ORIGINAL RESEARCH

Comparison of Paravertebral Block with Spinal Anaesthesia in Unilateral Inguinal Hernia Repair

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ABSTRACTS

Introduction: Paravertebral block is utilised as anaesthesia for surgical operations such as breast surgery, thoracotomy, inguinal hernia repair, renal surgery mostly in unilateral procedures, as well as in chest trauma (rib fracture) for pain relief.PVB has been demonstrated to be more beneficial than traditional spinal anaesthesia for inguinal hernia repair, in relation to early walking and improved postoperative pain ratings. **Materials and Methods:**The study was a controlled experiment that used a double-blind, randomised design. After receiving approval from the institutional ethical committee, a total of 60 male patients between the ages of 18 and 65, with ASA physical status 1 and 2, who were scheduled for elective unilateral hernia surgery, were chosen for the study. The patients were informed about the surgery and its potential complications, as well as the use of VAS rating during the preoperative evaluation. Participants were randomised at random to two groups, labelled P and S, using a sealed envelope procedure. They were then given one of two anaesthetic techniques: Paravertebral block (PVB) or Spinal anaesthesia (SA), depending on their group. Two segment block, T10 and L1, was administered as a para vertebral block. **Result:** The two groups were statistically similar in terms of age, weight, preoperative vital statistics, SBP, DBP, and SPO2. During the operation, the occurrence of low blood pressure and the use of medication to raise blood pressure was more common in group S, with 25 patients (50%), compared to no such occurrences in group P. The total amount of propofol consumed was greater in group P than in group S ($p< 0.001$). The VAS score reached its peak at 6 hours for group P ($p < 0.001$) and at 4 hours for group S ($p < 0.001$). The significance was observed at both 4 and 6 hours. At 12 and 24 hours, there was no noticeable distinction. The pain reliever Tramadol was administered intravenously in 50mg doses as needed when the pain score on the Visual Analogue Scale (VAS) was greater than 4. **Conclusion:**Paravertebral block can be utilised as a substitute for spinal anaesthesia in the surgical treatment of unilateral inguinal hernias. The effectiveness of this can be observed in improved management of blood flow, longer-lasting pain relief after surgery, absence of lingering muscle weakness, early ability to walk, and reduced occurrence of urine retention.

Keywords: Paravertebral block, spinal anaesthesia, surgical treatment, inguinal hernias.

INTRODUCTION

Paravertebral block is employed as anaesthesia for surgical operations such as breast surgery, thoracotomy, inguinal hernia repair, renal surgery mostly in unilateral procedures as well as in chest trauma (rib fracture) for pain relief. Paravertebral block can also be employed for surgical anaesthesia in patients with significant co-morbidities such as chest infection, bronchial asthma, etc., who are unable to tolerate general anaesthesia or neuraxial blocks.[1]An inguinal hernia occurs when a loop of the intestine protrudes into the inguinal canal. Repairing this type of hernia is one of the most common surgical procedures. Repairing or surgically treating an inguinal hernia can be done with either General Anaesthesia (GA) or Regional Anaesthesia (RA).[2]RA approach comprises spinal, epidural or nerve blocks like hernia block (Ilio-hypogastric-Ilioinguinal-Lower intercostals nerves T11 and T12 block) or paravertebral block. Several additional health conditions such as heart, kidney, brain, hormonal, and respiratory problems may be present and make the administration of anaesthesia more challenging. Managing postoperative pain is also a concern in patients at high risk.[3]Nowadays, unilateral spinal anaesthesia (unilateral SA) is commonly used for repairing unilateral inguinal hernias. It effectively blocks both sensory and motor functions.[4]Inguinal

hernia repair can be done utilising many types of anaesthesia, either alone or in combination, to ensure patient satisfaction. Both general anaesthesia and different regional anaesthetic procedures are authorised for the treatment of inguinal hernia. There are several advantages to choosing regional anaesthetic procedures. These include not experiencing unconsciousness, not having respiratory depression, having reduced rates of postoperative nausea and vomiting, and recovering more quickly.[5,6] For inguinal hernia surgery, which is usually performed with central-neuraxialanaesthesia, the Paravertebral block is a good option. It provides better control over the patient's blood pressure, longer-lasting pain relief after the surgery, and reduces complications such as post-operative nausea and vomiting (PONV), urinary retention, and delayed walking.[7] Paravertebral block is also employed in the ambulatory surgery unit for inguinal herniorrhaphy and in outpatient surgeries.[8]The paravertebral block (PVB) has been effectively utilised as both an anaesthetic and analgesic method for inguinal herniorrhaphy.[9,10] PVB offers pain relief similar to comprehensive peripheral nerve block for inguinal herniorrhaphy, providing an alternate approach to managing postoperative pain with fewer negative effects. PVB has been demonstrated to be more beneficial than traditional spinal anaesthesia for inguinal hernia repair, in relation to early walking and improved pain scores after surgery.[11]

