e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2024; 16(10); 311-319

Original Research Article

To Determine the Efficacy of Postoperative Analgesia in Paravertebral Block and Spinal Anesthesia in Unilateral Inguinal Hernia

Shantanu Kumar[1], Hari Damodar Singh[2], Bhuvneshwar Kumar[3], Sanjeev Kumar[4]

[1]PG-Student, Department of Anaesthesiology & critical care, Darbhanga medical college & hospital, Laheriasarai, Darbhanga, Bihar, India

[2]Professor and HOD, Department of Anaesthesiology & critical care, Darbhanga medical college & hospital, Laheriasarai, Darbhanga, Bihar, India

[3]Assistant Professor, Department of Anaesthesiology & critical care, Darbhanga medical college & hospital, Laheriasarai, Darbhanga, Bihar, India

[4]Senior Resident, Department of Anaesthesiology & critical care, Darbhanga medical college & hospital, Laheriasarai, Darbhanga, Bihar, India

Received: 03-07-2024 / Revised: 10-08-2024 / Accepted: 13-09-2024
Corresponding Author: Dr. Hari Damodar Singh
Conflict of interest: Nil

Abstract

Background: Inguinal Hernia Repair (IHR) is a common surgical procedure that can be performed under General Anesthesia (GA), Regional Anesthesia (RA), or peripheral nerve block (PNB). RA methods offer benefits such as the absence of unconsciousness, reduced respiratory depression, and faster recovery compared to GA. Both GA and RA are considered safe for lower abdominal surgeries. While GA is associated with patient satisfaction and suitability for longer surgeries, RA is preferred for its reduced blood loss, better operating conditions, and fewer cardiovascular and thromboembolic complications.

Aim: This study aims to evaluate the efficacy of postoperative analgesia in Paravertebral Block versus Spinal Anesthesia for unilateral inguinal hernia repair.

Methods: A randomized controlled trial was conducted at Darbhanga Medical College & Hospital over two years, enrolling 100 ASA Grade I and II patients aged 18–60 years. Patients were randomly assigned to receive either PVB (Group PVB) or SA (Group SA). Primary outcomes included postoperative analgesia, measured by VAS scores, time to ambulation, and hospital stay duration. Secondary outcomes included hemodynamic stability, complications, and patient satisfaction.

Results: Both groups showed comparable age and gender distributions. There was no significant difference in VAS scores between PVB and SA (P = 0.83), and both techniques had similar hemodynamic profiles and complication rates. However, PVB was associated with faster recovery and less postoperative pain.

Conclusion: PVB and SA are both effective anesthetic techniques for IHR. PVB offers advantages in terms of quicker recovery and reduced pain, making it a suitable alternative for patients, especially those with cardiovascular co-morbidities.

Keywords: Inguinal Hernia Repair, Paravertebral Block, Spinal Anesthesia, Postoperative Analgesia, Regional Anesthesia, General Anesthesia.

Introduction

"Inguinal Hernia repair (IHR) is a frequent surgical procedure" which can be done under GA, RA as well as peripheral nerve block. There are potential benefits of RA methods as compared to GA such as absence of unconsciousness, absence of respiratory depression, lower rates of PONV, and more rapid recovery. [1]. Both GA and RA are safe options for lower abdominal surgery. Benefits of employing GA (GA) include patient satisfaction as well as the ability to do lengthy procedures in a prone position without compromising airway integrity. [2]

The most significant benefits of RA, on the other hand, reduction in IOP blood loss with better operating conditions, a reduction in peri-operative cardiac ischemic events, post-operative hypoxic incidents, arterial or venous thrombosis, and the ability to appropriately manage pain following surgery. An acceptable anesthetic technique must have characteristics such as rapid onset and reversal of effects. Also, it must maintain stable hemodynamics during operation without need to increase blood transfusion. Lastly, an excellent

anesthetic must decrease recovery room stay while reducing postoperative pain, nausea, vomiting, and the requirement for additional analgesics. Our search in medical literature showed, there are controversies whether SA or GA offers advantages for lumbar disk surgery. [3] Spinal Anesthesia being a RA has become very popular over GA for IHR, as it suppresses the stress response to surgical intervention, decreasing morbidity in high-risk patient, and enabling maintenance of analgesia in the postoperative period, cardiovascular system specific adverse events such as arterial vasodilatation, peripheral vasoconstriction, bradycardia and hypotension may pose a problem. [3,4]

