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Croup

Assessment and management

Background

Croup is a common childhood disease characterised by sudden onset of a distinctive barking cough that is usually accompanied by stridor, hoarse voice, and respiratory distress resulting from upper airway obstruction. The introduction of steroids in the treatment of croup has seen a significant reduction in hospital admissions and improved outcomes for children.

Objective

This article discusses the key aspects of diagnosing croup and the evidence supporting the different treatment strategies.

Discussion

The assessment of airway, breathing and circulation, focusing on airway, is paramount in treating croup. However, it is important to take care not to cause the child undue distress. In mild to moderate croup, give prednisolone 1.0 mg/kg and review in 1 hour. In severe or life threatening croup, give 4 mL of adrenaline 1:1000 (undiluted) via nebuliser and send immediately to hospital via ambulance.

Keywords: child health; emergencies; croup



Croup, or laryngotracheobronchitis, is a common childhood upper airway disorder caused by a viral infection resulting in inflammation to the upper airway. This inflammation results in the classic symptoms of: barking cough, stridor, hoarse voice, and respiratory distress.¹

These features are typically more prominent at night time. The majority of cases of croup are self limiting but some can result in severe respiratory obstruction and rarely, death. Improved understanding and treatment in the community results in fewer admissions to hospital and adverse outcomes.

Croup is a clinical diagnosis. The classic symptoms are usually preceded by symptoms of an upper respiratory tract infection including coryza and fever. *Table 1* indicates diagnoses to consider in the differential for croup. There are often clues in the history or clinical features that suggest an alternative diagnosis. For instance, there may have been an episode of choking raising the possibility of a foreign body; the child may have known allergies; or may appear more toxic and obviously unwell (suggesting epiglottitis).

Croup is typically caused by parainfluenza, influenza or other viruses. The specific cause of croup can be confirmed by immunofluorescence and culture of a nasopharyngeal aspirate (NPA), but this does not alter the management in any way, and is likely to cause unnecessary distress to the child. A routine NPA is therefore not required for children with a typical clinical picture of croup.

Judging severity – making an assessment

As with any emergency situation, assessment of airway, breathing and circulation (ABC) is vital. Although attempts should be made to assess and improve the airway, care should be taken to avoid causing undue distress to the child.

The severity of croup can be assessed based on the following clinical features (*Table 2*):

- increased respiratory rate
- increased heart rate
- altered mental state – anxiety, agitation, confusion
- work of breathing – use of accessory muscles
- stridor (note that if a child's stridor becomes softer but the work of breathing remains increased, the obstruction may actually be becoming more severe).

Hypoxia is a late sign in croup as this reflects gas exchange at the alveolar level, while the disease in croup involves the airway. Thus, measuring oxygen saturations is of no clinical benefit.



Management

The management of croup depends on the severity of upper airway obstruction (*Table 2*).

- Mild to moderate croup – oral steroids
- Severe croup – nebulised adrenaline should be given urgently.

Providing high flow oxygen is an important component of the resuscitation

Table 1. Differential diagnoses for croup
<ul style="list-style-type: none"> • Epiglottitis • Bacterial tracheitis • Foreign body inhalation • Retropharyngeal abscess • Peritonsillar abscess • Angioneurotic oedema/allergic reaction • Congenital anomaly • Mediastinal mass (eg. lymphoma) • Diphtheria

of any sick child. However, although oxygen may result in minor improvement in oxygen saturations, if the underlying airway obstruction is not treated (with nebulised adrenaline), the child may still arrest.

The role of steroids

A 2004 Cochrane review analysed 31 randomised control trials (RCTs) looking at the role of corticosteroids in croup.² Steroids were shown to be of benefit in the treatment of moderate and severe croup as well as having a role in mild croup. Dexamethasone and budesonide were effective in relieving the symptoms of croup within 6 hours. There was also a reduction in repeat presentations to doctors, readmission to hospital, reduction in hospital stay and duration of need for intensive care.^{3,4} Children with mild croup benefit from treatment, irrespective of the duration of their illness or its severity.

Which corticosteroid and the dose required remain to be established.² The majority of RCTs were conducted using dexamethasone or budesonide. However in Australia, oral preparations

