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# Ivani's 'no turn technique': An easy, safe and effective alternative method for caudal epidural block in children

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## ABSTRACT

**Background**: The caudal epidural block is an effective technique that is very common and popular in pediatric regional anesthesia practice. The conventional method of the caudal epidural block is not free of complication. The "no turn" technique is a very easy approach that reduces the risks associated with the conventional method.

**Aim of the study**: Aim of the study was to evaluate the success rate and safety of the 'no turn technique' for caudal epidural block in pediatric patients.

**Methods**: This is a prospective observational study; 440 patients were enrolled and analyzed. The study was carried out in the period of July 2018 to December 2018 at the Department of pediatric anesthesiology, Bangladesh Shishu Hospital & Institute, Dhaka, Bangladesh. All patients were attempted Ivani's no turn technique of caudal epidural block.

**Result**: The mean time required to perform needle insertion was 0.8minutes.The technique was successfulin435 (98.86%)cases. The successful technique was considered as the needle was placed in caudal space with the absence of a bloody tap Subcutaneous placement of the needle after the first attempt occurred in two cases in the conventional method group and three cases in the new method group. No occurrence of duralpuncture. Among435 cases caudal was successful at the first attempt.3(0.68%) cases.1(0.23%) Patient needed second attempt and another1(0.23%) patient needed third attempt. The technique failed in 1(0.23%)case.

**Conclusion**: Ivani's 'no turn technique' is an easy method with a high success rate and less complications.

**Keywords:** *Ivani, No turn, Caudal and Epidural block*

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## INTRODUCTION

A caudal epidural block is a common regional anesthesia technique in pediatric patients undergoing lower abdominal and lower limb surgeries [1]. It is a simple, safe, and effective method of providing perioperative analgesia and can also relieve postoperative pain [2]. However, the success rate of caudal epidural block can be variable, with some studies reporting failure rates of up to 20% [3]. One of the factors that can contribute to the success of a caudal epidural block is the proper placement of the needle in the epidural space. This can be challenging, especially in pediatric patients, due to the small size of the sacral hiatus and the variation in the anatomy of the sacrum [4]. To overcome these challenges, Ivana et al. developed the 'no turn technique' for caudal epidural block in children [5]. When performing a caudal block, it is important to consider significant anatomical differences between adults and children. Children have a narrower and flatter sacrum compared to adults. At birth, the sacrum comprises five sacral vertebrae that are not fully ossified and continue fusing until age 8. The sacral hiatus is formed due to the incomplete fusion of the posterior arches of the fifth

and sometimes fourth sacral vertebrae, which is covered by a sacrococcygeal membrane. The caudal epidural space can be easily accessed in infants and children through the sacral hiatus. This technique involves inserting the needle into the sacral hiatus without rotating it, which helps to reduce the risk of trauma to the surrounding tissues and increases the block's success rate. While some studies have evaluated the efficacy of the 'no turn technique' in adult patients, there is limited data on its use in pediatric patients in Bangladesh. Therefore, this study aimed to evaluate the success rate and safety of the 'no turn technique' for caudal epidural block in pediatric patients undergoing lower abdominal and lower limb surgeries in Bangladesh.

**METHODOLOGY & MATERIALS**

This is an observational study; 440 patients were enrolled and analyzed. The study was carried out in the period of July 2018 to December 2018at the Department of Pediatric anesthesiology, Bangladesh Shishu Hospital & Institute, Dhaka. The inclusion criteria were children under the age of 0 to 12 years (American Society of Anesthesiologists physical status I to II) undergoing surgery below the umbilicus. This is an observational study; 440 patients were enrolled and analyzed. The study was carried out in the period of July 2018 to December 2018at the Department of Pediatric anesthesiology, Bangladesh Shishu Hospital & Institute, Dhaka. From the anesthesia charts, we recorded patient age, sex, and weight; types of surgeries performed; and details regarding general anesthesia induction and maintenance agents, airway control routes, local anesthetics, and adjuvant drugs. In addition, we also recorded unsuccessful interventions and complications (hypotension, subcutaneous injection, intravascular injection, intraosseous or intracolonic injections). The caudal block was classified as unsuccessful if any analgesia was given in the postoperative care unit.

- **Inclusion criteria:**

All patients with caudal block were included in the study.

