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PROSPECTIVE RANDOMISED COMPARISON OF UNILATERAL PARAVERTEBRAL BLOCK AND SPINAL ANAESTHESIA FOR INGUINAL HERNIA REPAIR SURGERY.

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ABSTRACT

Background
For removal of hernia spinal anesthesia is prevalent. However, unilateral blockades with the paravertebral technique have many benefits.
Objectives: This study is conducted to compare the paravertebral block and subarachnoid block as a technique of anesthesia in case of removal of an inguinal hernia

Materials and Methods
The patients undergoing inguinal herniorrhaphy were included in this study. They were divided into two groups. The first group was given a paravertebral block, and the second group was given a sub-arachnoid block. The vitals in both groups were compared preoperatively and throughout the surgery. The characteristics associated with anesthesia were compared statistically among the groups.

Results
the mean age of the Paravertebral block group was 38.67±13.27, and that of the Subarachnoid block group was 38.17±11.69 years. The mean duration of anesthesia produced in the paravertebral group was 360.34±25.6 minutes compared to the spinal anesthesia group which had a mean duration of 165.45±18.65 minutes. The time required for discharge in the paravertebral group was 195.54±25.6 minutes compared to the time required for the spinal anesthesia group which had a duration of 372.33±18.65 minutes. There were no side effects reported in the paravertebral block group.

Conclusion
The paravertebral unilateral blockade technique of anesthesia provides improved hemodynamic stability, decreased side effects, lesser duration of hospitalization, and optimum sensory blockade compared to spinal anesthesia.

Recommendation
The paravertebral blockade should be the preferred method of anesthesia for inguinal herniorrhaphy.

Keywords: *Inguinal herniorrhaphy, Spinal anesthesia, Paravertebral block*
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INTRODUCTION

Inguinal hernia is a very common disease that requires surgical intervention as herniorrhaphy. It is a regular procedure of removing hernia but the recovery and the surgical procedure are important in treating hernia [1]. Anesthesia used in this procedure decides the recovery and the environment of the surgical procedure. The use of spinal anesthesia has been preferred for decades now but with the advances in anesthetic techniques, it is necessary to reconsider the use of spinal anesthesia [2].

The spinal anesthesia is sufficient to produce to sensory and motor blockade required for the smooth conduction of the procedure. Nevertheless, postoperative hemodynamic instability and pain are the downsides of spinal anesthesia. Overall, spinal anesthesia produces systemic effects that are not required in the case of various procedures such as removal of hernia, breast surgery, thyroid surgery, renal surgery, and any other surgical intervention that is limited to one organ or a single region. The use of anesthesia such that it produces required anesthesia in a particular region of the body has been employed in various surgical procedures [3].

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The use of anesthesia that blocks only a region of the body has not been very common in hernia surgery. The unilateral paravertebral block is a method of anesthesia in which the anesthesia is not given directly into the spine [4]. It is given into the roots of the spinal nerve that leaves vertebral foramina, this procedure produces blockade in a single region and has faster recovery. The people who undergo the removal of hernia using this procedure return to daily activities more easily owing to the analgesia and the regional effect of anesthesia [5].

Apart from the non-systemic anesthesia, paravertebral blockade ensures that there is minimal cardiovascular and respiratory depression. The incidence of nausea, vomiting, and hypotension are less common with the paravertebral blockade. A local anesthetic agent is used in this procedure. It is injected in the roots of the spinal nerve and it produces optimum sensory and motor blockade for a safe environment during the surgery.

The use of this technique in removing hernia is limited. The literature discussing the prospects of paravertebral blockade in hernia surgery is scarce [6]. This study is conducted to compare conventional spinal anesthesia with the paravertebral blockade in surgery for treating inguinal hernia repair.

METHOD

Study design

This study was conducted prospectively for the period of 6 months (April 2024 to September 2024) at Patna Medical College and Hospital, Patna.

Inclusion criteria

The study included patients who were undergoing surgery for the removal of a hernia. These patients belong to ASA grade 1 and 11.

