

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 pallor². 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-

es were observed in neonates. These issues can result in apnea; therefore we try to treat the disorder by stabilizing the respiratory rhythm. Caffeine is one of the primary drugs which was used. AOP resolves with aging due to enhancing myelination of the brainstem^{3,4}. Preterm or neonates and infants with anemia who were undergoing surgery for repair of inguinal hernia, are affected more than term babies by postoperative complications⁵. 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 hernia⁶. 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 GA⁷. However, awake regional anesthesia is an alternative approach which can reduce the risk of apnea, but it was not confirmed^{8,9}. 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 times⁹. In other reports, spinal anesthesia (SA) was performed successfully¹⁰. 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 pollution¹¹. In cases of inguinal herniorrhaphy under RA, postoperative apnea reduces⁷. On the other hand, anesthetics such as isoflurane could result in general apoptosis in a developing brain¹². However, this problem was observed in animal studies¹³. 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 risk¹⁴. 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 group¹⁵. Caudal and spinal anesthesia are safe and new but all prefer GA for inguinal herniorrhaphy^{16,21}. Therefore, control of pain after surgery is an important point with regards to opioid induced respiratory depression¹⁷. The perioperative complications are observed differently among various ages¹⁸. Awake RA is a life saving approach that can

reduce respiratory complications in inguinal herniorrhaphy procedure which might result from GA¹⁹. The sedation with dexmedetomidine along with caudal anesthesia is another alternative approach to safe anesthesia in these cases which helps avoid complications²⁰. Several authors have suggested RA for premature infants²¹. General anesthesia in young children correlates with poor outcome. Awake RA had lower risk of poor outcome in the neurodeveloping brain²². The epidural caudal anesthesia with additive ketamine +/- midazolam or bupivacaine had a positive effect on block success rate²³. Sedation with caudal anesthesia is associated with advantages vs GA in high risk neonates under going reappearing of an inguinal hernia, and conversion of this anesthesia method to GA correlates with higher rates of complications²⁴. Two other advantages should also be mentioned: maintenance of respiratory condition and earlier restoration of oral feeding. In one study, continuous caudal analgesia with chloroprocaine is considered a safe method in infants²⁵. Here, we must attend to various syndromes which result in difficult intubation such as Dandy – walker syndrome²⁶. One survey reported successful awake caudal anesthesia with levobupivacaine in 15 low birth weight neonates²⁷. Ropivacaine 0.2% or levobupivacaine 0.125 to 0.175% 1mL/kg is the proper dose in most instances²⁸. Two patients with bilateral inguinal hernia underwent repair by a combination of sedation with dexmedetomidine and caudal anesthesia²⁹. Neostigmine and midazolam were compared with each other as adjuvant to bupivacaine in caudal anesthesia; and midazolam was associated with better sedation and lower rates of nausea and vomiting³⁰. 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 complications³¹. Some experts believe that spinal anesthesia is another good alternative even for incarcerated inguinal hernia, particularly in preterm infants or infants with such conditions³². 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 cases³³. 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 hernia³⁴. 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 repair³⁵. Administration of caudal and epidural anesthesia in combination with sedation; requires exact indications, operation room team work and appropriate fundamentals³⁶.

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 infants³⁷. 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

³⁸. Actually, caudal anesthesia in combination with sedation correlates with increased success rate and decreased undesirable occurrences ³⁹. 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 ⁴⁰. 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 ⁴¹. 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 ⁴².

Conflict of Interest

There is no conflict of interest.

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