VOLUME-8, ISSUE-1, JANUARY-2019 • PRINT ISSN No 2277 - 8160

Original Research Paper

Anaesthesiology

COMPARISON OF CAUDAL EPIDURAL BLOCK USING ULTRASOUND GUIDANCE VERSUS THE CONVENTIONAL TECHNIQUE IN ADULT PATIENTS UNDERGOING ELECTIVE PERIANAL SURGERY

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ABSTRACT

Background: Ultrasonography has been instrumental in the resurgence of regional anesthesia. Its ability to locate and define the sacral hiatus is the key to success of caudal epidural anesthesia. Ultrasound is known to guide the placement of the needle with a potential at technique enhancement and improved patient's acceptance in various nerve blocks . Various modalities, viz 'POP', 'swoosh', 'woosh' and 'LOR' exist for identifying the caudal epidural space. Their overall failure rate is about 41%. Use of imaging technology has been recommended to improve the success rate. Fluroscopy is the 'Gold Standard' for caudal epidural blocks. Several studies have shown a success rate >95% when performed under ultrasound guidance.

Objectives: To elucidate the role of ultrasound in improving the success rate in caudal epidural anesthesia and in improving overall patient comfort.

Materials & Methods: ASA grade I & II patients between ages 18–65 years, BMI <25 kg/m2, undergoing elective perianal surgery, were selected and allocated, by randomized lottery, into Group 'A' or 'B'. Group 'A' received the block under ultrasound guidance while group 'B' received the conventional 'loss of resistance' technique. 15.0ml of preservative free isobaric 0.5% Bupivacaine was administered for the block.

Results: The success rate was 94% in group 'A' vs 78% in group'B' (P=0.04). Mean time for procedure was 8.82±0.92 mins in group 'A' vs 10.78±2.5 mins in group 'B' (P<0.0005). Mean number of needle insertions were 1.38±0.6 in group 'A' vs 1.92±0.78 in group 'B' (P<0.0005). Mean number of needle redirections were 0.98±1.02 in group 'A' vs 2.7±1.59 in group 'B' (P<0.0005). The patient satisfaction score, on a scale of 1-5, was 4.24±0.87 in group 'A' vs 3.42±0.86 in group 'B' (P<0.0005).

Conclusion: Ultrasound can be a useful tool to guide the placement of the epidural needle with a potential at technique enhancement, improve patients acceptance, minimizing failure rates and reducing radiation exposure in chronic pain deserving further investigation. However, the use of ultrasonography, in several cases, is user dependant.

KEYWORDS :

INTRODUCTION

Sacrally administered epidural anaesthesia was first described by Sicardia in 1901. Sacral access to the epidural space in adults gained popularity in 1952 when corticosteroids were added to local anaesthetics for management of chronic pain. Over the past few decades, the caudal epidural block has gained an extremely wide range of applicability ranging from perineal, inguinal and anorectal surgeries, and, in acute and chronic pain management.

The caudal approach of the epidural space is done through the sacral hiatus, which is located in the inferior portion of the posterior sacrum and is formed by the lack of fusion of the posterior arches of the fifth sacral vertebra. The sacrococcygeal membrane formed by the intertwined fibres of the sacrococcygeal ligament, covers the sacral hiatus.[1]

The ability to locate the hiatus is the main factor for the success and safety of the caudal epidural anaesthesia. Considerable variability occurs in the anatomy of the sacral hiatus among individuals of seemingly similar backgrounds, race and stature. Also, with advancing age, the overlying ligaments and the cornua thicken, consequently making the identification of the hiatal margins more challenging. There seems to be resistance to caudal epidural anaesthesia, with the major points of criticism being, the cumbersome nature of the procedure as well as the high chance of failure.[2]

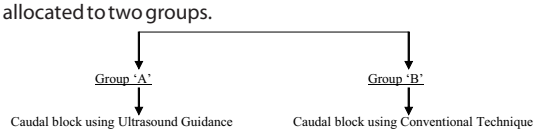
Sacral epidural anaesthesia conducted under fluoroscopic guidance has been acknowledged as the "gold standard" technique as it improves the efficacy and accuracy. This however carries the risk of radiation exposure, especially to the gonads which lie in close proximity to the sacrum.[3]

Ultrasound is a safe and non invasive tool that can be readily used without the involvement of any radiation exposure. The real time images allow the user to see the spinal anatomy, identify the midline and predict the depth of the epidural space. The optimal site for needle puncture can be located and the trajectory of the needle can be traced. Ultrasound is however, operator dependent and a sound idea of the sonological images of the various anatomical structures is needed.[4]

There are few studies comparing the benefits of ultrasound guided caudal blocks vis a vis the conventional technique in adults. Furthermore, there is a paucity of such studies among Indian subjects. Our study was conducted to elucidate the role of ultrasound in improving the success rate and decreasing the need of multiple punctures in caudal epidural anaesthesia in adult patients, thereby improving the overall patient comfort during the procedure and physician acceptance.

