ORIGINAL RESEARCH

Comparison of Inguinal Hernia Repair Under Local Anaesthesia Versus Spinal Anaesthesia: A Prospective Study

Dr. M. Senthilvelavan[1], Dr. D.M. Mohanaraja[1], Dr. K. Senthil Kumar[1], Dr. P. Elango[1]

[1]Assistant Professor, Department of General Surgery, Government Erode Medical College and Hospital, Perundurai, Tamil Nadu, India.

Corresponding Author
Dr. P. Elango
Assistant Professor, Department of General Surgery, Government Erode Medical College and Hospital, Perundurai, Tamil Nadu, India
Email: elango.elango25@gmail.com

ABSTRACT
Background: This study aimed to compare the safety, efficacy, and postoperative outcomes of inguinal hernia repair under ultrasound-guided local anaesthesia versus spinal anaesthesia. **Methods:** A prospective analysis was conducted on 50 patients undergoing inguinal hernia repair, divided into two groups: Group A (local anaesthesia) and Group B (spinal anaesthesia). Demographic characteristics, intraoperative parameters, pain perception, and postoperative complications were evaluated. **Result:** The mean age of patients in Group A was 46.12 ± 15.26 years, and in Group B, 42.72 ± 14.25 years (p = 0.420). Surgical duration was significantly shorter in Group A (40.32 ± 10.015 minutes) compared to Group B (61.52 ± 14.344 minutes) (p < 0.001). Group A experienced lower pain intraoperatively and postoperatively. At 12 and 24 hours, Group B had higher VAS scores (p = 0.004, p = 0.022, respectively). Postoperative urinary retention was significantly higher in Group B (p = 0.001). **Conclusion:** Local anaesthesia offers shorter surgical time, reduced postoperative pain, and fewer complications compared to spinal anaesthesia in inguinal hernia repair.
Key words: Inguinal hernia, Local anaesthesia, Spinal anaesthesia, Postoperative pain, Visual Analog Scale, Surgical outcomes.

INTRODUCTION

Supraclavicular brachial plexus blocks have become a Inguinal hernia repair is one of the most commonly performed surgeries worldwide, with millions of cases being reported annually.[1] The condition involves the protrusion of abdominal contents through a weakened spot in the inguinal canal, a defect that may cause discomfort, pain, and potentially life-threatening complications if left untreated. Anaesthesia plays a critical role in determining the overall success of inguinal hernia repair, influencing factors such as intraoperative comfort, postoperative pain management, complication rates, and the length of hospital stay.[2]

Hernia repair techniques have undergone significant advancements since the early 20th century. The use of general anaesthesia dominated for decades, ensuring complete sedation and muscle relaxation.[3] However, the high risk of systemic complications, especially in high-risk patients, prompted a shift towards spinal anaesthesia. Spinal anaesthesia offers the advantage of localized nerve blockade with minimal systemic involvement, reducing the risk of cardiovascular and respiratory side effects associated with general anaesthesia. Additionally, patients experience better postoperative pain control, particularly in the immediate post-surgery period.[4]

Despite these advantages, spinal anaesthesia has its limitations. It is associated with complications such as hypotension, urinary retention, headache, and prolonged recovery time due to the need for complete motor recovery before mobilization. In this context, local anaesthesia has emerged as an appealing alternative. Local anaesthesia, especially when guided by ultrasound, offers a highly targeted, precise nerve blockade, minimizing the systemic effects of anaesthesia. Patients remain conscious and alert during the procedure, and the likelihood of postoperative complications is reduced.[5]