High-quality analgesia can be obtained using paravertebral nerve blocks (PVBs), which is advantageous for "patients undergoing various surgical procedures" as well as those with trauma and chronic pain. Even though most clinical reports as well as research focus on unilateral PVB, a variety of research papers refute the notion that midline surgery cannot benefit from it. It has been effective to employ bilateral PVB in the pelvic, abdominal, and thoracic areas. Recently PVB has gained popularity as a good alternative for aesthetic management for IHR.' The special merit of PVB is that it involves "the unilateral administration" of LA drugs to "the nerve roots and related dermatomes without intervening central nervous system [5]. Thus, it can be presumed that PVB avoids the adverse effects of spinal and it is a good alternative method in patients with cardiovascular diseases and co-morbidities. It has been observed that PVB provides rapid recovery and faster return to daily activities.

This study was conducted to compare the efficacy and safety of PVB versus SA concerning post-operative analgesia (POA) measured by VAS score, patient ambulation, duration of hospital stays, and incidence of postoperative complications. The present study has compared various aspects of both procedures so that a reasonable opinion can be drawn.

Material and methods

Study Design

Open Label Randomised Controlled Trial with Parallel 1:1 Allocation

Study Area

Department of Anaesthesiology and Critical Care, Darbhanga Medical College & Hospital, Laheriasarai, Darbhanga, Bihar

Study Duration: 2 Years

Source of Data

ASA grade 1 and 2 patients of male aged between 18 and 60 years posted for elective unilateral IH at Darbhanga Medical College and Hospital.

Ethical Statement

The study protocol was approved by the institutional ethics committee of DMCH, Laheriasarai and complied with International Conference on Harmonization Guideline for Good Clinical Practice and the Declaration of Helsinki. Informed consent was taken from patients before surgery. Participant Information Sheet (PIS) was provided and explained to patients in their local language. Thereafter, consent was approved by taking their signature or thumb impression on the informed consent form. The data were obtained from the hospital record system after appropriate approval from the concerned authorities."

Sample Size

"A total of 100 patients were recruited into the study with 50 patients in each group. Consecutive sampling was done to enroll and randomize all patients with unilateral IH in our study setting and study duration." With VAS score of 2.8 ± 0.25 in SA and 2.6 in PVB group with respect to finding of Bhattacharya P et al. (2010) [6], the minimum sample size for achieving 95% power with "0.05 alpha value" was calculated to be 82.

Sample Selection Criteria

Inclusion Criteria

- Patient of either sex, male or female.
- Patients of ASA Grade I and II
- "Patients of age 18-60 years"
- Patient posted for elective unilateral IH

Exclusion Criteria

- Patient/Patient group refuse to participate
- Infection at proposed site
- Coagulopathies
- Allergy to LAs
- Pre-existing neurological deficit in inguinal, abdominal, and lower limb area.

Procedure

Introduction and Setup

Patients undergoing surgery were categorized into two groups based on the anesthesia technique used: Group PVB (Paravertebral Block) and Group SA (Spinal Anesthesia). For Group PVB, patients were positioned sitting on the surgical table, and the needle entry points were identified 2.5–3 cm lateral to the spinous processes of thoracic vertebrae T10 to lumbar vertebrae L1. For Group SA, patients were

placed in a lateral decubitus position with the operative side dependent. The procedures aimed to ensure effective sensory and motor blocks for pain management and surgical intervention.

Paravertebral Block (PVB) Technique

Using a 25Gauge spinal needle, the paravertebral block was administered by advancing the needle perpendicular to the skin in a parasagittal plane until it touched the transverse processes. The needle was then redirected to "walk off" the caudad edge, advancing 0.5–1 cm deeper before injecting 20 ml of 0.5% bupivacaine (5 ml at each level). This procedure was repeated for T11, T12, and L1 vertebral levels. Success criteria included the onset of sensory block within 15 minutes and achievement of T10-L2 dermatomal sensory block within 30 minutes.

