

TITLE: Pediatric Airway Emergencies

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Pediatric airway emergencies, fortunately, are infrequently encountered. The sound of stridor in an acute setting can be very alarming for a physician. Stridor is not a diagnosis but a symptom produced by turbulent airflow related to partial airway obstruction. The obstruction can be fixed or dynamic and there are many causes such as congenital, traumatic, iatrogenic, inflammatory, and neoplastic. History and physical examination are crucial to a timely and often life saving diagnosis. There is a great amount of difference between the adult airway and the pediatric airway in both anatomy and the diseases that affect them. A sound knowledge of the pediatric airway is necessary in the workup of pediatric airway emergencies.

Anatomy

The complex structures of the human airway vary in anatomy and physiology from birth to adulthood. The infant's larynx and trachea are significantly smaller than the adult's. The vocal cords of the newborn infant are 6-8 mm long and the vocal processes of the arytenoids extend one half of that length. The posterior glottis' transverse length is approximately 4 mm. The subglottis has a diameter of between 5 and 7 mm. The trachea itself is about 4 cm long and as a diameter of 3.6 mm. These dimensions leave little margin for obstruction in the infant, unlike the adult. The area of a circle is equal to the square of the radius, therefore a very small change in mucosal edema can lead to significant changes in airway caliber.

The infant's oral airway differs from the adult's as well. The infant's epiglottis nearly touches the soft palate. Also, the infant's tongue is larger than that of the adult, and generally occupies all of the space in the infant's mouth. These factors contribute to making the infant a preferential nasal breather for 2 to 5 months. Because infants are nasal breathers, nasal obstruction can lead to significant respiratory distress. The act of oral breathing is a reflex that often does not develop at all until several weeks after birth. The nasopharyngeal airway of the infant and child is significantly narrower than that of the adult because of the increased relative size of the child's adenoid pad, lingual and palatine tonsils. The coordination of swallowing is usually well developed in a full term infant. However, before the 34th week of gestation, the pre-term infant generally demonstrates a poorly coordinated suckling response and may be unable to protect the airway.

History

The first step in evaluation of the child with airway difficulty is assessment of the urgency of the situation. Immediate history and physical examination should proceed simultaneously until the general status of the patient is known. Once it is established that the child is not in immediately life-threatening respiratory distress, the examiner should take a thorough medical history. It is very important to ask about the onset of respiratory distress. For instance, sudden onset of choking followed by respiratory distress is strongly indicative of foreign body aspiration. The examiner should always specifically ask about a history of foreign body ingestion or aspiration. Knowledge of the age at onset of symptoms can narrow the diagnostic possibilities, as discussed below. The family should be questioned about noisy breathing, the types and associations of which are discussed below. The family should be asked about aggravating factors, such as feeding or sleeping. Respiratory distress associated with feeding may indicate the presence of aspiration or of nasal airway compromise. The examiner should note previous history of intubation and surgical interventions. Respiratory distress or stridor immediately after extubation may be due to subglottic edema whereas distress that starts after two to three weeks may indicate early subglottic stenosis or vocal cord granuloma. The investigator should ask about throat or neck pain and fever, indicating inflammatory causes of airway obstruction. Birth history should be carefully explored, including history of birth trauma, as vocal cord paralysis due to birth trauma is a common cause of respiratory distress or stridor in infants. History of other congenital anomalies should also be noted.

Physical Examination

The physical examination should begin with careful inspection of the patient. The patient can remain in the caregiver's arms while the examiner assesses the respiratory rate and the degree of distress. Increased rate of respiration, nasal flaring, use of accessory muscles or presence of respiratory fatigue can indicate serious respiratory distress. Cyanosis is usually a very late sign of respiratory compromise. The above findings, especially if progressive, often indicate a need for immediate airway stabilization (for example, by endoscopy followed by intubation).

