AUCTORES
Globalize your Research

Journal of Clinical Research and Reports

Krishna Prasad T *

Open Access

Review Article

Early Ambulation in Paediatric Surgeries Following Caudal Anaesthesia – A Narrative Review

Divya S, Krishna Prasad. T*, Dilip Kumar. G, Soundarya Priyadharsini. K

Shri Sathya Sai Medical College and RI, Ammapettai, Kanchipuram Dt-603108. INDIA

***Corresponding Author:** Krishna Prasad T, Professor, Dept of Anaesthesiology, Shri Sathya Sai Medical College and RI, Ammapettai, Deemed University, Kanchipuram Dt- 603108. India.

Received date: June 12, 2024; Accepted date: June 19, 2024; Published date: June 24, 2024

Citation: Divya S, Krishna Prasad. T, Dilip Kumar. G, Soundarya Priyadharsini. K, (2024), Early Ambulation in Paediatric Surgeries Following Caudal Anaesthesia – A Narrative Review, *J Clinical Research and Reports*, 16(1); **DOI:10.31579/2690-1919/384**

Abstract

Postoperative early ambulation improves oxygenation, circulation, restoration of normal GI motility, reduces the risk of respiratory infections. Local anaesthetics which are commonly used in the caudal block are bupivacaine, levobupivacaine, and ropivacaine in different concentrations with additives like fentanyl, morphine, clonidine and dexmedetomidine which are added to improve their efficacy. In terms of motor blockade, ropivacaine and levobupivacaine provides less intense motor blockade and facilitates in early ambulation compared to bupivacaine. The purpose of this review is to choose better option of drug for early ambulation in paediatric surgeries following caudal anaesthesia.

Keywords: paediatric surgery; early ambulation; caudal anaesthesia

Introduction:

Caudal anaesthesia involves introduction of local anaesthetic drug into the epidural space and it requires the child must be placed in appropriate position and performed under deep sedation or general anaesthesia [1]. The landmark technique provides a convincing success rate [2,3]. The neuronal hyperexcitability mediated by upregulation of sensory neuron-specific sodium channels and phenotypic switching of large myelinated axons, dorsal horn neuron sprouting, and loss of inhibitory neurons play a pivotal role in originating pain [4]. Epidural block before surgery acts by blocking sensory input at the spinal cord level [5]. Local anaesthetics which are commonly used in the caudal block are bupivacaine, levobupivacaine, and ropivacaine in different concentrations with additives like fentanyl, morphine, butorphanol, tramadol, clonidine, dexmedetomidine and dexamethasone which are added to improve their efficacy [6-10]. The addition of adjuvant has allowed the use of lower concentration of the local anaesthetic for achieving the same level of anaesthesia but with a prolonged duration of analgesia which increases the margin of safety and reduces the incidence of unwanted motor blockades [11-13]

Effectiveness of local anaesthetic with opiod and non opiod drug in caudal analgesia:

Bupivacaine: Bupivacaine is an amide local anaesthetic which provides reliable analgesia with more intense and longer duration of motor blockade. When compared to other commonly used local anaesthetic, it provides significantly longer duration of motor nerve blockade, only property of bupivacaine that limits its use is its property of cardiotoxicity. Jagdeep et al showed that there was significantly longer duration of motor nerve blockade and prolonged duration of postoperative analgesia with bupivacaine in caudal epidural anaesthesia [14]

Ropivacaine: Ropivacaine is also an amide local anaesthetic which provides delayed onset, less intense and shorter duration of motor action. It can be used as an less cardiotoxic alternative to bupivacaine. It selectively blocks the pain regulating nerve fibres (A delta and C fibres) whereas it causes lesser degree of blockade of nerve fibres which regulates the motor functions (A beta fibres).

Swapnadeep et al showed that the ropivaine had significantly shorter duration of motor nerve blockade and lesser total analgesic requirement with comparable hemodynamic stability with both ropivacaine and bupivacaine [15].

Tarlika P et al observed that there was significantly increased time for first rescue analgesia with ropivacaine and the complications were low with ropivacaine when compared with bupivacaine in caudal epidural and no significant diferrence in haemodynamic stability between both the drugs [16].

Levo-bupivacaine:

Levo-bupivacaine a S (-) enantiomer of bupivacaine has specific advantage such as less cardiotoxicity and comparable motor blockade when compared with bupivacaine. It has comparable sensory and motor blockade in equal dose range, in low doses it provides rapid recovery. The susceptibility for any seizure activity following levo-bupivacaine is less compared to racemic mixture of bupivacaine.

