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# Comparative evaluation of single level paravertebral block versus caudal block for postoperative analgesia in pediatric inguinal surgery

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## ABSTRACT

**Background and Aims:** To compare and evaluate the efficacy of Single Level Paravertebral Block (SLPVB) with Caudal Block (CB) using 0.2% ropivacaine. **Materials and Methods:** A prospective study was performed for 40 children aged 2-8 years, undergoing paediatric inguinal hernia repair. They were divided into 2 groups, of 20 patients each, and SLPVB or CB was administered. They were followed up for 24 hours and assessed for efficacy of the block in terms of duration of analgesia and quality of block as assessed by FLACC score. The amount of rescue analgesia used, parent satisfaction, and complications if any were also noted. The data collected was analyzed using SPSS software version 17 and a P value of <0.05 was considered significant and appropriate tests were applied. **Results:** The mean duration of action was found to be 1001.25±564.34 minutes (Median 1440 and IQR 975 minutes) in CB and 1440 minutes (Median 1440 IQR 0) in the PVB. This was statistically significant (P value = 0.03). The efficacy of the block as assessed by the FLACC score was comparable in the two groups. Rescue analgesia was required in 8 patients in the CB as compared to none in the PVB. The parent satisfaction levels were also significantly higher with PVB as compared to CB. No complications were noted with PVB. Failure of block occurred in 1 patient with CB, and there was complaint of urinary retention in 3 patients in the same group. **Conclusion:** SLPVB has been demonstrated to be superior to CB to provide postoperative analgesia children undergoing inguinal hernia surgery.

**Key words:** Analgesia, Caudal, Inguinal, Lumbar, Paravertebral, Ropivacaine

## INTRODUCTION

Introduction of regional anaesthetic techniques into modern pediatric anaesthesia has revolutionized pain management. Regional anaesthesia also reduces general anaesthesia requirement, thereby reducing the potential risks associated with deeper planes of anaesthesia<sup>1</sup>.

Surgeries through inguinal approach like orchidopexy, orchidectomy and especially inguinal hernia repair are fairly common surgeries in paediatric population. This type of surgery can cause significant discomfort postoperatively and CB is often used to provide pain relief<sup>2</sup>. However single shot CB has the disadvantage of short duration of action with more children needing supplementary analgesia in the immediate postoperative period.

Paravertebral block has been used for postoperative analgesia in children since 1992. It provides excellent pain relief following both continuous and multi-level nerve stimulator – guided techniques<sup>4</sup>. Through this study we evaluated if a single level, single injection paravertebral block can provide longer duration of analgesia with lesser requirement to supplement analgesia than single shot caudal block for children undergoing inguinal surgery.

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**How to cite this article:** Saini SS, Saxena KN, Taneja B, Bansal S. Comparative evaluation of single level paravertebral block versus caudal block for postoperative analgesia in pediatric inguinal surgery. Northern Journal of ISA. 2017;2: 47-51.

This study compared the effect of caudal block versus SLPVB using 0.2% Ropivacaine following inguinal surgery in children in terms of postoperative analgesia and complications encountered during the study.

## MATERIALS AND METHODS

This prospective randomized study was conducted in a tertiary care Centre and Institutional ethics committee clearance was obtained.

Forty Children of the age group of 2 years to 8 years, posted for inguinal hernia repair surgery were enrolled for the study over a period of 1 year. Written informed consent was taken from the parents of the children.

Inclusion Criterion included children who were American Society of Anaesthesiologists (ASA) grade 1 and posted for inguinal hernia surgery. Children with history of allergy to local anaesthetics, coagulation abnormality or bleeding disorders or with infection at the site of the block or any abnormality or disease of the spine were excluded from the study.

A detailed pre anaesthetic check up was carried out in all the cases.

Patients were randomly allocated by computer generated random tables into two groups of 20 patients each namely, group P, where SLPVB was administered and group C, where caudal block was administered.

Before the surgery, premedication was done with oral midazolam (0.5mg/kg). Patient was taken up in the operative room and standard monitoring devices (electrocardiogram, pulse oximetry and non invasive arterial blood pressure) were attached to the patient. Anaesthesia was induced with 6-8 % sevoflurane by facemask and maintained with N<sub>2</sub>O:O<sub>2</sub> 50:50 in 0.5 to 2.5% sevoflurane. After securing intravenous access injection fentanyl (2mcg/kg) was administered and appropriate size Proseal LMA was inserted according to the age of the patient and connected to Mapleson F modification of Ayre's T piece. No neuromuscular blocking drugs were given and the spontaneous ventilation was assisted as required. Fluid administration was as per standard protocol.

