DOI: 10.7860/JCDR/2022/58669.17104

Original Article

Anaesthesia Section

Efficacy of a Novel Face-to-Face Lateral Position (Partha's Technique) in Children to Aid Identification of Caudal Space during Single Dose Caudal Epidural Anaesthesia for Elective Infraumblical Surgeries- A Feasibility Study

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ABSTRACT

Introduction: A single dose of caudal epidural block accounts for 30-40% of paediatric regional anaesthesia. For infraumblical procedures, it is administered with or without general anaesthesia. The traditional patient position for assisting caudal blocks in children is lateral, with the child's back facing the anaesthesiologist. For caudal epidural block, a novel face-to-face orientation of the anaesthesiologist with respect to the child in lateral position was used.

Aim: To determine whether a novel face-to-face position of the anesthesiologist and the child is feasible in identification of the caudal epidural space during administration of caudal epidural anaesthesia following general anaesthesia in paediatric patients undergoing elective infraumblical surgery.

Materials and Methods: This prospective feasibility study was conducted from November 2020 to November 2021 on 15 children belonging to American Society of Anaesthesiologists (ASA) physical status I, who were scheduled for elective infraumblical procedures under general anaesthesia, with single dose caudal epidural anaesthesia. While performing caudal block, a novel face-to-face orientation of the anaesthesiologist and patient was used. The following variables were recorded: first pass success rate, number of attempts, block performance time, block failure rate, performer satisfaction score, duration of postoperative analgesia, and complications.

Results: There were eight males and seven females. The mean age of the population was 6.6±2 years and the mean weight was 20.6±3.4 kilograms. The first pass success rate was 86.6% (13/15) with overall success rate of 100%. Number of attempts for successful block were 1.2±0.5. Block performance time and duration of postoperative analgesia were 31.8±12.1 seconds and 176±31.8 minutes, respectively. Performer's satisfaction score was excellent in 86.6% (13/15) and good in 13.3% (2/15). No incidence of block failure and complications were noted.

Conclusion: The novel face-to-face position in child ergonomics with respect to anaesthesiologist during caudal epidural block performance is a feasible and effective method in children undergoing elective infraumblical procedures.

Keywords: Block, Ergonomics, Success

INTRODUCTION

Surgery is always associated with an undesirable hormonal stress response secondary to pain in the perioperative period in patients of all ages [1]. It is an extremely difficult task for anaesthesiologists to provide adequate necessary perioperative pain relief, especially in the case of paediatric patients, because drug handling in children differs from that in adults due to immature liver and renal systems [2]. Regional anaesthesia has been proven beyond doubt to provide safe and effective perioperative pain relief in children. Furthermore, regional anaesthesia reduces the need for inhalational agents, promotes a smooth postoperative recovery, shortens hospital stays, reduces analgesic requirements, and provides excellent patient satisfaction with minimal side-effects [3-5]. Caudal epidural block, with or without general anaesthesia, is widely used (30-40%) in children for perioperative anaesthesia and analgesia for infraumblical surgeries [6,7].

The traditional position for caudal epidural block in children after preprocedural sedation or general anaesthesia is lateral position with flexion of the neck, hip, and knee, with the anaesthesiologist facing the patient's back [8]. The traditional positioning has been observed to have some fallbacks. It may lead to difficulty in identification of loss of resistance as the needle passes through the sacrococcygeal ligament, needle displacements during connection of injectate filled syringes when it is operated by a single performer after acquiring the caudal space leading to drug delivery in unwanted places (subcutaneous injections, sub periosteal injections, intrathecal injections, intravascular injections), and always warrants airway monitoring as the children are either sedated or under general anaesthesia during caudal blocks. To circumvent all the above said problems, an alternate novel face-to-face technique, as well as lateral positioning of the child, with the anaesthesiologist facing the child's face (Partha's Technique) has been tried in this study.

Hence, this feasibility study was conducted on 15 paediatric patients who were scheduled for elective infraumbilical surgeries at a tertiary care hospital. The primary goal was to determine the frequency of first-pass success rates, and the secondary goals were to count the number of attempts, overall block success rate, block performance time, performer's satisfaction score, block failure rate, duration of postoperative analgesia and complications.