Spinal Anesthesia (SA) Technique

Spinal anesthesia involved the insertion of a 25G Quincke spinal needle into the subarachnoid space, followed by the administration of 3 ml of 0.5% bupivacaine over 30 seconds. After maintaining the lateral decubitus position for 10 minutes, patients were repositioned to supine. Sensory block onset was assessed through pinprick tests at dermatomes T10 to L1, graded from sharp sensation (Grade 0) to no sensation (Grade 2). "Motor block was assessed using the Modified Bromage Scale, ranging from no motor block (Grade 0)" to complete motor block (Grade 3).

Outcome Measurements

Primary outcomes included the time to surgical anesthesia, postoperative analgesia (measured by VAS scores), and time to ambulation. "Hemodynamic parameters such as heart rate, SBP, and DBP were recorded" at predefined intervals intraoperatively and postoperatively. Adverse events like bradycardia, hypotension, and vomiting were managed appropriately and documented. Patient satisfaction was assessed using a numerical scale (1–5) 48 hours post-surgery.

Rescue Analgesia and Monitoring

Rescue analgesia with 50 mg tramadol hydrochloride was administered intravenously if the VAS score exceeded 3. The total number of rescue analgesia doses was recorded over 24 hours. VAS scores were monitored during and after the surgery up to 24 hours postoperatively. The time from anesthetic administration to achieving surgical anesthesia (sensory block at T10) was noted. Overall, the study systematically evaluated the efficacy, safety, and patient satisfaction of the two anesthetic techniques.

Statistical Analysis

"Data from patients with unilateral IHR were presented in tabular form using Microsoft Excel 365 and transferred to SPSS version 24 for further statistical analysis. Continuous data such as BMI, VAS score, time to ambulation, time to surgical anaesthesia, blood pressure, and heart rate were expressed as mean ± SD (standard deviation). Statistical significance of difference in continuous data between group PVB and SA was evaluated by unpaired t-test. Categorical data, including incidence of complications, outcome, age group, gender, type of surgery and frequency of use of rescue drug were reported as percentages and frequencies and then compared by chi-square test or Fisher's exact test. A p-value of less than 0.05 was taken as cut-off for statistical significance."

Results

Table 1 compares the age distribution between the PVB and SA groups, with no statistically significant difference observed (p = 0.83). Both groups had similar proportions of patients across age categories. The majority of patients were in the 31–40 age range (34.00% in PVB and 38.00% in SA), followed by the 41–50 age range (28.00% in PVB and 26.00% in SA). Fewer patients were aged 18–30 (18.00% in PVB and 22.00% in SA) and 51–60 (20.00% in PVB and 14.00% in SA). This indicates that age distribution was comparable, ensuring that differences in outcomes were not influenced by age variations between the groups.

Table 1: Comparison of Age between PVB and SA Group

Age Group	Number of Patients (%)		P-Value
	PVB Group (N = 50)	SA Group (N = 50)	(Chi-square test)
18-30	9 (18.00)	11 (22.00)	0.83
31-40	17 (34.00)	19 (38.00)	
41-50	14 (28.00)	13 (26.00)	
51-60	10 (20.00)	7 (14.00)	

Table 2 compares the gender distribution between the PVB and SA groups, showing no statistically significant difference ($p > 0.99$). Both groups had a predominance of male patients, with 92.00% in the PVB group and 94.00% in the SA group. Female patients comprised only 8.00% in the PVB group and 6.00% in the SA group. The similarity in gender distribution ensures that gender-related factors did not influence the comparative outcomes between the two groups.

Table 2: Comparison of Gender between PVB and SA Group

Gender	Number of Patients (%)		P-Value
	PVB Group (N = 50)	SA Group (N = 50)	(Fisher's Exact test)
Male	46 (92.00)	47 (94.00)	>0.99
Female	4 (8.00)	3 (6.00)	

Table 3 presents a comparison of anthropometric parameters (weight, height, and BMI) between the PVB and SA groups, with no statistically significant differences observed across these variables. The mean weight was 62.83 ± 8.67 kg in the PVB group and 64.59 ± 7.61 kg in the SA group ($p = 0.28$). Similarly, the mean height was 1.63 ± 0.18 meters in the PVB group and 1.65 ± 0.17 meters in the SA group ($p = 0.56$). The BMI values were also comparable, with 23.82 ± 2.97 kg/m² in the PVB group and 23.54 ± 2.65 kg/m² in the SA group ($p = 0.62$). These findings indicate that the two groups were well-matched in terms of anthropometric characteristics, ensuring that these factors did not influence the study outcomes.