In a stable child, the examination can proceed. Auscultation of the noises made by the child on respiration is helpful in determining the level of the obstruction. Patients with nasal obstruction generally have a normal voice or cry, except when the obstruction is severe, when the voice becomes hyponasal. Nasal flaring and snorting is a frequent finding, with chest retractions noted in severe nasal compromise. Neonates, who are obligate nasal breathers, often experience serious respiratory distress with nasal obstruction. Older children with nasal obstruction characteristically breathe with their mouths open. Most children with nasal obstruction will experience some respiratory distress during feeding. Auscultation of each nare with the cord of a stethoscope is often useful to determine whether there is any airflow through either side individually.

Patients with oropharyngeal obstruction usually have a normal voice, though it may be throaty or full. They usually present with inspiratory stridor that is coarse (also known as stertor) and increases during sleep. Sternal and intercostal retractions are common and may increase to total chest retractions. Feeding is often difficult or impossible, and patients may be unable to handle their own saliva. These patients, like those with nasal obstruction, tend to breathe with their mouths open and jaw forward. As with nasal obstruction, cough is usually not a symptom.

Patients with supraglottic laryngeal obstruction often present with a muffled or throaty voice. These patients tend to snore while sleeping and produce coarse inspiratory sounds at rest. Feeding is difficult for these patients and mouth breathing is the norm. Cough is not usually present. Patients with glottic obstruction are usually hoarse and may even be aphonic. They usually have an inspiratory stridor initially, but will develop biphasic stridor with progression. Chest retractions are common with severe obstruction, but mouth breathing and coughing are not. Patients with subglottic obstruction may have a hoarse, husky, or even normal voice. These patients generally have an inspiratory stridor that can progress to biphasic. Feeding is normal and nose breathing is the norm. These patients often have a barking cough. Patients with tracheobronchial obstruction usually have a normal voice and their stridor is generally expiratory with a component of wheezing. Feeding is uncommon, and a brassy cough is usually present.

After observation and auscultation of the patient with respiratory difficulty, the examiner should attempt to reposition the patient to determine the effect on noisy breathing. Noisy breathing caused by laryngomalacia, micrognathia, macroglossia, and innominate artery compression diminishes when the baby lies prone with the neck extended. Respiratory distress caused by unilateral vocal cord paralysis may improve with the baby lying on the affected side.

Flexible laryngoscopy is usually, but not always, required for the complete evaluation of the infant or child with respiratory obstruction. Only uncommonly is indirect laryngoscopy with a mirror successful. For flexible laryngoscopy, the examiner should have suction, oxygen, and bag ventilation kits available, as flexible laryngoscopy in small children may cause apnea by unclear pathways. The exam should begin with bilateral evaluation of the nasal cavities, choanae and nasopharynx. The vocal cords should be visualized and their mobility documented, and pooling of secretions should be noted in the hypopharynx. Findings of laryngopharyngeal reflux such as posterior glottic edema, hypervascularity, and pseudoculcus should be noted. The flexible laryngoscope is generally not useful for detecting subglottic pathology. If such pathology is suspected, radiography and endoscopy are usually required for its detection.

Radiography

Radiographic imaging is very important in evaluation of the pediatric airway. While plain radiographs are usually the first and only radiographic studies ordered for the evaluation of children with stridor, their usefulness is controversial. Chest radiographs prior to general anesthesia to evaluate for major vascular and pulmonary changes are justified. But correlation with plain radiographs and direct laryngoscopy and bronchoscopy has failed to show a strong correlation in many studies.

Airway fluoroscopy is a quick, noninvasive, and dynamic study of the entire airway that provides important additional information to the history and physical examination. It is far superior to plain films. Airway fluoroscopy has had a significant role in evaluating foreign bodies. Blazer et al, found that fluoroscopy contributed to the diagnosis in 80-90% of bronchial foreign bodies but only 32-40% of foreign bodies above the carina. As most foreign bodies are radiolucent, the advantage is that focal air trapping can be detected during dynamic movement of the airway.

