

COMPARISON OF UNILATERAL PARAVERTEBRAL BLOCK WITH SUBARACHNOID BLOCK FOR POSTOPERATIVE ANALGESIA IN UNILATERAL INGUINAL HERNIA SURGERIES

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ABSTRACT

BACKGROUND

Paravertebral Block (PVB) is emerging as an alternative anaesthesia technique for inguinal hernia repair with some advantages over Subarachnoid Block (SAB). This study compares unilateral paravertebral block with subarachnoid block for postoperative analgesia in unilateral inguinal hernia surgeries.

The aim of the study is to study the comparison of Paravertebral Block (PVB) with Subarachnoid Block (SAB) for postoperative pain at 0, 1, 2, 4, 6, 12 and 24 hours and analgesic requirement in first 24 hours in unilateral inguinal hernia surgeries. The onset and extent of sensory and motor block, time to ambulation and patient and surgeon comfort level were also assessed.

MATERIALS AND METHODS

Sixty adult male patients, aged 18-65 years with American Society of Anaesthesiologist (ASA) grade I and II presenting for unilateral inguinal hernia repair over a period of one year were allocated into two groups to receive SAB (Group I, 2.5 cc of 0.5% bupivacaine with clonidine 30 µg at L3-4 level) or PVB (Group II, 30 mL of 0.25% bupivacaine and clonidine 30 µg given at T10, T12 and L2 level). The primary objective was to assess postoperative pain scores on Visual Analogue Scale (VAS) of 0-10 at 0, 1, 2, 4, 6, 12 and 24 hours and analgesic requirement in first 24 hours after surgery. Secondary objectives were to compare onset and depth of sensory and motor block, intraoperative haemodynamic, patient and surgeon comfort level and time for ambulation were also recorded.

RESULTS

Onset of sensory block was faster in Group I (4.5 ± 0.5 vs. 13.1 ± 0.6 mins. in Group II) (P value <0.001). PVB had advantage of limited extent of sensory and motor block (T8 to L3 as compared to T6 to S5 in Group I). Postoperative Visual Analogue Scale (VAS) was lower in Group II at 4, 6 and 12 hours (P value <0.001). The mean consumption of diclofenac sodium in first 24 hours in Group I was 72.5 mg while in Group II was 7.5 mg (P value <0.001). Patient (76.6% vs. 56.6%) and surgeon (86.6% vs. 43.3%) satisfaction was better in Group II.

CONCLUSION

Paravertebral block is better than SAB for unilateral hernia repair in terms of less postoperative pain scores and analgesic requirements in first 24 hours along with less intraoperative haemodynamic variation, no motor blockade and better patient and surgeon satisfaction.

KEYWORDS

Paravertebral Block, Subarachnoid Block, Inguinal Hernia, Postoperative Pain.

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BACKGROUND

Inguinal herniorrhaphy is one of the frequently performed surgeries, which can be performed under general anaesthesia, regional anaesthesia, nerve blocks and paravertebral blocks. Subarachnoid Block (SAB) for inguinal

hernia has attained popularity due to advantages of an awake patient and minimal drug and equipment costs, easy technique and less complications as compared to general anaesthesia, but with drawbacks like hypotension, motor weakness, prolonged recovery room stay, urinary retention, post-spinal headache^{1,2,3,4} and risk of higher block and prolonged hospital stay.

Paravertebral block presents an alternative anaesthetic and analgesic technique for inguinal hernia repair.^{5,6} It produces ipsilateral segmental block through injection of local anaesthetic around the spinal nerve roots along the vertebral column. It has also been used for unilateral procedure like thoracotomy and breast surgery, etc.^{7,8}

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The primary objective in present study is to compare the postoperative pain score at 0, 1, 2, 4, 6, 12 and 24 hours and analgesic requirements in first 24 hours in unilateral inguinal hernia surgeries with SAB and unilateral PVB. The secondary objective is to assess the extent of sensory and motor block, time to ambulation and patient and surgeon satisfaction in unilateral inguinal hernia surgery under SAB or PVB.

MATERIALS AND METHODS

After approval by the institutional scrutiny committee and written informed consent from patients willing to participate, the study was carried out as prospective, randomised and single-blind study in 60, American Society of Anaesthesiologist (ASA) Grade I and II male adult patients aged between 18 and 65 years posted for unilateral inguinal hernia repair. Each patient fulfilling the inclusion criteria were explained the purpose of study and about numerical rating scale in ward or PAC clinic.

