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Review

Infectious Diseases and Anesthesia in Children

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ABSTRACT

Due to vaccination and better socioeconomic conditions, childhood infectious diseases have dramatically decreased in recent years. Respiratory tract infections (RTI) are common childhood infection diseases. Although most of the upper respiratory tract infections are usually self-limited and resolve within 7-10 days, some patients have persistent symptoms for more than 3-4 weeks. Presence of both respiratory comorbidities and recent RTI can be independent predictors for adverse events during anesthesia. A RTI can increase the risk of perioperative respiratory complications from 2-7 times, hence postponement of anesthesia for elective surgeries for several weeks is applied in daily practice. The complications are most frequent during an active respiratory infection, however, bronchial hyper-reactivity can persist for 6 weeks or more even after the disappearance of clinical symptoms. In general, signs of an active lower respiratory infection, and presence of a systemic illness should warrant canceling an elective procedure. Minimum 2 weeks, up to 6 weeks of interval is advised. The potential risks of RTIs during the perioperative period lead to the cancellation of elective procedures until at least being asymptomatic. This cancellation can have important social, economic, and emotional consequences for both the child, his/her family, and the medical team. In general, signs of an active lower respiratory infection, and presence of a systemic illness should warrant canceling an elective procedure.
A consensus guideline derived from multidisciplinary points of view can provide a detailed and valid algorithm for especially challenging cases. In addition, ongoing exclusive educational and training programs could aid the clinicians in their everyday practice.

INFECTIOUS DISEASES IN CHILDREN

Due to vaccination and better socioeconomic conditions, childhood infectious diseases have dramatically decreased in recent years.

Although infectious diseases in childhood are decreasing, children come across in different situations in anesthesia practice as.[1]

1. Recently vaccinated
2. Recently exposed to an infectious disease
3. Ill with an infectious disease

Respiratory tract infections (RTI) are common childhood infectious diseases. The highest incidence rates of acute respiratory infections (ARI) are during the first 2 years of life where on average infants experience six to eight ARIs each year.[2] Although most of the upper respiratory tract infections (URTIs) are usually self-limited and resolve within 7-10 days, some patients have persistent symptoms for more than 3-4 weeks. A variety of respiratory viruses, such as influenza, parainfluenza, rhinovirus, human bocavirus, and human metapneumovirus are responsible for RTIs. Their common feature is to invade the respiratory mucosa and result in airway inflammation, edema, and bronchoconstriction which sensitize the airway to secretions and volatile agents.[3] Viral infections also induce an increased acetylcholine secretion and consecutive bronchoconstriction due to the inhibition of host cholinergic M2 receptors.[2]

Presence of both respiratory comorbidities and recent RTI can be independent predictors for adverse events during anesthesia.[4] Recently, a prospective observational multicentre cohort study of children from birth to 15 years of age undergoing elective or urgent anesthesia for diagnostic or surgical procedures (APRICOT study) was performed in 261 hospitals in Europe.[5] Among 31,127 anesthetic procedures in 30,874 children, the incidences of severe perioperative critical events was 5.2%, respiratory events was 3.1%, and cardiovascular events was 1.9%. A RTI can increase the risk of perioperative respiratory complications from 2-7 times,[6] hence postponement of anesthesia for elective surgeries for several weeks is applied in daily practice. The complications are most frequent during an active respiratory infection, however, bronchial hyper-reactivity can persist for 6 weeks or more even after the disappearance of clinical symptoms.[7] In this period, the airway becomes ëhyper-reactiveí resembling the pathophysiological mechanisms seen in those of asthma. Eventual bronchial changes can result in perioperative severe complications such as, functional obstruction of the upper (laryngospasm) and the lower airways (bronchospasm).[8] Laryngospasm incidence increases in children with RTI or any airway anomaly. Using a laryngeal mask can also be a contributor factor during general anesthesia.[9] Perioperative RTIs also contribute to the occurrence of oxygen desaturation and long-term cough in children.[10] Increase in dysphoria and sputum production and neurological developmental disorders and sequela secondary to hypoxia are additional complications in these children.[11,12]

Risk factors for perioperative complications in children with RTIs:

• *Symptoms and signs*: RTIs consist of variable distinct infections, including sinusitis, otitis media, pneumonia, and bronchiolitis, etc. Although nasal congestion, purulent secretions, moist cough, or detectable focus are well-known to be more risky, without an obvious focus, even a serous, clear nasal discharge can trigger perioperative adverse events.[10] In a recent study, it was shown that while patient height increases, airway resistance decreases and airway compliance decreases in patients undergoing adenotonsillectomy.[13] Rales detected during preoperative auscultation and sputum suction were also associated with intraoperative airway resistance and compliance in these children. Anesthesiologists generally accept fever, productive cough, wheezing, rales, and rhonchus as contraindications for cancellation of elective surgeries.[14] For prediction of perioperative adverse events, anesthesiologists and pediatricians declared to prefer to perform laboratory and radiological tests, such as hemogram, C-reactive protein, and chest radiograph.[14,15]

