Children with stridor

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Introduction

Stridor is a common presenting symptom in general practitioner office or accident emergency department in hospital. Parents or patients were anxious when they experienced the symptom. Quick and throughout evaluation of the patient is needed in all of the cases. In some of the cases, the diagnosis is benign in nature requiring conservative treatment. However, in hospital setting, we encountered difficult cases that required urgent and intensive treatments at time. Respiratory failure was not uncommonly seen and various methods were needed to establish patent airway and adequate ventilation. The following cases illustrated the complexity of cases that were encountered in hospital. Reviews of various equipments for establishing patent airway would be made.

Case 1

A 9-month-old boy presented with shortness of breath for 1 day. It was associated with hoarseness of voice, cough and low grade temperature. The symptoms worsened over 1 day. Physical examination showed mild stridor and suprasternal insucking. Chest was clear on both sides. Chest X-ray showed symmetrical lung field. There was neither steeple sign nor foreign body noted. The working diagnosis was croup. Oral dexamethasone (0.6 mg/kg) was prescribed. There was no improvement after steroid was given. Nebulized budesonide and adrenaline were added in view of increasing oxygen requirement. The child went into respiratory failure progressively. Oral intubation was tried but failed. Emergency tracheotomy was performed in order to establish patent airway. Subsequent rigid bronchoscopic examination revealed a fish bone stuck at the vocal cord and the fish bone (Figure 1) was removed with rigid bronchoscopy. Interview of the mother was carried out again and revealed there was history of choking while the child was fed with fish congee. The child was ventilated for 1 day. A course of antibiotics was given. Tracheotomy was closed after brochosopic review of the airway showing it was normal. The diagnosis was inhaled foreign body.

Case 2

An 18-month-old body presented with progressive shortness of breath and hoarseness of voice for 1 day. There were preceding corzyal symptoms. Physical examination showed temperature of 38.4°C. There were stridor, hoarseness of voice, barking cough and severe insucking. The air entry of the chest was poor on both sides. The saturation was 100% while he was on 2 liter/minute oxygen through nasal cannula. Neck X-ray showed steeple sign. The preliminary diagnosis was croup and he was given oral dexamethasone (0.6 mg/kg/dose). There was no response to steroid. The respiratory distress worsened and intubation of the airway was done. Intra-venous

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Figure 1. Fish bone removed from the airway.
Case 1

Dexamethasone was added. Clinical condition improved and ventilator support could be weaned off in 2 days. The diagnosis was severe croup.

Case 3

An 8-year-old boy was on chemotherapy for acute myeloid leukaemia. He complained of sore throat, hoarseness of voice and progressive odynophagia. Broad spectrum antibiotics including ampicillin, sulperazon and fluconazole were prescribed. The clinical condition did not improve. Stridor was noted on day 2 of symptoms. Lateral neck X-ray revealed thumb sign and loss of normal lordosis of the cervical vertebrae. Rigid bronchoscopy was performed in operation theater and swollen epiglottis was noted. Tracheotomy was done subsequently. Antibiotic were changed to Ciprofloxacin, metronidazole and amphotericin lipid complex. Clinical condition improved and the child was able to wean off from ventilator. The diagnosis was acute epiglottis.

Case 4

A 5-year-old boy with history of asthma was admitted with head injury after falling from height. He had loss of consciousness. He was intubated and ventilated for 1 week. Prophylactic dexamethasone was given before extubation was done. There was noisy breathing noted 3 weeks after extubation. Chest examination revealed stridor and wheezing. Air entry on both sides was equal. Inhale ventolin and oral steroid were given and the respiratory distress persisted. In view of the presence of stridor and history of intubation, bronchoscopy was done. Subglottic stenosis was noted (Figure 2). Laser excision was planned and it was scheduled in 1 week time. However, the respiratory distress increased and the oxygen saturation decreased in 1-2 days. Emergency intubation was attempted and the stenosis was so severe that only 2.5 mm endotracheal tube could be passed through the stenosis. Emergency tracheotomy was done in order to provide adequate ventilation and to secure the airway. Serial laser excisions of the subglottic stenosis were done subsequently. The tracheotomy was closed afterward. The diagnosis was subglottic stenosis complicating intubation.

Case 5

A 5-month-old boy presented with stridor and failure to thrive. There was regurgitation noted after the child was fed with milk. Physical examination showed moderate suprasternal and subcostal insucking chest. There was stridor noted. Air entry on both side of the chest was normal. Continuous oximetry measurement showed episodes of desaturations down to 85%. Flexible bronchoscopy was done and it showed floppy epiglottis. The floppy epiglottis was occluding the airway. The diagnosis was severe laryngomalacia leading to failure to thrive. Laser treatment was performed by ENT surgeon. Stridor and insucking chest were improved. There was no more desaturation noted. The feeding was improved also.