All patients in group C received CB. As per the technique mentioned by Suresh et. al<sup>5</sup>, with the child in lateral position, flexion of hips was done.

Sacral cornua was located either by palpating near the cephalad margin of the gluteal crease or by palpating the posterior superior iliac spine and taking the line between them as one side of an equilateral triangle. The depression inferior to the cornua, that is, the sacral hiatus was then identified and caudal needle inserted at an angle of 45 degrees. While advancing the needle a decrease in resistance to needle insertion was felt as it pierced the sacrococcygeal membrane. At this point 0.2% ropivacaine (1ml/kg) was given after aspiration.

Patients in-group P were given PVB as per the technique described by Berta et al<sup>6</sup>. With the patient in lateral decubitus position, and under all aseptic precautions, needle insertion was made at an easily palpable second lumbar vertebrae (L2) lateral to the spinal process with the distance from the midline being about 1-2cm as per the formula given by Lonnqvist et. al<sup>7</sup>. A 19 gauge epidural needle was inserted perpendicular to the skin in all planes until contact with the transverse process was made. The needle was then withdrawn to the subcutaneous tissue and angled to walk off the cranial edge of the transverse process. The needle was then advanced under the transverse process and the paravertebral space identified by loss of resistance to air. After aspiration, a bolus of 0.2ml/kg of ropivacaine (0.2%) was injected.

After completion of the surgery, 100% oxygen was administered and proseal removed. In both the groups, assessment was done at 30mins, 1hour, 1hour 30mins, 2, 4, 8, 12 and 24 hours in postoperative ward by an independent observer who was blinded to which group the patient belonged.

Complications were noted and compared in the above two groups.

Efficacy of the block: Assessed by duration of analgesia and FLACC SCORE Face, Legs, Activity, Cry and Consolability (FLACC) score<sup>8</sup> was used to evaluate the effectiveness of the block (supplementary Table 1).

**Table 1: Age and weight distribution in the two groups (C = caudal group, P = paravertebral group)**

Groups	Mean Age (years)	Mean Weight( kg)
Group C	5.60 ±2.46	17.15±7.15
Group P	4.90± 2.13	15.50±4.84
C VS P (P value)	0.171(NS)	0.199(NS)

**Rescue Analgesia:** The time and required dose of rescue analgesia was noted and compared. If a FLACC score  $>2$  were recorded, the child was first managed by non-pharmacological means (tactile stimulation, change of position, warming etc). If no response was noted within 5-10 minutes, intravenous tramadol (1mg/kg) was administered. Patients were also attended whenever the child experienced pain even if that was not the assessment time of the study and analgesia was provided as per the protocol. If rescue opioid was needed within the first two postoperative hours, the block was considered a failure.

Parental satisfaction to treatment given was evaluated based on the child's comfort and activity level. Parents were asked to rate their degree of satisfaction and scored as very satisfied (3), acceptably satisfied (2), somewhat satisfied (1) or dissatisfied (score 0).

Any events like bladder hesitancy, postural hypotension, prolonged motor blockade leading to delayed ambulation, epidural spread or any other of the rare complications like nerve injury, intravascular injection and pneumothorax were noted.

Researchers have recorded the mean duration of analgesia in C group as  $4.52 \pm 2.02$  hours as compared to  $21.67 \pm 5.61$  hours in the P group<sup>3,9,10</sup>. Assuming these as reference values, the minimum required sample size at 5% level of significance and 95% power is 3 patients in each group. We have taken 20 patients in each group considering the influx of patients in our hospital and the duration of study.

For quantitative data (pain score, parent satisfaction score), for comparison b/w the two groups, difference between the two means was observed by t-test for normally distributed data and Mann Whitney test (non parametric) for non normal distributed data.

Chi square or Fischer test was used for computing consumption of analgesics and other categorical variables.

## RESULTS

A total of 40 patients were enrolled, 20 in each group and all the patients were included and analyzed.

The data collected was analyzed using SPSS statistical software version 17 and  $p\text{-value} < 0.05$  was considered statistically significant. A total of 40 patients were studied with 20 patients in each group. The incidence of inguinal hernia was found to be more in males as compared to females and more common on the right side as compared to the left.