Airway fluoroscopy is less sensitive to supraglottic and glottic lesions detecting only 33% and 17%, respectively, but is much more sensitive in detecting subglottic, tracheal and bronchial lesions, detecting 80%, 73%, and 80%. The main disadvantage of airway fluoroscopy is

increased radiation exposure. To our knowledge, there is no literature to support an increased risk of malignancy after airway fluoroscopy, which is usually less than 1 minute and equivalent to 10 rads (0.1Gy).

Magnetic resonance imaging (MRI) with gadolinium or computed tomography (CT) with contrast is useful when the plain film or the clinical history suggests vascular compression or mass lesions of the mediastinum. Computed tomography is the most useful study to detect and delineate choanal atresia or stenosis when it is suspected. The barium esophogram or the modified barium swallow study can be useful when feeding difficulties and aspiration are associated with respiratory distress.

Treatment

The ultimate treatment outcome of a pediatric airway emergency is rapid reversal of the impending airway complication. If rapid reversal to the physiologic state is not possible, then temporary securing of the airway is the successful treatment outcome. The approach to management of children with any airway emergency should always include a full and frank discussion of the risks with the parents, and child if appropriate. The possibility of tracheostomy and failure to secure the airway should always be mentioned.

When a patient is unable to adequately perform self ventilation the most common method of securing the airway is oral or nasal intubation. In a large multicenter trial, pediatric intubations occurred in 156 of 1288 total emergency room intubations. Initial intubation attempts were all oral, and included rapid sequence intubation in 81%, without medications in 13%, and sedation with neuromuscular blockade in 6%. Older children and trauma patients were more likely to be intubated with RSI. Overall, successful intubation occurred in 99% of RSI and 97% of non-RS intubation attempts. Only one of 156 patients required surgical airway management. The Pediatric Emergency Medicine Committee of the American College of Emergency Physicians advocates consideration of RSI in every emergency intubation involving a child with intact upper-airway reflexes.

The use of helium-oxygen (Heliox) has been shown to be effective in cases of upper airway obstruction, postextubation stridor, and viral croup. The principle behind using heliox in these clinical situations is established by Graham's Law, which defines the flow rate of any gas as being inversely proportional to the square root of the density. Helium is seven times less dense than nitrogen, which is the most abundant atmospheric gas. Because of its much lower density, replacing nitrogen with helium lowers airway resistance and decreases the work of breathing and alleviates airway obstruction. Patient selection for this treatment is widespread. In a study by Gosz et al, the majority of the diagnosis receiving heliox included congenital heart disease, laryngotracheobronchitis, prematurity and noncardiac postintubation. They found an immediate positive response, as measured by immediate decreased work of breathing within 5-10 minutes, in 73% of the patients. The average duration of treatment was 15 minutes to 384 hours, with an overall mean of 29.1 hours. They found that patients with laryngotracheobronchitis were more likely to respond to heliox whereas the other causes were not statistically associated with response or failure.

It is preferable to perform a tracheotomy on an adult or a child in a controlled fashion. This, unfortunately, is not always the case. In a child, it is especially difficult to perform a cricothyrotomy because of the very small size of the membrane and difficulty in palpating the

structures. Some authors have suggested using a large-bore needle transtracheally, but this too is very difficult due to the flexibility of the child's larynx and trachea. Basically, in a life-threatening situation, any means of obtaining an airway is better than the consequence of not. Complications of tracheostomy may be classified as early or late. Early complications include pneumomediastinum/pneumothorax, acute hemorrhage, accidental decannulation, tubal obstruction, and local infection. Late complications include tracheal granuloma, decannulation, subglottic stenosis, tracheocutaneous fistula

