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"EFFICACY OF CAUDAL ANAESTHESIA USING NERVE STIMULATOR IN PAEDIATRIC PATIENTS

Anaesthesiology

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ABSTRACT

INTRODUCTION – Caudal anaesthesia is most commonly performed regional anaesthetic technique in paediatrics patients. Although simple to learn and perform, the success rate of the block may be variable. So the aim of the study is to know the success rate of caudal anaesthesia using nerve stimulator in pediatric patients.

METHODS – A total of forty two cases were involved in our study out of which only forty patients received caudal anaesthesia. After inducing general anaesthesia, Caudal anaesthesia was given using a 5cm stimuplex® needle. After pop off was felt in caudal space nerve stimulator was connected and positive or negative response is noted. postoperative pain was assessed by CHEOPS score.

RESULTS – Among forty patients the test showed the sensitivity and specificity of nerve stimulator to predict caudal anaesthesia was 94.44% and 75% respectively. Test showed positive predictive value of 97% and negative predictive value of 60%. Even though pop was felt and local anaesthetic was injected without resistance/ subcutaneous bulge in all forty patients, only thirty six of the patients developed good postoperative analgesia as assessed by CHEOPS scoring. Remaining patients were maintained with opioids and NSAIDs.

CONCLUSION- Caudal anaesthesia using nerve stimulator has got good success rate and can be used in adjunct to pop off technique with high sensitivity and specificity values. Nerve stimulator is a good predictor of needle placement in caudal space

KEYWORDS

Caudal anaesthesia, Nerve stimulator, Paediatric patients

INTRODUCTION

Paediatric caudal anaesthesia not only improves intraoperative and postoperative pain relief, but also promotes earlier ambulation, reduces time spent in the catabolic state and lowers circulating stress hormones[6]. Successful caudal anaesthesia relies on the proper needle placement in the caudal space. There are several ways to identify the caudal space with the most common being detecting the characteristic "give" or "pop" when the sacrococcygeal ligament is penetrated [1,5]The lack of subcutaneous bulging or resistance on injection of local anaesthetic are also important signs of proper needle placement. However, final confirmation of the proper needle placement can be made only after observing the clinical effect of the injected medication. Although easy to perform, even with experienced physicians, the failure rate of "pop" method of placement of needles into the caudal space can be up to 25%[1].

The nerve stimulation test is easy, reliable, quick, safe method to confirm caudal needle placement[1]. The purpose of this study was to examine the practicality of using nerve stimulator in the placement of the needle into the caudal epidural space and to identify the predictive role of nerve stimulator in locating the caudal space in paediatric patients.

MATERIALS AND METHODS

After obtaining the ethical committee clearance, paediatric patients who were posted for various lower abdominal, urogenital and lower limb surgeries during the period of July 2017 to September 2017 were included in the study with informed consent of the patient's parents. Patients <8yrs undergoing elective minor / major surgeries with ASA grade 1, 2 were included in the study. Patients with spinal cord/ vertebral/ anorectal malformation, meningitis, increased intracranial pressure, patients who were too ill preoperatively and the parents who did not consent for caudal anaesthesia were excluded from the study. Total sample size was forty two among which only forty patients could be included in the study. Patients were premedicated according to institutional protocols. After shifting to operating theatre, pre induction monitors were connected to the patient. Under aseptic precautions, caudal anaesthesia was performed after the induction of general anaesthesia with inhalational or/and intravenous agents without neuromuscular agents with bag mask ventilation. Patients turned to lateral position and sacral hiatus identified by palpation using bony landmarks. 5cm insulated stimuplex® needle (B Braun) inserted into sacral hiatus until the anaesthesiologist feels the "give" or "pop" as needle penetrates through sacrococcygeal membrane. After anaesthesiologist was satisfied with needle placement a separate investigator connects the nerve stimulator and confirms the needle placement in caudal space. After negative aspiration, local anaesthetic (0.25% bupivacaine according to armitage formula) will be injected by anaesthesiologist who felt pop off and careful observation for no subcutaneous bulge at the site of injection.

The output current in nerve stimulator was gradually increased from zero until motor activity or twitch response in the anal sphincter (S2-4) was visible. Correct placement is indicated by a motor response (anal sphincter contraction) elicited with a current between 1 mA and 10 mA. If current required is more than 10mA then needle is taken out and repositioned. Any motor response observed with a significantly lower threshold current (less than 1 mA) may indicate needle placement is in the subarachnoid space or is in close proximity to a nerve root. So needle is replaced. If there is subcutaneous bulge at the site of injection, CSF/blood aspirated through caudal needle, needle will be taken out and was repositioned. Postoperative pain assessed by CHEOPS pain scores[7] by anaesthesiologist who was blinded for nerve stimulator results.