Exclusion criteria

The patients who had cardiovascular disease, respiratory disease, systemic infection, previous surgery less than 6 months ago, infection at the site of surgery, and problems associated with anesthesia in previous surgery are not included in the study.

Intervention

Initially, there were 45 patients recruited for the study as per the inclusion criteria but 5 of them were later excluded as optimum sensory and motor blockade was not obtained while anesthetizing the patients with local anesthetics. In total, 40 participants in this study were randomized into the double-blinded study. 20 of them were given spinal anesthesia using hyperbaric bupivacaine between T10 and L2 the other 20 were given bupivacaine along with epinephrin, and the anesthesia was given in between L2 and L3 or between and L4 paravertebral unilateral anesthesia. The first group was named S and the latter group was named P. The presurgical treatment was kept the same in both groups that is both groups were given intravenous fentanyl and midazolam. They were started with a ringer's solution before anesthetizing them.

The presurgical vitals such as oxygen saturation, heart rate, and blood pressure were recorded, and they were considered as baseline measurements. After anesthesia the pinprick method was used to determine the reach of the blockade, it was performed after 5 min until 30 mins. If after 30 minutes no blockade was observed then they were excluded from the study. In this study, 5 patients did not have blockade. The patients were monitored, and the vitals were recorded after every 3 minutes until surgery. During the surgery, the vitals were recorded every 10 minutes. Post-surgery they were recorded at 2,4,6,8 and 10 hours respectively.

The details regarding the time required for anesthesia, the time required for the surgery to begin, the hospital stay of the patient, nausea, vomiting, or pruritic experience by the patients were recorded. Any incidence of hypotension was treated with mephentermine, the incidence of bradycardia was treated with atropine, and the patients having nausea were given ondansetron.

Randomization

Sequence Generation

The random allocation sequence was generated using a computerized random number generator to ensure an unbiased assignment of participants into two groups: Group P (Paravertebral block) and Group S (Spinal anesthesia). Each participant was assigned a random code corresponding to one of the treatment groups.

Type of Randomization

Simple randomization was applied without restrictions, such as blocking or block sizes, as there's no mention of restrictions in the provided document. This approach allowed for an equal probability of assignment to either group.

Allocation Concealment Mechanism

Allocation was concealed using sequentially numbered, opaque, sealed envelopes. Each envelope contained the

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assignment (either Group P or Group S), which was opened only at the time of intervention to prevent selection bias. The study staff were instructed not to reveal the assignment sequence until participants were randomized.

Implementation

The random allocation sequence was generated by a senior researcher or statistician not involved in the clinical care of participants. Participants were enrolled by a study coordinator, who was also responsible for preparing the sealed envelopes. The anesthesia provider, who did not participate in the randomization process, assigned the participants to their allocated group according to the sequence.

Blinding

This study was double-blinded. Participants were not informed of their assigned anesthesia technique to reduce bias in reporting postoperative outcomes. The primary care providers (anesthesia providers) knew the allocation, as they needed to administer the specific anesthesia technique. However, the postoperative outcome assessors, who recorded vitals and other intraoperative and postoperative data, were blinded to the treatment allocation to maintain objectivity in data collection.

Statistical analysis

The categorical data of the patients such as age and vital measurement were recorded as mean and standard deviation. The data of the two groups were arranged in a tabular format. The data was compared using the student's t-test. The p-value was obtained for the comparison between each parameter.

Ethical consideration

The institutional ethics committee approved this study and information consent was obtained from the patients participating in the study.

RESULTS

There were 5 patients whose block failed from both the groups, they were eliminated from the study. So, the study included 20 patients in the paravertebral group and 20 patients in the subarachnoid spinal anesthesia group. The demographical characteristics such as the age and weight of the patients were comparable. All the patients belong to ASA grade I or II. The baseline vitals were also comparable. However, amongst the intraoperative vital the mean arterial pressure was significantly lower in the spinal anesthesia compared to the paravertebral group. 3 patients from the spinal anesthesia group had significant hypotension and were treated with mephentermin. Tables no.1 and 2 (a-c) give a comparison of the demographical characteristics and preoperative and postoperative vitals of the patients.

