

“To Assess The Efficacy Of Nerve Stimulation In Identifying The Correct Caudal Epidural Needle Placement In Adults.”

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Abstract:

Background: Caudal epidural block is useful to provide anaesthesia for perineal and penile surgical procedures and also in pain procedures in the adults like suffering from Chronic pain problems such as leg pain after prolapsed intervertebral disc. In blind caudal epidural block (CEB), incorrect needle insertion has been reported to occur in 15% to 38% of attempts. There had been lots of assessment techniques used in past like whoosh test, loss of resistance, swoosh test but have lesser success rate. Hence, In this study we assessed the efficacy of peripheral nerve stimulator as a tool to identify caudal epidural space in adults.

Objective: To test the efficacy of nerve stimulation in identifying the correct caudal needle placement in adults.

Methods: Twenty five patients of age between 30yrs to 65yrs were enrolled in the study having chronic low back pain or posted for perineal or penile surgery. Patients with symptoms requiring emergency surgery, any active sensory or motor deficit and pregnancy were excluded. A 22- gauge insulated needle was inserted into the caudal canal via the sacral notch until a “pop” was felt. The needle placement was classified as correct or incorrect depending upon the presence or absence of anal sphincter contraction (S2-S4) to electrical stimulation (1 to 5mA).

Results: Two patients were excluded because the patient’s anatomy precluded any attempt at a caudal block. The sensitivity and specificity of the test were both 100% in predicting clinical outcomes of the caudal block. Four patients had a negative stimulation test after the first attempt to place the needle. All of them went on to receive a second attempt of needle insertion after a subcutaneous bulge or resistance to local anesthetic injection were observed. Following needle reinsertion, positive stimulation tests were elicited. These patients received the local anesthetic injection or steroid injection with ease and had good analgesia postoperatively. The positive predictive value of the test was greater than the presence of a “pop” alone ($P < 0.05$) but not significantly different ($P = 0.492$) over the presence of “pop” and easy injection.

Conclusion: Peripheral nerve stimulator improves the efficiency, safety and patient comfort of caudal block in adults; and make it a practical and viable option. This test may be used as a teaching and adjuvant tool in performing caudal block in setup with limited resources.

Keywords: peripheral nerve stimulator, caudal epidural block, sacrococcygeal ligament, Pop up, loss of resistance.

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I. Introduction

Caudal epidural block (CEB) involves injection of drug into the caudal epidural space through sacral hiatus usually in lateral position or prone position. It has been profoundly in use in paediatric age groups for various surgical procedures. There has been limited number of studies in adults due to difficult anatomical curvature and accessibility.

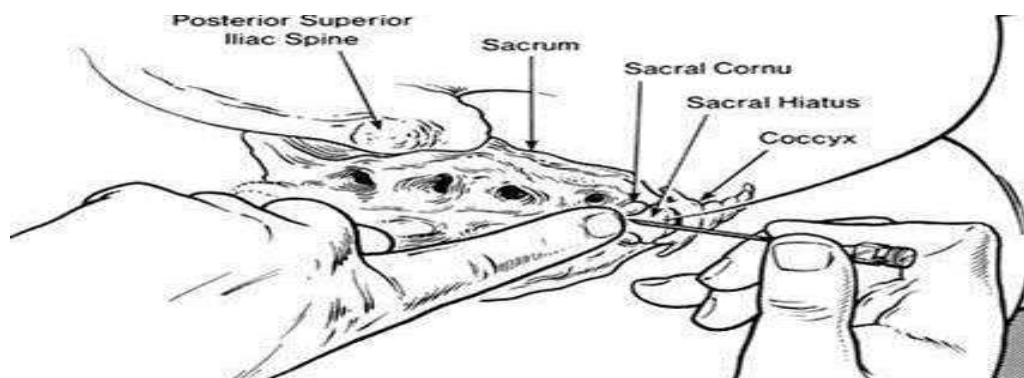


Fig: The needle is advanced until bone is contacted at an angle of 45, and then slightly withdrawn to redirect and inserted to pierce sacrococcygeal membrane to feel the pop test.