RESULTS

A total of forty two patients were considered for the study among which only forty were included in study. In two patients who were excluded from study one patient had difficulty in locating the caudal space. In another patient blood was aspirated from caudal needle even after repeated attempts so caudal procedure was abandoned and both patients were maintained with postoperative opioids and other analgesics. Mean age of our study group was 4.2yrs. Age of the patients varied from 2months to 8yrs. 31 were male patients & 9 were females. Various below the umbilicus surgeries were done which includes 28 urogenital surgeries, seven orthopedic procedures, five appendectomies.

Among these forty patients, anaesthesiologist could feel pop off in all patients; local anaesthetic was injected in all patients. Investigator attached the nerve stimulator and caudal needle placement was tested for positive or negative response in all of them.

Out of forty patients, thirty-six patients developed good postoperative analgesia assessed by CHEOPS score. Four patients did not develop postoperative analgesia instead of satisfactory pop off with no resistance/subcutaneous bulge to local anaesthetic injection into caudal space.

Out of forty patients, thirty five patients showed nerve stimulator positive i.e placement of needle in caudal space showed positive anal sphincter contraction within the current range of 1 to 5mA. Among

which thirty four had good postoperative analgesia and one patient had poor postoperative analgesia as shown by CHEOPS scores. Remaining five patients showed negative results for nerve stimulator among whom two patients had good postoperative analgesia.

Table 1. RESULTS OF NERVE STIMULATOR TEST AND DEVELOPMENT OF POSTOPERATIVE ANALGESIA

	Nerve Stimulator +	Nerve Stimultor -	
Postoperative analgesia +	34	2	36
Postoperative analgesia -	1	3	4
Total	35	5	40

The nerve stimulator test had the sensitivity of 94.44%, specificity of 75%. It showed positive predictive value of 97% and negative predictive value of 60%. Pop off was felt in all patients in our study. Five patients had poor CHEOPS scoring instead of pop off feel and local anaesthetic injection without any subcutaneous bulge or resistance. These patients were maintained with opioids and NSAIDs without any major complications.

DISCUSSION

Caudal anaesthesia is a well known regional anesthetic technique in paediatric patients because of its simplicity, easy anatomical locations. Although simple to learn and perform, the success rate of the caudal block may be variable.

Pop off or give away technique while passing through sacrococcygeal ligament was the routinely used technique to administer caudal anaesthesia. Other methods used to identify caudal space are the "whoosh" test, "swoosh" test, nerve stimulation[6], ultrasound[6] and fluoroscopy. Whoosh test which includes injecting air and swoosh test which involves injecting saline into caudal space are also used now a days. But they have their own disadvantages. Ultrasound and fluoroscopy needs expertise and men power to administer caudal in pediatric patients. So nerve stimulator technique is safe, simple tool which can be used to locate caudal space in children with no side effects. It can also help us to know accidental needle placement into intravascular or intrathecal space (positive response for <1mA).

Among forty two patients, only forty patients could be included in the study. 2 patients who were not included in the study in which one patient had blood on aspiration, in other patient anatomical landmarks were not satisfactory. Remaining 40 patients received caudal anesthesia under general anaesthesia. Under general anaesthesia, there is risk of nerve injury by the needle as it may go unnoticed. By using nerve stimulator this risk can be minimized specially in pediatric patients who require general anaesthesia or sedation for regional anaesthetic techniques. None of the patients showed any intraoperative or postoperative complications for the procedure.

In our study, nerve stimulator showed good sensitivity with 94.4%. Studies done by Ban CH Tsui[1] et al show higher sensitive values of 100%. They involved only 30 patients in their study. We found the specificity of 60% but studies done by Ban CH Tsui[1] et al has found specificity of 100%. Ban CH[4] et al conducted another study to confirm epidural catheter placement using nerve stimulator. They found 96.1% sensitivity, 76.9% specificity, positive predictive value 89% and negative predictive value 90%. Our study showed similar results with positive predictive value of 97% but with negative predictive value of 60%.

In our study, there were 5 patients who showed nerve stimulation negative results among which two patients developed good postoperative analgesia. These patients who showed negative results to detect the caudal space using nerve stimulator could have showed positive results if current was increased upto 10mA. But in our institute nerve stimulator had maximum current of 5mA. Many authors[1,2,4] have described the use of current up to 10mA to locate caudal space.

Electrical stimulation methods are well accepted for identifying peripheral nerves when performing regional anaesthesia[4]. Nerve stimulators were used to know epidural catheter placement also. Influenced by the results of these studies nerve stimulator was used to locate caudal space. So this new technique not only helps in finding needle placement in caudal space but also helps to identify subarachnoid or intravascular needle placement thus avoiding major complications during caudal block[8]. Nerve stimulator technique can minimize the inter individual variability which can be seen in whoosh, swoosh test and also in pop off technique as nerve stimulator test relies on objective observation of motor movement.

CONCLUSION

Success rate of caudal anaesthesia can be improved when nerve stimulator test used alone or in conjugation with pop off or other techniques with good sensitivity and specificity. Nerve stimulator is a simple, cost effective technique which has good learning curve and can be used in teaching hospitals also. This technique can also be employed to reduce accidental complications like intrathecal and intravascular injections thus making it safer to use in paediatric population.

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