MATERIALS AND METHODS

The study was carried out in the Department of Anaesthesiology and Intensive Care at VardhmanMahavir Medical College, New Delhi, after seeking ethical clearance. American Society of Anaesthesiology (ASA) Grade I and Grade II patients between the age of 18-65 years of either gender undergoing elective perianal surgery were included in the study. The patients were randomly allocated to two groups.



Patients with BMI >25 kg/m2, any active sensory or motor deficit, sepsis at the proposed site of injection, or with coagulopathies were excluded from the ambit of the study. Mentally challenged patients and those not consenting for the procedure were also excluded. Patients allocated to group A received the caudal block using ultrasound guidance, while those allocated to group B received the

block using the conventional technique. The patients in group A were placed in prone position with a bolster under the pubic symphysis. With all aseptic precautions, ultrasound scanning of the sacrum was done to assess the relevant anatomy. Ultrasound imaging was performed using a portable ultrasound echographic device (L'Imagine Agile, KONTRON MEDICAL, USA) with a linear probe. Sagittal and transverse scanning was done at the sacral hiatus using a (5-7 Hz) linear transducer.The site of injection was infiltrated with 1% preservative free Lignocaine. Following this, an 18Gauge Touhy needle was inserted in the midline under ultrasound guidance (transverse scanning) [fig 1]. After piercing the sacrococcygeal membrane, the transducer was turned 90° to obtain a longitudinal view (sagittal scanning) [fig 2]. The needle was then advanced under sagittal visualization and 15ml of 0.5% preservative free Bupivacaine was injected after confirming its position in the sacral hiatus, and negative aspiration of blood and cerebrospinal fluid. The patient was then turned back into supine position.The patients in group B were positioned, draped and prepared in a manner similar to group A. The site of the sacral hiatus was palpated and an 18Gauge Touhy needle was inserted in the midline of the canal. Epidural space was confirmed by the characteristic give of the sacrococcygeal ligament. Loss of resistance to flow of saline was used to confirm the correct placement of the needle. Following this, 15ml of 0.5% Bupivacaine (plain) solution was injected through the needle, after confirming negative aspiration of blood and cerebrospinal fluid.

A successful block was defined by loss of response to painful stimulus in the form of pin prick in the dermatomes supplied by the sacral segments bilaterally and loss of anal sphincter tone. Number of attempts and time taken to perform the block were recorded. The patient graded the level of comfort and satisfaction after the procedure on a scale of 1-5. The five point scale was as follows ; 5=very good, 4=good, 3=satisfactory, 2=unpleasant, 1=very unpleasant.

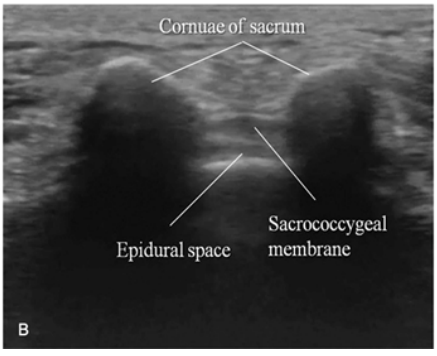


Fig. 1: Sonographic image of the caudal space in transverse view.

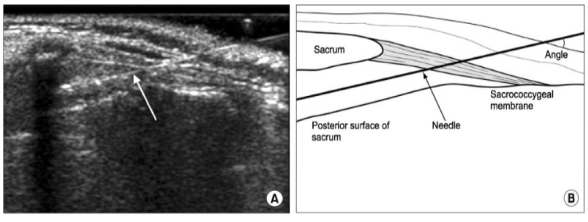


Fig. 2: Sonographic image (A) and schematic drawing (B) of the caudal space in longitudinal view. The white arrow indicates the needle

STATISTICAL ANALYSIS

Data was presented as categorical and continuous variables. Categorical variables were presented in number and percentage (%). Continuous variables were presented as mean ± SD.

For comparing the statistical significance of qualitative variables, Chi square/ Fishers exact test was used. For quantitative variables, statistical significance was determined by unpaired student t-test or the non parametric Mann- Whitney test. $P < 0.05$ was taken as a level of statistical significance. The data was analysed by the most recent version of SPSS Statistical Software.

RESULTS

All demographic variables like age, height, weight, BMI and ASA status showed a statistically similar distribution in both Group A and B. We noted the following results at the end of our study (Table 1.1).

Table 1.1 Comparison of various observations between Group A and Group B

Observations	**Group A** (USG guidance)	**Group B** (Conventional Technique)	**P - Value**
Successful Block	94%	78%	0.04
Number of needle insertions	1.38±0.6	1.92±0.78	<0.0005
Number of needle redirections	0.98±1.02	2.7±1.59	<0.0005
Time taken to perform the procedure	8.82±0.92 mins	10.78±2.5 mins	<0.0005
Patient Satisfaction Score	4.24±0.87	3.42±0.86	<0.0005

All the ultrasound guided caudal blocks were performed without any evidence of intravascular or intrathecal injection of drug during the procedure. The caudal blocks using the conventional technique, also did not result in any intravascular injections. We however, encountered one case of accidental dural puncture while performing the block using the conventional landmark technique. Regional anesthesia related adverse effects such as nausea, vomiting, dizziness and seizures were not observed in our study.

