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Original Research Article

# Paravertebral Block versus Sub Arachnoid Block for Inguinal Hernia Repair: A Tertiary Care Experience

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**Abstract**

**Background:** This study aimed to assess the effectiveness and safety of unilateral paravertebral block (PVB) as the primary anesthetic technique for inguinal hernia repair, as it is currently not widely utilized even by experienced practitioners. The study sought to compare PVB with subarachnoid block (SAB) anesthesia for these procedures, both of which can be employed alongside general, regional, and peripheral nerve block anesthesia to ensure satisfactory anesthetic conditions during surgery.

**Methods**: Patients were selected from elective inguinal hernia surgeries in our hospital. Group I Paravertebral block (20 patients) received ipsilateral Paravertebral block from T10 to L2, where 5ml of bupivacaine (0.5%) with 1:400,000 epinephrine was administered at each segment. On the other hand, Group II (20 patients) received a Subarachnoid block with 12.5ml of hyperbaric bupivacaine (0.5%).

**Results:** The Visual analog scale was evaluated in the two groups of patients at different intervals of time as depicted in Table 3. The mean overall values of group I paravertebral block have a reduced range over a time period as compared to group II Subarachnoid block and were found to be statistically significant. Rescue Tramadol was administered only after 24 hours in both types of blocks. When we compared the total rescue analgesic used in the two groups, it was notably lower in group I as compared to group II although this difference did not reach statistical significance, as indicated by a P-value of 0.411.

**Conclusion:** Paravertebral block can be considered a superior and safe alternative to unilateral spinal anesthesia for inguinal hernia repair. It offers advantages such as unilateral and segmental anesthesia, extended postoperative pain relief, early ambulation, stable intraoperative hemodynamics, and minimal side effects.

**Keywords:** Inguinal hernia, paravertebral block, postoperative analgesia subarachnoid block.



## Introduction

Inguinal Herniorrhaphy is the most frequently performed surgical procedure in males, and there is a growing trend of conducting this surgery on a day-care basis, emphasizing early ambulation. [1] Traditionally, the surgery has been performed under various anesthetic methods, including general, regional, and peripheral nerve blocks, and local infiltration. [2] In recent times, Fast Track Anesthesia has become a popular choice for this type of ambulatory surgery. The main advantage of rapid anesthesia is that the patient remains awake, breathing comfortably, and maintains stable vital signs upon leaving the operation room. Regional and peripheral nerve blocks are particularly effective techniques for ambulatory surgeries. Subarachnoid block (SAB) has gained widespread popularity for Inguinal Herniorrhaphy due to its benefits, such as keeping the patient awake, and minimal drug and equipment costs. However, SAB may not be the ideal anesthetic technique for fast-track ambulatory surgery because of concerns related to undesirable hemodynamic responses, potential complications like prolonged recovery and hospital stay, urinary retention, and post-spinal headaches. [3] The concept of paravertebral block, introduced by Hugo Selheim of Leipzig in 1905, has emerged as an excellent alternative anesthesia technique for hernia repair. [4] This method provides unilateral anesthesia, requiring a low degree of postoperative analgesia and resulting in less postoperative nausea and vomiting. [5, 6] Paravertebral block has been successfully employed in various unilateral procedures such as thoracotomy, breast surgery, chest wall trauma, hernia repair, renal surgery, and cholecystectomy. [7,8]. Both unilateral subarachnoid block and paravertebral block offer optimal anesthesia with stable hemodynamics and minimal adverse events. However, paravertebral

block provides the additional advantage of prolonged postoperative analgesia, early ambulation, a lower incidence of postoperative nausea and vomiting, and higher patient satisfaction. It is also considered a viable alternative for elderly patients with co-existing health conditions. Nevertheless, it does have some drawbacks, including the need for a learning curve, the possibility of block failure, a longer time required to perform the block, and the risk of pneumothorax and inadvertent intravascular injection. These issues can be addressed by using a nerve stimulator and ultrasonography to administer a more precise block. [3] In this study, we aimed to compare the hemodynamic stability, duration of postoperative analgesia, incidence of adverse effects, and time for ambulation in patients undergoing hernia repair. The comparison was made between those who received paravertebral block and those who received unilateral subarachnoid block as their anesthesia technique.