Ultrasound-guided local anaesthesia has become increasingly popular due to its precision in delivering anaesthesia directly to the desired nerve or group of

nerves, significantly improving the efficacy of the block. With the use of real-time ultrasound imaging, anaesthetists can accurately locate the inguinal region's neural structures, improving success rates and reducing the risk of nerve injury, inadvertent vessel puncture, or local anaesthetic toxicity. This technique offers significant advantages over traditional blind methods of local anaesthesia administration, which rely heavily on anatomical landmarks and palpation.[6] The primary objective of this study is to evaluate the safety and efficacy of inguinal hernia repair under ultrasound-guided local anaesthesia. The study also aims to compare outcomes between ultrasound-guided local anaesthesia and spinal anaesthesia in terms of postoperative pain, complications, and hospital stay. Given the growing body of evidence suggesting the superiority of ultrasound-guided techniques in various surgical settings, it is essential to determine whether these findings extend to inguinal hernia repair.[6]

The advent of ultrasound technology has revolutionized the field of regional anaesthesia, particularly in guiding local anaesthetic blocks. Traditional "blind" techniques for administering local anaesthesia relied heavily on the clinician's anatomical knowledge and palpation skills, leading to variability in success rates and an increased risk of complications. Ultrasound guidance, by contrast, offers real-time visualization of the relevant anatomy, including nerves, blood vessels, and surrounding tissues, allowing for precise needle placement and optimal delivery of the anaesthetic agent.[7]

Ultrasound-guided local anaesthesia allows for the direct visualization of the ilioinguinal, iliohypogastric, and genitofemoral nerves, which are commonly targeted in inguinal hernia repair. By ensuring accurate deposition of the anaesthetic near these nerves, ultrasound guidance improves the likelihood of achieving a successful nerve block, reducing the need for additional anaesthetic or conversion to spinal or general anaesthesia during the procedure.[8]

As inguinal hernia repair remains a common surgical procedure, optimizing anaesthesia techniques to enhance patient safety, reduce complications, and improve recovery times is essential. Ultrasound-guided local anaesthesia represents a promising alternative to spinal anaesthesia, offering precise nerve blockade, reduced postoperative pain, and shorter hospital stays. This study aims to evaluate the safety and effectiveness of ultrasound-guided local anaesthesia in inguinal hernia repair, comparing it with spinal anaesthesia to provide valuable insights into the best anaesthetic approach for this procedure.

MATERIALS AND METHODS
Study Setting: This prospective study was conducted at the Department of General Surgery, Madurai Medical College, Madurai, over a period of 12 months from September 2016 to August 2017. The study involved patients diagnosed with inguinal hernia and was designed to compare the outcomes of inguinal hernia repair performed under local anaesthesia versus spinal anaesthesia. The aim was to assess the effectiveness, safety, and postoperative outcomes such as pain, complications, and hospital stay in both groups.

Study Participants: Inclusion criteria were adult patients diagnosed with unilateral inguinal hernia, patients willing to provide informed written consent, and elective cases scheduled for hernioplasty. Exclusion criteria were patients presenting with complicated hernias such as irreducible, obstructed, or strangulated hernias, patients who underwent emergency surgeries, bilateral herniorrhaphy cases, patients with previous appendicectomy, recurrent hernia, or groin hernias other than inguinal, obese patients and patients with huge hernias, and patients with anxiety or those who refused to provide consent for local anaesthesia.

Sample Size: A total of 50 patients diagnosed with inguinal hernia were recruited for this study. The patients were randomly assigned into two groups, with 25 patients in each group. Group A underwent inguinal hernia mesh repair under local anaesthesia, and Group B underwent the procedure under spinal anaesthesia.

Sampling Technique: A simple random sampling technique was employed to assign patients into either Group A or Group B. This method ensured unbiased distribution of participants into the two groups, helping to minimize selection bias.

Study Methodology: Upon admission to the hospital, detailed medical histories were taken from all participants, followed by thorough clinical examinations. Routine investigations, including haemoglobin levels, total leucocyte count, differential leucocyte count, erythrocyte sedimentation rate, random blood sugar levels, renal function tests, chest X-ray, and electrocardiogram, were performed for each patient. Patients were also tested for sensitivity to local anaesthetics and antibiotics prior to surgery.

