Some Viewpoints about Apnea of Prematurity in Neonates under Inguinal Herniorrhaphy: A Brief Review

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Abstract

Inguinal hernia is more common in premature male babies. Using General Anesthesia (GA) for the repair operation may cause apnea in them. Caudal anesthesia on the other hand provides effective anesthesia and analgesia without the complication of GA. Here we discuss different methods of anesthesia in inguinal herniorrhaphy and their merits and downfalls.

Keywords
- Induction of anesthesia
- apnea
- preterm
- Inguinal hernia
- caudal anesthesia
- neonate

The Apnea of prematurity involve infants in age range of younger than 28 weeks of gestational age or weight lower than 1000 gram at birth. Apnea of Prematurity (AOP) is a prevalent condition in pre-term infants. Untreated AOP is also correlated with undesirable events. Due to such outcomes, ideal treatment approaches to AOP plays an important role in the care of affected infants 1,4. Based on definition of the American Academy of Pediatrics, apnea is a abruption of breath for 20 second or a short pause in association with bradycardia, cyanosis, or pallor 2. AOP is considered as remarkable clinical occurrence with presentations of unstable respiratory rhythm, which demonstrate immaturity of respiratory controlling pathways. However, we do not know everything about the neuronal mechanisms of apnea but currently; we have obtained wider insights to respiratory rhythm especially in neonates. Impairment responses to hypoxemia and hypercarbia and enhancement of inhibitory reflex-
cases were observed in neonates. These issues can result in apnea; therefore we try to treat the disorder by stabling the respiratory rhythm. Caffeine is one of the primary drugs which was used. AOP resolves with aging due to enhancing myelination of the brainstem. Preterm or neonates and infants with anemia who were undergoing surgery for repair of inguinal hernia, are affected more than term babies by postoperative complications. Development of intensive care for neonates result in higher survival rate of preterm infants thus more cases are referred for operations such as inguinal herniorrhaphy with a prevalence of 38% in weight range of 751 to 1000 gram at early periods of infancy. About 20 to 30% of healthy cases of inguinal hernia whom underwent general anesthesia, experienced apnea in the postoperative period. On the other hand, surveys could not demonstrate that outcomes of apnea are distinct from other unpleasant events (e.g. brain injuries due to severe prematurity) or evaluate apnea effects on neurodevelopment. It seems that anesthetic agents have some toxic effects on the developing brain. Regional anesthesia (RA), which may probably decrease the possibility of postoperative apnea, results in avoidance of anesthetic induced neurotoxicity, and these actions can improve neuronal developing outcome of preterm neonates with inguinal hernia. Neonatology and pediatric anesthesiology developments lead to current recommendations. Yet, it is interesting that these improvements could not eliminate apnea in repairing of inguinal hernia in preterm infants by RA, RA with sedation or GA techniques, the onset of apnea may occur in the post anesthesia care unit (PACU) or in the ward. Apnea after GA is also observed in PACU. Davidson et al showed that RA was slightly better than GA. However, awake regional anesthesia is an alternative approach which can reduce the risk of apnea, but it was not confirmed. Other studies showed that 20 to 30% of healthy infants with inguinal hernia who undergo surgery under GA, experience apneic episode for one or more times. In other reports, spinal anesthesia (SA) was performed successfully. Therefore, GA correlates with some different complications particularly in infants with congenital malformations. This risk decreases with aging. SA is more cost effective (rapid recovery and short hospital stay), better blunting effects of surgery induced neuroendocrine response (good outcome), avoidance of intubation and anesthetics, a better alternative in patients with respiratory disease, avoidance of anesthetic effects on developing brain and environmental pollution. In cases of inguinal herniorrhaphy under RA, postoperative apnea reduces. On the other hand, anesthetics such as isoflurane could result in general apoptosis in a developing brain. However, this problem was observed in animal studies. Some factors, for example, high ASA score, number of coexisting diseases and prior history of anesthesia, emergency surgery, duration of fasting time before operation < 8 hours are associated with a higher risk. Higher percentage of infants with post conceptual age less than 32 weeks had bronchopulmonary disease, and in herniorrhaphy by GA more respiratory complications occurs in this group. Caudal and spinal anesthesia are safe and new but all prefer GA for inguinal herniorrhaphy. Therefore, control of pain after surgery is an important point with regards to opioid induced respiratory depression. The perioperative complications are observed differently among various ages. Awake RA is a life saving approach that can