In adults it involves injection of a drug into the epidural space through the sacral hiatus to provide analgesia and anaesthesia in various clinical settings.^{1,2} The sacrum articulates with the fifth lumbar vertebra above and the coccyx below. The remnants of the inferior articular process elongate downwards on both sides of the sacral hiatus. These two bony processes are called the sacral cornua (horns) and define important clinical landmarks during CEB.^{3,4} The sacral hiatus is located at the distal (caudal) part of the sacrum and its lateral margins are formed by the two sacral cornua. The sacral hiatus is shaped by incomplete midline fusion of the posterior elements of the distal portion of the fifth or sometimes the fourth sacral vertebra. The hiatus is covered only by skin, a subcutaneous fatty layer and the sacrococcygeal membrane.⁵ The distal most portion of the dural sac and the sacral hiatus usually terminate between levels S1 and S3. The main goal of this study is to identify correct caudal epidural space using peripheral nerve block approach in adults.

II. Material And Methods

This interventional study was conducted at Operation Theatre, Bokaro General Hospital after taking ethical committee approval. A total 25 adult subject (both male and females) were for in this study.

Study Design: Interventional study

Study Location: This was a tertiary care teaching hospital based study done in Department of Operation theatre, Bokaro General Hospital, Bokaro, Jharkhand.

Study Duration: from Jan2022 to July 2022

Sample size: 25 patients.

Sample size calculation: The sample size was estimated on the basis of 80% power and level of significance 5%. The sample size obtained for this study was came out to be 25 patients.

Subjects & selection method: The study population was drawn from surgical patients who were posted for perineal, penile procedures and gave consent for the intervention required.

Inclusion criteria:

- 1.Both males and females
- 2.Aged \geq 18 years
- 3.Patients posted for perineal and penile surgeries
- 4.Chronic low back pain procedures.

Exclusion criteria:

- 1.Pregnant women;
- 2.Any emergency surgery
- 3.Any active sensory or motor deficit

Methodology

After written informed consent was obtained, the basic parameters like socio-demographic

characteristics such as age, gender, sex, body mass index and ASA grading recorded. All blocks were performed on awake patients after securing i.v. access and following establishment of ASA standard monitoring. Patients were positioned in lateral position with legs flexed up.

Under aseptic precautions, PNS needle (Stimplex, Braun) was inserted at an angle of 45° to the skin and advanced until a "give" or "pop" was felt as the needle penetrated the sacrococcygeal membrane. The output current was gradually increased from zero until motor activity or twitch response in the anal sphincter (S2-S4) was visible. Depending on the observed Response to current stimulation (1 to 5 mA), the needle placement considered to be correct or incorrect according to the test criteria.

Statistical Analysis

Data was analyzed using SPSS version 20. Student's t-test was used to ascertain the significance of differences between mean values of two continuous variables and confirmed by nonparametric Mann-Whitney test. Chi-square and Fisher exact tests were performed to test for differences in proportions of categorical variables between two or more groups. The level P < 0.05 was considered as the cutoff value or significance.

III. Observation and Results

Based on methodology 25 patients were observed for the success of caudal epidural block using peripheral nerve stimulator as assessing method. This study takes Test Criteria as confirmation for the success. We ensured that none of patients had received any local anesthetic via caudal needle prior to the testing.

Table1:

Positive criteria	Negative criteria
<input type="checkbox"/> The current should be within 1 to 5 mA for anal sphincter (S2-S4) contraction response.	<input type="checkbox"/> If the current needed is less than 1 mA, it is likely to be subarachnoid placement or directly against a nerve root.
<input type="checkbox"/> The motor response should be unchanged in term of strength or location regardless of placement of the anode grounding electrode.	<input type="checkbox"/> The needle is not in the caudal epidural space and is likely posterior to the sacrococcygeal membrane (ie., subcutaneous)

Table2: Observation of Demographic parameters:

Demographic parameters (n=25)	
Age(yrs)	48years(average)
Weight (kg)	56kg (average)
Sex (M/F)	18 Males/ 07 Females
ASA PS 1	09(36%)
ASA PS 2	16(64%)

Table 3: Predictive value of test:

Predictive value of test			
Tests	Caudal successful	Caudal unsuccessful	Predictive value(%)
"Pop" present	19	06	76.0
"Pop" present and easy injection	19	04	82.6
Positive stimulation	19	04 on 2 nd attempt	100

Based on pop test, predictability of success of peripheral nerve stimulator was observed.