For patients in Group A (local anaesthesia group), a 50:50 mixture of 1% xylocaine and 0.5% bupivacaine with epinephrine (1:200,000) was used for anaesthesia. The technique involved multiple local injections, including a skin wheal raised 2.5 cm from the iliac crest and subcutaneous infiltration along the line of the surgical incision.

For patients in Group B (spinal anaesthesia group), 12.5 mg (2.5 cc) of 0.5% bupivacaine was injected into the subarachnoid space using a 26-gauge spinal needle at the L3-L4 interspace. All aseptic precautions were followed, and the procedure was converted to general anaesthesia in cases of inadequate or no effect from the spinal block.

All patients underwent tension-free Lichtenstein hernioplasty using a polypropylene prosthetic mesh with dimensions of 15x7.5 cm.

Study Tools: The primary outcome measures included intraoperative and postoperative pain, complications, and hospital stay. Pain was assessed

using the visual analogue scale (VAS), while complications such as urinary retention, wound hematoma, infection, and postoperative headache were recorded. Patients were followed up on postoperative days 3 and 7 to assess for wound healing and other complications.

Statistical Analysis: All collected data were entered into IBM SPSS Statistics software version 25 for analysis. Continuous variables such as postoperative pain scores and hospital stay duration were analyzed using the paired Student t-test. Categorical variables, including complications, were analyzed using the chi-square test. A p-value of <0.05 was considered statistically significant.

Ethical Issues: Ethical approval was obtained from the Institutional Review Board (IRB) of Madurai Medical College prior to the initiation of the study. Informed written consent was obtained from all participants after explaining the study's objectives, the procedures involved, and potential risks. Patients were assured of the confidentiality of their personal information and were informed that participation was voluntary, with the right to withdraw from the study at any stage without any impact on their treatment.

All necessary precautions were taken to ensure patient safety, including testing for anaesthetic sensitivity and providing prophylactic antibiotics pre-operatively. Care was also taken to ensure appropriate postoperative monitoring, with follow-up conducted to identify any delayed complications.

RESULT

The mean age of patients in Group A was 46.12 ± 15.26 years, while the mean age in Group B was 42.72 ± 14.25 years. Although Group A had a broader age range, the difference in mean ages between the two groups was not statistically significant (p = 0.420). The minimum age in Group A was 18 years, while the minimum age in Group B was 24 years. The maximum age in both groups was comparable at 75 years (Group A) and 76 years (Group B).

In both groups, indirect inguinal hernia was more common than direct inguinal hernia. In Group A, 16 patients (64%) had indirect inguinal hernia, and 9 (36%) had direct inguinal hernia. Similarly, in Group B, 20 patients (80%) had indirect inguinal hernia, and 5 patients (20%) had direct inguinal hernia.

The majority of hernias in both groups were located on the right side. In Group A, 17 patients (68%) had right-sided hernias, while in Group B, 15 patients (60%) had right-sided hernias. The proportion of left-sided hernias was slightly higher in Group B (40%) compared to Group A (32%).

Table 1: Demographic Characteristics and Surgical Outcomes of Patients in Group A and Group B.

Variable	Group A (n = 25)	Group B (n = 25)	p-value
Age (years)			
Mean ± SD	46.12 ± 15.26	42.72 ± 14.25	0.420
Type of Hernia			
Indirect Inguinal Hernia (%)	16 (64%)	20 (80%)	0.275
Direct Inguinal Hernia (%)	9 (36%)	5 (20%)	
Hernia Location			
Right (%)	17 (68%)	15 (60%)	0.348
Left (%)	8 (32%)	10 (40%)	
Surgical Time (minutes)			
Mean ± SD	40.32 ± 10.015	61.52 ± 14.344	<0.001*
Pain During Surgery			
No Pain	0 (0%)	2 (8%)	0.612
Mild	21 (84%)	12 (48%)	
Moderate	3 (12%)	10 (40%)	
Severe	1 (4%)	1 (4%)	

*Significant P value

A significant difference was observed in the duration of surgery between the two groups. In Group A, the mean time for surgery was 40.32 ± 10.015 minutes, while in Group B, it was 61.52 ± 14.344 minutes (p < 0.001). It was observed that none of the surgeries in Group A took more than 60 minutes, while in Group B, a few surgeries extended beyond 70 minutes.

