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

Mahin Seyed Hejazi[1] Tohid Karami[1*] Daryoush Sheikhzadeh[1]

Behzad Aliakbari Sharabiani[1] Haleh Farzin[1]

[1]Tabriz University of Medical Sciences, Tabriz, Iran

*Address for Corresponder: Dr. Tohid Karami, Tabriz University of Medical Sciences, Tabriz, Iran (email: karami.tohid@gmail.com)

How to cite this article:
Seyed Hejazi M, Karami T, Sheikhzadeh D, Aliakbar Sharabiani B, Farzin H. The Some Viewpoints about Apnea of Prematurity in Neonates under Inguinal Herniorrhaphy: The Brief Review. Iranian Journal of Pediatric Surgery 2018; 4(1): 1-6.

DOI: htt://dx.doi.org/10.22037/irjps.v3i3.20954

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 preterm 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 reflexes 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 [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 complications [5].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 rangeof 751 to 1000 gram at early periods of infancy.About 20 to 30% of healthy cases of inguinal hernia whomunderwent general anesthesia, experienced apnea in the postoperative period. On the other hand, surveys could not demonstratethat 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), whichmay 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 [6]. 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 [7]. 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, experince apneic episode for one or more times [9]. In other reports, spinal anesthesia (SA) was performed successfully [10].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 [11]. In cases of inguinal herniorrhaphy under RA, postoperative apnea reduces [7]. On the other hand, anesthetics such as isoflurane could result in general apoptosis in a developing brain [12]. However, this problem was observed in animal studies [13]. 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 [14].Higher percentage of infants with post conceptual age less than 32 weeks had bronchopulmonary disease, and in herniorrhaphy by GA more respiratory complications occurs nin this group [15].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 opiod induced respiratory depression [17]. The perioperative complications are observed

differently among variuos ages [18]. Awake RA is a life saving approch that can reduce respiratory complications in inguinal herniorrhaphy procedure which might result from GA [19]. The sedation with dexmedetomidine along with caudal anesthesia is another alternative approch to safe anesthesia in these cases which helps aviode complications [20].Several authors have suggested RA for premature infants [21].General anesthesia in young children correlates with poor outcome. Awake RA had lower risk of poor outcome in the neurodeveloping brain [22]. The epidural caudal anesthesia with additive ketamine +/- midazolam or bupivacaine had a positive effect on block success rate [23]. Sedation with caudal anesthesia is associated with advantages vs GA in high risk neonates under going reapairing of an inguinal hernia, and conversion of this anesthesia method to GA correlates with higher rates of complications [24]. Two other advantages should also be mentioned: maintenance of respiratory condition and earlier restoration of oral feeding. In one study, continus cadual analgesia with chloroprocaine is considred a safe method in infants [25]. Here, we must attend to variuos syndromes wich result in difficult intubation such as Dandy – walker syndrom [26].One survey reported successful awake caudal anesthesia with levobupivacaine in 15 low birth weight neonates [27]. Ropivacaine 0.2% or levobupivacaine 0.125 to 0.175% 1mL/kg is the proper dose in most instances [28]. Two patients with bilateral inguinal hernia underwent repair by a combination of sedation with dexmedetomidine and caudal anesthesia [29]. 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 [30]. 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 [31]. Some experts believe that spinal anesthesia is another good alternative even for incarcerated inguinal hernia, particularly in preterm infants or infants with such conditions [32]. 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 [33]. 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 [34]. 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 [35]. Administration of caudal and epidural anesthesia in combination with sedation; requires exact indications, operation room team work and appropriate fundamentals [36].

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 [37]. 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 avoide 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].

References

1. Hoelzle M, Weiss M, Dillier C, et al: Comparison of awake spinal with awake caudal anesthesia in preterm and ex-preterm infants for herniotomy. Pediatric Anesthesia 2010;20(7):620-4.

2. Eichenwald EC: Apnea of prematurity. Pediatrics 2016;137(1):e20153757.

3. Mathew O: Apnea of prematurity: pathogenesis and management strategies. Journal of Perinatology 2011;31(5):302.

4. Williamson JR, Bliss DW, Paydarfar D: Forecasting respiratory collapse: theory and practice for averting life-threatening infant apneas. Respiratory physiology & neurobiology 2013;189(2):223-31.