Fisher exact test was used to compare the positive predictive value between the new test and the standard method (i.e., "pop" alone and "pop" and easy injection). Differences among predictive values were considered statistically significant when $P < 0.05$.

Table4: Reliability of test:

Reliability of test			
Stimulation	Caudal successful	Caudal unsuccessful	Total
Positive	19	00	19
Negative	00	04	04*
Total	19	04	23

It was calculated by success of caudal epidural block with positive stimulation.

Sensitivity and specificity of the new test=100%, positive and negative predictive value=100%
*four patients underwent second attempt.

Table 5: Observation of Reattempt cases:

Observation of Reattempt cases				
Age	1 st attempt Test result	Clinical assessment	2 nd attempt test result	Clinical assessment
40yrs/M	Negative(5mA,back muscle twitch)	Resistance upon injection	Positive (2.5mA)	Easy Injection, good postoperative pain relief
54yrs/M	Negative(5mA,back muscle twitch)	Bulging upon injection	Positive (2.0mA)	Easy Injection, good postoperative pain relief
60yrs/M	Negative(5mA,back muscle twitch)	Bulging upon injection	Positive (2.0mA)	Easy Injection, good postoperative pain relief
63yrs/M	Negative(5mA,back muscle twitch)	Resistance upon injection	Positive (1.8mA)	Easy Injection, good postoperative pain relief

IV.Discussion

Earlier Ban C. H. Tsui, et al⁷ had studied in 32 pediatric patients and found Peripheral nerve stimulator(1-10mA) to be effective tool for identification of caudal epidural space. Blind Caudal epidural block is difficult in adult age group and have successful rate of 62 to 75% only as documented by Price et al⁹ and Bartynski et al¹⁰. In our study we have determine the efficacy of PNS tool. Sensitivity and specificity of the tests applied were both 100% in predicting clinical outcomes of the caudal block using Peripheral Nerve Stimulator as tool. Two patients were excluded because the patient's anatomy precluded any attempt at a caudal block. Four patients needed 2nd attempt to achieve positive stimulation test. All patients received drugs with ease and had good anaesthesia and analgesia postoperatively.

The positive predictive value of the test with presence of a "pop" alone $P < 0.05$ and $P = 0.490$ over the presence of "pop" and easy injection. Our study had been found to have similar results in aspects of swoosh technique i.e R. M. L'E.Orme¹⁵ had studied swoosh technique for identification of caudal epidural space in 113 children undergoing elective surgery and Ban C. H. Tsui¹⁶, et al also had studied among 108 patients with a successful block, 98 had a positive 'swoosh' test, there were no false positive results.

Drugs in our study used were 15ml of 2% lignocaine+ 8ml of 0.5% Bupivacaine(19 surgical cases) for surgical procedures and 9ml of 0.5% lignocaine + 40mg of inj Methylprednisolone for chronic pain procedures (4 patients- 3M/1F). Caudal epidural block in adult population is gaining importance because of increased successful rate using PNS, USG and Fluoroscopic guidance as tool. It has lesser complications and safer to use. Chronic pain procedures requiring caudal epidural block shows prolonged successful recovery as compared to other methods. Kumar K, Nath et al²² had used spinal cord stimulation techniques for the treatment of chronic pain and electrical stimulation methods for localizing peripheral nerves have been used for decades. In recent years there has been on study by Anupam sharma et al²³ that had studied reliability of various assessment techniques for identification of caudal epidural space in children and conclude nerve stimulator to be excellent objective tool. Our study had been conducted in adult patients and found nerve stimulator as excellent tool having less failure rates.

V.Conclusion

For easy localization of caudal epidural space, peripheral nerve stimulator machine should be preferred. Peripheral nerve stimulator is medical boon in peripheral hospital establishments where ultrasonography machine is not available. Further studies is recommended as we have included only small sample size for observation.

References

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