related documents**

**Procedures, Guidelines, Protocols**

- Flowchart: Emergency Management of Croup in Children
- Parent Information: Acute Croup
- Admission/Discharge Criteria for Children with Croup
Introduction

Croup (acute laryngotracheobronchitis) is a clinical syndrome characterised by barking cough, inspiratory stridor and hoarseness of voice with or without respiratory distress.\textsuperscript{1,2} It is a common cause of upper airway obstruction in young children, accounting for approximately 2.3% of emergency presentations in Australia and New Zealand.\textsuperscript{3,4} Although croup is usually a mild and self-limited illness, significant upper airway obstruction, respiratory distress and rarely death, can occur.\textsuperscript{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 then result in narrowing of the subglottic region.\textsuperscript{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.\textsuperscript{6,7,8} This results in paradoxical breathing, and consequently the child becomes fatigued. If untreated, these events may lead to hypoxia and hypercapnoea, which may eventually result in respiratory failure and arrest.\textsuperscript{6-8}

Typical viral croup develops over a few days with a concurrent coryzal illness. A number of viruses may cause croup, the most common of which are Parainfluenza and RSV.\textsuperscript{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.\textsuperscript{1,2,11,12} Croup mostly affects children between 6 and 36 months, although it may occur in older children or infants as young as 3 months.\textsuperscript{10} It is rare beyond 6 years of age.\textsuperscript{5,13} Alternative causes of upper airway obstruction should be considered and excluded in all children presenting with symptoms of upper airway obstruction but particularly in those outside of this typical age range. Always consider foreign bodies in young children.

General consensus is that children with croup should be made as comfortable as possible, and clinicians should take special care during assessment and treatment not to frighten or upset the child because agitation may cause substantial worsening of symptoms.\textsuperscript{13}

Assessment

Children with croup may present with a range of symptoms and varying levels of severity (mild, moderate, severe and life-threatening). Accurate assessment of the severity of croup is important for initial management. Croup severity scores have been used in hospital-based clinical research studies to assess the suitability of patients for treatment in a standardised manner.\textsuperscript{14} However, they are of limited value in clinical practice.\textsuperscript{14} It is also important to always consider differential diagnosis of an acute episode of stridor (Table 1).

Table 1: Differential diagnosis of acute onset stridor and respiratory distress

<table>
<thead>
<tr>
<th>Toxic appearance</th>
<th>Non-toxic appearance</th>
</tr>
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<tbody>
<tr>
<td>Bacterial tracheitis</td>
<td>Spasmodic croup</td>
</tr>
<tr>
<td>Epiglottitis</td>
<td>Angioneurotic oedema</td>
</tr>
<tr>
<td>Retropharyngeal abscess</td>
<td>Laryngeal foreign body</td>
</tr>
<tr>
<td>Peritonsillar abscess (quinsy)</td>
<td>Subglottic haemangioma</td>
</tr>
</tbody>
</table>

Note: Toxic appearance is defined as a child who looks unwell and has reduced interaction with their environment\textsuperscript{13}

Adapted from: Sydney West area health service\textsuperscript{15} and Royal Children’s Hospital, Melbourne\textsuperscript{16}
Due to the lack of strong evidence for reliable croup severity scores CHQ consensus opinion is that the initial assessment of a child presenting with croup should be based on the Nurse Practitioner Clinical Practice Guideline for the Management of Croup developed by Sydney west area health service.\textsuperscript{15} When performing the clinical assessment, the following clinical features should be considered to inform treatment (Table 2).

