

Literature Reviews

Anesthesia and the child with Asthma. GM Doherty, A Chisakuta, P Crean, MD Shields. *Pediatric Anesthesia* 2005; 15:446-454

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The authors have written an excellent review article on asthma in children. The rising prevalence of asthma in childhood means that the anesthesiologists with increasing frequency are encountering children with asthma scheduled for surgery. Even with greater understanding of the pathology, the fundamental factors underlying the development of asthma remain unknown. Genetic predisposition, atopy, prenatal, and early life environment and the influence of chronic airway inflammation on a susceptible airway all appear to influence the development of asthma. Association with atopy is strong. Atopy is the tendency towards immunoglobulin-E mediated hypersensitivity, and is implicated in several disease processes including allergy, allergic rhinitis, and atopic dermatitis. It has long been recognized that many young children who wheeze do not have atopic asthma. Tucson Children's Respiratory Study has clarified a distinction between wheezy bronchitis and asthma. Children were classified as transient wheezers, nonatopic wheezers, and atopic wheezers.

Transient wheezers are characterized by a reduced lung function in infancy. They wheeze in response to viral infections, possibly reflecting reduced airway caliber. Their symptoms resolve after the first few years of life. Nonatopic wheezer children, wheeze beyond the first few years of life, often in response to viral infections, but the persistence of wheeze is less pronounced than in atopic wheezers. Atopic wheezers are clinical asthmatics. The early atopic wheezers are most at risk from severe persistent symptoms. The relevance of these distinctions to the anesthesiologist are unclear. It is wise to assume that any child with a history of reactive airways disease is at increased risk of perioperative bronchospasm and that children with atopy have an increased risk of severe allergic reaction.

Asthma in childhood is a notoriously difficult condition to diagnose. There is no confirmatory diagnostic blood test, or radiographic or histopathological investigation. Asthma is characterized by variable and intermittent airflow obstruction. It presents as a wheeze and a cough. Older children may complain of shortness of breath, chest tightness or discomfort. Unremitting wheeze or stridor is suggestive of fixed obstruction. A dry unproductive cough is often seen in asthma but a persistent wet, productive cough is suggestive of suppurative lung disease.

In children it is important to establish both the severity of the disease and the quality of control, as the two aspects are closely linked. Mild asthma that is poorly controlled may appear severe in terms of frequent or persistent symptoms. Whereas a child with severe asthma may have well controlled symptoms but require high doses of inhaled corticosteroids. Both, the British Thoracic Society and the National Heart, Lung and

Blood Institute define the severity of asthma in a five step scale dependent upon the amount of treatment required to control symptoms. The first step requires occasional use of a short acting Beta 2- agonist. The second step being the addition of inhaled steroids at up to 400 mcg of beclomethasone dipropionate or equivalent per day. The third step is the addition of a third therapy such as a long acting Beta 2-agonist or leukotriene-receptor antagonist. This addition a third drug may obviate the need for an increase in inhaled steroids. The fourth step suggests a cautious increase of inhaled steroids, to a maximum of 800 mcg per day. The final, fifth, step is the introduction of oral steroids, high dose of inhaled steroids >1000 mcg per day or other systemic steroid sparing agents such as aminophylline. Most children will be on the first two steps of treatment protocol but the anesthesiologist must be extra cautious when anesthetizing children on steps four and five.

Difficult asthma is defined as that which is poorly controlled in spite of high dose of inhaled steroids. Although some children do have asthma which is poorly responsive to steroids, the most common reasons for difficult asthma are poor compliance with treatment, inadequate inhaler technique, or the incorrect diagnosis of asthma. In addition, a small group of children may have poorly controlled asthma caused by sudden onset of asphyxiating or anaphylactic type asthmatic attack. A previous history of life threatening exacerbations or intensive care is indicative of a particularly vulnerable group. A sudden asphyxiating attack may also be precipitated by nonsteroidal analgesics or irritant anesthetic gas.

Objective testing is not diagnostic but can support a clinical diagnosis. Most tests have a positive predictive value but a poor negative predictive value. Some tests may also help in assessing current control or severity of airway control. Some of the various tests employed include chest radiograph, computed tomography scanning, pulmonary function tests, evidence of inflammatory markers, and measures of atopy.

The anesthesiologist must be aware of other associated problems in particular atopic asthmatics are more prone to allergic reactions. A detailed history about potential allergies to drugs and latex should be obtained. Asthmatic children can safely receive certain premedications such as midazolam. They should be encouraged to use their inhalers as usual on the day of surgery, but also to take inhaled Beta 2-agonists prior to admission to the operating room. Corticosteroids may help to prevent perioperative bronchospasm although evidence is limited. Intravenous hydrocortisone is recommended to avoid adrenal crisis in those children on systemic corticosteroids and also on high dose inhaled corticosteroids. Inhaled topical lidocaine has been used to blunt the response to tracheal intubation, but paradoxically it can induce irritation and bronchospasm. Both gaseous or intravenous inductions have been used. Ketamine has been advocated as the intravenous agent of choice in severe asthmatics. It has a bronchodilator effect, possibly mediated by direct relaxation of airway smooth muscles. It

also inhibits vagal pathways and augments catecholamine release. As ketamine increases bronchial secretion, it should be accompanied by an anticholinergic agent. Propofol is less bronchoconstrictive than barbiturates but there have been case reports of severe bronchospasm with its use. With regards to other agents, morphine appears to release more histamine than fentanyl, and atropine more than succinylcholine. Volatile agents used are well known as bronchodilating drugs. The effects of these drugs differ slightly. Halothane was the agent of choice in the past. Sevoflurane is the most commonly used agent now. Tracheal intubation is more likely to produce adverse events. Laryngeal mask airways may be useful but have not been fully investigated in children. The best approach to anesthetizing a child might be the use of face mask but only in the presence of a good airway and the suitability of the surgical procedure. Recognizing and treating complications as they occur is very important. Bronchospasm may occur because of the increased airway reactivity or secondary to an anaphylactic reaction. Bronchospasm is recognized by bilateral expiratory wheeze, prolonged expiration, active expiration with increased respiratory effort, increased airway pressure, rising end tidal carbon dioxide and hypoxemia. Bronchospasm can be treated by the administration of inhaled Beta 2-agonists via the endotracheal tube. If need be intravenous salbutamol or aminophylline may be used. Children who have any thing other than minor bronchospasm should also receive corticosteroids. If any systemic evidence should suggest that this reaction is anaphylactic, rather than asthmatic, then it is safer to over

treat bronchospasm as anaphylaxis than to delay treatment of true anaphylaxis. Anaphylaxis which can be caused by drugs such as neuromuscular blocking agents is rare but potentially catastrophic. A more common cause is latex allergy which appears to be more closely associated with atopy. Anaphylaxis should be treated aggressively as per established protocols. Epinephrine is the drug of choice administered intramuscularly, but in the presence of an established intravenous route, 1:10,000 epinephrine is titrated to effect.

Non steroidal analgesics are commonly used in pediatric surgery. Their association with sudden deterioration of children with asthma is a cause for concern. It has been suggested that it is best to avoid this class of drugs, though ibuprofen has been used and is found to be safe.

Comments: Any one involved in pediatric anesthesia and in management of asthmatic children, more so the person who administers pediatric anesthesia infrequently would benefit from reading this review article in toto. The article covers the pathophysiology of childhood wheeze all the way to anaesthetic management of the surgical patient. However, even though an adverse events during anesthesia of a child with asthma is rare, the potential remains for an initially routine anesthesia to suddenly convert to a complicated and dangerous situation.