Table no.1: Comparing the demographics

Parameters	Paravertebral block	Subarachnoid block	P-value/ Significance
Age in years	38.67±13.27	38.17±11.69	0.99
Weight in Kgs	64.30±8.34	64.37±7.25	0.214

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Table no.2a: Comparing the preoperative, and intraoperative vitals (Oxygen saturation in percentage)

Parameters	Paravertebral block	Subarachnoid block	P-value/ Significance
Baseline	99.34±0.54	98.97±0.87	0.231
After anesthesia	98.15±0.56	99.23±0.45	0.213
3 minutes	99.24±0.69	99.55±0.67	0.324
6 minutes	98.13±0.54	99.33±0.65	0.354
9 minutes	99.43±0.65	98.45±0.57	0.322
12 minutes	98.55±0.87	99.57±0.67	0.355
15 minutes	99.67±0.68	98.54±0.65	0.243
25 minutes	98.56±0.76	98.43±0.86	0.245
35 minutes	99.35±0.65	98.76±0.85	0.231
45 minutes	98.54±0.87	99.65±0.78	0.345
55 minutes	99.56±0.56	98.76±0.78	0.333
65 minutes	98.12±0.23	99.23±0.89	0.321

Table no. 2b: Comparing the preoperative, and intraoperative vitals (Mean arterial pressure)

Parameters	Paravertebral block	Subarachnoid block	P-value/ Significance
Baseline	90.60±0.53	94.07±0.64	0.243
After anesthesia	88.05±0.76	80.55±0.65	0.001
3 minutes	90.78±0.65	73.05±0.62	0.001
6 minutes	90.66±0.23	71.04±0.45	0.001
9 minutes	90.55±0.34	70.56±0.54	0.001
12 minutes	90.54±0.63	74.35±0.65	0.001
15 minutes	90.77±0.56	74.88±0.76	0.001
25 minutes	90.89±0.67	75.66±0.45	0.001
35 minutes	91.23±0.54	74.34±0.56	0.001
45 minutes	90.32±0.53	75.45±0.67	0.001
55 minutes	90.55±0.67	77.80±0.55	0.001
65 minutes	90.66±0.45	79.41±0.23	0.001

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Table no.2c: Comparing the preoperative, and intraoperative vitals (Heart rate)

Parameters	Paravertebral block	Subarachnoid block	P-value/ Significance
Baseline	84.55±0.67	88.63±0.34	0.06
After anesthesia	80.45±0.44	84.54±0.33	0.05
3 minutes	80.34±0.56	82.36±0.77	0.01
6 minutes	80.56±0.44	77.45±0.34	0.001
9 minutes	80.33±0.66	78.54±0.55	0.001
12 minutes	80.37±0.55	77.43±0.53	0.001
15 minutes	80.43±0.54	76.46±0.66	0.0001
25 minutes	79.88±0.43	75.08±0.54	0.00024
35 minutes	80.58±0.34	76.04±0.75	0.0001
45 minutes	80.43±0.55	76.34±0.54	0.00034
55 minutes	80.21±0.38	75.07±0.56	0.00021
65 minutes	80.78±0.47	76.45±0.68	0.00023

The visual analogue score was comparable after the anesthesia and after 12 hours of anesthesia. However, during the 4^{th} hour and 6^{th} hour, the score was significantly different. The scores were lowest just after the anesthesia, and they improved with time. Table no.3 compares the visual analogue scale at different time points for both groups.