**Table 2: Assessment of severity**

<table>
<thead>
<tr>
<th></th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
<th>Life Threatening</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mild</strong></td>
<td>Occasional barking cough</td>
<td>Frequent barking cough</td>
<td>Persistent stridor at rest (may be expiratory)</td>
<td>Audible stridor may be quieter</td>
</tr>
<tr>
<td></td>
<td>Mild or no respiratory distress at rest</td>
<td>Audible stridor at rest</td>
<td>Severe respiratory distress including increased work of breathing (wob), increased respiratory rate and use of accessory muscles</td>
<td>Cyanosis</td>
</tr>
<tr>
<td></td>
<td>No audible stridor at rest</td>
<td>Respiratory distress including increased work of breathing (wob), increased respiratory rate and use of accessory muscles</td>
<td>Severe respiratory distress including increased effort, marked decreased air entry, hypotonia and pallor</td>
<td>Lethargy or decreased level of consciousness</td>
</tr>
<tr>
<td></td>
<td>No cyanosis</td>
<td>No cyanosis</td>
<td>Fatigue or altered mental state</td>
<td>No response to pharmacotherapy</td>
</tr>
<tr>
<td></td>
<td>Normal saO\textsubscript{2}</td>
<td>Normal saO\textsubscript{2}</td>
<td>Hypoxia (cyanosis or saO\textsubscript{2} ≤ 93%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Little or no agitation</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Adapted from: Sydney West Area Health Service\textsuperscript{15} and Cherry\textsuperscript{17}

Blood tests and a CXR are rarely indicated in the assessment of croup. Lateral x-ray of the neck is not routinely required and seldom provides information that affects management.\textsuperscript{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 neck extension required for the procedure may precipitate sudden severe obstruction.\textsuperscript{14}

**Management**

The important steps in the management of croup include the appropriate use of systemic (or nebulised) corticosteroids and nebulised adrenaline.\textsuperscript{18-23} These interventions have led to a demonstrated reduction in the need for, and duration of, endotracheal intubation, length of stay, and representation rates to emergency services.\textsuperscript{18,19,21,24-26} The use of nebulized medications must be considered in light of the amount of distress this procedure causes a small child (risk vs benefit).

Given there is no definitive treatment for the viruses that cause croup, therapy should be directed toward decreasing airway oedema and providing supportive care (respiratory support and maintenance of hydration). Other important recommendations for the management of croup include:

- avoid distressing procedures (e.g. examining throat) as anxiety may exacerbate croup
- nurse the child sitting upright on carer's lap
- blood tests, SaO2 monitoring and oxygen mask are rarely indicated
- a routine NPA is not required for children with a typical clinical picture of croup
- antibiotics are not indicated for typical croup.
Corticosteroids

The precise mechanism by which corticosteroids exert their effect is not fully known. It is presumed to be on the basis of vasoconstrictive actions in the upper airway followed by the systemic anti-inflammatory properties. Corticosteroids take approximately 30 minutes after treatment to lessen respiratory distress, more quickly if given by nebulization.

The method of delivery of corticosteroids has been compared in a number of trials with oral (liquid form), IV, IM and inhaled (nebulised) routes all being shown to be superior to placebo. Oral administration is recommended, whenever possible, to reduce pain and distress to the child, and to lessen the risk of further airway swelling and compromise.

Oral corticosteroids have the advantage of being inexpensive and therefore readily available and easy to administer. Studies have demonstrated oral dexamethasone at doses between 0.15 to 0.6 mg/kg/dose to be equivocal. It is therefore suggested that the smallest dose (0.15 mg/kg orally) be administered to achieve the desired outcome. Higher doses (up to 0.6 mg/kg) are acceptable if repeat doses are required or to ensure the desired oral dose is achieved in a distressed child who is resistant to taking oral medicine.

Prednisolone (at a dose of 1 mg/kg/dose) is a commonly used alternative to dexamethasone. Dexamethasone and prednisolone have been shown to provide equivalent initial clinical response, but prednisolone use is associated with a higher representation rate. Current therapeutic guidelines therefore suggest that, if prednisolone is used, a second dose be prescribed, to be taken on the evening following the initial presentation. Note that oral dexamethasone may not be as readily available at community pharmacies or all hospitals, while oral prednisolone is now available commercially and is manufactured in a palatable liquid solution.

Nebulised budesonide

Nebulised budesonide has an onset of action within 30 minutes. This is comparable to adrenaline and slightly faster compared to orally or intramuscularly administered corticosteroids. Oral corticosteroids however are the preferred option (unless the child repeatedly vomits the oral medication), due to the availability and cost of the medication, equipment required, the time needed for administration and the potential for the child to become distressed when nebulised preparations are used.