Prenatally detected giant neck masses such as cervical teratomas and cystic hygromas, and congenital high airway obstruction syndrome (CHAOS) caused by conditions such as laryngeal atresia can cause airway obstruction and may result in profound hypoxia or death due to the inability to obtain an airway at the time of birth. The EXIT (ex utero intrapartum treatment) procedure was originally described in cases of severe diaphragmatic hernia, it is now being used for other diagnoses which can obstruct the airway. In an EXIT procedure, the head, neck, thorax, and one arm of the baby are then delivered ensuring the umbilical cord is contained and not compressed within the uterus and the fetal airway is evaluated via bronchoscopy and intubation before the actual birth. The utero-placental circulation and gas exchange is maintained during the procedure, and the surgeons are thus able to establish a fetal airway in preparation for birth. Occasionally, a tracheostomy or emergent resection of the mass is performed if necessary. Placental circulation allows surgeons 45 to 60 minutes to secure the airway, administer exogenous surfactant, and place umbilical lines. Additional surgery may be indicated once the baby is born.

Etiologies of Airway Emergencies:

Neck Masses

Teratoid and Dermoid cysts are rare causes of neck masses. These developmental anomalies are composed of different germ cell layers. They are thought to possibly arise from isolation of pluripotent stem cells during migration with resultant disorganized growth or from entrapment of germ cell layers at points of failed embryonic fusion lines. The lesions are classified according to their composition. Dermoid cysts are composed of mesoderm and ectoderm and may contain hair follicles, sebaceous glands, and sweat glands. They are often midline or paramedian, painless, and do not elevate with tongue protrusion.

Teratoid cysts and Teratomas contain all three germ layers. These lesions commonly present within the first year of life and are usually larger midline or paramedian masses than Dermoid cysts. Teratomas are distinguished by cellular differentiation enough to have recognizable organs or structures. The larger size of these lesions results in secondary aerodigestive compressive symptoms. There is an associated 20% incidence of maternal polyhydramnios which can often lead to the diagnosis with maternal ultrasound.

Lymphangiomas are lymphatic cysts that are isolated from their normal route of drainage into the venous system. The embryological development of the lymphatic system is theorized by the centrifugal theory and the centripetal theory. The centrifugal theory states that lymphatic channels grow outward from venous channels. The centripetal theory states that lymphatic channels grow independently of venous channels. Regardless of the theory, the lymphatic cysts become either totally or partially isolated from the venous system. Histologically, they are classified into capillary, cavernous, and cystic types based on the size of the lymphatic spaces.

Cystic hygromas are large, soft, painless, and compressible masses that usually present by the age of 3. These lesions most commonly present in the posterior triangle where mass effect is limited. When they present in the anterior triangles, airway obstruction is more of a concern. CT is of greatest diagnostic value. Spontaneous regression is rare and surgical excision for obstructing lesions is the treatment of choice. Recurrence rates are generally high because of the poor encapsulation and dissection planes.

The larger size and obstructive potential of lymphangiomas and teratomas may lead to CHAOS (Congenital High Airway Obstruction Syndrome). Emergent airway management at the time of delivery is key for survival. High resolution fetal ultrasound may show flattened diaphragms, polyhydramnios, and a cervical mass. Appropriate team members include a maternal-fetal medicine specialist, neonatologist, anesthesiologist and an otolaryngologist. Management involves elective Caesarean section with establishment of the airway while still on placental oxygenation.

Laryngotracheobronchitis

Infectious agents are frequent causes of airway emergencies in children. Viral laryngotracheobronchitis, known as “croup,” is the most common infectious cause of stridor with a peak incidence in the second year of life. Parainfluenza type 1 is the most common culprit. Croup usually develops from an upper respiratory infection (URI) to a “barking” cough and high-pitched inspiratory stridor associated with varying amounts of respiratory distress. Although radiography is not required in the presence of these classic symptoms, neck films often show the “steeple sign,” – symmetric narrowing of the subglottic space.