Table 3: Comparison of Anthropometric Parameters between PVB and SA Group

Parameters	Parameters in Mean ± SD		P-Value
	PVB Group (N = 50)	SA Group (N = 50)	(Unpaired t test)
Weight in kg	62.83 ± 8.67	64.59 ± 7.61	0.28
Height in meter	1.63 ± 0.18	1.65 ± 0.17	0.56
BMI in kg/m2	23.82 ± 2.97	23.54 ± 2.65	0.62

Table 4 compares the ASA (American Society of Anesthesiologists) status between the PVB and SA groups, showing no statistically significant difference ($p > 0.99$). In the PVB group, 44.00% of patients were classified as ASA I, and 56.00% were ASA II. Similarly, the SA group had 46.00% of patients as ASA I and 54.00% as ASA II. The comparable distribution of ASA status in both groups indicates that the baseline physical health of patients was similar, minimizing any confounding effects related to preoperative health status.

Table 4: Comparison of ASA Status between PVB and SA Group

Gender	Number of Patients (%)		P-Value
	PVB Group (N = 50)	SA Group (N = 50)	(Fisher's Exact test)
ASA I	22 (44.00)	23 (46.00)	>0.99
ASA II	28 (56.00)	27 (54.00)	

Table 5 compares the duration of surgery between the PVB and SA groups. The mean duration was slightly shorter in the PVB group (63.26 ± 11.31 minutes) compared to the SA group (66.85 ± 9.11 minutes), with a mean difference of -3.59 minutes. However, this difference was not statistically

significant (p = 0.08). The 95% confidence interval for the mean difference (-7.6657 to 0.4857) includes zero, further indicating no significant disparity in surgical duration between the two groups. This suggests that the choice of anesthesia method did not markedly impact the time required for surgery.

Table 5: Comparison of Duration of Surgery between PVB and SA Group

	PVB Group	SA Group
Number of Patients (N)	50	50
Duration of Surgery in Minutes	63.26	66.85
Standard Deviation (SD)	11.31	9.11
Difference in Mean	-3.59	
95% CI of Mean Difference	-7.6657 to 0.4857	
P-Value (Unpaired t-test)	0.08	