The recommended dose of budesonide is 2 mg/dose (independent of age and weight) to be nebulised with high flow oxygen. The child's eyes should be covered and their face washed afterwards to prevent facial irritation.

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. Nebulized adrenaline is associated with clinically and statistically significant transient reduction of symptoms of croup 30 minutes post-treatment.

The recommended dose for adrenaline is independent of age and weight (5 mL of undiluted 1:1000 adrenaline nebulised with oxygen). The child should be reassessed regularly following administration (clinical observations every 15 minutes for the first hour) and the dose may be repeated if there is inadequate response. If a child requires more than one dose of nebulised adrenaline the paediatric team and/or PICU should be notified.
Adrenaline has a rapid onset of action with an improvement in croup symptom scores within 30 minutes.\textsuperscript{18,33} The duration of effect is approximately 2 hours.\textsuperscript{1,2,34,44} Historically, children were admitted for 24 hours after an initial dose of nebulised adrenaline. However, combined data from 5 prospective clinical trials in 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).\textsuperscript{23,35-38} There were no reported adverse outcomes. This prospectively derived data, along with 2 retrospective cohort studies, provides good evidence that children treated with nebulised adrenaline may be safely discharged home, provided they have tolerated an effective dose of systemic steroids and their symptoms have not recurred within 2 hours of the nebulised adrenaline dose.\textsuperscript{22,34,44} To allow a margin of safety it is therefore recommended that children who require nebulised adrenaline should be observed for at least 3 hours after the administration of both adrenaline and an effective, tolerated, dose of systemic steroid before discharge is considered.

Other Treatments

Supplemental oxygen therapy may be required for children with severe viral croup who have significant oxygen de-saturation (SaO$_2$ < 93%). Oxygen may be administered without causing the child to be agitated via a plastic hose with the opening held within a few centimetres of the nose and mouth (blow-by oxygen at minimum 10 litres per minute flow rate).\textsuperscript{13} The use of steam inhalations has not been shown to be of significant benefit in acute croup treatment.\textsuperscript{39} It is also contraindicated as the use of steam inhalers has been associated with scalds and burns in young children.\textsuperscript{40} A recent update to the Cochrane review of heliox treatment in croup in children pooled data from 3 RCT (total 91 patients) and showed a statistically significant difference in croup scores at 60 minutes in favour of heliox but no significant difference after 120minutes.\textsuperscript{42} Given the cost and complexity involved in this treatment until further RCT evidence is available heliox is not routinely recommended in the treatment of croup. Individual clinicians can consider its use in refractory cases of moderate or severe croup.

Disposition

See flowchart Appendix 2 – Admission/Discharge Criteria for Children with Acute Croup

Most children with appropriately diagnosed croup who are managed with corticosteroids, and adrenaline where indicated, will eventually be discharged from the emergency department. Prior to discharge clinicians should ensure that the child has adequately responded to treatment, can access further doses of any prescribed medication and has parents who have been appropriately educated about the condition, have access to transport or emergency services and feel comfortable with the diagnosis and what to do if symptoms recur.

The decision to admit a child with acute croup is made after initial treatment and observation. The presence of ongoing stridor at rest after treatment necessitates admission.

When a decision is made to transfer a child to a higher level facility (Level 6), referral must be made through RSQ.\textsuperscript{43} Activation of the QLD emergency medical system coordination centre (QCC)

Further information on the preparation of a infant prior to transport can be obtained through RSQ Clinical Guidelines paediatric section (pages 31-35).\textsuperscript{43} Statewide RSQ clinical guidelines—Paediatrics
Consultation

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- Dr Geoff Pearce – Paediatric Emergency Fellow, Mater Children’s Hospital
- Dr Grant Stone – Director, Paediatric Emergency Department, Mater Children’s Hospital

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We would like to acknowledge the original members of the Greater Brisbane metropolitan area clinical procedures working group who established this guideline.