The exclusion criteria included patient's refusal for block, history of allergy to local anaesthetics, history of any coagulopathy, infection at block site, recurrent inguinal hernia, obstructed or strangulated hernia, laparoscopic hernia repair, uncontrolled hypertension and renal, hepatic or cardiac impairment.

The patients were allocated to two groups, Group I (subarachnoid block) and Group II (paravertebral block) of 30 patients each using computer generated randomisation table. The information was kept in sealed envelope and was opened in operation theatre and patients were assigned to group as per sequence of allocation. The postoperative pain assessment was done by independent anaesthesiologist who was not a part of block giving team.

All patients underwent a routine preanaesthetic checkup and premedication was given (Tab. Alprazolam 0.25 mg) the night before and on the morning of day of surgery. Overnight fasting was ensured in all patients. Monitors for Heart Rate (HR), Noninvasive Blood Pressure (NIBP), ECG and Pulse Oximetry (SpO₂) were attached and parameters recorded every 5 minutes. Patients were preloaded with 15 mL/kg of normal saline. In case of discomfort due to hernial sac manipulation during surgery, Inj. Fentanyl 50 µg was to be used.

In Group I (SAB), a 26G Quincke's spinal needle was used to perform subarachnoid block at L3-L4 level in sitting position using 26G spinal needle, 2.5 cc of 0.5 hyperbaric bupivacaine plus Inj. Clonidine 30 µg was used for the block. The patient was then placed in the supine position. The sensory level was assessed every 3 minutes until a sensory block of T8-T10 was achieved to allow the surgery.

In Group II Paravertebral Block (PVB) was carried out with the patients in the sitting position. It was performed unilaterally with a 23G Quincke's spinal needle using a standard technique described by Hadzic and Vloka.⁹ The spinous processes of T10, T12 and L2 vertebrae were marked in the midline. A line was drawn parallel to the midline at a distance of 2.5 cms and points corresponding to T10, T12 and L2 levels were marked on this line. The local

anaesthetic mixture was prepared by mixing 30 mL of 0.25% Inj. Bupivacaine plus Inj. Clonidine (30 µg). After walking off superior and inferior surfaces of the transverse process of T10 and T12 vertebrae, the needle was inserted 1 cm deeper and 5 mL of local anaesthetic mixture was injected at each site. At L2 vertebra, the needle was inserted 1 cm deeper to the superior surface of transverse process and 10 mL of local anaesthetic mixture was injected. After performing the paravertebral block, patients were returned to the supine position. The sensory level was assessed with needle every 3 minutes for 15 minutes for the effect of the block and if adequate sensory block was achieved within 30 minutes, surgery was allowed.

Adequate sensory block was defined as inability to perceive pinprick at the level of T10 to L2 dermatomes and was achieved in all the patients. The motor block was assessed in terms of onset, duration and ambulation using Bromage scale¹⁰ of 0-3 (0 = full flexion of knees and feet; 1 = just able to flex knees; 2 = unable to flex knees, but able to move foot; 3 = unable to move legs or feet).

Continuous monitoring of HR, NIBP, ECG and SpO₂ was done before giving the block and then at every 5 minutes. Any episode of bradycardia (HR <60) was treated with Inj. Atropine 0.6 mg intravenous. Any episode of hypotension (MAP <20% of baseline value) was treated with intravenous fluids and if needed with Inj. Mephentermine 6 mg intravenous as bolus.

The resident evaluating the patient for postoperative pain was blinded to anaesthetic technique used. For the assessment of postoperative pain, Visual Analogue Scale (VAS) was used and when the VAS was 4 or more on the scale of 0-10, the patient was administered Inj. Diclofenac sodium 75 mg intramuscular. If there was no relief in pain after administration of Inj. Diclofenac sodium in the next 30 minutes, then Inj. Morphine 5 mg intravenous was to be used as additional analgesic.

The patients were assessed for postoperative pain using the VAS at interval of 0, 1, 2, 4, 6, 12 and 24 hours, the total analgesic requirement in the first 24 hours of postoperative period and time to ambulation.