In summary, we presented five cases of upper airway obstruction leading to respiratory failure in the patients. The diagnosis included foreign body inhalation, croup, acute epiglottis, post-intubation subglottic stenosis and severe laryngomalacia. Various form of procedures were carried out in order to secure and to provide adequate ventilation for the patient.

Discussion

Stridor is a harsh high-pitched sound, predominantly inspiratory, signifying obstruction to airflow in the extrathoracic airways. Causes vary greatly and can...
include congenital, infection, trauma, malignancy and neurological. We will discuss the management of some of the common etiology, including foreign body, acute laryngotracheobronchitis, acute epiglottitis, subglottic stenosis and congenital laryngomalacia. Sometimes the maintenance of the obstructed airway is challenging, and we will have a brief discussion of the difficult airway management at the end of the paper.

Foreign body aspiration
Nuts are the most common cause of foreign body aspiration in children. History is the most important clue to diagnosis, but most of the time there is a lack of history of clear choking/aspiration at initial presentation. In a local study, most children with foreign body aspiration presented as chronic cough, and many were misdiagnosed as respiratory infection or asthma. Foreign body aspiration must always be kept in mind as a cause for stridor.

Viral croup
Viral croup is a common disease in children. The main stage of treatment includes supportive treatment and medication including steroid – oral or parenteral dexamethasone, nebulized budesonide; and nebulized epinephrine racemic or otherwise.

Acute epiglottitis
Acute epiglottitis is a medical emergency with H. influenza as the most common organism identified. It usually affects young children and rarely occurs in local Chinese children. We describe the clinical course in an acute leukemic child and successfully managed with antibiotics and tracheotomy.

Subglottic stenosis
Acquired subglottic stenosis usually follows tracheal intubation, trauma, and infection, inflammatory, thermal or caustic injuries. Patients present as biphasic stridor and respiratory distress. Management depends on severity of stenosis, ranging from conservative, laser resection, reconstructive surgery or airway stent.

Congenital laryngomalacia
Congenital laryngomalacia is one of the commonest causes of stridor in infant. Majority of them can be managed conservatively and resolves spontaneously by 12 to 18 months. For the small numbers of patient severe enough to affect growth and development, which need airway support, laser laryngoplasty may be considered.

Management of difficult airway
No universally accepted definition of the difficult airway exists, but in broad terms, difficult airway control may be defined as problematic ventilation using a face mask, incomplete laryngoscopic visualization, or as a difficult intubation with standard airway equipment.

The goal of difficult airway management is rapid control and correction of an impending airway obstruction. In general, we should always anticipate that the present method of obtaining a secure airway will not be successful and always be ready to advance through the algorithm of management options. The following series of modalities used to access the airway is presented in an escalating fashion from standard to more invasive methods.

Mask ventilation
Mask ventilation is an essential element of airway management and is used before intubation and as a rescue technique during unsuccessful attempts at laryngoscopy and intubation. Hyperoxegenation of a patient by vigorous mask ventilation provides adequate time for intubation or contemplation of the approach to the airway. Mask does not protect from aspiration. When high pressures are required, air may become forced into the esophagus or stomach, elevating the diaphragm and further impairing respiration.

Tracheal intubation
When the patient is prepared for intubation, standard laryngoscopy is performed and if the airway is visualized, the endotracheal tube is inserted. If the airway is not adequately seen, the patient is placed into the modified Jackson’s position, backward pressure on the cricoid cartilage, or the BURP maneuver (backward, upward, and rightward pressure), applied by an assistant may improve the view of the larynx at direct laryngoscopy. The benefit of BURP may be enhanced further by combining it
with mandibular advancement. External laryngeal manipulation involves a cricoid pressure or BURP-type maneuver performed initially by the laryngoscopist and then maintained by an assistant. It has been shown to improve the view at direct laryngoscopy. Often, these three steps during conventional laryngoscopy provide adequate exposure for direct visualization of the true vocal cords to allow for securing of the airway. Prolonged, persistent repeated laryngoscopy and intubation attempts have been demonstrated to cause laryngeal bleeding, increased secretions, and increasing edema resulting in further inability to adequately ventilate. Ultimately, poor management will lead to hypoxia with significant morbidity or mortality.