DISCUSSION

When a local anaesthetic solution is injected into the sacral canal, it ascends upwards in the extradural space for a distance which is determined by numerous factors including - volume of solution, force of injection, amount of leakage through the eight sacral foramina, consistency of connective tissue in the space. While the first two are controllablethe latter are not. Hence, the unpredictability of the block and the unexpected results. The rate of successful needle placement in the caudal space using conventional technique varies between 74.1% and 91.3%.[5] The ultrasound guided caudal block has been found to be successful in 94% to 100% subjects.[6, 7] We were able to establish a successful caudal block using ultrasound guidance in 94% patients. This was found to be statistically superior in comparison to a success rate of 78% using the conventional technique. Our findings reiterate the fact that ultrasound is an effective tool in improving the overall success rate of caudal epidural block.

We believe that the time taken to perform the block using either technique depends on a number of factors such as the operator's expertise, amount of assistance available and patient comfort and cooperation. We attribute the comparatively less time taken to perform the block using ultrasound guidance to the relative ease in locating the sacral hiatus. Ultrasound guided blocks also resulted in lesser needle insertions and redirections, resulting in relative ease in performing the procedure, and improved patient comfort and cooperation, as was evident from the higher patient satisfaction scores.

We encountered one case of dural puncture using the conventional technique. There have been a few reports of inadvertent dural puncture during the caudal approach caused by an abnormally low termination of the dural sac in the sacral canal. In adults, the dural sac generally terminates at the 2nd sacral vertebra.[8] However, a cadaveric study reported terminations of the dura at the 3rd sacral vertebra level in about 8%, suggesting a potential risk of accidental

dural puncture during caudal injections.[9]

There is another important limitation to this method. Inadvertent intravenous injection, which has been reported to occur in about 5% to 9% of procedures, cannot be avoided with this technique, because aspiration of blood does not appear to be very sensitive or specific for intravascular positioning of the needle, with large number of false negatives.[10]

Our initial experience suggested that ultrasound guided caudal blocks were technically demanding.Technically, it can be difficult to simultaneously stabilize and advance the Tuohy needle, and maintain the acoustic window, holding the ultrasound probe in the optimal position. However, as the learning curve progressed, we became more comfortable with the technique, and also noticed an overall reduction in time taken and improved patient satisfaction. We envision that as ultrasound technology continues to improve and as more anesthesiologists embrace it and acquire the skills necessary to perform ultrasound guided caudal blocks, it may become the standard of care for anorectal surgeries in the future.

REFERENCES

1. Crighton IM, Barry BP, Hobbs GJ. A study of the anatomy of the caudal space using magnetic resonance imaging. Br J Anaesth 1997; 78: 391–395.
2. Busoni P, Sarti A. Sacral Intervertebral epidural block. Anaesthesiology 1987; 67: 993 – 995.
3. Manchikanti L, Cash KA, McManus CD, Pampati V, Abdi S. Preliminary results of randomized, equivalence trial of fluoroscopic caudal epidural injections in managing chronic low back pain: Part 4. Spinal stenosis. Pain Physician 2008; 11: 833–848.
4. Senoglu N, Senoglu M, Oksuz H. Landmarks of the sacral hiatus for caudal epidural block: an anatomical study. Br J Anaesth 2005; 95: 692–695.
5. Hadzic A – The New York School of Regional Anesthesia: Text¬book of Regional Anesthesia and Acute Pain Management, New York, McGrawHill Medical, 2007;269-283, 727-745.
6. Carl P, Chen C. Ultrasound Guidance in Caudal Epidural Needle Placement. Anesthesiology 2004; 101:181– 4.
7. Nikooseresht M, Hashemi M, Mohajerani SA, Shahandeh F, Agah M. Ultrasound as a Screening Tool for Performing Caudal Epidural Injections. Iran J Radiol. May 2014; 11(2).
8. Klocke R, Jenkinson MB, Glew D. Sonographically guided caudal epidural steroid injections. J Ultrasound Med 2003; 22:1229-1232.
9. SenogluN, Senoglu M, Ozkan F, Kesilmez C, Kizildag B, Celik M. The level of termination of dural sac by MRI and it's clinical relevance in caudal epidural block in adults. Surg Radiol Anat 2013; 35: 579-584
10. Fukazawa K, Matsuki Y, Ueno H, Hosokawa T, Hirose M. Risk factors related to accidental intravascular injection during caudal anesthesia. J Anesth. 2014;28:940–943.