- **Exclusion criteria:**

Patients were excluded from the study who had bleeding clotting disorders, local infections, sepsis, abnormal vertebral anatomy, and low body weight (<2kg)

All the caudal blocks were performed by Ivani's 'no turn technique' by three anesthesiology specialists at our hospital. It is easy to detect the sacral hiatus: the landmarks are the sacral cornua and the posterior superior iliac spines. The sacral hiatus may be represented as the tip of an equilateral triangle turned upside down, in which the upper angles are the fine posterior spines. Otherwise, it can be identified by its palpable margins formed by the sacral cornua, remnants of the lower articular apophyses of the fifth sacral vertebra. The right point of the hiatus can be found by palpating the sacral spinous processes. After the last process, carefully moving the index finger down, detecting the dimple surrounded by the sacral cornua is possible. The sacrococcygeal ligament, an elastic membrane connecting the sacral and coccygeal bones, covers the sacral hiatus. The standard technique inserts the needle at a 90-degree angle to the cutaneous plane. After passing, the sacrococcygeal membrane is lowered 30 degrees and then advanced several millimeters into the sacral canal. As described in newborns and infants, there is a severe risk of dural puncture. Inside the operating room, standard monitoring was performed for all children (electrocardiogram, noninvasive blood pressure, peripheral oxygen saturation). Intravenous catheters were placed before the patients were taken to operating rooms. General anesthetic induction was given with IV agents propofol, sodium thiopental orketal. If no IV catheter could be placed, then induction done with sevoflurane inhalation. The airway was controlled by face mask ventilation, Laryngeal mask airways or Endotracheal tube (ETT).Halothane or sevoflurane was used for the maintenance of sedation. Caudal block was performed with the patientinleft lateral decubitus position, caudal after local cleaning using needles of appropriate size under sterile conditions. In our study instead of entering the caudal needle at 80-60 degree to the skin we entered at an angle of 60 degree. When the sacrococcygeal ligament was passed with the classic ‘pop’ sensation we did not turn the needle trying to enter the sacral canal but injected the drug directly there. To evaluate the technique we investigated success rate. We recorded number of attempts and length of time needed to succeed the block. We looked for complications like dural puncture, Intravascular injection and subcutaneous swelling. SPSS was used with descriptive statistical methods (frequency analysis, cross-table analysis, percentage, mean, standard deviation) to evaluate study data and statistical analysis.

**RESULT**

A total of 440 children were enrolled in the study. Age data are presented in Table 1, The failure rate at the first attempt of caudal block was3.1%. The mean time required to perform caudal1.2±0.5 minutes respectively. There were one cases aspirating the needle to find blood and no case to find cerebrospinal fluid. The mean time required to perform needle insertion was 0.8 minutes. The technique was successful in 435 (98.86%) cases. The successful technique was considered as the needle was placed in caudal spsce with the absence of a bloody tap Subcutaneous placement of the needle after the first attempt occurred in two cases in the conventional method group and three cases in the new method group. No occurrence of dural puncture. Among 435 cases caudal was successful at first attempt in. 3(0.68%) cases.

1(0.23%) Patient needed second attempt and another 1(0.23%) patient needed third attempt. The technique was failed in 1(0.23%) case.

**Table 1:** Age distribution of the study population (N=440).

| Age group (Months) | Frequency | Percentage |
|---|---|---|
| <1 | 0 | 0.00 |
| 1-12 | 48 | 10.91 |
| 13-24 | 57 | 12.95 |
| 25-36 | 80 | 18.18 |
| 37-72 | 158 | 35.91 |
| >72 | 97 | 22.05 |
| Total | 440 | 100.00 |

**Table 2:** Distribution according to operation type and local anesthetic.

| Types of surgery | N. of patients | Percentage |
|---|---|---|
| Circumcision | 51 | 11.59 |
| Inguinal hernia | 207 | 47.05 |
| Hydrocele | 98 | 22.27 |
| Undescended testicles | 35 | 7.95 |
| Hypospadias | 27 | 6.14 |
| Others | 22 | 5.00 |
| Total | 440 | 100.00 |

**Table 3:** Distribution according to methods used for induction, maintenance and airway control.

| Anesthesia induction | | | Anesthesia maintenance | | | Airway control | | |
|---|---|---|---|---|---|---|---|---|
| | N | % | | N | % | | N | % |
| Propotofol | 279 | 63.40 | Sevoflurane | 374 | 85.00 | Mask | 13 | 2.95 |
| Ketofol | 83 | 18.86 | Halothane | 62 | 14.09 | cLMA | 154 | 35.00 |
| Thiopental | 48 | 6.82 | TIVa | 4 | 0.91 | PLMA | 193 | 43.86 |
| Sevoflurane | 30 | 4.55 | - | - | - | ETT | 80 | 18.18 |