## Material and methods

This prospective study was conducted in the Department of Anesthesiology, Prathima Institute of Medical Sciences, Naganoor, Karimnagar. Institutional Ethical approval was obtained for the study as per the Helsinki Protocol involving human research subjects. Written consent was obtained from all the patients included in the study. Consecutive cases undergoing inguinal hernia repair were included.

### Inclusion criteria

1. Adult males 18 years and above
2. ASA I and II categories
3. Undergoing elective inguinal hernia repair
4. Fully reducible direct or indirect inguinal hernia
5. Willing to participate in the study.

### Exclusion criteria

1. Allergy to Local Anaesthetics
2. Coagulopathy
3. Thoracic Vertebral disease or deformity
4. Chronic analgesic use
5. Systemic or local sepsis
6. H/O seizures & any neurological deficit
7. Psychiatric disease
8. Not satisfying inclusion criteria

Before the surgery, the patients were assigned randomly to two equal groups using a computer-generated sequence. Group I Paravertebral block (20 patients) received ipsilateral Paravertebral block from T10 to L2, where 5ml of bupivacaine (0.5%) with 1:400,000 epinephrine was administered at each segment. On the other hand, Group II (20 patients) received a Subarachnoid block with 12.5ml of hyperbaric bupivacaine (0.5%). The Paravertebral block (PVB) was performed with the patient in a sitting position, adhering to complete aseptic precautions, and using a low-resistant technique with saline. A 25-G Quincke needle was used to establish contact with the transverse process of the thoracic vertebra, followed by sliding the needle caudally for 1–1.5 cm into the paravertebral space. Then, 5 ml of bupivacaine 0.5% with 1:400,000 epinephrine was injected at each segment.

For the Subarachnoid block (SAB), the patient was in a sitting position, and the skin at the puncture site was infiltrated with 2 ml of 2% xylocaine. A 25-G Quincke needle was inserted into the L3-L4 space, and 12.5mg (2.5ml) of hyperbaric bupivacaine (0.5%) was injected into the subarachnoid space. Hypotension was defined as a decrease of more than 20% of the baseline mean blood pressure (MBP) and was treated with increments of 6 mg bolus doses of intravenous ephedrine and 250 ml fluid bolus. Intraoperative hemodynamics were closely monitored. After the surgery, the patients were transferred to the ward, and the VAS Score (Visual Analog Scale) and Modified Post Anesthesia Discharge Scoring were observed. Postoperative analgesia was provided using tramadol, and pain intensity was measured using the VAS pain score. Nausea lasting more than 10 minutes or vomiting was treated with ondansetron 4 mg. Any complications related to the local anesthetic drug and the PVB technique, such as pneumothorax or epidural spread of the local anesthetic, as evidenced by tests for the sensory deficit on the contralateral side, were also recorded. Chest X-ray was requested for any patient in the PVB group who experienced difficulty in breathing, desaturation, or diminished air entry after the block. The primary outcome measured was the time to the first analgesia in minutes, recorded as the first registration of a VAS pain score >6. Secondary outcome measures included mean VAS scores, intra and post-operative hemodynamic variables, and the incidence of postoperative nausea and vomiting (PONV).

## Results

A total of 40 cases were included in the study divided equally into two groups. The age range of the cohort was 19 years to 59 years and the mean age of Group I was 35.5 ± 5.5 years, and the mean age of Group II was 39.8 ± 6.4 years. The p values were found to be >0.05 hence the distribution of cases in both groups was uniform.

The maximum number of cases in group I was 31 – 40 years with 40% of cases of the group and in group II the maximum number of cases were found in 51 – 60 years with 40% of cases of the group. The detailed age-wise and group-wise distribution of cases is depicted in Table 1.

**Table 1: Distribution of cases based on the age group**

| Age group | Group I | Group II | Total |
|---|---|---|---|
| 18 – 20 | 2 | 1 | 3 |
| 21 – 30 | 3 | 1 | 4 |
| 31 – 40 | 8 | 7 | 15 |
| 41 – 50 | 5 | 8 | 13 |
| 51 – 60 | 2 | 3 | 5 |
| Total | 20 | 20 | 40 |

The baseline estimation of parameters is shown in Table 2. There is no significant difference in baseline value between both groups except for $SPO_2$.