The statistical data obtained was analysed by Chi-square test and Student's t-test using SPSS version 14.0 (SPSS Inc., Chicago, IL).

RESULTS

All 60 patients were male adult divided into two groups of 30 patients each. The mean age of patients in Group I was 47.8 ± 10.6 and in Group II 42.5 ± 12.2 (p value 0.07). The mean weight of patient in Group I was 66.5 ± 4.7 and in Group II was 68.5 ± 7.2 (p value 0.205). The baseline heart rate in Group I was 80.5 ± 10.9 and in Group II was 77.7 ± 11.3 (p value 0.334). The baseline mean blood pressure in Group I was 86.2 ± 9.6, and in Group II, it was 87.4 ± 8.0 (p value 0.620). The baseline SpO₂ in Group I was 96.6 ± 1.4, while in Group II, the value was 96.2 ± 0.05. The two groups were comparable with respect to age, bodyweight and preoperative baseline vital parameters.

Sl. No.	Parameter	Mean $\pm$ SD Group SAB	Mean $\pm$ SD Group PVB	p value
1.	Time for onset of sensory blockade TOS (mins.)	4.5 $\pm$ 0.5	13.1 $\pm$ 0.68	<0.001
2.	Highest sensory level achieved	T6-6	T8-9	
		T7-16	T9-21	
		T8-7		
		T9-1		
3.	Lowest sensory level achieved	S5-30	L2-16	
			L3-14	
4.	Time for onset of motor blockade (mins.)	5.7 $\pm$ 0.5	No block	
5.	Maximum motor block achieved (Bromage scale)	4 $\pm$ 0	0	

Table 1. Trends of Sensory and Motor Blockade

The mean time of onset of sensory blockade was significantly higher in Group II (13.1 $\pm$ 0.6) as compared to Group I (4.5 $\pm$ 0.5). The highest sensory level achieved in Group I was between T6 and T9 with 16 patients (53.3%) achieving T7 level. In Group II, the highest level achieved was either T8 or T9 with 21 patients (70%) achieving level of T9. The lowest sensory level achieved was S5 in all patients of Group I, while it varied among L2 in 16 patients (53.3%) and L3 in 14 patients (46.6%) in Group II. All patients in Group I had complete motor block (Bromage scale value = 3) with onset time of 5.7 $\pm$ 0.5 mins., while there was no motor block in Group II (Bromage scale value=0) (Table 1).

There were episodes of bradycardia in 5 patients (16.6%) from Group I, while no patient (0%) had bradycardia in Group II, but this was not statistically significant.

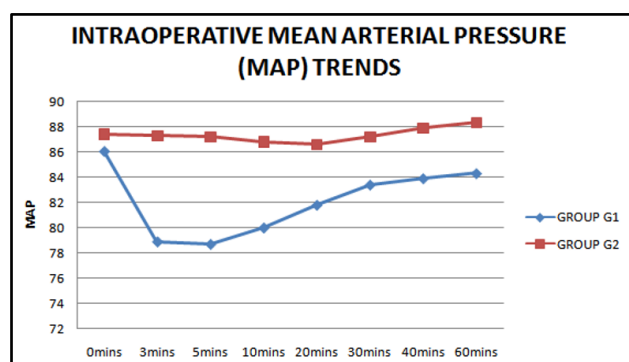


Figure 1. Intraoperative Mean Arterial Pressure Trends

Intraoperative vitals were comparable in both groups except for the MAP (Figure 1), which was significantly reduced in the Group I, which persisted till around 20 minutes into surgery time and stabilised thereafter. The decrease in MBP was managed with infusion of IV fluids and four patients required Inj. Mephentermine 6 mg bolus in Group I.