reduce respiratory complications in inguinal hernia repair procedure which might result from GA. The sedation with dexmedetomidine along with caudal anesthesia is another alternative approach to safe anesthesia in these cases which helps avoid complications. Several authors have suggested RA for premature infants. General anesthesia in young children correlates with poor outcome. Awake RA had lower risk of poor outcome in the neurodeveloping brain. The epidural caudal anesthesia with additive ketamine +/- midazolam or bupivacaine had a positive effect on block success rate. Sedation with caudal anesthesia is associated with advantages vs GA in high risk neonates under going reparing of an inguinal hernia, and conversion of this anesthesia method to GA correlates with higher rates of complications. Two other advantages should also be mentioned: maintenance of respiratory condition and earlier restoration of oral feeding. In one study, continous caudal analgesia with chlorprocaine is considred a safe method in infants. Here, we must attend to various syndromes wich result in difficult intubation such as Dandy – walker syndrom. One survey reported successful awake caudal anesthesia with levobupivacaine in 15 low birth weight neonates. Ropivacaine 0.2% or levobupivacaine 0.125 to 0.175% 1mL/kg is the proper dose in most instances. Two patients with bilateral inguinal hernia underwent repair by a combination of sedation with dexametomidine and caudal anesthesia. Neostegmine and midazolam were compared with each other as adjuvant to bupivacaine in caudal anesthesia; and midazaolam was associated with better sedation and lower rates of nausea and vomiting. One systematic review demonstrated that single shot caudal block was commonly used for repair of inguinal hernia with benefits such as early return of gastrointestinal motility and reduced GA related complications. Some experts believe that spinal anesthesia is another good alternative even for incarcerated inguinal hernia, particularly in preterm infants or infants with such conditions. For management of perioperative pain in herniotomies, local infiltration with bupivacaine and rectal diclofenac suppository were less invasive and a safe alternative for caudal anesthesia in herniotomy cases. We must consider apnea monitoring after surgery for infants with low birth weight, anemia, and history of respiratory complication especially in formerly premature infants who are undergoing repair of inguinal hernia. One case report reported a premature infant (PGA= 36 weeks) who underwent inguinal hernia repair by GA without instrumentation of airway. Transversus abdominis block was associated with some benefits versus neuroaxial block in inguinal hernia repair. Administration of caudal and epidural anesthesia in combination with sedation; requires exact indications, operation room team work and appropriate fundamentals. Currently, regional techniques especially neuroaxial anesthesia with light GA or sedation have widespread acceptance, even neuroaxial catheter deliver drug during the operation and after it. Among them, awake RA is a good alternative in preterm neonates and infants. One of the important conditions which should be emphasized on is cystic lung disease with respiratory symptoms, infections and pulmonary hypoplasia. These infants are known as “anesthesiology challenges”. Caudal anesthesia with light sevoflurane sedation was successful in an infant with cystic lung disease.
Actually, caudal anesthesia in combination with sedation correlates with increased success rate and decreased undesirable occurrences. Ilioinguinal/iliohypogastric (II/IH) nerve block for Inguinal hernia repair has the same quality and duration of pain relief (over one 1 hour) after the operation. We have no factual data for estimation of the minimum post-conceptual age which result in postoperative anesthetic complications. In order to avoid the risk of postoperative complications in high risk infants, regional anesthetic techniques (e.g. spinal, caudal, and caudal epidural anesthesia) are used as an alternative for surgical procedures below the umbilicus. However, it seems that RA can lower the chance of hypotension which is a requirement in the treatment of preterm infants undergoing inguinal hernia surgery.

**Conflict of Interest**

There is no conflict of interest.

**References**