5. Mahdavi A, Mohajerzadeh L, Razavi S, et al: Postoperative apnea among premature or anemic infants undergoing inguinal hernia repair. Iranian Journal of Pediatric Surgery 2017;2(2):77-80.

6. Jones LJ, Craven PD, Lakkundi A, et al: Regional (spinal, epidural, caudal) versus general anaesthesia in preterm infants undergoing inguinal herniorrhaphy in early infancy. The Cochrane Library 2015.

7. Kurth CD, Coté CJ: Postoperative Apnea in Former Preterm Infants General Anesthesia or Spinal Anesthesia—Do We Have an Answer? Anesthesiology: The Journal of the American Society of Anesthesiologists 2015;123(1):15-7.

8. Davidson AJ, Morton NS, Arnup SJ, et al: Apnea after Awake Regional and General Anesthesia in InfantsThe General Anesthesia Compared to Spinal Anesthesia Study—Comparing Apnea and Neurodevelopmental Outcomes, a Randomized Controlled Trial. Anesthesiology: The Journal of the American Society of Anesthesiologists 2015;123(1):38-54.

9. Craven PD, Badawi N, Henderson-Smart DJ, et al: Regional (spinal, epidural, caudal) versus general anaesthesia in preterm infants undergoing inguinal herniorrhaphy in early infancy. The Cochrane Library 2003.

10. Pedrazzi GM, Montanari G, Domenichelli V: Spinal Anesthesia in Infant with Ventriculoperitoneal Shunt: A Case Report of Inguinal Hernia Repair. Open Journal of Anesthesiology 2016;6(06):97.

11. Ghani N, Varshney A, Hasan M, et al: Spinal Anaesthesia or General Anaesthesia: Which is better in Premature Neonates: A Case Report. 2015.

12. Brambrink AM, Back SA, Riddle A, et al: Isoflurane-induced apoptosis of oligodendrocytes in the neonatal primate brain. Annals of neurology 2012;72(4):525-35.

13. Graham MR, Brownell M, Chateau DG, et al: Neurodevelopmental Assessment in Kindergarten in Children

Exposed to General Anesthesia before the Age of 4 YearsA Retrospective Matched Cohort Study. Anesthesiology: The Journal of the American Society of Anesthesiologists 2016;125(4):667-77.

14. Tiret L, Nivoche Y, Hatton F, et al: Complications related to anaesthesia in infants and children: a prospective survey of 40240 anaesthetics. BJA: British Journal of Anaesthesia 1988;61(3):263-9.

15. Gurria J, Kuo P, Kao A, et al: General endotracheal vs. non-endotracheal regional anesthesia for elective inguinal hernia surgery in very preterm neonates: A single institution experience. Journal of pediatric surgery 2017;52(1):56-9.

16. Uguralp S, Mutus M, Koroglu A, et al: Regional anesthesia is a good alternative to general anesthesia in pediatric surgery: Experience in 1,554 children. Journal of pediatric surgery 2002;37(4):610-3.

17. Pietropaoli Jr JA, Keller MS, Smail DF, et al: Regional anesthesia in pediatric surgery: Complications and postoperative comfort level in 174 children. Journal of pediatric surgery 1993;28(4):560-4.

18. Westerkamp AC, de Geus AF, Molenbuur B, et al: Comparing peri-operative complications of paediatric and adult anaesthesia: A retrospective cohort study of 81 267 cases. European Journal of Anaesthesiology (EJA) 2018;35(4):280-8.

19. Fellmann C, Gerber AC, Weiss M: Apnoea in a former preterm infant after caudal bupivacaine with clonidine for inguinal herniorrhaphy. Pediatric Anesthesia 2002;12(7):637-40.

20. Bong CL, Yeo AS, Fabila T, et al: A pilot study of dexmedetomidine sedation and caudal anesthesia for inguinal hernia repair in infants. Pediatric Anesthesia 2016;26(6):621-7.

21. Seyedhejazi M, Moghadam A, Sharabiani BA, et al: Success rates and complications of awake caudal versus spinal block in preterm infants undergoing inguinal hernia repair: A prospective study. Saudi journal of anaesthesia 2015;9(4):348.

22. Davidson AJ, Disma N, De Graaff JC, et al: Neurodevelopmental outcome at 2 years of age after general anaesthesia and awake-regional anaesthesia in infancy (GAS): an international multicentre, randomised controlled trial. The Lancet 2016;387(10015):239-50.