Table no.3: Post-operative visual analogue score

Time interval	Paravertebral block	Subarachnoid block	P-value/ Significance
2 hours	0.5	0.5	0.243
4 hours	2.1	3	0.145
6 hours	3.3	2.4	0.067
12 hours	2.5	2.5	0.345
24 hours	2.57	2.58	0.053

The anesthesia took longer time in the paravertebral group compared to the spinal anesthesia group. The time to start the surgery was also longer. The difference in the amount of fentanyl required was significantly different amongst both groups. The paravertebral did not require the boluses for the treatment of hypotension. The IV fluids required for the subarachnoid group were much higher than the other group. The duration of analgesia produced in the spinal anesthesia group was lesser. None of the side effects were experienced by the paravertebral group whereas the spinal anesthesia group had some significant side-effects. Numerically the difference was significant however it was not significant statistically. The patients in the paravertebral group were discharged earlier and they did not require any recovery period after surgery. The characteristics of the anesthesia are compared in Table no.4.

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Table no. 4: Characteristics associated with anesthesia

Characteristics	Paravertebral block	Subarachnoid block	P-value/ Significance
Preoperative			
Time required to perform anesthesia	18.73±1.93	6.05±1.23	0.0000
Time required to start the surgery	17.34±1.43	5.4±2.1	0.000
Intraoperative			
Number of boluses of mephentermine	0	2	0.000
Total amount of fentanyl required	86.54±22.43	50±00	0.001
Amount of intravenous fluids required	1187.27±123.1-	1665.7±243.33	0.000
Postoperative			
Average time required for discharge (min)	195.54±25.6	372.33±18.65	0.001
Analgesia duration (min)	360.34±25.6	165.45±18.65	0.0001
Number of patients who did not require recovery	20	08	0.345
Number of patients who had nausea	0	04	0.243
Number of patients who had backache	0	03	0.23
Number of patients who had a headache	0	5	0.54

DISCUSSION

In this study, it was found that the prevertebral block provided better hemodynamic stability had lesser discharge time, and longer duration of analgesia. Also, there were no side effects reported in the paravertebral group. The removal of inguinal hernia generally employs spinal anesthesia as the preferred technique but recently there were reports regarding the benefits of the unilateral blockade, so to compare and contrast the benefits the paravertebral anesthesia were compared with spinal anesthesia [7,8].

The hemodynamic stability was found in the spinal anaesthesia especially in mean arterial pressure due to complete sympathetic blockade. Similar findings are reported in the other studies as well [9,10]. However, the heart rate and the oxygen saturation were comparable during the whole surgical procedure.

The time required for performing anesthesia was higher in the paravertebral group compared to the spinal anesthesia group. This is attributed to the fact that multiple injections are required in the paravertebral procedure also locating the landmarks for injection is difficult in this case. This finding was consistent with other studies [11,12]. The duration of analgesia was significantly higher in the paravertebral group compared to the spinal anesthesia group. The difference was significant. Also, the side effects reported in this study were numerically much greater in the spinal anesthesia group compared to the paravertebral group. The duration of analgesia and no side effects contributed to the earlier discharge of the patients in the paravertebral group [13].

The earlier discharge lowers the healthcare cost as well as no side effects ensures that the treatment for hypotension and more amount of analgesics are not required. Also, the sensory blockade produced by the paravertebral technique was comparable to that produced by spinal anesthesia [14]. Paravertebral unilateral blockade can be an effective alternative for anesthesia in case of inguinal herniorrhaphy.

CONCLUSION

The paravertebral unilateral blockade technique of anesthesia provides improved hemodynamic stability, decreased side effects, lesser duration of hospitalization, and optimum sensory blockade compared to spinal anesthesia.

LIMITATION

The cohort taken for the study was much smaller. To confirm the findings studies on a larger cohort are required. The study was not double-blinded because the procedures for both anesthesia were completely different.

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RECOMMENDATION

The paravertebral blockade should be the preferred method of anesthesia for inguinal herniorrhaphy.

ACKNOWLEDGMENT

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LIST OF ABBREVIATIONS

PVB- Paravertebral blockade
SAB- Subarachnoid blockade

SOURCE OF FUNDING

No funding was received.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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