Treatments for croup include, humidification, inhaled and systemic steroids, and inhaled epinephrine. There is no scientific data for the use of a humidifier as air is 100% saturated by the time it reaches the nasopharynx during the inspiratory cycle. Racemic epinephrine provides vasoconstriction of the mucosa and bronchial smooth muscle relaxation. Because of the possibility of relapse and the short duration of action, any child that receives racemic epinephrine should be observed for at least 2 hours post treatment. The rationale for steroid use is very solid, however their effectiveness remains in question. It is important to remember that when utilizing systemic steroids it will take at least 3 hours for the medication to produce any significant effects. Thus far, nebulized budesonide rather than nebulized dexamethasone appears to be comparable to that of oral or intravenous steroids.

Children rarely require intubation for this disorder, and those who fail extubation or require repeated hospitalizations should undergo direct laryngoscopy and bronchoscopy to check for subglottic stenosis.

Bacterial Tracheitis

Membranous, or bacterial tracheitis is thought to be a complication of viral laryngotracheobronchitis. The most common causative agent is *Staphylococcus aureus*. Children with the disorder present after a URI that progresses rapidly to harsh biphasic stridor with high fever and respiratory distress. Treatment is by endoscopy (flexible or rigid) with suctioning of the bacterial membranes on the trachea, placement of an endotracheal tube and antibiotics directed against the most common etiologic agents. Extubation should not be attempted until the patient has remained afebrile and there has been much improvement in the

secretions.

Acute supraglottitis

Acute supraglottitis is a disease that is caused by infection of the epiglottis and surrounding structures. The disease used to be caused frequently by *Haemophilus influenzae* type B in children 1 to 5 years of age. However, since conjugate vaccines for this bacteria were introduced in 1987, the disease's incidence has declined greatly, the age of occurrence has increased, and other pathogens such as *Candida albicans*, *Haemophilus parainfluenzae*, and staphylococcus have become more common culprits. The child with the disorder typically presents with a mild URI that progresses over the course of hours to severe throat pain, drooling, fever and respiratory distress. The diagnosis is generally made by history with a very limited physical exam to avoid compromising the airway. Radiography is not generally necessary, but it will show epiglottic swelling, the "thumbprint sign." Management is by halothane and oxygen induction of anesthesia, placement of an intravenous line, and direct laryngoscopy with blood and epiglottic cultures, followed by endotracheal intubation. Extubation is carried out when leak around the endotracheal tube occurs with less than 20 cm H₂O of pressure. Antibiotic therapy with ampicillin and chloramphenicol are initiated and modified to culture results.

Congenital Syndromes

It is not surprising that patients with craniofacial syndromes frequently have associated airway anomalies because of the close embryologic development of the airway with the craniofacial structures. Prominent abnormalities may become immediately apparent at birth or soon after, or they may be more subtle and take months or years to develop. Also, the etiologies of craniofacial syndromal airway obstruction and restriction are not based only on anatomic deformity, such as in the case of mucopolysaccharidoses, in which there is infiltration of the soft tissues of the airway.

Pierre Robin sequence consists of micrognathia and relative macroglossia with or without cleft palate. In the severe case, airway obstruction develops in the first four weeks of life. Especially when the baby is supine, the nasopharynx will fill with the tongue and cause varying degrees of nasal obstruction. Matters become worse when the child becomes agitated and generates greater negative thoracic pressures. The larynx can almost appear invisible to conventional equipment and is best approached by sweeping the tongue in order to visualize the laryngeal structures.

Treacher Collins syndrome consists of abnormalities of the external, middle and inner ear, mandible, and minor eye abnormalities. Usually the zygoma and mandible are hypoplastic. The degree of hypoplasia may render the larynx nearly impossible to approach via the midline. Goldenhar syndrome may present with similar maxillomandibular findings as Treacher Collins but may also be complicated by a short immobile neck.

The mucopolysaccharidoses (Hurler's, Hunter's and Marfan-Lamy syndromes) are hereditary progressive disorders in which deficiency of an enzyme results in excessive intralysosomal accumulation of mucopolysaccharidoses. This causes a generalized infiltration of the structures of the airway. The tongue may fill the oropharynx, the neck is typically short and immobile and the temporomandibular joints may be involved.