MATERIALS AND METHODS

The study was a controlled experiment that followed a double-blind randomised design. After receiving approval from the Institutional Ethics Committee, a total of 60 male patients between the ages of 18 and 65, with ASA physical status 1 and 2, who were scheduled for elective unilateral hernia surgery, were chosen for the study. The patients were informed about the surgery and its potential complications, as well as the use of VAS rating during the preoperative evaluation. The grounds for exclusion were the patient's refusal, substantial cardiovascular, respiratory, hepatic, diabetic, metabolic diseases, morbid obesity, coagulation disorders, mental dysfunction, and allergy to local anaesthetics. Participants were randomised at random to two groups, labelled P and S, using a sealed envelope procedure. They were then given one of two anaesthetic techniques: Paravertebral block (PVB) or Spinal anaesthesia (SA), depending on their group. Para vertebral block was administered as a two-segment block, targeting T10 and L1.[12] The patient was placed in a seated position. The back should adopt a kyphotic position comparable to the one needed for neuraxialanaesthesia. The patient's feet were placed on a stool to provide more comfort and accommodate a larger degree of kyphosis. This widens the gap between the nearby transverse processes and makes it easier to move the needle past the point of contact with the transverse process. Using sterile precautions, a spot 3 cm to the side of the upper part of the bony projections of the spine at the 10th and 1st lumbar vertebrae was identified. The skin was injected with 2% lignocaine at this stage. A 23 gauge Quincke (QBC) needle was put vertically into the skin at this location to reach the transverse process. The needle was then pulled back slightly and moved along the transverse process by adjusting the needle upwards or downwards by 1 cm. Following the withdrawal of blood and cerebrospinal fluid (CSF), using an extension line connected to a Quincke (QBC) needle, 15 ml of bupivacaine (0.5%) was administered at T10 and 5 ml of bupivacaine (0.5%) was given at L1. Patients were moved to a lying position on their backs after the surgery. The patients in group S were given a pre-determined amount of IV fluid, specifically 15ml per kilogramme of body weight. Using stringent aseptic procedures, the L3 - L4 level was accessed after the skin was infiltrated with 2% lignocaine. A 25 G QBC needle was used to approach the subarachnoid area. 12.5 milligrammes of 0.5 percent Bupivacaine (H) administered. Following the procedure, patients were moved to a lying position on their backs. The level of sensory block was evaluated using a pinprick test, and a level slightly above T10 would be attained. Motor blockage was evaluated using the Modified Bromage score.[13]0–3 (0- complete bending of knees and feet; 1- barely able to bend knees, complete bending of feet; 2 - unable to bend knees, but some bending of feet feasible; 3-unable to move legs or feet). Episodes of low blood pressure (mean arterial pressure, MAP <70mmHg) were treated by administering a rapid infusion of intravenous fluids and 6mg of intravenous mephentermine, which was repeated if needed. Episodes of bradycardia (heart rate below 45 beats per minute) were managed by administering an intravenous injection of Atropine 0.6 mg. During the procedure, patients from both groups were given an intravenous infusion of propofol that could be adjusted to achieve a state of light slumber with the ability to easily wake up. The recorded amount of propofol administered was observed. Following the surgical procedure, patients were either sent to the recovery room where they were closely monitored, or they were directly transported to the ward provided they met the necessary requirements for transfer. The recovery room anaesthetist assessed patients using a modified Aldrete score to determine if they were eligible to skip recovery and proceed directly to the ward. The components encompass the capacity to mobilise limbs, exert respiratory force, maintain awareness, regulate blood pressure, and sustain oxygen saturation. Patients were transferred to the recovery room only if they had a modified Aldrete score of 9 or higher.[14]The time it took for the first rescue pain relief after surgery, the time it took for the patient to start walking, the total amount of pain relief medication used in the first 24 hours, and the

occurrence of any adverse effects were recorded. Pain was evaluated using a visual acuity score VAS (ranging from 0 to 10, where 0 represents no pain and 10 represents the most severe pain). Before the surgery, all the patients were informed about the VAS score. Patients having a VAS score more than 4 were given rescue analgesia in the form of a 50 mg injection of Tramadol. The injection could be repeated if needed. An intravenous dose of 4 mg of ondansetron was administered as a rescue medication for anti-emetic purposes. <Any individual, in the event that they have not urinated for a period exceeding 3 hours or are experiencing symptoms of urinary retention, would undergo catheterization.> Additional grievances and adverse reactions were recorded.