B Locatelli et al observed that the bupivacaine delivered higher incidence of residual motor nerve blockade when compared to ropivacaine and levobupivacaine, hemodynamic stability is comparable with all the three drugs [17].

Christian Breschan et al found that there was significant lesser motor nerve blockade with ropivacaine and levobupivacaine [18].

The most frequent method to prolong a postoperative anesthesia is to add different adjuvant drugs to the local anesthetic solution. These additives can be divided in non-opioids (clonidine, dexmedetomidine) and opioids (morphine, fentanyl)

Dexmedetomidine: The effect is due to local vasoconstriction and increased potassium conductance in Aδ and C fibers. Dexmedetomidine enters the central nervous system either via systemic absorption or by diffusion into the cerebrospinal fluid and reaches α2 receptors in the superficial laminae of the spinal cord and brainstem or indirectly activating the spinal cholinergic neurons

Caudally administered dexmedetomidine is a good alternative for prolonging postoperative analgesia with less pain, decreased intraoperative end-tidal sevoflurane concentration, and full postoperative sedation.

Tong Y Et al showed that the duration of caudal anaesthesia is longer with dexmedetomidine and has lesser side effects than morphine when added as an adjuvant in caudal epidural block [19]

Clonidine: Several mechanisms have been postulated for analgesic action of clonidine. It crosses the blood-brain barrier and combines with α2 adrenoceptors at spinal and supraspinal sites hence producing analgesia. It also causes direct suppression of the spinal cord nociceptive neurons and suppresses peripheral sensory Aδ and C nerve fibre neurotransmission. The pharmacokinetics of clonidine suggests that it may also function by inducing vasoconstriction through α 2b adrenoceptors which are located at the peripheral vascular smooth muscles

Wang Y et al suggested that Clonidine is just as effective as other opiods when used an adjuvant to local anaesthetic for caudal block, and has a more desirable side effect profile, particularly with respect to postoperative nausea and vomiting [20].

Morphine: The use of preservative free morphine as an adjunct to caudal anesthesia is associated with various side effects such as nausea/vomiting, pruritis, urinary retention and potential life-threatening respiratory depression, discouraging's its use, especially in pediatric age group. This led to the use of various other caudal additives such as clonidine, midazolam, ketamine, and tramadol.

Baduni N Et al showed that morphine has prolonged duration and intensity of analgesia when given in caudal epidural route and when given in higher doses, patient must be monitored for respiratory depression [21].

Fentanyl:

It is a complere mu opiod receptor agonist, the mechanism of action is by hyperpolarisation. When compared to local anaesthetics it potentiates the activity of nerve blockade, hence the dose requirement of local anaesthetic requirement reduces. The potency of fentanyl is several times more than that of morphine with decreased complications such as vomiting, sluggish GI motility.

Some studies suggest that addition of fentanyl to local anaesthetic drug prolongs its action of motor and sensory nerve blocake with fewer side effects such as postoperative nausea and vomiting [15,16].

Conclusion:

This review article concludes that haemodynamic stability is comparable between bupivacaine, ropivacaine and levobupivacaine in equipotent doses. Addition of both opiod and non opiod adjuvants are useful in prolongation of duration of postoperative analgesia and reduces the use of other modes of analgesia postoperatively with fewer side effects. In terms of motor blockade, ropivacaine and levobupivacaine provides less intense motor blockade and facilitates in early ambulation compared to bupivacaine.

Prior publication - Nil

Support - NIL

Conflicts of interest - NIL

Permissions - NIL

References:

1. R. D. Shah, S. Suresh, (2013).Applications of regional anaesthesia in paediatrics, BJA: British Journal of Anaesthesia, Volume 111, Issue suppl_1, December, Pages i114–i124,
2. Polaner D.M., Taenzer A.H., Walker B.J.(2012). Paediatric Regional Anesthesia Network (PRAN): a multi-institutional study of the use and incidence of complications of pediatric regional anesthesia. *Anesth Analg.* ;115:1353–1364.
3. Mirjalili S.A., Taghavi K., Frawley G., Craw S.(2015). Should we abandon landmark-based technique for caudal anesthesia in neonates and infants. *Paediatr Anaesth.* ;25:511–516
4. Bolay H, Moskowitz MA.(2002).Mechanisms of pain modulation in chronic syndromes. *Neurology.* ;59:S2–S7
5. Al Oweidi AS, Klasen J, Al-Mustafa MM, Abu-Halaweh SA, Al-Zaben KR, Massad IM, et al.(2010). The impact of long-lasting preemptive epidural analgesia before total hip replacement on the hormonal stress response. A prospective, randomized, double-blind study. *Middle East J Anaesthesiol.* ;20:679–684.
6. Brown DL, Carpenter RL,(1990).Thompson GE. Comparison of 0.5% ropivacaine and 0.5% bupivacaine for epidural anesthesia in patients undergoing lower-extremity surgery. Anesthesiology;72:633-636.
7. Concepcion M, Arthur GR, Steele SM, Bader AM, Covino BG. (1990).A new local anesthetic, ropivacaine. Its epidural effects in humans. Anesth Analg;70:805.
8. Zaric D, Axelsson K, Nydahl PA, Philipsson L, Larsson P, Jansson JR.(1991). Sensory and motor blockade during epidural analgesia with 1%, 0.75%, and 0.5% ropivacaine – a double-blind study. Anesth Analg;72:509-515
9. Locatelli B, Ingelmo P, Sonzogni V, et al.(2005). Randomized, double-blind, phase III, controlled trial comparing levobupivacaine 0.25%, ropivacaine 0.25% and bupivacaine 0.25% by the caudal route in children. Br J Anaesth; 94(3): 366-371.
10. Solanki NM, Engineer SR, Jansari DB, Patel RJ. (2016).Comparison of caudal tramadol versus caudal fentanyl with bupivacaine for prolongation of postoperative analgesia in pediatric patients. Saudi J Anaesth; 10(2): 154-160
11. Tsui BC, Berde CB.(. 2005).Caudal analgesia and anaesthesia techniques in children. *Curr Opin Anaesthesiol*;18:283–288
12. Hansen TG, Henneberg SW, Walther-Larsen S.(2004).Caudal bupivacaine supplemented with caudal or intravenous clonidine in children undergoing hypospadias repair: A double-blind study. *Br J Anaesth.* ;92:223–227.
13. Ivani G, De Negri P, Conio A.(2000). Ropivacaine-clonidine combination for caudal blockade in children. *Acta Anaesthesiol Scand.* ;44:446–449.
14. Sharma J, Gupta R, Kumari A, Mahajan L, Singh J. (2018).A Comparative Study of 0.25% Levobupivacaine, 0.25%

Ropivacaine, and 0.25% Bupivacaine in Paediatric Single Shot Caudal Block. Anesthesiol Res Pract.;2018:1486261.
15. Sengupta S, Mukherji S, Sheet J, Mandal A, Swaika S. (2015).Caudal-epidural bupivacaine versus ropivacaine with fentanyl for paediatric postoperative analgesia. Anesth essays Res.;9(2):208–212.
16. Doctor TP, Dalwadi DB, Abraham L, Shah N, Chadha IA, Shah BJ.(2013). Comparison of ropivacaine and bupivacaine with fentanyl for caudal epidural in pediatric surgery. Anesth essays Res.;7(2):212–215.
17. Locatelli B, Ingelmo P, Sonzogni V, Zanella A, Gatti V, Spotti A, et al.(2005). Randomized, double-blind, phase III, controlled trial comparing levobupivacaine 0.25%, ropivacaine 0.25% and bupivacaine 0.25% by the caudal route in children. Br J Anaesth. Mar;94(3):366–371.
18. Breschan C, Jost R, Krumpholz R, Schaumberger F, Stettner H, Marhofer P, et al.(2005). A prospective study comparing the analgesic efficacy of levobupivacaine, ropivacaine and bupivacaine in pediatric patients undergoing caudal blockade. Pediatr Anesth.;15(4):301–306.
19. Tong Y., Ren H., Ding X., Jin S., Chen Z., Li Q. (2014).Analgesic effect and adverse events of dexmedetomidine as additive for pediatric caudal anesthesia: a meta-analysis. *Paediatr Anaesth.* ;24:1224–1230
20. Wang Y, Guo Q, An Q, Zhao L, Wu M, Guo Z, Zhang C. (2021).Clonidine as an Additive to Local Anesthetics in Caudal Block for Postoperative Analgesia in Pediatric Surgery: A Systematic Review and Meta-Analysis. Front Med (Lausanne). 14;8:723191
21. Baduni N, Sanwal MK, Vajifdar H, Agarwala R. (2016).Postoperative analgesia in children: A comparison of three different doses of caudal epidural morphine. *J Anaesthesiol Clin Pharmacol*.;32(2):220-223.

DOI:10.31579/2690-1919/384