Ophthalmic Anesthesia in Pediatrics- An overview

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Abstract

Summary - Owing to a very high birth rate the burden of childhood eye diseases in India is likely to be enormous. Early detection with timely surgical management of these ophthalmic pathologies can prevent the prevalence of several pediatric eye diseases. Anesthesia administration is required for most of these ophthalmic procedures hence a precise planning with good anesthetic management of these high risk pediatric patients will help in successful completion of their ophthalmologic procedure.

Introduction

There exists a high prevalence of ocular pathologies like cataract, strabismus, retinopathy and amblyopia that require surgical correction among pediatric patients [1-6]. Anesthesia administration is required for most of these ophthalmic procedures varying from examination of the eye for detecting the ophthalmic pathology to surgical corrections mainly because of reasons that include age, level of development and lack of cooperation [7]. Owing to many complex factors involved, a precise planning with good anesthetic management of these high risk pediatric patients will help in successful completion of their ophthalmologic procedure.

Anesthesia and Concerns

Management and execution of eye anesthesia in pediatric age group involves special considerations [8-10]. Regional eye anesthesia is not suitable option in pediatric patients mainly owing to the lack of cooperation and understanding. Awake endotracheal intubation may significantly increase intraocular pressure and become very cumbersome in children hence should be avoided. Topical Eutectic Mixture of Local Anesthetics (EMLA) cream can be routinely applied for all pediatric patients to alleviate any painful stimulation while securing the intravenous cannula.

Sevoflurane owing to its better hemodynamic stability may be used as a sole inhalational agent along with oxygen for induction and maintenance of anesthesia. The fasting guidelines are of prior importance in this population and a greater emphasis should be made to maintain a strict nil per oral status prior administration of anesthesia (>6hrs for solid food, >4hrs breast milk and >2hrs clear liquids).

Balance anesthesia to be maintained with adequate analgesia and muscle relaxation. Maintaining normothermia by implementing the use of overhead warming lamps, raised operating room temperatures, forced warm air systems by strict temperature monitoring along with precise intravenous fluid management, including monitoring of serum glucose levels, is important [11].

Complications

The oculocardiac reflex (OCR) commonly seen in eye surgeries can be defined as 10% decrease in heart rate or any arrhythmia occurring secondary to direct pressure placed on the eyeball or traction of the extraocular muscles during the surgical manipulation [12].
The reflex usually manifest as sinus bradycardia and pediatric patients are found to be more vulnerable to this reflex because of the relative increase in vagal tone [13]. Studies reveal high association of fatal cardiac arrhythmia (1 in 3500) with the oculocardiac reflex. Most of the times withdrawal of the surgical stimulations reverts back the response and if persistent may require treatment with injection Atropine 15 mcg/kg [14].

Perioperative respiratory adverse events (PRAEs) have been established as the most common cause of serious adverse events in children receiving anesthesia [15]. Laryngospasm at the time of inhalational induction of anesthesia is a common complication in pediatric anesthesia and can lead to significant morbidity and mortality due to life-threatening complications like desaturation, bradycardia, pulmonary edema and even cardiorespiratory arrest [16-18]. Masseter spasm is another dreaded complication as children are more susceptible to apnea due to their increased oxygen consumption rates as compared to adults and their smaller airway size with a smaller lung functional residual capacity [19].

Strabismus surgery done for the correction of poor alignment of the visual axis with amblyopia in children of age group 1 to 6 years usually involves manipulation of extraocular muscles. Such surgical intervention must occur as early as 4 months of age if proper stereoscopic visual development is to proceed [20]. Problems associated with strabismus surgery include increased risk of malignant hyperthermia, OCR and postoperative nausea and vomiting (PONV). The risk of malignant hyperthermia may be reduced by avoiding the use succinylcholine and halothane. Succinylcholine is also known to increases extraocular muscle tone which in turn interferes with the forced duction test (used for evaluating muscle tone) for approximately 15 minutes. Because the overall incidence of malignant hyperthermia in pediatric population is only 1 in 15,000, the frequent incidence of masseter spasm after succinylcholine administration in patients with strabismus suggests that malignant hyperthermia may be more likely to develop in children [21-23]. PONV following squint correction surgery may require treatment with antiemetic medications namely injection Ondansetron and injection Dexamethasone. PONV is known to be a significant cause for morbidity, prolonged hospital stay resulting in increased hospital costs and perhaps most importantly, poor patient satisfaction [24]. The rate of PONV has been found to be as high as 60%-70% following pediatric strabismus surgery, if adequate nausea prophylaxis is not administered.[25] Several studies have established combination therapy with dexamethasone and ondansetron is more effective at reducing postoperative nausea than giving one agent alone [25].

Congenital Syndromes in Ophthalmic Pathology: Association of Marfan’s syndrome (a connective tissue disorder) with subluxated lenses and detached retinas has already been established [26].

Children with Down syndrome often have strabismus and cataracts [27]. Anesthesia management in these children should consider the possibility of heart valve defects, thoracic aneurysms, and kyphoscoliosis. Other concerns include hypothyroidism, macroglossia, seizures. Patients with craniofacial abnormalities like Alport’s syndrome or Crouzon’s disease may have an associated exophthalmos, myopia or glaucoma. Co-existing systemic disease is present in more than 50% of the patients with congenital and developmental cataract [28,29]. In syndromic patients, increased difficulty with airway management should be anticipated and younger children especially neonates and infants are known to have a higher incidence of airway management problems than older children as shown in several studies [30].

Difficult intravenous access, a commonly faced ordeal by anesthesiologists catering to this age group may lead to prolonged delivery of anesthetic agent during multiple attempts and lack of meticulous titration of these anesthetic agents can consequently result in overdosing, undesirable myocardial depression and hemodynamic instability. This further emphasizes the need to identify children with a possibility of difficult intravenous access, thus making it easier for prior planning of alternative access and availability of equipments like ultrasound machine in operation theatre [31].

Emergency surgeries like pediatric eye injuries may further increase the risk of gastric aspiration during administration of anesthesia. Precautions include administration of injection metoclopramide and a H2 receptor antagonist as with adults and decompressing the stomach during surgery [11].

Babies with Retinopathy of Prematurity (ROP) often have a history of immaturity, hypoxia, apnea, bradycardia, jaundice, patent ductus arteriosus, and developmental delays. Anesthetic management of these "ex-premies" requires vigilant and precise attention [32].

Pediatric glaucoma unlike adult glaucoma requires mainly surgical management with medical therapy playing an adjunctive role [33]. Despite all the challenges with cooperation, measuring intraocular pressure remains central to following glaucoma stability in children. Hence screening, diagnosis, treatment and follow-up may all require repeated anesthesia administration to these children [34]. Even syndromes like Weil Marchesani patients have high association with glaucoma along with other ocular abnormalities [35].

Conclusion

Meticulous risk stratification and a good preoperative workup of these children undergoing ophthalmic procedures may help guide decisions on adequate anesthesia management as well as reduce untoward adverse events ensuring that these cases are done safely and effectively.

References

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