• *Underlying disorders*: Children with asthma have an elevated risk of perioperative respiratory adverse events due to elevated risks for bronchospasm and hypoxemia[16]. Prematurity is also a challenging disorder because general anesthesia brings a high risk of morbidity, in particular when the babies have intraventricular hemorrhage, patent ductus arteriosus, necrotizing enterocolitis, or bronchopulmonary dysplasia.[17] Cystic fibrosis is another disorder with potential risks, for which elective surgeries need optimization as much as possible. More intense daily physiotherapy and nebulized drugs will be appropriate. The risk of pulmonary complications will increase on the event that duration of surgery/anesthesia increases, or the surgical site is upper abdominal and thoracic regions, or nasogastric tube insertion is used.[18] Children with infection due to respiratory syncytial virus can suffer more frequently from morbidities when they are anesthetized.[19]

• *Age, Passive smoking:* Pulmonary complications due to a respiratory infection are inversely correlated with age. Children younger than 5 years have a significantly increased risk compared to the older children.[7] A recent study investigating the effect of recent URTI on the incidence of perioperative complications in children undergoing therapeutic cardiac catheterization revealed that small age, passive smoking, and presence of rhinorrhea or moist cough were the independent risk factors for perioperative respiratory adverse events in these children.[11]

• *Airway management*: Orotracheal intubation has an increased probability of complications when compared with laryngeal mask airway and facemask[6]. The risk of respiratory complications are 11 times more in children with endotracheal intubation when respiratory infectious symptoms

are present. It is better to use a mask airway instead of tracheal intubation to minimize the risk if appropriate.[6,20] Surgeries associated with upper airways result in an increased incidence of perioperative adverse events.[21]

• *Parental considerations*: If parents declare that their child has a 'cold' on the day of surgery and the child has snores, these can be assumed as predictors of anesthetic adverse events.[6]

• *Anesthetic agents*: Desflurane causes lesser episodes of laryngospasm than sevoflurane. Additionally, the emergence time and the quality of recovery are better with sevoflurane. Also, desfluraneís bronchoconstrictive effects should also be kept in mind.[22,23]

The duration for cancellation in elective surgeries

The potential risks of RTIs during the perioperative period lead to the cancellation of elective procedures until at least being asymptomatic. This cancellation can have important social, economic, and emotional consequences for both the child, his/her family, and the medical team. Re-planning and eventual disorganization in addition to delays in treatments of critical and cancer patients happen. Unfortunately, there is not any consensus guideline, but there are lots of studies and scoring systems to deal with these patients perioperative management.[2,12,24,25] In general, surgeons give the decision for elective surgeries together with anesthesiologists. New onset or ongoing RTI symptoms require pediatrician consultation.[26] There are no definitive rules for canceling a procedure when there is any RTI. From the point of some authorsí view, children with a mild URTI can be safely anesthetized because no big problems are encountered and they are easily treated without long-term sequelae.[27] In general, signs of an active lower respiratory infection, and the presence of a systemic illness should warrant canceling an elective procedure.[28] Minimum 2 weeks, up to 6 weeks of an interval is advised.

Strategies during the perioperative period

Generally, except for sufficient history and clinical examination, any additional investigation is not routinely advised in most children presenting with URTI. If any proven or probable underlying disorders, such as asthma or a bacterial infection are suspected, consultation from the specialist should be made to initiate appropriate investigations (respiratory function test, cultures, etc.) and treatments (bronchodilators, steroids, antibiotics, etc.).

• If the patients do not have any underlying respiratory disorders, such as allergy, corticosteroids and other adjunctive therapies result in inconsistent results.[29,30] Therefore, they should be used with caution.

• The least invasive method should be chosen. If it is sorted, the order is as facemask > laryngeal mask airway > endotracheal tube.[31] Additionally, uncuffed endotracheal tubes are superior to cuffed ones. Experienced anesthetists should do the airway control. Premature babies are among the special populations. Their cardiorespiratory systems are fragile and any intervention can aggravate cardiac and respiratory instability. Hence, they are sensitive to both respiratory infections and bronchospastic episodes.[17] Sedoanalgesia and avoidance of endotracheal intubation would be the most suitable anesthetic technique for them.

• In high-risk children, it is better to choose IV propofol rather than inhalational drugs during induction.[31] Intravenous anesthetic agents are superior when intraoperative laryngospasm is present. On the other hand, volatile anesthetic agents are more suitable for intraoperative bronchospasm. Sevoflurane has advantages over the other volatile anesthetic agents.

In our clinic, elective surgeries of children with preoperative upper respiratory tract infections are cancelled until 2 weeks after the symptoms are asymptomatic. In this process, a pediatric consultation is requested to receive appropriate treatment for the current infection. As a conclusion, a child with a RTI can also be safely anesthetized, only if the physician follows appropriate perioperative anesthesia evaluation and management approaches. A consensus guideline derived from multidisciplinary points of view can provide a detailed and valid algorithm for especially challenging cases. In addition, ongoing exclusive educational and training programs could aid the clinicians in their everyday practice.

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