Table 2. Assessment of degree of airway obstruction (always treat in the category with the most severe symptoms)			
Mild	Moderate	Severe	Life threatening
Normal mental state	Anxious, tired	Agitated, exhausted	Confused, drowsy
No stridor or only when distressed	Stridor at rest	Stridor at rest	Stridor at rest
No accessory muscle use, tracheal tug or chest wall retraction	Minor accessory muscle use, tracheal tug, chest wall retraction	Marked accessory muscle use, tracheal tug and chest wall retraction	Maximal accessory muscle use, tracheal tug, chest wall retraction
Normal heart rate	Increased heart rate	Markedly increased heart rate	Markedly increased heart rate or falling heart rate
Able to talk/feed	Some limitation or talking/feeding	Increased respiratory rate, too breathless to talk or feed	Poor respiratory effort Silent chest
		Pallor Low muscle tone	Cyanosis
Initial treatment			
		<ul style="list-style-type: none"> • Send to hospital by ambulance • Give oxygen • Nebulised adrenaline (4.0 mL) 1:1000 <ul style="list-style-type: none"> – do not dilute – drive with oxygen where possible 	
Consider oral prednisolone 1.0 mg/kg	Oral prednisolone 1.0 mg/kg	Oral prednisolone 1.0 mg/kg or IM dexamethasone 0.6 mg/kg	
Allow child to adopt the position that they find most comfortable; provide parent information			
Send home if stable or reassess after 1 hour if stable	Observe if facilities available in surgery and reassess after 1 hour		
Response to treatment			
<ul style="list-style-type: none"> • Good response <ul style="list-style-type: none"> – send home if child has no symptoms or signs of moderate or severe airway obstruction – consider further doses of prednisolone 12 hourly for next 24 hours – provide parent information including when to return • Poor response <ul style="list-style-type: none"> – send to hospital via ambulance 			
Adapted from Evidence based guidelines for the management of croup ⁵			



of prednisolone are more widely available. A dose of 1 mg/kg prednisolone is recommended in many guidelines.^{5,6} Although this is not equivalent to the 0.6 mg/kg dose of dexamethasone used in many RCTs, it is effective in treating croup.⁷ A recent Australian study compared prednisolone 1.0 mg/kg, dexamethasone 0.15 mg/kg and dexamethasone 0.6 mg/kg for the treatment of mild to moderate croup.⁷ Outcome measures included improvement in symptoms, rate of return for medical care with ongoing croup, and further treatment with steroids in the week following first presentation. There were no significant differences between the three treatment groups.

Some guidelines recommend that prednisolone be given 12 hourly for up to four doses. This may prevent representation with ongoing stridor. However, there are no RCTs assessing the role of multiple doses of steroids.¹

Regarding the route of administration, although intramuscular or intravenous dexamethasone or hydrocortisone may be given, these should be reserved for children who are unable or too sick to take oral prednisolone, as an injection may cause distress with increased respiratory obstruction.

Treatment of croup with steroids is safe, although prednisolone is associated with more vomiting than oral dexamethasone.¹

The role of nebulised adrenaline

Nebulised adrenaline (epinephrine) should be administered urgently to children with severe or life threatening croup. An improvement of symptoms can be expected within 10–30 minutes.¹ Adrenaline 1:1000 4 mL (undiluted) should be given via nebuliser, preferably with oxygen. Traditionally, racemic (2.25%) adrenaline has been used to treat croup, but this is as effective as the 1:1000 preparation.¹ The clinical effect of adrenaline normally disappears within 2 hours of administration,¹ and rebound airway obstruction may occur during this period. Children should therefore be monitored for 2 hours after administration of adrenaline; if there is no stridor, no chest retractions and the child appears well, he/she may be safely discharged home. Any child who shows no signs of improvement after the administration of adrenaline should be transferred immediately to the nearest hospital.

Adrenaline has not been associated with any adverse effects and only mild side effects of pallor and tachycardia.¹

Other strategies

Children with croup may have wheeze due to involvement of the lower airways (laryngotracheobronchitis) and salbutamol may be of benefit. However, if a child has wheeze and stridor, adrenaline should always be considered first, as it will also treat the upper airway component. Paracetamol or ibuprofen may be used to treat discomfort.

There is some evidence to support the effectiveness of helium oxygen mixture (Heliox) in the treatment of severe croup. However, as it confers no additional benefit and can be difficult to use in unskilled hands, it does not form part of the recommendation for treating croup.¹

There is no evidence base for the role of other strategies in treating croup including humidified or cold air, prophylactic antibiotics or antitussive agents.

Level of care

Children with mild croup can be safely managed in general practice. Those with moderate croup should be monitored for 2–4 hours after administration of steroids to assess for an improvement in their symptoms. This can also be done in the general practice setting. If there is inadequate improvement, and in cases of severe croup, adrenaline should be administered and an ambulance called. These children should be transferred to the nearest hospital for further management.

Conclusion

Croup is a common cause of upper airway obstruction in infants and young children. Steroids should be given to almost all children presenting with croup, while adrenaline may prevent complete airway obstruction in those with severe croup.

Summary of important points

- Croup is characterised by a barking cough, stridor with or without the presence of respiratory distress.
- Assessment of A, B, C, focusing on airway, is paramount in treating croup.
- Take care not to cause the child undue distress.
- Mild/moderate croup – give prednisolone 1 mg/kg and review in 1 hour.
- Severe or life threatening croup – give 4 mL of adrenaline 1:1000 (undiluted) via nebuliser, preferably with oxygen, and send immediately to hospital via ambulance.

Authors

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