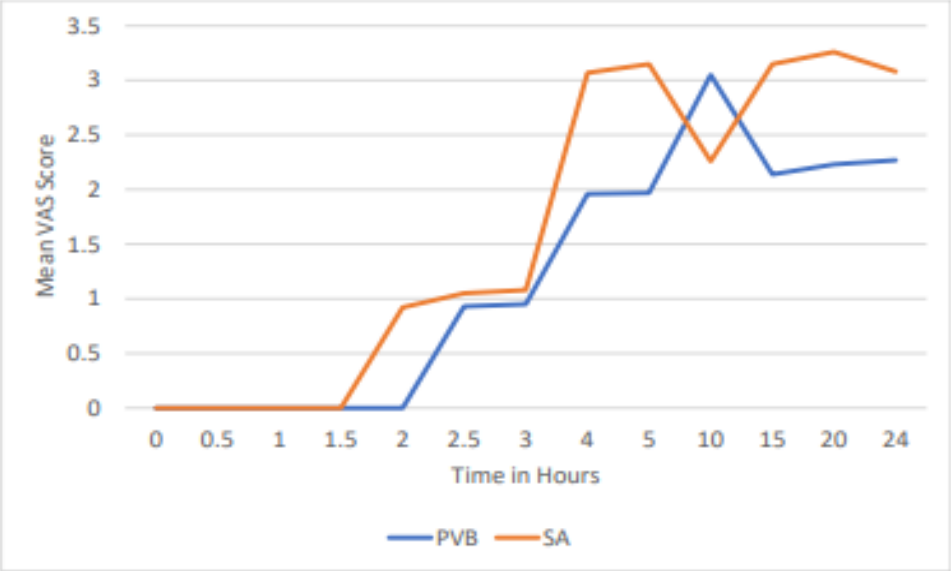

Figure 1: Comparison of VAS Score between PVB and SA Group

The table compares three key outcomes between the PVB and SA groups. The mean time to surgical anesthesia was significantly longer in the PVB group (16.53 ± 2.17 minutes) compared to the SA group (8.51 ± 1.32 minutes), with a mean difference of 8.02 minutes ($p < 0.0001$). Conversely, the time to ambulation was significantly shorter in the PVB group (154.26 ± 17.09 minutes) than in the SA group (237.12 ± 19.04 minutes), with a mean difference of -82.86 minutes ($p < 0.0001$). Additionally, patient satisfaction scores were higher in the PVB group (4.19 ± 0.47) compared to the SA group (3.48 ± 0.51), with a mean difference of 0.71 ($p < 0.0001$). These results suggest that the PVB technique offers advantages in terms of quicker recovery and greater patient satisfaction despite a longer time to achieve surgical anesthesia.

Table 6 Comparison of Key Outcomes Between PVB and SA Groups					
Parameter	**PVB Group (N = 50)**	**SA Group (N = 50)**	**Difference in Mean**	**95% CI of Mean Difference**	**P-Value (Unpaired t-test)**
Time to Surgical Anesthesia (minutes)	16.53 ± 2.17	8.51 ± 1.32	8.02	7.3072 to 8.7328	<0.0001
Time to Ambulation (minutes)	154.26 ± 17.09	237.12 ± 19.04	-82.86	-90.04 to -75.68	<0.0001
Patient Satisfaction Score	4.19 ± 0.47	3.48 ± 0.51	0.71	0.52 to 0.90	<0.0001