All the subjects were ASA grade 1. The two groups were comparable in terms of age and weight (Table 1).

The mean duration of action, as determined by the time to rescue analgesia was found to be  $1001.25 \pm 564.34$  minutes (Median 1440 and IQR 975 minutes) and 1440 minutes (Median 1440) in the paravertebral group (Patients were followed up only for 24hrs) and this difference was found to be statistically significant ( $P\text{ value} = 0.03$ ) by Mann Whitney U test.

The efficacy of the block as assessed by the FLACC score was comparable in the two groups (Table 2).

Rescue analgesia was required in 8 patients in the caudal group as compared to none in the paravertebral group. This was statistically significant ( $P = 0.003$ ). Rescue was provided with inj. Tramadol 1mg/kg i.v. None of the patients required rescue analgesia for more than once in 24 hrs.

In PVB group, 90% parents were completely satisfied with the postoperative comfort of their children compared to

**Table 2: Comparison of FLACC score between the two groups at different time intervals**

FLACC score median (IQR)	30min	1hr	1.5hr	2hr	4hr	8hr	12hr	24hr
C	0 (1.5)	0 (0)	0 (0)	1 (1)	1 (1)	1 (1)	0 (0)	0 (0)
P	0 (0)	0 (0)	0 (1)	0 (0)	0 (0)	0 (0)	0.5 (0.5)	0 (0)
C vs. P (p-value)	0.18	0.41	0.50	0.20	0.44	0.09	0.49	0.99
Group C: caudal epidural block group; Group P: paravertebral block group								

only 45% in the CB group (Table 3). This was statistically significant ( $P = 0.011$ )

Table 3: Comparison of parental satisfaction score between the two groups				
Parent satisfaction score	C		P	
	Frequency	%	Frequency	%
0 (dissatisfied)	0	0	0	0
1 (somewhat satisfied)	4	20	0	0
2 (acceptably satisfied)	7	35	2	10
3 (very satisfied)	9	45	18	90
Total	20	100	20	100
Mean±S.D	2.25±0.79		2.90±0.31	
p-value	0.01			

No complications were noted in the paravertebral group. Failure of block occurred in 1 patient in the caudal group, and there was complaint of urinary retention in 3 patients in the same group. No other complications with the local anaesthetics or blocks were noted.

## DISCUSSION

Inguinal hernia repair is the most common surgery performed worldwide and has the potential of being performed on an outpatient basis. The spectrum of regional anaesthetic techniques extend from CB and lumbar epidurals<sup>1</sup> to various other techniques like combined ilioinguinaliliohypogastric<sup>4</sup> nerve block, field blocks to wound infiltration with local anaesthetic agents in children.

CB is an established technique for providing postoperative analgesia. The technique of CB is easy to perform, however large volumes of drug are required and there is always a risk motor paralysis, subarachnoid block, urinary retention and failure of block even in experienced hands.

This prospective study was undertaken to compare CB and PVB with respect to the effectiveness and duration of block and the complications of the two techniques. The results shows that caudal as well as PVB are effective in decreasing postoperative pain. We found that there was a significant increase in the duration of postoperative analgesia in the group treated with PVB compared to those undergoing caudal. All this was achieved with a dose of local anaesthetic (0.2ml/kg) that was one fifth of the dose of the local anaesthetic used in the caudal group (1ml/kg). Needless to say this would also translate into a lesser incidence of side effects and risk of toxicity associated with local anaesthetics.

Though the technique of PVB requires some expertise it was

noted that the location of the transverse process very well corroborated with the formula given by Berta and Lonnqvist et al<sup>6</sup>, thus making the technique easiest to master. Besides none of the 20 patients had a block failure. In our study none of the patients in the paravertebral group required supplemental analgesia. The mean duration of analgesia (as described by the time to rescue analgesia) was noted to be 1440 minutes i.e., 24 hours in the paravertebral group as compared to 1001.25±564.34 minutes in the caudal group. We found that majority of the children had maximum pain in the first 24hrs following which they were discharged with oral analgesic medication. Therefore, a technique, which can provide analgesia for 24hours without any need for supplemental analgesia, is certainly more desirable.