**Table 2: Comparison of baseline parameters between the two groups**

| Parameters | Group I | | Group II | | |
|---|---|---|---|---|---|
| | Mean | ± SD | Mean | ± SD | |
| Heart Rate | 80.5 | 8.21 | 82.1 | 9.5 | 0.254 |
| SBP | 124.2 | 10.5 | 122.3 | 10.64 | 0.514 |
| DBP | 82.4 | 9.36 | 79.4 | 6.87 | 0.398 |
| MAP | 96.4 | 8.54 | 94.13 | 7.90 | 0.145 |
| SPO2 | 98.76 | 0.73 | 99.2 | 0.61 | 0.036* |

* Significant

During the surgical procedure, there was a noticeable disparity in heart rate between the two groups: the heart rate was significantly higher in patients undergoing SAB (Spinal Anesthesia Block) compared to those receiving PVB (Paravertebral Block). This variation was assessed using an unpaired t-test and was found to be statistically significant at multiple time points, particularly within the first 30 minutes (figure 1)

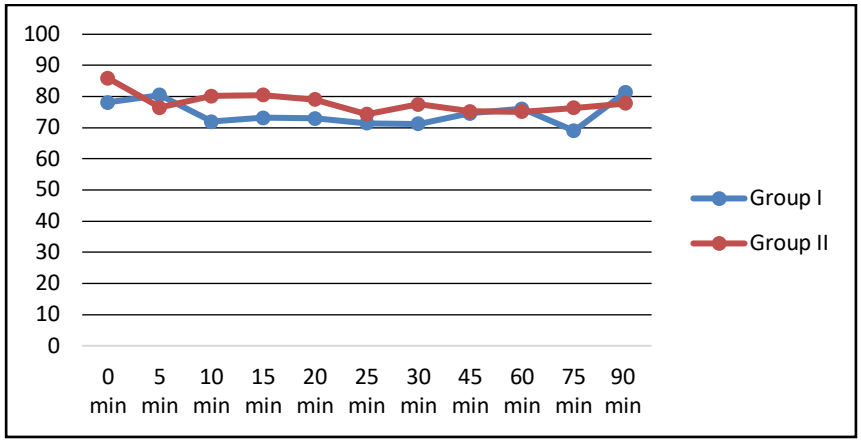


**Figure 1: The mean values of Heart rate at different intraoperative intervals**

During the intraoperative period, there was a notable difference in systolic blood pressure (SBP) between the two blocks, with SBP being comparatively lower in the subarachnoid block (SAB) than in the paravertebral block (PVB). The mean values of MAP in both groups have been depicted in Figure 2.

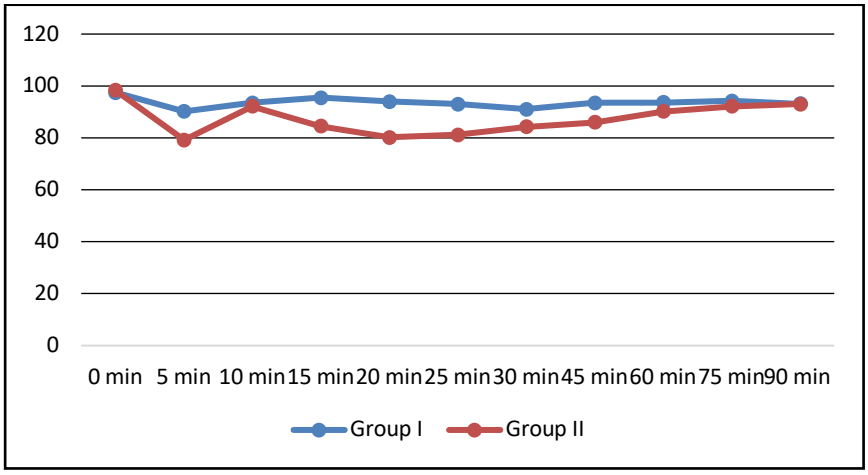


**Figure 2: Mean values of MAP at different intraoperative intervals**

The mean values of SPO2 have been depicted in Figure 3. Intraoperatively, there is little disparity in the SpO2 levels between the two groups, except at later stages where the difference is not substantial enough to be deemed significant. To analyze this difference, an unpaired t-test was performed, and it was not found to be statistically significant at various intervals Figure 3.