Definition of terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Children</td>
<td>0-14 years of age</td>
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<tr>
<td>CHS</td>
<td>Children’s Health Services</td>
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<tr>
<td>CPAP</td>
<td>Continuous positive airway pressure</td>
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<td>CRP</td>
<td>C-reactive protein</td>
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<tr>
<td>CXR</td>
<td>Chest x-ray</td>
</tr>
<tr>
<td>FBC</td>
<td>Full blood count</td>
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<tr>
<td>HR</td>
<td>Heart rate</td>
</tr>
<tr>
<td>INH</td>
<td>Inhaler</td>
</tr>
<tr>
<td>IV</td>
<td>Intravenous</td>
</tr>
<tr>
<td>MDI</td>
<td>Metered dose inhaler</td>
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<tr>
<td>NaCl</td>
<td>Sodium chloride</td>
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<tr>
<td>NBM</td>
<td>Nil by mouth</td>
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<tr>
<td>NEB</td>
<td>Nebuliser</td>
</tr>
<tr>
<td>NIV</td>
<td>Non invasive ventilation</td>
</tr>
<tr>
<td>PICU</td>
<td>Paediatric Intensive Care Unit</td>
</tr>
<tr>
<td>PO</td>
<td>Orally</td>
</tr>
<tr>
<td>RR</td>
<td>Respiratory rate</td>
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<tr>
<td>RSQ</td>
<td>Retrieval Services Queensland</td>
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<tr>
<td>SaO2</td>
<td>Oxygen saturations</td>
</tr>
<tr>
<td>U&amp;E’s</td>
<td>Urea and electrolytes (serum electrolyte analysis)</td>
</tr>
<tr>
<td>VBG</td>
<td>Venous blood gas</td>
</tr>
</tbody>
</table>
References and suggested reading

20. 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 revision and approval history

<table>
<thead>
<tr>
<th>Version No.</th>
<th>Modified by</th>
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<tr>
<td>1.1</td>
<td>Greater Brisbane metropolitan area clinical procedures working group</td>
<td>Greater Brisbane metropolitan area clinical procedures editorial group</td>
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</tbody>
</table>

Keywords
- Children, croup, emergency management, guideline

Accreditation references
- EQuIP National Standards: 1, 12
Appendix 1  Admission/Discharge Criteria for Children with Croup

High risk factors in acute croup

Risk factors for acute croup in children include:
- age <6 months
- underlying structural upper airway condition, e.g. tracheomalacia, subglottic stenosis
- history of previous severe croup
- unplanned representation to the emergency service within 24 hours following a diagnosis of croup at first presentation.

Criteria for discharge from the emergency service

Criteria for discharging a child with croup from the emergency service includes:
- responded effectively to treatment – no respiratory distress or stridor at rest
- differential diagnoses considered and acute croup remains primary diagnosis
- 3 hours post nebulised adrenaline with no recurrence of symptoms
- parent information sheet given and discussed.

When discharging a child with croup, their social circumstances should be considered and appropriately addressed after the initial assessment and observation period:
- time of day
- parents/carers comprehension and compliance
- access to transport should return be required
- distance to local hospital.

Criteria for admission to children’s inpatient service

Criteria for admission to the children’s inpatient service for a child with croup includes:
- age < 6 months
- history of severe obstruction
- history of previous severe croup or known structural airway anomaly (e.g. subglottic stenosis)
- trisomy 21
- persistence of symptoms (e.g. respiratory distress or stridor at rest) after treatment and 4 hours observation
- inadequate fluid intake
- representation to the emergency service within 24 hours following a diagnosis of croup at first presentation
- uncertain diagnosis.

Criteria for admission to Level 6 emergency or PICU service

Consultation with the paediatric specialty team in the current facility and/or discussion with a Level 6 children’s health service via Retrieval Services Queensland (RSQ) is required when:
- presents with symptoms and/or signs of life threatening acute croup or airway obstruction
- persistent stridor and respiratory distress despite 2 doses of nebulised adrenaline
- requirement for respiratory support (intubation and ventilation) as indicated by failure to maintain saturations despite supplemental oxygen or severe respiratory distress
- signs of progressive fatigue.

Guideline 00702 – Acute Croup: Emergency Management in Children
Children’s Health Queensland Hospital and Health Service