**Stylet ('Introducer') and Gum Elastic Bougie**
The stylet is a smooth, malleable metal or plastic rod that is placed inside an ETT to adjust the curvature, typically into a J or "hockey stick" shape to allow the tip of the ETT to be directed through a poorly visualized or unseen glottis. The stylet must not project beyond the end of the ETT to avoid potential airway injury. In contrast, the gum elastic bougie is a blunt-ended, malleable rod that may be passed through the poorly or nonvisualized larynx by putting a J-shaped bend at the tip and passing it "blindly" in the midline upward beyond the base of the epiglottis. The ETT can then be "railroaded" over the bougie, which is then withdrawn. For many, it is the first choice adjunct in the difficult intubation situation.

**Lighted stylet**
The lighted stylet (light wand) is a malleable fiberoptic light source on which an ETT can be mounted and subsequently railroaded into the trachea when the light source has passed beyond the glottis. It facilitates blind tracheal intubation by distinguishing the tracheal lumen from the (more posterior) esophagus as a result of the greater intensity of light visible through anterior soft tissues of the neck as the light source passes beyond the vocal cords. A potential disadvantage is the need for low ambient light, which may not be desirable (or easily achieved) in a critical care setting. Light wand devices may be contraindicated in patients with known abnormal upper airway anatomy and those in whom detectable transillumination is unlikely to be adequately achieved.

**Fiberoptic intubation**
The next choice in a difficult airway may be awake fiber-optic intubation using topical anesthesia. The fiberoptic scope can be used in the unanticipated difficult airway but only if it is readily available and the operator is skilled. The flexible bronchoscope is first passed through the endotracheal tube and then through an anesthetized nare or the oral cavity and into the trachea of the awake patient. The jaw may need to be lifted forward to gain optimal visualization of the vocal cords. The bronchoscope serves as a visual guide into the trachea and also as a stylet for introduction of the endotracheal tube into the trachea to confirm its placement above the carina.

**Video laryngoscope**
Intubation can also be accomplished with a video laryngoscope in which the view from the end of the laryngoscope is transmitted fiberoptically to a monitor screen. The screen displays the larynx and the ETT as the latter is advanced to the correct position. Commercial Video laryngoscope (Glidescope) is now available.

**Laryngeal mask airway**
The laryngeal mask airway (LMA) is a supraglottic airway device that sits over the laryngeal introitus and can facilitate positive pressure ventilation, provided the vocal cords are relaxed and open. The classic LMA is a small latex mask mounted on a hollow plastic tube. It is placed "blindly" in the lower pharynx overlying the glottis. The inflatable cuff on the mask helps wedge the mask in the hypopharynx so that it sits obliquely over the laryngeal inlet. Although the LMA produces a seal that will allow ventilation with gentle positive pressure, it does not definitively protect the airway from aspiration. Compared with an ETT, an LMA can be appropriately placed more rapidly and more successfully by operators with limited advanced airway skills.

LMA is available in pediatric sizes that are suitable for use in neonates, infants, and children (Table 1).

**Combitube (Esophageal-Tracheal Double-Lumen Airway)**
The Combitube is a combined esophageal obturator and tracheal tube and is usually inserted blindly. Whether the "tracheal" lumen is placed in the trachea...
or esophagus, the Combitube will allow ventilation of the lungs and give partial protection against aspiration. In many situations, the Combitube is a (less widely used) alternative to the LMA. Disadvantages include the inability to suction the trachea when placed in the esophagus (the most common position). Insertion may also cause trauma and is contraindicated in patients with known esophageal pathology, intact laryngeal reflexes, or in those who have ingested caustic substances.

**Surgical airway**

The indication for a surgical airway is inability to intubate the trachea in a patient who requires it and the techniques available are cricothyroidotomy or tracheostomy. Conventional wisdom states that tracheostomy is the more complex and time-consuming procedure, which should only be performed by an experienced surgeon. Studies in the critical care environment suggest that, in the elective situation, cricothyroidotomy is simpler and (at worst) has a similar complication rate. Cricothyroidotomy may be performed using three techniques: needle, wire-guided percutaneous, or surgical. Although needle cricothyroidotomy has long been advocated, recent work suggests surgical cricothyroidotomy is superior. When compared with a wire-guided technique, the surgical technique was both quicker (even when performed by nonsurgeons) and produced more effective ventilation.

In summary, paediatrician should be familiar with causes of stridor in children. Quick and thorough evaluation of the patient is important. There are various methods for establishing patency of airway and adequate ventilation. Paediatrician has to be familiar with the equipment that is available in his/her local setting.

**References**


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<th>Size of LMA</th>
<th>Weight of patient (kg)</th>
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Table 1. Size of laryngeal mask airway related to weight of child and recommended maximum cuff inflation volume.