Children with Down's syndrome have midface hypoplasia, macroglossia, a narrow

nasopharynx, and a shortened palate. These anatomical abnormalities along with generalized hypotonia, an immature immune system, and a tendency towards obesity predispose them to upper airway obstruction. Furthermore, gastroesophageal reflux disease is very common in these children and may

Nasal obstruction

Nasal obstruction is typically an airway emergency only in the neonate, since newborns are obligate nasal breathers. Causes of nasal obstruction in neonates and infants are varied. Choanal atresia should be suspected in an infant whose nasal airways are shown to be occluded by methodologies suggested above. These infants often have severe respiratory distress alleviated somewhat by crying. Computed tomography confirms the diagnosis. Choanal atresia usually presents as an airway emergency only when it is bilateral. Choanal atresia occurs in 1 in 8000 births with twice as high an incidence in female as males. It is believed to be caused by a failure of the breakdown of the bucopharyngeal membrane or persistence of epithelial rest cells in the nasal cavities during embryonic development. The atresia usually has mixed bony and membranous components. Choanal atresia can present as part of the CHARGE association, consisting of colobomas, heart abnormalities, renal anomalies, genital defects and ear (external, middle and inner) anomalies. Diagnosis of choanal atresia should prompt a search for those associated anomalies. Bilateral choanal atresia is managed urgently with a taped-in neonatal oropharyngeal airway or a McGovern nipple and nasogastric feeding. Definitive surgery is usually carried out soon after diagnosis, though it can be delayed in the presence of other pathology.

Laryngomalacia

Laryngomalacia is the most common congenital laryngeal anomaly. The incidence among males is twice that among females. The symptoms often do not present for days to weeks after birth, but then peak at around two weeks after birth and resolve by 12 to 18 months. The disorder is associated with a low pitched stridor that has a fluttering quality and is more noticeable when the child is agitated or in the supine position. The stridor is relieved by placing the patient prone and extending the neck. On endoscopy, laryngomalacia is characterized by several anatomic abnormalities including shortened aryepiglottic folds and a curled epiglottis (“omega shaped epiglottis”). Shortened aryepiglottic folds can draw the cuneiform and corniculate cartilages forward over the laryngeal inlet, causing the larynx to prolapse during inspiration. Most theories about the cause of laryngomalacia center on the immaturity of the cartilaginous supraglottis and on immature laryngeal neuromuscular control. Surgical intervention usually is not necessary. However, for symptoms of obstructive apnea, failure to thrive, or cor pulmonale, supraglottoplasty is performed during direct laryngoscopy. This procedure is individualized to the infant’s anatomy contributing to the airway collapse. It can include trimming of the epiglottis, excision of redundant mucosa and cartilage in the cuneiform and corniculate cartilages, or removing a wedge of tissue from the aryepiglottic folds.

Subglottic Hemangioma

Subglottic hemangiomas are benign congenital vascular tumors characterized by cellular hyperplasia of endothelial cells, mast cells, fibroblasts, and macrophages. Subglottic hemangiomas grow rapidly, but growth generally slows in the first year of life and the hemangiomas generally resolve by the age of five. Their incidence is two times as common

among females as males. Infants become symptomatic usually between the age of 3 to 6 months with inspiratory or biphasic stridor, barking cough and occasionally hoarseness. Only rarely does the disorder present as an airway emergency. Asymmetric subglottic narrowing is seen on anteroposterior neck films. MRI or CT demonstrate the extent of the lesion, including extension into the neck or mediastinum. Diagnosis by endoscopy is possible without the need for biopsy because the lesion has a characteristic appearance of a compressible asymmetric submucosal mass, occasionally with a bluish or reddish discoloration and in the posterior lateral subglottis. Choices for therapy are many and include tracheotomy (avoided if possible), systemic or intralesional steroids, the CO₂ laser for partial excision, open surgical excision, and interferon alfa-2a therapy.