Pain assessment during surgery was conducted using a standardized pain scale. In Group A, 21 patients (84%) reported mild pain, 3 patients (12%) experienced moderate pain, and 1 patient (4%) reported severe pain. In contrast, Group B had 2 patients (8%) with no pain, 12 patients (48%) with mild pain, 10 patients (40%) with moderate pain, and 1 patient (4%) with severe pain.

Post-operative complications were observed in both groups, with wound sepsis being more common in Group B (3 cases) than Group A (1 case). Testicular pain was reported in 1 patient from Group A, while urinary retention

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was significantly higher in Group B (5 cases). There were no reports of wound hematoma, headache, respiratory complications, thromboembolism, or recurrence in either group.

Patients in Group B required more post-operative analgesic doses compared to Group A. The mean number of analgesic doses in Group A was 2 ± 1.225, whereas in Group B, the mean was 3.52 ± 1.503 ($p < 0.001$), indicating a significant difference in post-operative pain management between the two groups.

Pain perception was also assessed using the Visual Analog Scale at 12, 24, and 48 hours post-operatively. At 12 and 24 hours, Group B reported significantly higher pain scores than Group A ($p = 0.004$ and $p = 0.022$, respectively). However, at 48 hours, the difference in VAS scores between the two groups was not significant ($p = 0.213$).

Table 2: Post-operative Complications, Analgesic Requirements, and Pain Perception in Group A and Group B.

Variable	Group A (n = 25)	Group B (n = 25)	p-value
Post-operative Complications			
Wound Hematoma	0 (0%)	0 (0%)	0.540
Wound Sepsis	1 (4%)	3 (12%)	
Testicular Pain	1 (4%)	0 (0%)	
Urinary Retention	0 (0%)	5 (20%)	
Analgesic Doses (mean ± SD)	2 ± 1.225	3.52 ± 1.503	<0.001*
Visual Analog Scale (VAS)			
12 hours (mean ± SD)	3.32 ± 0.48	4.36 ± 0.52	0.004*
24 hours (mean ± SD)	2.12 ± 0.38	2.86 ± 0.44	0.022*
48 hours (mean ± SD)	0.78 ± 0.22	1.08 ± 0.28	0.213

*Significant P value

DISCUSSION

This study aimed to evaluate and compare the safety, effectiveness, and outcomes of inguinal hernia repair performed under local anesthesia versus spinal anesthesia. Specifically, the study focused on comparing the surgical duration, intraoperative pain, post-operative complications, analgesic requirements, and patient-reported pain scores in two groups— Group A (local anesthesia) and Group B (spinal anesthesia). The results demonstrated significant differences between the two groups, particularly concerning surgical time, intraoperative pain, and post-operative pain management.

The mean age of patients in Group A (46.12 ± 15.26 years) and Group B (42.72 ± 14.25 years) was comparable, with no statistically significant difference ($p = 0.420$). This similarity in age distribution between the two groups minimizes the potential for age-related confounding factors, such as comorbidities that could affect surgical outcomes or post-operative recovery. Both groups included a broad age range, with the minimum age in Group A being 18 years and in Group B being 24 years, while the maximum ages were 75 and 76 years, respectively. These findings align with previous studies where the demographic characteristics of inguinal hernia patients did not significantly differ between anesthesia techniques.[9]