23. Seyedhejazi M, Mashhoori M, Azarfarin R, et al: The success rate and complications of awake caudal epidural bupivacaine alone or in combination with intravenous midazolam and ketamine in pre-term infants. African journal of paediatric surgery (AJPS) 2015;12(4):236.

24. Balent E, Edwards M, Lustik M, et al: Caudal anesthesia with sedation for inguinal hernia repair in high risk neonates. Journal of pediatric surgery 2014;49(8):1304-7.

25. Mueller CM, Sinclair TJ, Stevens M, et a: Regional block via continuous caudal infusion as sole anesthetic for inguinal hernia repair in conscious neonates. Pediatric surgery international 2017;33(3):341-5.

26. Sari S, Gulasti F, Erdem AO, et al: Caudal Anesthesia in a Neonate with Dandy-Walker Syndrome. J Syndromes 2015;2(1):2.

27. Geze S, Imamoğlu M, Cekic B: Awake caudal anesthesia for inguinal hernia operations. Der Anaesthesist 2011;60(9):841-4.

28. Jöhr M: Regional anaesthesia in neonates, infants and children: an educational review. European Journal of Anaesthesiology (EJA) 2015;32(5):289-97.

29. Waring J, Lowenwirt A, Flaum M, et al: The Use of Caudal/Epidural Catheter as the Primary Anesthetic with Dexmedetomidine Secondary to High Risk of Post-Operative Apnea in Premature Infants. Open Journal of Anesthesiology 2016;6(04):63.

30. Sadeghi A, Tabari AK, Razavi SS, et al: Comparing midazolam-bupivacaine and neostigmine-bupivacaine for caudal anesthesia among pediatric patients undergoing herniorrhaphy operations. Iranian Journal of Pediatric Surgery 2017;2(2):71-6.

31. Maitra S, Baidya DK, Pawar DK, et al: Epidural anesthesia and analgesia in the neonate: a review of current evidences. Journal of anesthesia 2014;28(5):768-79.

32. Lambertz A, Schälte G, Winter J, et al: Spinal anesthesia for inguinal hernia repair in infants: a feasible and safe method even in emergency cases. Pediatric surgery international 2014;30(10):1069-73.

33. Amminnikutty C, Karthik A, Kodakkat AK: Postoperative analgesia in pediatric herniotomy-Comparison of caudal bupivacaine to bupivacaine infiltration with diclofenac suppository. Anesthesia, essays and researches 2016;10(2):250.

34. Özdemir T, Arıkan A: Postoperative apnea after inguinal hernia repair in formerly premature infants: impacts of gestational age, postconceptional age and comorbidities. Pediatric surgery international 2013;29(8):801-4.

35. Ramachandran R, Bansal S, Yadav P, et al: Transversus Abdominis Plane Block for Inguinal Hernia Repair in a Premature Infant: A Case Report. A&A Practice 2017;8(2):31-2.

36. Marhofer P, Keplinger M, Klug W, et al: Awake caudals and epidurals should be used more frequently in neonates and infants. Pediatric Anesthesia 2015;25(1):93-9.

37. Sathyamoorthy M: Pediatric regional anesthesia: an Update. Current Anesthesiology Reports 2017;7(2):150-5.

38. Jung J-W, Kim SR, Jeon SY, et al: Successful use of caudal anesthesia and light sevoflurane mask ventilation for inguinal hernia repair in an infant with multiple large intrapulmonary cysts. Korean journal of anesthesiology 2014;67(Suppl):S87-S8.

39. Palkhiwla BB, Gajjar HR, Shah RS: Study of caudal anaesthesia with ropivacaine under sedation for infraumbilical surgery in paediatrics patients. NHL Journal of Medical Sciences 2014;3(1).

40. Toker MK, Altan Y, Çiftci F, et al: A comparison of pre-emptive regional analgesic modalities for unilateral inguinal hernia repair in children. Int J Clin Exp Med 2016;9(6):11244-51.

41. Zavras N, Christou A, Misiakos E, et al: Current Trends in the Management of Inguinal Hernia in Children. International Journal of Clinical Medicine 2014;5(13):770.

42. McCann M, Withington DE, Arnup SJ, et al: Differences in Blood Pressure in Infants After General Anesthesia Compared to Awake Regional Anesthesia (GAS Study—A Prospective Randomized Trial). Anesthesia & Analgesia 2017;125(3):837-45.