MATERIALS AND METHODS

The present study was a prospective feasibility study which was conducted after obtaining written and informed consent from parents/ guardians, from 15 ASA physical status I children from November 2020 to November 2021, in Mahatma Gandhi Medical College and Research Institute, Puducherry, India. The children were recruited by continuous sampling technique. The study was approved by the academic research committee of the institute and

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Inclusion criteria: Children aged between 2 to 12 years belonging to ASA I who underwent elective infraumbilical surgeries in the study institute during the study period were included in the study.

Exclusion criteria: Paediatric patients belonging to ASA physical status II and above, skin infection over the sacral hiatus, any bony deformity of sacrum, history of coagulopathy, allergy to local anaesthetic drugs, emergent surgical scenarios, prior neurological deficits or disorders and children whose guardians refused to give willful informed and written consent for anaesthesia and enrollment into the study were excluded from this study.

Procedure

All the children were kept nil per oral for 2 hours for clear fluids and 4 hours for milk. In the preoperative area, patients were premedicated with oral midazolam 0.5 mg/kg, 15-20 minutes before the scheduled procedure. The individual parent consent was taken from each parent. After the patients were sedated, they were shifted inside the operating room. Patients were connected to routine preinduction parameters (non invasive blood pressure, heart rate, electrocardiography, oxygen saturation, and end tidal carbon dioxide). Baseline values were recorded and documented.

Anaesthesia induction was done by inhalation of sevoflurane 6-8% via a face mask. An intravenous line was started. Injection glycopyrrolate 0.1 milligram per kilogram, injection fentanyl 2 microgram per kilogram and injection succinylcholine 2 milligram per kilogram was given through the intravenous line along with intravenous fluids. Appropriate sized I-gel laryngeal mask airway was placed according to the weight of the child. Anaesthesia was maintained with 33% Oxygen (O_2): 67% Nitrous Oxide (N_2O) mixture and sevoflurane reduced to 1-2% to target minimum alveolar concentration of 1, with a total fresh gas flow of 6 litres per minute and the child was allowed to breath spontaneous thereafter throughout the surgery. The patient was positioned in the lateral position facing the anaesthesiologist (Face-to-Face position) and a caudal block was performed by a single experienced anaesthesiologist who had performed more than 500 paediatric caudal epidural injections. Under strict aseptic precautions, sacral cornua, and sacral hiatus was palpated using the non dominant hand (left hand) of the anaesthesiologist over the skin after slightly bending forward over the child. A 25 gauge, 1 inch hypodermic needle was inserted at angle of 60 to 80 degree measured on the skin surface by the anaesthesiologist in a direction towards him. The needle was further advanced until sacrococcygeal ligament was felt and crossed with a "give way or pop" for identification of caudal epidural space using "standard loss of resistance" technique.

Then, the angle was further reduced by 20 to 30 degree and the needle was advanced by 2 to 3 millimeters to enter the sacral canal. Then, the needle in the sacral canal was held firmly by the same anaesthesiologist. Under aseptic precautions, the syringe with the local anaesthetic solution which was previously prepared by the same anaesthesiologist prior to needling, was connected to the needle firmly without dislodging the needle tip by an experienced anaesthesia assistant/technician. Then, the syringe was aspirated for blood/CSF and once the position was confirmed, the local anaesthetic drug was administered by an experienced anaesthesia assistant/technician without dislodging the needle after careful negative aspiration for every 2 millilitre of injection. About 1 millilitre per kilogram body weight of 0.25% bupivacaine was given in the caudal epidural space [9]. The number of attempts, block performance time, procedure failure rate, performer's satisfaction score and complications, if any were noted. The surgical incision was made after 10 minutes of caudal placement.

Successful caudal block was defined as no change or change in heart rate or mean arterial pressure or both not more than 15% from the baseline as a response to skin incision. Caudal block failure was defined as rise of either heart rate or mean arterial pressure or both more than 15% from the baseline during the scheduled surgical procedure. In such case scenarios, a bolus of 1 to 2 micrograms of fentanyl was administered every hour throughout the surgery for pain relief. After the surgery was over, sevoflurane was stopped and the 100% oxygen was administered and the child was extubated after the child satisfied extubation criteria.