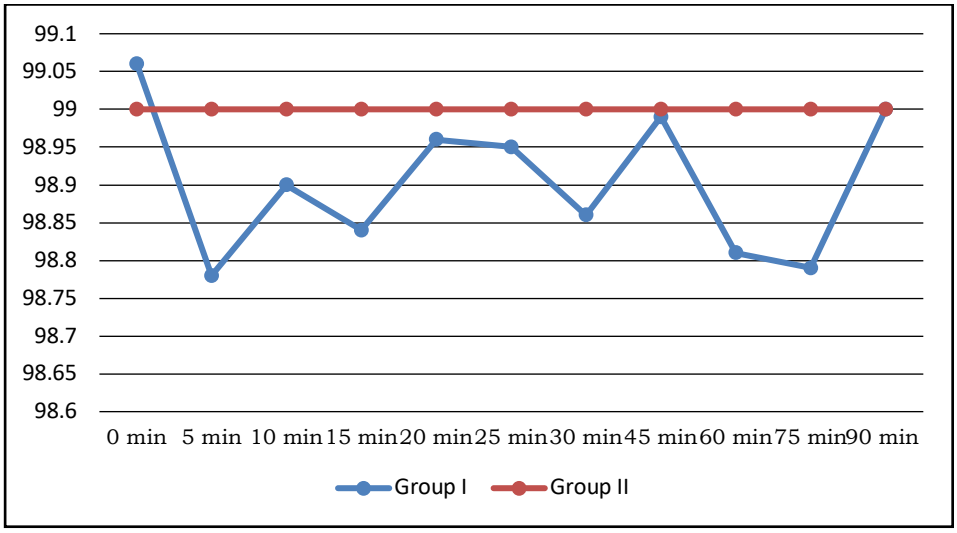


**Figure 3: Mean values of $SPO_2$ at different intraoperative intervals**

The Visual analog scale was evaluated in the two groups of patients at different intervals of time as depicted in Table 3. The mean overall values of group I paravertebral block have a reduced range over a time period as compared to group II Subarachnoid block and were found to be statistically significant.

**Table 3: VAS scores at different intervals of time in both groups**

| Time in hours | Group I | Group II | P value |
|---|---|---|---|
| 2 | 0 | 1.5 | 0.0125* |
| 4 | 1.0 | 2.0 | |
| 6 | 1.0 | 2.0 | |
| 10 | 1.5 | 2.5 | |
| 12 | 2.0 | 3.5 | |
| 18 | 2.0 | 3.0 | |
| 24 | 2.5 | 3.5 | |

The average duration of postoperative analgesia is significantly longer in the paravertebral block compared to the subarachnoid block, indicating that analgesia is sustained for a more extended period with paravertebral administration. This difference is statistically significant, with a P-value of 0.013. Moreover, during the surgery, the anesthetic discharge scoring consistently favors the paravertebral block, demonstrating its superior effectiveness and availability for the patients (Table 4).

**Table 4: showing the duration of post-op analgesia and time to mean discharge criteria**

| | Mean | SD | P value |
|---|---|---|---|
| Duration of post operative analgesia (min) | | | |
| Group I | 366 | 20.5 | 0.0113* |
| Group II | 219 | 17.6 | |
| Time to Mean discharge criteria (min) | | | |
| Group I | 325.0 | 57.4 | 0.0451* |
| Group II | 185.4 | 39.5 | |

* Significant

Rescue Tramadol was administered only after 24 hours in both types of blocks. When we compared the total rescue analgesic used in the two groups, it was notably lower in group I as compared to group II although this difference did not reach statistical significance, as indicated by a P-value of 0.411.Adverse effects such as Nausea, Catheterization, Headache, and Backache all are seen in only a few cases that too only in subarachnoid block Group II. The details are depicted in Table 5.