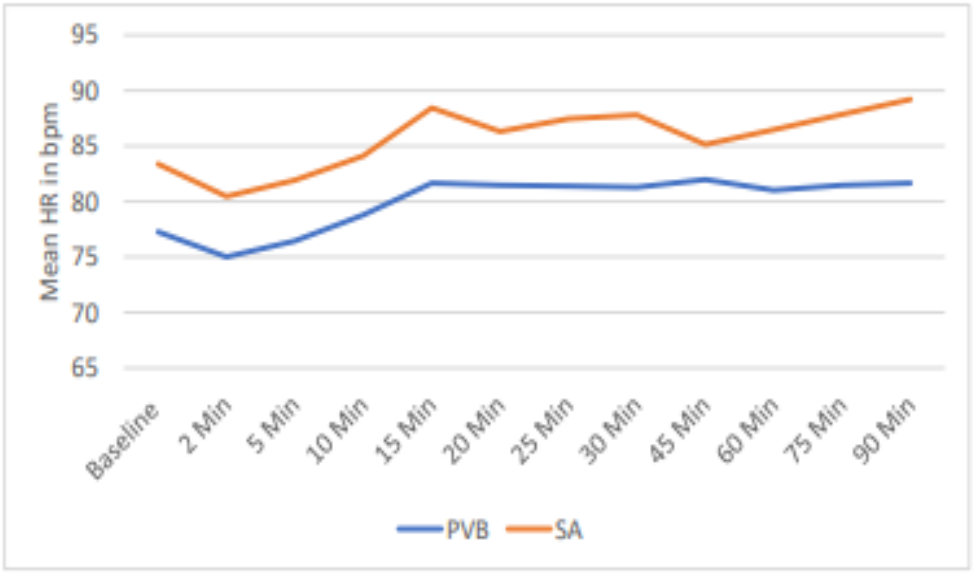

Figure 2: Comparison of HR between PVB and SA Group

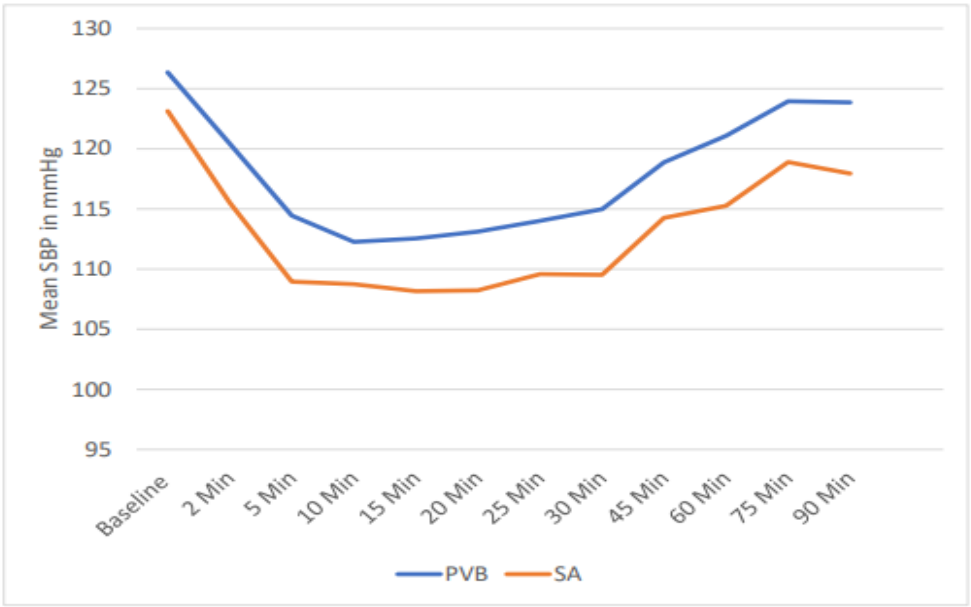

Figure 3: Comparison of SBP between PVB and SA Group

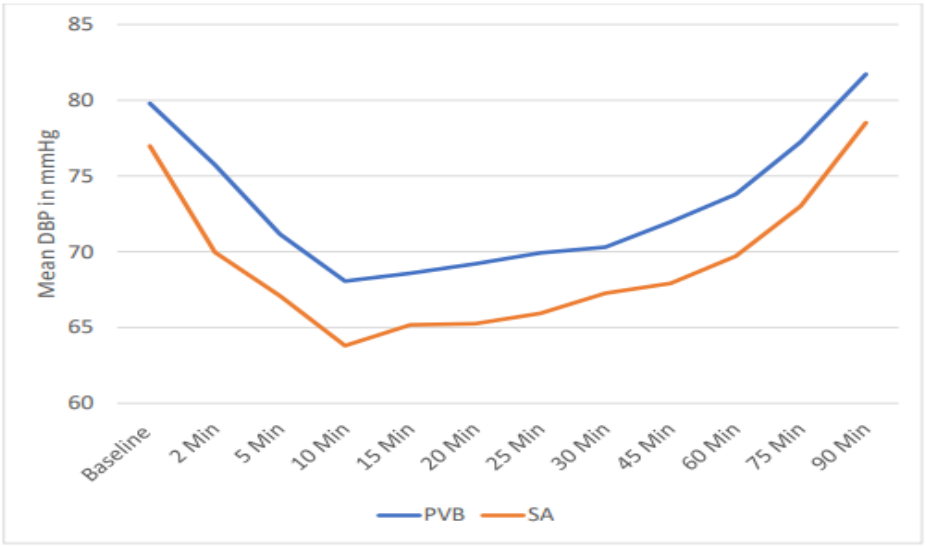

Figure 4: Comparison of DBP between PVB and SA Group

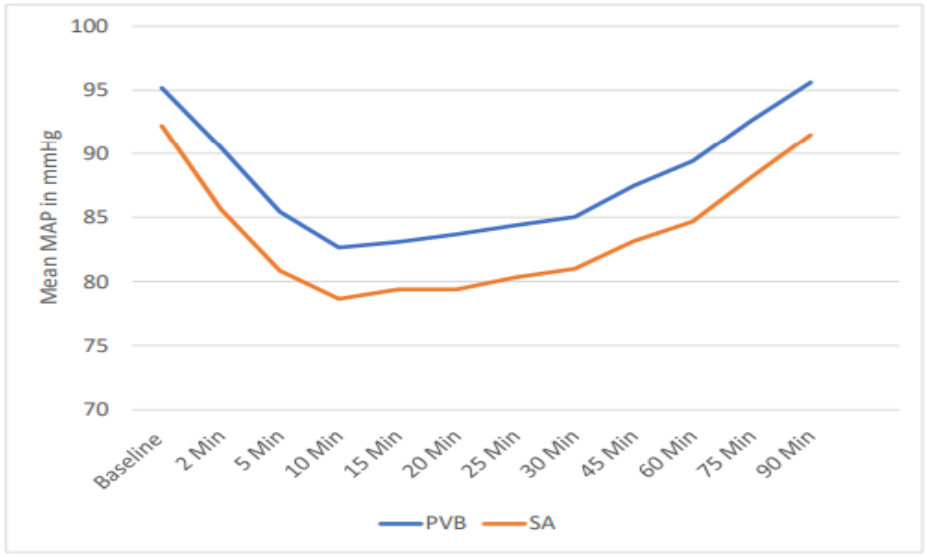

Figure 5: Comparison of MAP between PVB and SA Group

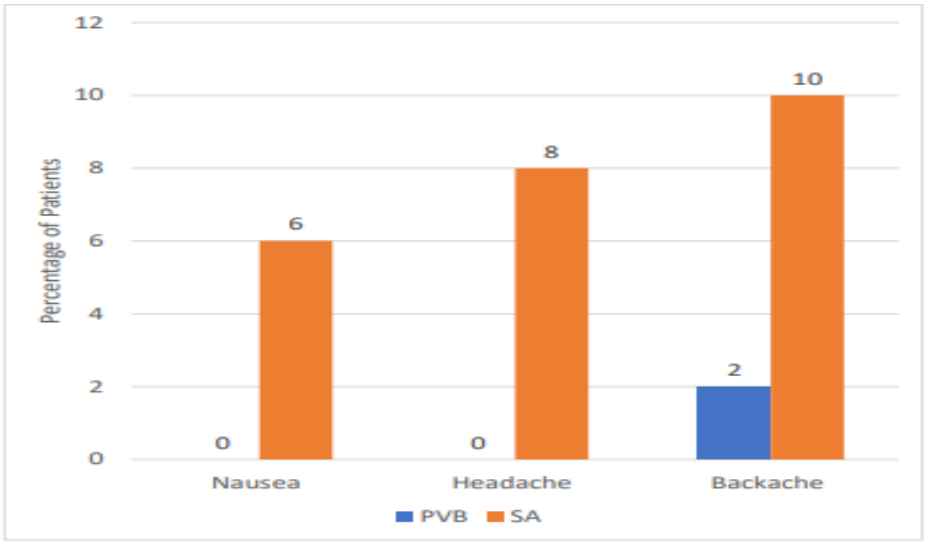

Figure 6: Comparison of complications between PVB and SA Group

Discussion

This randomized controlled trial assessed and compared the efficacy of PVB and spinal anesthesia (SA) in unilateral inguinal hernia (UIH) surgeries. The findings indicated that PVB offers superior postoperative analgesia (POA) with fewer complications compared to SA. Pain severity was significantly lower in the PVB group, with a prolonged duration of analgesia (15.2 ± 3.4 hours in PVB vs. 4.7 ± 1.0 hours in SA). Additionally, PVB facilitated early ambulation, with significantly shorter time to mobilization and discharge compared to SA. Patient satisfaction was notably higher in the PVB group, aligning with findings by Khetarpal R et al. (2017) [7] and other studies.

PVB demonstrated advantages such as maintaining motor function, providing localized sensory block, and reducing postoperative nausea and vomiting (PONV). Hemodynamic parameters, including HR, SBP, and DBP, were more stable in the PVB group due to the unilateral nature of the block and reduced sympathetic involvement. This stability contrasts with the significant hemodynamic changes observed in the SA group, which are attributed to sympathetic blockade, as documented in prior studies [8,9]. Furthermore, the incidence of side effects, including headache, backache, and urinary retention, was significantly higher in the SA group [8].

Despite its benefits, PVB presented challenges such as a longer procedure time due to multiple injections and the requirement for technical expertise. However, this did not impact discharge readiness or patient satisfaction. Complications like pneumothorax, which are associated with deep needle penetration in PVB, were not observed in this study, as the blocks were performed at T10–L1 levels. These findings are consistent with previous literature emphasizing the safety of appropriately executed PVB. The longer sensory block duration in PVB is attributed to reduced blood flow in the paravertebral area, leading to slower absorption of local anesthetics (LAs) [6].

The study also highlighted differences in ambulation and postoperative recovery. No motor block was observed in the PVB group, allowing for earlier mobilization and better functional outcomes. In contrast, SA caused bilateral motor block, delaying mobility until the anesthesia effects subsided. These findings underscore the suitability of PVB for day-care procedures like IHR, where early recovery and minimal side effects are priorities. Additionally, the segmental nature of PVB ensured effective pain relief without restricting movement, further contributing to higher patient satisfaction compared to SA [10,11].