Incidence of first pass success rate which was defined as needle reaching the sacral hiatus with a subjective feeling of give or loss of resistance on puncture of the sacrococcygeal ligament on first puncture without withdrawal from the skin. Number of attempts was defined as the number of skin punctures for successful caudal block. Block performance time was defined as the time from start of palpation of land marks to end of successful administration of drug solution in the caudal epidural space. Duration of postoperative analgesia was defined as the time duration from end of general anaesthesia to the time of Wong Bakers face scale of more than 2 or time of request to first dose of analgesia in the Postoperative Care Unit (PACU), whichever is first [10]. Performer's Satisfaction Score was obtained in a scale of four (0- worst, 1- bad, 2- good, 3- excellent). Complications such as intravascular injection, intrathecal injection, subcutaneous injection and intraosseous/subperiosteal injection were noted.

The haemodynamcis (heart rate, non invasive blood pressure), oxygen saturations were monitored every three minutes during the first half an hour of anaesthesia and thereafter every 15 minutes during rest of the intraoperative period and every 30 minutes for six hours in the postoperative period. The postoperative pain was monitored using Wong Bakers faces scale every 30 minutes once for first six hours and thereafter every two hours once till 24 hours in the PACU. Anesthesiologists who were collecting the entered data in the operating room and anesthesiologists in PACU were blinded to the anaesthetic technique used.

STATISTICAL ANALYSIS

All the data was recorded in Microsoft Excel sheet. Statistical analysis was carried out using Statistical Package for the Social Sciences (SPSS) version 19.0 (Armonk,NY:IBMcorp) software. Descriptive analyses were reported as mean and standard deviation of continuous variables.

RESULTS

The mean age was 6.6±2 years and, weight was 20.6±3.4 kilograms. Out of 15 children, 8 were males and 7 were females. The surgeries which the patients underwent included tendoachilles lengthening, lower limb fractures, appendicectomy, orchidopexy and herniotomies. The mean duration of surgery was 50.6±18.4 minutes.

The first pass success rate was 86.6% (13/15). Overall success rate was 100% (15/15). Mean number of attempts was 1.2±0.5. The number of attempts required for a successful caudal epidural block are described in [Table/Fig-1]. Block performance time was 31.8±12.1 seconds. There was no incidence of any failed block and complications. Duration of postoperative analgesia was 176±31.8 minutes. Performer's satisfaction score was excellent in 86.6% (13/15) and good in 13.3% (2/15). All the patients were haemodynamically stable in the intraoperative and postoperative period and no much difference in postoperative pain scores were noted.

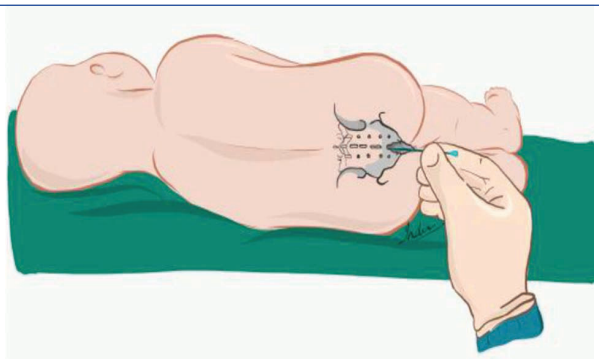
Number of attempts	Number of patients n=15 (%)
1	13 (86.6%)
2	1 (6.7%)
3	1 (6.7%)

[Table/Fig-1]: Number of attempts required for successful caudal epidural block contacted.