**Table 5: Comparison of adverse effects in both the groups**

| Adverse effect | Group I | Group II | P value |
|---|---|---|---|
| Nausea and vomiting | 0 | 2 | 0.124 |
| Catheterization | 0 | 3 | 0.336 |
| Headache | 0 | 3 | 0.336 |
| Backache and tenderness | 2 | 3 | 0.336 |

## Discussion

The selection of the anesthetic technique for inguinal hernia repair is influenced by various factors, including the preferences of the surgeon, anesthesiologist, and the patient's cooperation. Other important considerations include the complexity and expected duration of the procedure, the feasibility of the technique, efficacy in providing intra and postoperative pain control, recovery time, postoperative morbidity, and cost efficiency [3 of clinical].The current study compared paravertebral block with spinal anesthesia in patients who underwent unilateral inguinal hernia repair. The mean heart rate (HR) in Figure 1 and oxygen saturation (SpO2) were statistically similar in both groups throughout the surgery, as depicted in Figure 3. This finding aligns with a study by Bhattacharya et al. [9] In Group I, there were no significant changes in the mean arterial pressure (MAP) compared to the baseline, as shown in Figure 2. This can be attributed to the less significant sympathetic blockade and the unilateral nature of the block. The findings revealed that the paravertebral block provided sufficient anesthesia during the procedure while maintaining hemodynamic stability. Our study results were consistent with findings from other studies as well [10, 11]However, in Group II, there was a notable decrease in MAP compared to the baseline, persisting throughout the surgery due to the sympathetic blockade. In the intergroup comparison, there was a statistically significant decrease in mean arterial pressure (MAP) in Group II compared to Group I, both after the block and throughout the surgery. The time required to perform the block in Group P was 18.83 ± 1.98 minutes, which was significantly higher than Group S with a time of 6.07 ± 1.17 minutes. This difference in time can be attributed to the multiple injections required and the difficulty in identifying anatomical landmarks in the paravertebral block (PVB) compared to the subarachnoid block (SAB). Similar longer times have been observed in studies where a single level (L1) PVB was used [9].

Postoperatively, patients' analgesia was assessed using the visual analog scale (VAS) score. Whenever the VAS score reached ≥4, Tramadol 50 mg was administered as rescue analgesia. The patients were monitored continuously until they required rescue analgesia. In our study, some patients in Group I experienced only mild pain at 240 minutes (VAS ≤3) and did not require any additional analgesia. However, at 300 minutes, 70% of patients reported pain, and 30% continued to experience pain beyond 360 minutes.In Group II, 30% of patients had mild pain at 90 minutes, for which no analgesia was necessary. However, at 120 minutes, 20% of patients had pain (VAS ≥4), and this percentage increased to 55% at 180 minutes (VAS ≥4), and 25% at 240 minutes (VAS ≥4). These differences between the groups were statistically significant ($p<0.05$).A similar study conducted by Akcaboy et al. [3] also found lower VAS scores at 4, 6, and 12 hours in the paravertebral group compared to the subarachnoid group, which was statistically significant and consistent with the results of our study.

In our study, the visual analog scale (VAS) score was consistently lower in the paravertebral block group compared to the subarachnoid block group, as supported by previous studies [2, 3, 12, 13]. Rescue analgesia was administered when the VAS score reached ≥4. In Group I, patients required rescue analgesia between 280 to 360 minutes, with a mean time of 324±52.84 minutes. In contrast, in Group II, rescue analgesia was needed between 100 to 280 minutes, with a mean time of 182±40.13 minutes, indicating significant differences between the two groups. A study by Akcaboy et al. [3] found that the time to rescue analgesia was 16.1±7.8 hours in the paravertebral group and 4.7±2.3 hours in the subarachnoid group, which is consistent with our study's findings. The occurrence of postoperative nausea and vomiting was approximately 10% in Group II and none in Group I, which aligns with similar findings reported by MC Mandal et al. [2] Additionally, urinary retention was observed in three patients in Group II, while two patients in Group P experienced local tenderness at the site of insertion, consistent with the findings of Naja et al. [12]

## Conclusion

Paravertebral block can be considered a superior and safe alternative to unilateral spinal anesthesia for inguinal hernia repair. It offers advantages such as unilateral and segmental anesthesia, extended postoperative pain relief, early ambulation, stable intraoperative hemodynamics, and minimal side effects. Nonetheless, it is important to acknowledge that performing a paravertebral block requires specialized expertise, and the procedure-related time and longer onset of effect may be considered primary concerns.

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