RESULT

The two groups were statistically similar in terms of age, weight, preoperative vital statistics, SBP, DBP, and SPO2. During the operation, the occurrence of low blood pressure and the use of a medication to increase blood pressure was more common in group S, with 25 patients (50%), compared to no such occurrence in group P. The total usage of propofol was greater in group P when compared to group S ($p < 0.001$). The VAS score reached its peak at 6 hours for group P ($p < 0.001$) and at 4 hours for group S ($p < 0.001$), with significant differences observed at both 4 and 6 hours. At 12 and 24 hours, there was no notable distinction. The pain reliever Tramadol, in doses of 50mg administered intravenously, was used as needed if the pain score on the Visual Analogue Scale (VAS) was greater than 4. It was repeated every 15 minutes until the pain was reduced and the VAS score was less than 3. The time until the first dose of pain reliever was noticeably different in the two groups ($P< 0.0001$), and the total amount of pain reliever consumed within 24 hours was likewise noteworthy in both groups ($p<0.001$). The time taken for walking was also found to be significant between the two groups, with group S having a longer time ($P< 0.001$). Four patients in group S and one patient in group P suffered postoperative nausea and vomiting (PONV), although this difference was not statistically significant ($p = 0.161$). 5 patients in group S were catheterized during the postoperative period because of urine retention, but no patients in group P required catheterization ($p= 0.05$, significant). All patients in group P skipped the recovery room.

TABLE 1: Demographic profile and baseline vital parameters for patients undergoing inguinal hernia repair

PARAMETERS	GROUP P(n =50)	GROUP S(n =50)
AGE (in years)	48±8.21	48±12.98
WEIGHT (in kg.)	61.18±9.98	59.48±9.98
PRE OP SBP (mm of Hg.)	137.42±16.24	134.40±15.06
PRE OP DBP (mm of Hg.)	84.84±7.826	82.26±8.24
PRE OP SPO2 (%)	99.98 ±0.936	99.68±0.898

All tests are Fischer's exact T test. All values are presented as mean±SD.
Group P Paravertebral group, Group S spinal group, SBP Systolic Blood pressure, DBP diastolic blood pressure, SPO2 oxygen saturation, Pre operative.

TABLE 2: Intra-operative drug requirement in both groups P and S

PARAMETERS	GROUP P	GROUP S
Use of Mephentermine (n & %)	0(0%)	25(50%)*
Propofol dosage (mg.)	168±20	66±10*

For use of Mephentermine Pearson's chi square test was used results presented as no. of patients; For propofol dosage
Fischer's exact T test was used and results described as mean ± SD

TABLE 3: Postoperative recovery times and adverse events

PARAMETERS	GROUP P	GROUP S
Time to first analgesia(min)	350±40	209±27*
Time to ambulation (min)	251±22	372±19
Total analgesia consumption (Tramodol in mg.)	76±33	162±37
Patients with PONV(n)#	2	6
Urinary catheterization(n)#	0	7
Recovery room bypass(n)#	50	17

*Significant ($p<0.05$)
#Pearson's chi square test was used. For others Fischer's Exact T test was used. Results presented as mean ± SD, no. of patients (n), total amount in mg.