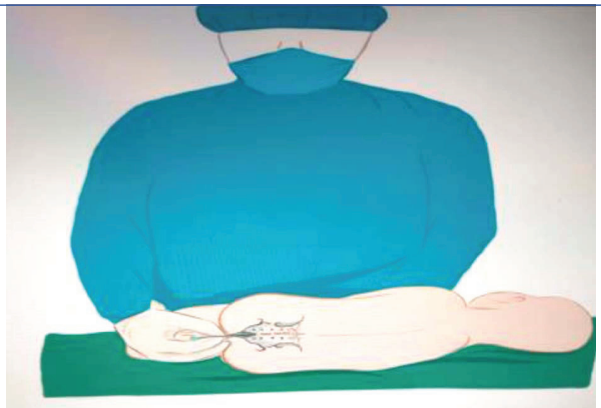
DISCUSSION

Caudal epidural anaesthesia is one of the most commonly used and performed techniques in children for perioperative pain after thoracic, abdominal, and infraumblical procedures [8]. A needle is inserted through the sacral hiatus to deliver medications, usually local anaesthetics, into the epidural space [8]. It is now used to manage a few chronic pain disorders in adults [11]. There are numerous approaches to caudal epidural anaesthesia. It can be done using either a landmark or an image (fluoroscopic or ultrasound guidance) [12]. In landmark guided technique, the sacral cornua as two bony prominences, the sacral hiatus can be identified as a dimple in between the prominences by palpation. A needle is inserted at 45° to the sacrum and need to be redirected if the posterior surface of sacral bone is contacted. A subjective feeling of give or loss of resistance usually suggests piercing the sacrococcygeal ligament. There are a few tests like whoosch and swoosch tests for confirmation [13]. It is recommended that caudal epidural block should be performed by ultrasound guidance rather than conventional landmark guidance or blind technique because of its inaccuracy [14-16]. Recently ultrasound guidance is becoming popular with more precision and drug visualisation. Still ultrasound guided caudal anaesthesia is not popular among a majority of anaesthesia specialists because of lack of expertise or lack of ultrasound machines in operating rooms.

Koo BN et al., have demonstrated that in lateral patient position with maximum flexion of neck, hip and knees, there is significant cephalic displacement of the dural sac [17]. Hence, finding the right position of the patient can aid in avoiding complications associated with the caudal blocks. So far, the position of the attending anaesthesiologist has been the traditional technique of seeing the back of the child as depicted in [Table/Fig-2]. Authors propose a change of the position of the child (face-to-face position of child with respect to anaesthesiologist) as depicted in [Table/Fig-3] may help in increasing the comfort for the anaesthesiologist.



[Table/Fig-2]: Conventional caudal epidural technique (anaesthesiologist facing back of the child placed laterally and needle directed near to farer, away from him/her).



[Table/Fig-3]: Novel face-to-face caudal epidural technique (Partha's technique - anaesthesiologist facing face of the child placed laterally and needle directed farer to nearer towards him/her).

Whichever be the technique, the administrator works behind the patient and introduces the needle from closer to farer from him. This predisposes to a technical difficulty in feeling the so called "give" of the space [Table/Fig-2]. After getting into the space, the anaesthesiologist may find difficulty in giving the injection as there will be a subtle needle movement while engaging the injectate filled syringe with the needle hub before administration of the drug. This may hamper the position of the needle. Hence authors thought, if the needle is coming towards the administrator [Table/Fig-3] the feel of the negative space may be better and the injection can be given by a technician without even a very minimal movement of the needle into the desired caudal space alone.

There are several advantages of this novel face-to-face technique (Partha's technique or method) of caudal epidural block. Firstly, the airway can be monitored directly by the anaesthesiologist who is performing the caudal block since the anaesthesiologist is facing the face of the child rather than facing the back of the child in conventional technique to avoid any airway related morbidities during the performance of caudal block by the anaesthesiologist. Secondly, there can be better child cooperation in a child with procedural sedation since it simulates hugging of the child which will keep the child more comfortable. Thirdly, there will be better feel of give way of sacrococcygeal ligament and negative space since the needle travels before backwards towards the anaesthesiologist in contrast to closer to farer direction in conventional technique, hence can be easily performed by naive anaesthesiologists and also in difficult caudal cases such as in children with excess soft tissues overlying the sacral cornua. Fourthly, this novel technique is likely to be more successful when compared to conventional technique as the anaesthesiologist hand holds firmly on the needle and injectate is delivered by an assistant anaesthesiologist/technician avoiding even subtle needle tip movement during engaging the syringe and the needle before injection, swoosh testing for confirming correct caudal needle placement, needle movements during injection and thus, avoiding complications such as inadvertant intradural injections, subperiosteal injections, intravascular injections and subcutaneous injections.