This finding has been corroborated by previous studies by Tug et al<sup>3</sup>, who gave PVB in children and found the mean duration of action in the paravertebral group to be 1300 minutes. Akcaboy et al reported that PVB obtained very long and effective analgesia compared with spinal block in adult patients<sup>10</sup>. A comparison study between PVB (using 2%lidocaine) and field block (using 0.5% bupivacaine and 1%lidocaine) by Wassef et al in children also showed that the PVB had a higher success rate in terms of frequency of pain relative to surgical manipulation of spermatic cord, hernia sac and also in terms of supplementing analgesia using local anaesthetics<sup>2</sup>. Various other studies by Naja et al and Berta et al in children have also reported the effect of PVB to last from 12-48 hours<sup>4,5</sup>. These results support our findings. It was claimed that this results from the relative a vascularity of the paravertebral space and hence the slow uptake of local anaesthetics. Division of the spinal nerves into smaller branches in the paravertebral space also enables better penetration of the local anaesthetic<sup>5</sup>.

We did not encounter any complications with PVB in our study. However, we had failure of block in one patient in the CB group and 3 patients also complained of urinary retention. Because of the inherent nature of the PVB and the lesser amount of drug required, there is negligible risk of damage to the spinal cord, lower limb weakness, urinary retention and widespread sympathetic blockade.

Previously, multiple level paravertebral blocks had been used to provide adequate blockade<sup>5</sup>. Since the psoas muscle enveloped each lumbar nerve within the paravertebral space, it was considered essential to block each lumbar segment individually to achieve sufficient blockade. However, cadaveric studies have reported that if the dye was injected at L1 level, it was observed that the genitofemoral, ilioinguinal, iliohypogastric and lateral cutaneous nerves were stained with dye<sup>3</sup>. This may explain

why the PVB obtained in our study was very effective. Besides, multiple segments PVB also increase the risk of pleural puncture and pneumothorax.

Further research can compare the effectiveness of the block using Ultrasound guidance and the inability to do that is also one of the limitations of our study.

To conclude this study has demonstrated that a single level, single shot PVB has been found to be superior in providing postoperative analgesia in terms of duration of analgesia, quality of analgesia and need for rescue analgesics as compared to CB in children undergoing inguinal hernia repair. It has also been noted to have lesser complications and higher parent satisfaction.

## REFERENCES

1. Yaster M, Maxwell LG. Paediatric regional anaesthesia. *Anesthesiology*. 1989; 70:324–38. crossref PMID:2643896
2. Wassef MR, Randazzo T, Ward W. The paravertebral nerve root block for inguinal herniorrhaphy- A comparison with field block approach. *Reg Anesth Pain Med*. 1998; 23:451–6. crossref
3. Tug R, Ozcengiz D, Gunes Y. Single level paravertebral versus caudal block in paediatric inguinal surgery. *Anaesth Intensive Care*. 2011; 39:909–13. PMID:21970138
4. Naja ZM, Raf M, El Rajab M, Ziade FM, Al-Tannir MA, Lonnqvist PA. A comparison of nerve stimulator guided paravertebral block and ilio inguinal nerve block for analgesia after inguinal herniorrhaphy in children. *Anaesthesia*. 2006; 61:1064–68. crossref PMID:17042844
5. Suresh S, Wheeler M. Practical paediatric regional anaesthesia. *Anesthesiol Clin North America*. 2002; 20:83–113. crossref
6. Berta E, Spanhel J, Gabrhelik T, Lonnqvist PA. Paravertebral block in children. *Tech Reg Anesth Pain Manag*. 2007; 11:247–54. crossref
7. Lonnqvist PA, Hesser U. Location of the paravertebral space in children and adolescents in relation to surface anatomy assessed by computed tomography. *Pediatr Anaesth*. 1992; 285–9.
8. Merkel SI, Voepel-Lewis T, Shayevitz JR, Malviya S. The FLACC: A behavioural scale for scoring post operative pain in younger children. *Pediatr Nurs*. 1997; 23:293–7 PMID:9220806
9. Ivani G, Lampugnani E, Torre M, Calevo MG, DeNegri P, Borrometi F, et al. Comparison of ropivacaine with bupivacaine for paediatric caudal block. *Br J Anaesth*. 1998; 81:247–8. crossref PMID:9813532
10. Akcaboy EY, Akcaboy ZN, Gougus N. Ambulatory inguinal herniorrhaphy: Paravertebral block versus spinal anaesthesia. *Minerva Anesthesiol*. 2009; 75:684–91. PMID:19940820