Time (hrs.)	Group I (SAB) Mean $\pm$ SD	Group II (PVB) Mean $\pm$ SD	p value
0	0	0	-
1	0	0	-
2	0	0.06 $\pm$ 0.2	0.158
4	3.8 $\pm$ 0.7	1.6 $\pm$ 0.5	<0.001
6	4.5 $\pm$ 0.8	2.6 $\pm$ 0.6	<0.001
12	3.6 $\pm$ 0.5	2.7 $\pm$ 0.4	<0.001
24	2.4 $\pm$ 0.6	2.2 $\pm$ 0.6	0.304

Table 2. Postoperative VAS Scores

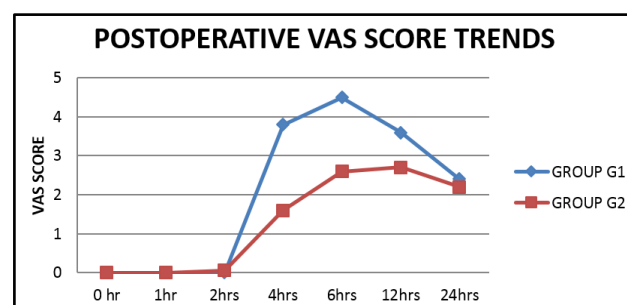


Figure 2. Postoperative VAS Scores

Postoperative VAS scores were comparable up to 2 hours of postoperative time and the difference was not statistically significant. Thereafter, the mean VAS scores in Group I varied between 3.8 $\pm$ 0.7 at 4 hours, 4.5 $\pm$ 0.8 at 6 hours, 3.6 $\pm$ 0.5 at 12 hours and 2.4 $\pm$ 0.6 at 24 hours, while in group II, mean VAS scores were significantly lower as compared to group SAB, i.e. 1.6 $\pm$ 0.5 at 4 hours, 2.6 $\pm$ 0.6 at 6 hours, 2.7 $\pm$ 0.4 at 12 hours and 2.2 $\pm$ 0.6 at 24 hours. This difference between the VAS scores at 4, 6 and 12 hours postoperative time interval was statistically significant (p-value <0.001) (Table 2, Figure 2).

Number of Doses of Inj. Diclofenac Sodium (75 mg/dose)	SAB n=30	PVB n=30	p-value
Nil dose	5	27	<0.001
1 dose	21	3	<0.001
2 doses	4	0	<0.001
Total number of doses	29	3	<0.001
Total diclofenac required in 24 hrs. (mg)	2175	225	<0.001
Mean (mg)	72.5	7.5	<0.001

Table 3. Analgesic Required in Postoperative Period

In Group I, 25 patients asked for rescue analgesia and mean time for first rescue analgesic was 3.44 hrs. (range 3-5 hrs.). In Group II, only 3 patients asked for rescue analgesia and mean time for first rescue analgesic was 6.33 hrs. (range 5-8 hrs.). Total number of analgesic doses required in the first 24 postoperative hours was significantly higher in Group I. The mean consumption of diclofenac sodium in 24 hours postoperatively in Group I was 72.5 mg, while in Group II, it was 7.5 mg. None of the patients in either group required Inj. Morphine for pain relief (Table 3).

The time to ambulation, i.e. the time it took for the patient to be able to stand without support was also noted.

The time for ambulation in Group I was 6.8 ± 0.924 hrs., while in Group II, all the patients were mobile immediately after the block. The difference between the two groups was statistically significant (p -value <0.001).

In Group II, 23 patients (76.6%) were very satisfied as compared to 17 patients (56.6%) in Group I. The surgeon was 'very satisfied' in 26 patients (86.6%) of Group II as compared to 13 (43.3%) in Group I.

Incidence of Complications

Two patients (6.6%) in Group I of our study had urinary retention that required catheterisation and 3 patients (10%) complained of nausea in postoperative period that was successfully treated with Inj. Ondansetron 4 mg IV. Three patients complained of headache in Group I. No patient experienced any such complaints in the Group II.

DISCUSSION

The results of this study shows that paravertebral block is more effective in reducing postoperative pain and have less side effects as compared to subarachnoid block in patients undergoing unilateral inguinal hernia surgery. The onset of surgical anaesthesia in Group II in our study was $13.1.1 \pm 0.6$, while in other studies, it ranged between 17 to 20 minutes.^{1,2} We performed the block at 3 levels as compared to other studies, which performed the block at 1 or 2 levels, which may have contributed to better and faster distribution of local anaesthetic, thus influencing the time of onset of surgical block.¹¹