Riaz A et al., found that block success on first attempt with conventional position of anaesthesiologist facing child's back to be significantly higher with ultrasound guided caudal epidural block (95%) compared to land mark guided caudal block (70.83%) (p-value <0.001) [15]. Similar finding was observed with Kollipara N et al., [13] where first puncture success with ultrasound guided technique was observed to be 90.56% and landmark guided technique was found to be 64.2% (p-value=0.001) with traditional positioning of child's back facing anaesthesiologist which definitely lesser when compared to present study. Dhadwal SS et al., also found that the block success with first attempt was 61.29% with conventional positioning for landmark guided caudal epidural and 90.32% with ultrasound guidance (p-value=0.008) [16]. In the present study, with this novel face-to-face positioning, the first pass success rate was found to be 86.6% which is definitely more than conventional positioning for landmark guided caudal block used in previously mentioned studies. It was found that the first pass success rate was even closer to success rate on first attempt of ultrasound guided caudal block with traditional positioning of the child. This clearly states that the anaesthesiologists can perform the caudal epidural block with ease with current novel face to face position of the child.

Kollipara N et al., found that the mean number of needle punctures were 1.45±0.667 with landmark based technique and 1.09±0.295 with ultrasound guided technique (p-value=0.01) in their study [14]. In the present study, a similar number of attempts of 1.2±0.5 with the novel face-to-face position for caudal block was observed. One child had to undergo second attempt and one child had to undergo third attempt for successful administration of caudal block since

the bone was encountered by the needle hindering the correct placement of the needle tip in the caudal space. Kollipara N et al., and Dhadwal SS et al., observed that the block success rates with landmark guided caudal blocks with traditional positioning was 98.1% and 83.87%, respectively. The block success rate with ultrasound guided caudal blocks with traditional positioning was 100% with both Kollipara N et al., [14] and Dhadwal SS et al., [16]. In the current study also had similar block success rate of 100% which implies that the novel positioning had a comparable success rates with ultrasound guided caudal blocks and increased success rate when compared to landmark guided caudal blocks with traditional position of the child.

Riaz A et al., observed that block performance time with traditional positioning was 63.62±13.10 seconds which was more than the block performance time in the current study (31.8±12.1 seconds). Kollipara N et al., [14] and Dhadwal SS et al., [16] observed that the block performance time was 30.34±7.34 seconds and 39.3 seconds, respectively which was similar to the current study (31.8±12.1 seconds). When comparing with block performance time with ultrasound guided caudal block with traditional positioning of the child as observed by Riaz A et al., [15] (118.88±16.11 seconds), Kollipara N et al., [13] (53.19±10.97 seconds) and Dhadwal SS et al., [16] (52.2 seconds), it was observed that current study had a very less time to block performance with the novel face-to-face position (31.8±12.1 seconds). Dhadwal SS et al., [16] noted that significantly higher incidence of subcutaneous bulging in patients who underwent landmark guided caudal block (25.81%) compared to ultrasound guided caudal block (6.45%) with traditional position of the child, In contrast, no complications were observed in the current study. There was no incidence of intrathecal injections, intravascular injections, intraosseous/subperiosteal injection and haemodynamic imbalances in present study. The duration of postoperative analgesia was satisfactory with mean duration of 176±31.8 minutes. The intraoperative and postoperative haemodynamics were stable.

Limitation(s)

This study was conducted on a very small population. Secondly, the caudal epidural block in this novel face-to-face position was performed by a single senior anaesthesiologist with over 500 caudal blocks of experience. As a result, future studies should be conducted in a much larger population, with anaesthesiologists of varying experience, and compared to conventional approaches.

CONCLUSION(S)

In terms of adequate first pass success rate and shorter block performance time without complications, the novel face-to-face position of the anaesthesiologist with respect to the child while performing caudal epidural anaesthesia (Partha's technique) is a feasible and effective method of caudal anaesthesia in children undergoing elective infraumblical procedures.