Laryngeal Web and Atresia

Laryngeal webs and atresias are caused by failure of recanalization of the larynx during prenatal development. Most of these disorders occur in the glottic area and have an extension into the subglottic larynx. Congenital webs rarely occur in the supraglottic larynx. Webs of the larynx only rarely present with airway emergency. Instead, they most commonly present with hoarseness in the cry or aphonia or stridor. Complete laryngeal atresia presents as a respiratory emergency that leads to death unless emergent tracheotomy is performed. Minor webbing with no airway symptoms can be observed, but more severe webs require tracheotomy, incision of the web with keel placement, and possible laryngeal reconstruction.

Tracheoesophageal Fistula and Laryngeal Cleft

Tracheoesophageal fistula takes many different forms and can present as respiratory distress, particularly in cases in which esophageal atresia is present, where children present with aspiration and cough. Laryngeal clefts are rare anomalies in which, like with tracheoesophageal fistula, the lumen between the larynx and esophagus fails to completely develop. Treatment for mild laryngeal clefting may include observation, but more severe forms, and all forms of tracheoesophageal fistula require operative repair.

Vascular Anomaly

Vascular anomalies may lead to significant respiratory distress in the neonate because of the proximity of the great vessels to the airway. These disorders are best diagnosed by MRI or CT with contrast when suspected. An aberrant right subclavian artery sometimes arises from the left descending aorta, passes behind the esophagus and trachea and then follows its normal course on the right side. This produces aspiration and respiratory distress, and is strongly suggested by compression on a barium esophagram. The double aortic arch malformation is characterized by duplicate aortic arches that meet posterior to the esophagus and trachea and lead to formation of a complete vascular ring. Treatment is by division of one of the arches. Inominate artery compression of the trachea can lead to apneic episodes and respiratory distress when the artery arises more to the midline than usual.

Airway Foreign Bodies

Airway foreign bodies are common causes of respiratory distress in children. The problem includes foreign-body aspiration, in which the object is lodged in the laryngotracheobronchial axis, and foreign-body ingestion, in which the object is found in the esophagus. The most common age group affected is children between 2 and 4 years of age, with

a male to female ratio of 2:1. Most often, children have an acute episode of choking and gagging, though if this episode is not witnessed, diagnosis by history may be difficult. Patients may present with nonspecific pulmonary complaints such as intermittent coughing or wheezing; or they may present with severe respiratory distress. The most common culprits are food products, such as nuts, raisins, or seeds. Some objects, such as seeds, will swell and lead to complete bronchial obstruction. Plastic can be nonradiopaque and undetectable on plain films. Expiratory chest film is most useful in evaluation of foreign-bodies. Fluoroscopy may be necessary in younger children to obtain good expiratory views. On expiration, mediastinal shift and air trapping is seen. Bronchoscopy should be performed in the presence of suspicious history even in patients with negative films because of the risk of false negative films in up to 25% of patients. Rigid bronchoscopy allows removal of the foreign body and should be followed by careful examination of the airway for distant lesions. Post-instrumentation edema may necessitate intravenous steroids and inhaled bronchodilators. Esophageal foreign bodies may present with respiratory distress due to compression of the posterior tracheal airway, especially in smaller children. This occurs most commonly when the foreign body lodges at the level of cricopharyngeal muscle. Esophageal foreign bodies should be treated as airway emergencies because of the risk of conversion of an upper esophageal foreign body into an airway foreign body.

Direct laryngoscopy and bronchoscopy is most safely and efficiently accomplished by a ventilating bronchoscope under general anesthesia. The procedure should be carried out sooner than later, considering other patient factors, to decrease the hazard of an impending airway complication, such as an esophageal foreign body migrating into an airway foreign body, or swelling of an organic object.

Conclusion

Airway management and endotracheal intubation in children requires a solid knowledge of the anatomical differences found in the pediatric upper airway. Early assessment of the urgency of the situation followed by proper planning and airway team assembly will increase the likelihood of a successful outcome.

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