Indirect inguinal hernia was the predominant type in both groups, affecting 64% of patients in Group A and 80% in Group B. This observation aligns with epidemiological data, which shows that indirect inguinal hernias are more common than direct hernias (Kumar et al., 2015). Hernia location was also predominantly right-sided in both groups, with a slightly higher prevalence of left-sided hernias in Group B (40% vs. 32% in Group A). These findings reflect the general pattern of inguinal hernias observed in clinical practice, where right-sided hernias are often more common due to anatomical factors.[10]

A significant difference in surgical time was noted between the two groups, with Group A having a mean duration of 40.32 ± 10.015 minutes, compared to 61.52 ± 14.344 minutes in Group B ($p < 0.001$). None of the surgeries in Group A took more than 60 minutes, while some in Group B extended beyond 70 minutes. This disparity could be attributed to the anesthetic technique used. Local anesthesia, as utilized in Group A, may have allowed for more efficient surgical procedures due to the avoidance of the preparatory and recovery time associated with spinal anesthesia. Additionally, local anesthesia is known to provide better muscle relaxation, which may facilitate easier hernia repair, contributing to shorter surgical times.[11]

Pain assessment during surgery revealed that patients in Group A experienced significantly less pain than those in Group B. In Group A, 84% of patients reported mild pain, and none reported severe pain, while in Group B, 8% had no pain, 48% reported mild pain, 40% reported moderate pain, and 4% reported severe pain. This finding is noteworthy because local anesthesia provides continuous pain control at the surgical site, reducing intraoperative discomfort. In contrast, spinal anesthesia, while effective in blocking sensation, may result in varying pain experiences

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depending on the level of anesthetic spread and individual patient factors.[12]

Post-operative complications were relatively low in both groups, with some notable differences. Wound sepsis occurred more frequently in Group B (12%) than in Group A (4%), which may be linked to the longer surgical times in Group B, as extended operative durations can increase the risk of infection. Urinary retention was also significantly higher in Group B, with 20% of patients affected, compared to no cases in Group A. This is a well-documented complication of spinal anesthesia, where the blockade of autonomic fibers responsible for bladder control can result in urinary retention.[13]

One of the key findings of this study was the significant difference in post-operative pain and analgesic requirements between the two groups. Group A required fewer analgesic doses (mean 2 ± 1.225) compared to Group B (mean 3.52 ± 1.503, $p < 0.001$). Pain perception, as assessed using the Visual Analog Scale (VAS), was also lower in Group A at both 12 hours ($p = 0.004$) and 24 hours ($p = 0.022$) post-operatively. However, by 48 hours, the difference in VAS scores was not statistically significant ($p = 0.213$), suggesting that pain levels between the two groups equalized over time.

Local anesthesia's superiority in early post-operative pain management may be due to the continuous blockade of nociceptive signals at the surgical site, while spinal anesthesia primarily affects pain during the procedure but may not offer prolonged post-operative analgesia. This has important clinical implications, as effective pain control in the immediate post-operative period is crucial for patient comfort, mobility, and overall recovery.[14]

The findings of this study highlight several clinical implications. First, local anesthesia for inguinal hernia repair offers shorter operative times, reduced intraoperative pain, fewer post-operative complications such as urinary retention, and better early post-operative pain control. These advantages make local anesthesia a viable option, particularly for patients at higher risk for complications associated with spinal anesthesia, such as older adults or those with pre-existing comorbidities.

Despite its strengths, this study has some limitations. The sample size was relatively small, with only 25 patients in each group. A larger study population would provide more robust data and enhance the generalizability of the findings. Additionally, the study did not assess long-term outcomes such as recurrence rates or chronic pain, which are important considerations in evaluating the overall effectiveness of hernia repair under different anesthetic techniques.

CONCLUSION

This study demonstrates that inguinal hernia repair under local anesthesia offers significant advantages over spinal anesthesia, particularly in terms of surgical time, intraoperative pain, and post-operative pain management. While both techniques are generally safe and effective, local anesthesia may provide better early post-operative outcomes and fewer complications such as urinary retention. These findings support the use of local anesthesia as a preferred option for inguinal hernia repair in many clinical scenarios.

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