**Table 3:** Success rate of block

| | Number | Percentage (%) |
|---|---|---|
| Success at first attempt | 435 | 98.86 |
| Number of second attempt | 7 | 1.59 |
| Failure to perform technique | 2 | .45 |
| Success rate | 436 | 99 |

**Table 4:**Complications among the study population.

| Complications | Frequency |
|---|---|
| Intrathecal injection | 0 |
| Inravascularinjectio | 1 |
| Subcutaneous infiltration | 0 |

## DISCUSSION

Caudal block is increasingly used in pediatric regional anesthesia practices to provide effective postoperative pain relief in children undergoing sub-diaphragmatic surgeries [6,7-9]. Since many of these surgeries are day-case procedures, it is important to ensure that postoperative pain is effectively managed safely. Caudal block has the added benefit of reducing the need for systemic analgesics. Bupivacaine is the most commonly used local anesthetic agent for caudal block due to its long-lasting effects and well-known side effects [7,10]. A single-shot injection of bupivacaine provides effective postoperative analgesia [7,8]. For inguinal surgeries, 2-2.5 mg/kg of bupivacaine is typically given caudally, providing postoperative analgesia for 2 to 4 hours without additional analgesics [7].During caudal block, the most frequent complications due to the technique encountered were vessel perforation (1.6%-10.6%) and subcutaneous infiltration (5%-19%). A more serious complication was dural puncture, which has been reported by Begeç et al, 5/2262 (0.22%); Veykemans et al,1/1100 (0.09%); and Dalens et al,1/750 (0.13%)[8,9]. In contrast complications encountered in our study were only 1 case of vessel perforation. There has been no subcutaneous infiltrsation and duralpuncture. In a study done by Karaca O, et demonstrated that although both the conventional caudalblock and USG guided caudal block had no effect on the block success rate and block performing time, the USG guided caudal block increased the success rate of first puncture and reduced the complications such as vascular puncture or subcutaneous tissue

bulging.[10]Ultrasound-Guided versus Conventional Caudal Block in Children: A Prospective Randomized Study. European journal of pediatric surgery : official journal of Austrian Association of Pediatric Surgery ... [et al] = Zeitschrift fur Kinderchirurgie, 29(6), 533–538[11]. In our practice Although there are reports that needles without stylets can cause epidermal-dermal cell transportation during caudal and spinal blocks, we encountered this problem in only three patients due to increased experience performing caudal blocks [12,13]. Other complications include hypotension, total spinal block, arrhythmia, and injection into the bone, colon, or intravascular area. Single-shot caudal block with local anesthetic has proven to be a suitable and effective method for day-case surgeries, particularly in pediatric patients. Although the advent of fluoroscopy and ultrasound has markedly improved the success rates of caudal epidural injection, neither fluoroscopy nor USG is available in most of the healthcare facilities and is not affordable by many third world countries [14]. Even in advanced country like the USA, most single-injection caudal blocks in children take place without any technical aids or imaging[15]. So, for practical reason it is imperative not to be too much dependent on expensive technical aids; rather more attention is necessary to develop clinical skills and new techniques. No turn technique of caudal block is a safe, easy, and effective anesthetic technique that can be used for sub-umbilical surgeries in children and infants with a high success rate and a low incidence of complications or side effects.

***Limitations of the study:***

*Every hospital-based study has some limitations and the present study undertaken is no exception to this fact. The limitations of the present study are mentioned. Therefore, the results of the present study may not be representative of the whole of the country or the world at large. The number of patients included in the present study was less in comparison to other studies. Because the trial was short, it was difficult to remark on complications and mortality.*

## CONCLUSION AND RECOMMENDATIONS

The variability in anatomical structures can challenge successful caudal epidural block using a blind technique. However, the use of imaging technology, such as fluoroscopy and ultrasound, has significantly improved the success rates of this procedure. While fluoroscopy remains the gold standard, its limited availability and potential radiation exposure make it less practical in certain settings. In contrast, ultrasound has emerged as a viable alternative to fluoroscopy, with accumulating evidence showing comparable outcomes. Therefore, when fluoroscopy is unavailable, ultrasound should be the preferred method for guiding caudal epidural injection.

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