In conclusion, this study supports PVB as a superior anesthetic approach for unilateral inguinal hernia repair in ambulatory settings. It offers extended analgesia, better hemodynamic stability, and fewer side effects than SA, enhancing overall patient experience. While procedural challenges and training requirements remain, PVB's benefits outweigh its limitations, making it a promising alternative to SA. These findings align with prior research and emphasize the need for broader implementation of PVB in similar surgical contexts.

Conclusion

Peripheral nerve blocks (PVB), regional anesthesia (RA), or general anesthesia (GA) can all be used for the common technique known as IHR. RA, including spinal anesthesia (SA) and paravertebral block (PVB), offers advantages over GA, such as reduced unconsciousness, better respiratory function, lower post-operative nausea and vomiting (PONV), and faster recovery. RA techniques also minimize blood loss, reduce perioperative cardiac events, and improve pain management. PVB, particularly, is effective in reducing postoperative pain and provides rapid recovery, making it a valuable option, especially in patients with cardiovascular comorbidities. This study compared PVB and SA in terms of postoperative analgesia, ambulation time, hospital stay, and complications. The effectiveness and safety of both methods were assessed in 100 ASA grade I and II patients having elective unilateral IHR. The results showed comparable age, gender, and anthropometric characteristics between the two groups, ensuring a fair comparison.

References

1. Li L, Pang Y, Wang Y, Li Q, Meng X. Comparison of SA and GA in IHR in adult: a systematic review and meta-analysis. BMC Anesthesiol. 2020 Mar 10;20(1):64. doi: 10.1186/s12871-020- 00980-5. PMID: 32156258; PMCID: PMC7065351.
2. Abrishamkar S, Aminmansour B, Arti H. The effectiveness of computed tomography scans versus magnetic resonance imaging for decision making in patients with low back pain and radicular leg pain. Journal of Research in Medical Sciences. 2006;11(6):351–4.
3. Nnadozie UU, Sunday-Nweke NA, Maduba CC, Madu CI, Nnamonu MI, Akunekwe MI, Igboanugo AA, Okeke VU. Anaesthesia for IHR: Experience with a tertiary hospital-based surgical outreach in a developing world. Ann Afr Med. 2022 Apr-Jun;21(2):140-145. doi: 10.4103/aam.aam_95_20. PMID: 35848646; PMCID: PMC9383021.
4. Smith G, D'Cruz JR, Rondeau B, et al. GA for Surgeons. [Updated 2023 Aug 5]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from:

https://www.ncbi.nlm.nih.gov/books/NBK493199/

5. Ardon AE, Lee J, Franco CD, Riutort KT, Greengrass RA. PVB: anatomy and relevant safety issues. Korean J Anesthesiol. 2020 Oct;73(5):394-400. doi: 10.4097/kja.20065. Epub 2020 Mar 16. PMID: 32172551; PMCID: PMC7533185
6. Bhattacharya P, Mandal MC, Mukhopadhyay S, Das S, Pal PP, Basu SR. Unilateral PVB: an alternative to conventional SA for IHR. Acta anaesthesiologica scandinavica. 2010 Feb;54(2):246-51.
7. Khetarpal R, Chatrath V, Kaur A, Jassi R, Verma R. Comparison of SA and PVB in IHR. Anaesthesia Essays and Research. 2017 Jul 1;11(3):724-9.
8. Isil CT, Çinar AS, Oba S, Isil RG. Comparison of SA and PVB in unilateral IHR. Turk J Anaesthesiol Reanim. 2014; 42:257–63. [PMC free article]
9. Sinha SK, Brahmchari Y, Kaur M, Jain A. The comparative evaluation of safety and efficacy of unilateral PVB with conventional SA for IHR. Indian J Anaesth. 2016; 60:499–505. [PMC free article]
10. Lönnqvist PA, MacKenzie J, Soni AK, Conacher ID. PVBade. Failure rate and complications. Anaesthesia. 1995; 50:813–5.
11. Sinha SK, Brahmchari Y, Kaur M, Jain A. The comparative evaluation of safety and efficacy of unilateral PVB with conventional SA for IHR. Indian J Anaesth. 2016; 60:499–505. [PMC free article]