DISCUSSION

Based on our research, we discovered that a Paravertebral block (PVB) consisting of 2 segments can be used as an alternative to spinal anaesthesia for unilateral inguinal hernia. This was achievable because of the segmented structure of Paravertebral block (PVB) and the continued sensory block that led to extended pain alleviation. Even after walking, the patient experienced significant pain reduction, which was not observed with spinal anaesthesia. This is because spinal anaesthesia affects a larger area of the spine, including the lower thoracic and lumbar segments, and provides a shorter duration of pain relief. The results were comparable to Mandal et al, who conducted a comparison between PVB and unilateral spinal anaesthesia.[15]

Group S spinal anaesthesia group experienced a significant delay in recovery room bypass due to longer motor block ($p < 0.001$).Bilateral Spinal anaesthesia (SA) with a high amount of Bupivacaine without opioid could be the reason for the delayed ability to walk and greater requirement for recovery room utilisation in the spinal group. This could be due to the remaining motor and sympathetic blockade. On the other hand, walking is initiated earlier following PVB for inguinal hernia surgery, most likely because there is less motor impairment in the lower limbs in group P. Group P had a higher intake of propofol compared to group S because it took longer for the effects to start and because the innervation of the contents of the inguinal sac and the block at the segmental level were different.

Bhattacharya P et al utilised a 4-segment Paravertebral block in their investigation of inguinal hernia,[16]Mandal et al utilised a two-segment PVB in their study. Saito T and his colleagues preferred using a single injection, multi-segment Paravertebral block as an alternative to the multiple injection procedure.[17]While multi-segmental PVB offered effective anaesthesia, it caused patient discomfort due to many needle insertions and increased risk of pneumothorax at higher thoracic levels. Lonnquist and Hildngston discussed the interruption of the Paravertebral space by the psoas muscle at the T12 level.[18]In our work, we employed the same technique as Mandal et al, using a 2-segment PVB at T 10 and L 1. In the spinal anaesthesia group S, the administration of intra-operative mephentermine was elevated because of low blood pressure, which was not observed in the Paravertebral block group. This suggests that the PVB group had better control over their hemodynamics compared to group S. Five patients (16%) from group S needed urinary catheterization after 3 hours of the postoperative period, while none from group P required it. The higher occurrence of urine retention could be connected to low blood pressure, which necessitated more frequent fluid administration, as suggested by Fanelli et al.[19]During the recovery phase after surgery, Paravertebral block can help prevent the difficulties associated with spinal anaesthesia, such as urine retention and the need for catheterization, postoperative nausea and vomiting (PONV), and post dural puncture headache (PDPH). However, the use of smaller diameter pencil-point needles (25G) reduces the occurrence of post-dural puncture headache (PDPH). Drawbacks included the lack of frequent use of Paravertebral block, which was time-consuming and had a higher risk of failure and pneumothorax. The risk of pneumothorax increased with the number of injections and the level of the thoracic region. The likelihood of partial block or block failure may be greater due to lack of familiarity with the technique and the inconsistent nature of the block. Patients in the PVB group required a higher amount of propofol compared to those in the spinal anaesthesia group. Utilising a peripheral nerve stimulator (PNS) or ultrasound guiding block may reduce the rate of failure and enhance the effectiveness of the block.

CONCLUSION

In conclusion Paravertebral block can be used instead of spinal anaesthesia for unilateral inguinal hernia repair. The effectiveness of this can be observed in improved management of blood flow, longer-lasting pain relief after surgery, absence of lingering muscle paralysis, earlier ability to walk, and reduced occurrence of urine retention. The effectiveness of Paravertebral block can be enhanced by utilising Peripheral nerve stimulator (PNS) and ultrasound-guided block. PVB has benefits in offering localisedanaesthesia, allowing for early walking, and providing long-lasting pain relief. When used by skilled professionals, PVB can serve as a secure substitute for unilateral SA in the repair of unilateral inguinal hernias. An anesthesiologist who is familiar with the paramedian epidural block can readily learn PBV. PVB should be performed under the guidance of professionals to ensure the successful revival of this technology for ambulatory surgery. While Paravertebral Block takes more time to do and has a longer sensory onset and duration to achieve surgical anaesthesia, it is associated with much less problems such as nausea, hypotension, bradycardia, or urine retention compared to spinal anaesthesia. Paravertebral Block shows a specific type of blockage on one side, while Spinal Anaesthesia involves obstructions on both sides or many segments. Paravertebral Block using a nerve finder greatly extends the length of time that postoperative pain relief lasts and decreases the occurrence of problems in patients who are having surgery for a simple inguinal hernia on one side. The rate of success can be enhanced by practicing often and utilising ultrasound guidance and nerve stimulators. PVB can be a feasible option instead of central neuraxial block when the latter is not recommended. Paravertebral block could be considered as a substitute for spinal anaesthesia in inguinal hernia surgery, as it offers sufficient

anaesthesia during the perioperative phase and effective pain relief in the postoperative phase.

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