4) Acute Laryngeal Infections in Childhood - Dr. Hiwa

**Introduction**

Laryngeal infection in childhood causes airway obstruction, of which the cardinal symptom is stridor.

- **Croup**: a clinical condition characterized by a combination of stridor, hoarseness and barking cough is the commonest cause of acute airway obstruction in children, (90 percent).
- **Epiglottitis**: the next most common infective cause but is now seen much less frequently due to the widespread introduction of Haemophilus influenzae b (Hib) vaccine.
- **Bacterial laryngotracheobronchitis** and
- **Diphtheria** are less common.

*The differential diagnosis of acute acquired stridor includes:*

- spasmodic croup
- retropharyngeal abscess
- angioneurotic oedema
- acute laryngeal trauma and foreign body aspiration

*Good management depends on teamwork involving:*

- the primary care physician,
- the paediatrician,
- the paediatric otolaryngologist,
- the paediatric anaesthetist and
- the paediatric intensive care physician.

**Croup**

- A clinical syndrome of:
  - hoarseness,
  - inspiratory or biphasic stridor and
  - barking cough, due to mucosal oedema of the larynx and trachea.
- There is a preceding history of upper respiratory tract symptoms with fever and malaise.
- **Caused by**: parainfluenza virus type I, other viruses including:
  - parainfluenza virus type II,
  - respiratory syncytial virus (RSV) and
  - influenza virus types A and B, and
  - can complicate measles.
- Children between six months and three years of age, a peak incidence in two year olds.
- Boys > girls.
- The annual incidence: 1.5-6% in children younger than six years.
- Usually self-limiting; 50 percent  improve within 24 hours of the onset, and most recover within four days without treatment.
- However, airway symptoms can become serious and even life-threatening.
- In the absence of medical therapy, 20 percent of patients may be admitted to hospital and 10 percent of these may require intervention for acute airway obstruction, either intubation or tracheostomy.
Diagnosis:

- Clinical
- Is a diagnostic dilemma.
- X-Ray of the thoracic inlet: characteristic narrowing of the subglottis on an anteroposterior view (‘steeple’ or ‘pencil tip’ sign)

There are inflammatory changes throughout the airway in croup but the critical symptom of stridor is due to oedema in the subglottis, the narrowest part of the paediatric airway.

Just 1 mm of oedema in an 18-month old child with a subglottic diameter of 6.5 mm will reduce the cross-sectional area by approximately 50 percent.

Airflow is thus greatly reduced.

Factors predisposing to severe symptoms include:

- pre-existing subglottic or tracheal narrowing
- chronic lung disease
- airway reactivity, characterized by a history of inhalant or food allergies.

The Westley Croup Score

Severity of symptoms to be classified. Total score correlating with the diameter of the tracheal lumen.

![Westley Croup Score Table]

- A maximum score is 17
- a score of 2–3 equates to mild croup
- 4–7 to moderate croup
- 8 or more to severe croup

Treatment

- For mild croup, treatment can be supportive
- Reassurance of both parents and child, and observation and monitoring of the child's symptoms...
- Humidified environment
- Nebulized epinephrine (1 mL of 1 in 1000 epinephrine diluted in 3 mL of 0.9 percent saline) reducing mucosal oedema by an alpha-agonist effect causing vasoconstriction and bronchodilation;
- It may postpone or eliminate the need for an artificial airway, or give symptomatic relief until effective treatment can be given.
• **Corticosteroids** have a systemic antiinflammatory effect.
  • There is a reduction in capillary endothelial permeability and therefore in mucosal oedema,
  • Stabilization of lysosomal membranes, decreasing the inflammatory reaction.
  • Recent evidence suggests that glucocorticoid use should be not be confined to moderate or severe cases but should be extended to children with mild croup.

**Clinical benefit can be measured by**

- improvement in croup score
- reduced hospital admission rates
- shorter length of stay
- lower intubation rates or
- a reduced need for cointerventions such as the administration of epinephrine nebulizers.
- It is difficult to make definitive recommendations regarding the superiority of any glucocorticoid, dose, or route of administration.
- An oral dose of dexamethasone (0.6 mg/kg) is preferred because of its safety and efficacy.
- In a child who is vomiting, nebulized budesonide (2 mg) may be considered.

**Spasmodic croup**

- Some children appear to be prone to recurrent croup-like symptoms.
- Episodes may not be preceded by upper respiratory tract symptoms but typically begin suddenly, often at night, and resolve after a few hours.
- Attacks may be precipitated by gastro-oesophageal reflux.
- There is an association with low IgA levels
- Present in atopic children who later develop asthma or other allergic conditions.
- The symptoms can be relieved by a single dose of oral dexamethasone in a dose of 0.6 mg/kg in the same way as for viral croup.
- It is important to consider congenital or acquired mild subglottic stenosis in the differential diagnosis of infants presenting with ‘recurrent croup’.
- In persistent cases endoscopy is mandatory.