During intraoperative period, there were less haemodynamic changes in Group II as compared to Group I. During SAB, there is blockade of autonomic nervous system resulting in the fall of blood pressure and also bradycardia due to blockade of cardioacceleratory fibres, if level is high. In PVB, such complications are not seen as drug is deposited in paravertebral space, which contains somatic nerves as they emerge from the respective intervertebral foramina. Sensory and motor level is better controlled in PVB with upper and lower limits well-defined. Due to limited spread of drug in paravertebral space, somatic nerves below the level of L2 are not affected and no motor block is seen.¹² The mean onset time for sensory block in Group I was 4.5 ± 0.5 mins. and in Group II was 13.1 ± 0.6 mins. Though statistically significant, it does not affect the OT utilisation time. The onset of sensory block is delayed in PVB as drug has to diffuse through the tissues to reach the nerves while in SAB, drug is given in CSF, which bathes the nerves, hence leading to early onset of block.

The postoperative VAS score was significantly less in Group II after 2 hours from end of surgery and remained so in the entire observation period. The addition of clonidine to injectate solution increases the duration of analgesia in both groups. The total analgesic doses required and mean drug consumption of diclofenac was significantly less in Group II (7.5 mg) as compared to Group I (72.5 mg). This can be explained due to relative avascularity of paravertebral space and due to addition of clonidine to the injectate solution. The

side effects were also less in Group II as none of patient developed urinary retention, nausea/vomiting or headache.

The overall satisfaction of the patient regarding the experience was same in both the groups as they were not aware of the other procedure. As there was complete relaxation of abdominal muscles along with sensory block, none of the patients felt any pain during surgery in Group I. In Group II, during the intraoperative period, 7 patients complained of discomfort while the surgeon was applying traction to the peritoneal part of the hernia. This discomfort was very transient as the period of traction was short and was successfully managed by reassurance to the patient.

The satisfaction of surgeon is important as he was the person attending to both groups in intra and postoperative period. Significantly, higher numbers of surgeons were very satisfied in Group II (26 out of 30) as compared to Group I (13 out of 30) due to no incidence of motor block, perioperative hypotension, postdural puncture headache, urinary retention requiring catheterisation in Group II. Lack of relaxation was not complained by the surgeon as hernia surgery is superficial surgery where large muscles are not involved. Though intraoperatively in Group I, the surgical conditions were satisfactory in all patients as no surgeon complained of lack of relaxation and no patient complained of discomfort, however, the difference in the level of surgeon satisfaction was due to delayed ambulation and the need for prolonged nursing care. Delayed ambulation also predisposes the patient for deep vein thrombosis.

A major advantage of PVB is that it provides longer duration of analgesia in postoperative period as compared to SAB as evident by lower VAS scores and 24 hours average consumption of diclofenac sodium (7.5 mg in PVB group vs. 72.5 mg) as only 3 patients required one dose each in PVB group. This results from the relative avascularity of the paravertebral space, and hence, the slow uptake of local anaesthetics.¹⁰ The addition of clonidine to the injectate further increases the period of pain relief.

Our study is limited by small sample size and all of the patients were male. Also that, we used landmark technique and not ultrasound-guided block, which helps in proper placement of needle and to prevent pneumothorax.^{13,14} There are many techniques for ultrasound-guided PVB block.¹⁵ Our study was single-blind study as double blinding was not possible due to difference in two techniques and results like motor weakness in both legs in Group I. Accepting this limitation, we found that PVB fulfils many of the requirements of a satisfactory anaesthetic technique for inguinal hernia repair surgery. To summarise, PVB is easy to learn, requires no additional nursing surveillance, maintains longer duration of analgesia, maintains better haemodynamic stability and allows early ambulation for the patient postoperatively, hence fulfilling the criteria for fast-track anaesthesia and daycare surgery.¹⁶ However, paravertebral block has some limitations like higher time is taken for delivery of block, multiple pricks are required, there is longer time for onset of sensory block and it requires more technical skill. Also, needle placement of more than 1 cm deep to transverse process and lateral direction of needle

can penetrate pleura and lung and result in pneumothorax at T10 and T12 vertebra and renal injury at L2 vertebra level.

CONCLUSION

Unilateral paravertebral block has certain advantages over subarachnoid block for inguinal hernia surgeries. There is better haemodynamic control in intra and postoperative period, no motor weakness, effective postoperative analgesia, less stay in postanesthesia care unit, less complications like retention of urine and vomiting in paravertebral block. The patients is discharged early, thus making this technique more effective for daycare surgery.

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