Acknowledgments for diagram courtesy: Dr. Indubala Maurya, Assistant Professor, Department of Anaesthesia, Superspeciality Cancer Institute and Hospital, CG City, Lucknow, Uttar Pradesh, India.

REFERENCES

[1] Yuki K, Matsunami E, Tazawa K, Wang W, DiNardo JA, Koutsogiannaki S. Pediatric perioperative stress responses and anesthesia. Transl Perioper Pain Med. 2017;2(1):1-12.
[2] Bester K, Meyer H, Crowther M, Gray R. Anaesthesia for paediatric patients: Minimising the risk. SAMJ: South African Medical Journal. 2018;108(6):457-59.
[3] Wolf AR. Effects of regional analgesia on stress responses to pediatric surgery. Paediatr Anaesth. 2012;22(1):19-24.
[4] Shah RD, Suresh S. Applications of regional anaesthesia in paediatrics. BJA: British Journal of Anaesthesia. 2013;111(suppl_1):i114-24.
[5] Ponde V. Recent trends in paediatric regional anaesthesia. Indian Journal of Anaesthesia. 2019;63(9):746-53.
[6] Jöhr M, Berger TM. Caudal blocks. Paediatr Anaesth. 2012;22(1):44-50.
[7] Benka AU, Pandurov M, Galambos IF, Rakić G, Vrsajkov V, Drašković B, et al. Effects of caudal block in pediatric surgical patients: A randomized clinical trial. Braz J Anesthesiol. 2020;70(2):97-03.
[8] Wiegele M, Marhofer P, Lönnqvist PA. Caudal epidural blocks in paediatric patients: A review and practical considerations. Br J Anaesth. 2019;122(4):509-17.
[9] Suresh S, Ecoffey C, Bosenberg A, Lonnqvist PA, de Oliveira GS, de Leon Casasola O, et al. The European Society of regional anaesthesia and pain therapy/American Society of regional anesthesia and pain medicine Recommendations on local anesthetics and adjuvants dosage in Pediatric Regional Anesthesia. Reg Anesth Pain Med. 2018;43(2):211-16.
[10] Mazur A, Radziewicz Winnicki I, Szczepański T. Pain management in children. Ann Agric Environ Med. 2013;20(1):28-34.
[11] Vranken JH, Lycklama EWF, TerRiet SF, Sassen AM, Zuurmond WWA. Caudal epidural block in chronic pain management: Where does the anaesthetic solution go? European Journal of Anaesthesiology. 2000;17:183.
[12] Kao SC, Lin CS. Caudal epidural block: An updated review of anatomy and techniques. Bio Med Res Int. 2017;2017:e9217145.
[13] Talwar V, Tyagi R, Mullick P, Gogia AR. Comparison of "whoosh" and modified "swoosh" test for identification of the caudal epidural space in children. Paediatr Anaesth. 2006;16(2):134-39.
[14] Kollipara N, Kodali VRK, Parameswari A. A randomized double-blinded controlled trial comparing ultrasound-guided versus conventional injection for caudal block in children undergoing infra-umbilical surgeries. J Anaesthesiol Clin Pharmacol. 2021;37(2):249-54.
[15] Riaz A, Shah ARA, Jafri SAU. Comparison of pediatric caudal block with ultrasound guidance or landmark technique. Anaesthesia, Pain & Intensive Care. 2019 ;23(1).
[16] Dhadwal SS, Bhure A, Bhargava S. Ultrasound guided technique versus landmark technique for caudal epidural block in children: A randomized controlled study. Indian J Clin Anaesth. 2022;9(2):174-78.
[17] Koo BN, Hong JY, Kim JE, Kil HK. The effect of flexion on the level of termination of the dural sac in paediatric patients. Anaesthesia. 2009;64(10):1072-76.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Jun 28, 2022
- Manual Googling: Aug 08, 2022
- iThenticate Software: Aug 13, 2022 (10%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:
- Financial or Other Competing Interests: The techniques was copyrighted with the Government of India (L 91047- 2020).
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. Yes

Date of Submission: **Jun 25, 2022**
Date of Peer Review: **Jul 25, 2022**
Date of Acceptance: **Aug 17, 2022**
Date of Publishing: **Oct 01, 2022**