**Bacterial laryngotracheobronchitis**

- Severe form of laryngotracheobronchitis associated with sloughing of the respiratory epithelium and profuse mucopurulent secretions.
- Initial presentation is similar to croup but there is no response to steroids.
- The child rapidly progresses to a toxic state and there may be respiratory decompensation.
- It typically affects children older (mean age four years) than the usual age group for croup,
- Boys > girls,
- There is no single factor, clinical, radiological or laboratory-based which reliably distinguishes it from croup.
- It is a much less common condition than croup.
- Increased susceptibility in children with Down syndrome or immunodeficiency.
- The diagnosis can only be confirmed on airway endoscopy;
- there is a pseudomembrane in the subglottis and trachea and thick mucopus and debris extending into the bronchi.
• Direct laryngotracheobronchoscopy under general anaesthesia and removal of all tracheal secretions, with pulmonary toilet, is mandatory.
• It is necessary to secure the airway by endotracheal intubation for a period of days.
• The distal airway and the tube itself remain at continued risk of obstruction by secretions and expert nursing care is essential.
• Once the diagnosis is established, broad-spectrum parenteral antibiotics should be commenced immediately. Later can be adjusted according to C/S.
• Staphylococcus aureus is the pathogen most commonly isolated from tracheal cultures although Haemophilus influenzae, Moraxella catarrhalis, Streptococcus pneumoniae and Pseudomonas aeruginosa have also been reported.
• Blood cultures are rarely positive.

Complications of this dangerous condition include

• airway stenosis,
• respiratory failure,
• toxic shock syndrome,
• anoxic encephalopathy and death.

Management involves repeated therapeutic tracheobronchoscopy to free the airways.

**Diphtheria**

• Diphtheria is a rare condition in countries which have a routine childhood immunization programme, but remains an important differential diagnosis of acute laryngeal infection in children.
• The causative organism is Corynebacterium diphtheriae.
  - three strains, gravis, intermedius and mitis;
  - the gravis strain is responsible for major epidemics and for the high mortality.
• Initial symptoms are of pharyngitis with sore throat, fever and malaise.
• On examination there is a typical appearance of the pharyngeal tonsils with necrosis and the development of a characteristic grey pseudomembrane over the surface.
• This consists of necrotic tissue, bacteria and a rich fibrinous exudate.
• Early removal causes bleeding but the pseudomembrane may separate more easily later in the course of the disease.
• There may be a bull-neck appearance due to cellulitis and regional lymphadenopathy.
• Laryngeal diphtheria rarely occurs without prior pharyngeal infection.
• After progressive dysphagia and toxæmia, inspiratory stridor and a barking cough develop; the cough is frequently paroxysmal and exhausting.
• Death may follow owing to acute airway obstruction or as a result of the later effects of the endotoxin.
• The endotoxin can cause a toxic myocarditis in the second week of the disease and this may be fatal.
• Peripheral neuritis may also occur,
• palatal paralysis most common peripheral neuropathy and presenting with
  - nasal regurgitation of food and
  - hypernasal speech.
Treatment

- Successful treatment depends on early diagnosis,
- High dose benzylpenicillin and Antitoxin (10,000 to 100,000 units depending on the severity of infection).
- Airway management consists of
  - removal of the laryngeal membrane,
  - administration of oxygen
  - humidification
  - endotracheal intubation or tracheostomy if necessary.
- Systemic steroids may reduce the need for airway intervention. Bed rest is recommended until the danger of myocarditis is past.

Acute epiglottitis

- The classical presentation is:
  - a toxic child with a short history of sore throat
  - inspiratory stridor, muffled voice
  - drooling due to odynophagia and dysphagia.
  - progressive respiratory distress.
  - The child is febrile, tachypnoeic and is sitting upright, with the neck extended to optimize the airway, and using the arms to provide support to the shoulder girdle to maximize the efficiency of the accessory muscles of respiration.
- When acute epiglottitis is suspected, pharyngeal examination should not be attempted, as simple manipulation with a tongue depressor may precipitate acute airway obstruction.
- The use of a fibreoptic or small rigid endoscope can assist the diagnosis in patients with an atypical presentation. Endoscopic evaluation will confirm gross erythema & oedema of the supraglottic structures.
- When the diagnosis is confirmed, the airway should be secured by endotracheal intubation.
- If this is unsuccessful, a rigid bronchoscope may be passed to allow tracheostomy. Despite this, mortality remains as high as 2 percent.
- Investigations prior to securing the airway are contraindicated but a soft tissue lateral radiograph of the neck will typically show a thickened oedematous epiglottis – the ‘thumb sign’
- The causative organism can be identified from nasopharyngeal swabs, laryngeal swabs, sputum samples or blood cultures taken after intubation.
- Traditionally, acute epiglottitis has been a manifestation of invasive Hib infection. Other organisms are less common; they include: meningococcus, H. parainfluenzae & Staph aureus.
- Immunocompromised individuals are at increased risk of epiglottitis. It may be due to atypical organisms such as Streptococcus pneumoniae or Candida albicans.
- Children with acute epiglottitis should be screened after recovery from the acute episode to ensure there is no underlying predisposing condition.
- Group A β-hemolytic Streptococcus is a recognized cause of acute epiglottitis in older children & adults.

Treatment

- Treatment is with IV antibiotics; ampicillin resistance due to beta-lactamase production is now over 50 percent in Haemophilus influenzae, so empirical treatment with third-generation cephalosporins for five to seven days is advised. Chloramphenicol is an alternative in the event of allergy to cephalosporins.
- Penicillin-sensitive Streptococci are the usual cause of acute epiglottitis in children who have been immunized against Hib and they should be treated accordingly.
- Recovery is characterized by resolution of systemic symptoms and the supraglottic inflammation.
- The child can then be extubated and discharged from hospital.
- Rifampicin prophylaxis has been recommended to eradicate the carrier state for unimmunized members of the household who are four years old and younger.