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ORIGINAL ARTICLE

Influence of pre-operative infiltration of local anesthetics bupivacaine vs lignocaine vs tramadol on postoperative pain control following lichtenstein mesh hernioplasty.

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ABSTRACT… Objective: To evaluate the influence of pre-operative infiltration of local anesthetics bupivacaine V/S Lignocaine V/S Tramadol on postoperative analgesic pain control following Lichtenstein mesh hernioplasty. **Study Design:** Quasi-experimental Trial. **Setting:** Surgical Department, Ittefaq Hospital, Lahore. **Period:** Over four months, with an additional month for statistical analysis from March 2023 to July 2023. **Methods:** Ninety patients aged 18–65 years undergoing elective Lichtenstein mesh hernioplasty were randomized into three groups: Group A received tramadol 2 mg/kg, Group B received 0.25% bupivacaine, and Group C received 2% lignocaine for pre-operative local infiltration. Postoperative pain was assessed using the Visual Analogue Scale (VAS) at 2, 4, 6, 12, and 24 hours. The primary outcome was the duration of postoperative analgesia, defined as the time from completion of surgery to the first request for additional analgesia. **Results:** The tramadol group exhibited a significantly longer pain-free duration (12.25 ± 1.99 hours) compared to the bupivacaine (4.88 ± 1.30 hours) and lignocaine (3.81 ± 1.04 hours) groups ($p < 0.001$). VAS pain scores at all time points were consistently lower in the tramadol group. For instance, at 2 hours postoperatively, the VAS score was 2.09 ± 0.79 in the tramadol group, 3.68 ± 0.96 in the bupivacaine group, and 3.99 ± 1.26 in the lignocaine group ($p < 0.001$). No significant differences in adverse effects were observed among the groups. **Conclusion:** Pre-operative local infiltration with tramadol provides superior and prolonged postoperative analgesia compared to bupivacaine and lignocaine in inguinal hernia repair. Tramadol's cost-effectiveness and favorable safety profile make it a viable option for postoperative pain management, especially in resource-constrained settings.

Key words: Bupivacaine, Inguinal Hernia Repair, Lignocaine, Postoperative Pain, Tramadol.

INTRODUCTION

A hernia is a weakness or disruption of the fibromuscular tissue of the abdominal wall, classified based on its location. Inguinal hernia occurs in the inguinal canal, femoral hernia in the femoral canal, umbilical hernia at the umbilicus, and incisional hernia at a previous surgical site. Less common types include obturator, lumbar, gluteal, and Spigelian hernias. Among these, inguinal hernia is the most prevalent, particularly in males due to inherent weaknesses in the inguinal region.[1] It is further categorized into indirect and direct inguinal hernias. Indirect inguinal hernia, more common in young individuals, arises due to a persistent processus vaginalis and passes lateral to the inferior epigastric vessels. Direct inguinal hernia, seen more frequently in older individuals, protrudes medially through Hesselbach's triangle. Both types can be classified as complete or incomplete based on their extent.[2]

Hernias can also be categorized based on reducibility into reducible, irreducible, obstructed, and strangulated hernias. A reducible hernia can be manually returned to the abdominal cavity, whereas an irreducible hernia remains trapped due to adhesions or a narrow neck, increasing the risk of strangulation. An obstructed hernia causes intestinal blockage without compromising blood supply, while a strangulated hernia leads to vascular compromise, resulting in ischemia and potential necrosis.

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The hernia sac comprises peritoneal folds containing omentum or intestines, covered by layers of the abdominal wall.[3]

Surgical repair is the definitive treatment for hernias, with three primary techniques: herniotomy (removal of the sac), herniorrhaphy (herniotomy with posterior wall repair), and hernioplasty (mesh reinforcement of the posterior wall). These can be performed using open, laparoscopic, or robotic-assisted techniques. Open surgery remains the standard approach, especially in low-resource settings worldwide.[4] Laparoscopic techniques such as trans-abdominal preperitoneal (TAPP) and totally extraperitoneal (TEP) methods offer minimally invasive alternatives with better recovery outcomes.[5] Robotic surgery, primarily used for smaller hernias, enables precise repair with reduced recovery time. Despite surgical advancements, complications such as mesh infection, organ damage, recurrence, nerve injury, and seroma formation remain concerns, and the ideal technique remains under debate.[6]

Postoperative pain management is crucial, as pain is a major concern for surgical patients. Pain relief strategies include opioid and non-opioid analgesics. Non-opioid drugs include acetaminophen, NSAIDs, and metamizole, which provide analgesic and anti-inflammatory effects. Opioids, acting on central nervous system receptors, are categorized as weak (e.g., tramadol, codeine) and strong (e.g., morphine, fentanyl). Additionally, regional anesthesia techniques, particularly local anesthetic wound infiltration, have proven effective in reducing postoperative pain and opioid dependence.[3,9]

Local anesthetics used for wound infiltration, such as lidocaine and bupivacaine, block nerve signals at the surgical site, improving pain control and reducing opioid use. These agents can be administered as a single dose or via continuous infusion through a catheter. Wound infiltration is cost-effective, simple, and enhances postoperative recovery, reducing hospital stay and complications.[7] However, careful dose monitoring is essential to prevent systemic toxicity. Recent studies have explored tramadol as an alternative agent for wound infiltration, demonstrating superior and longer-lasting pain control when compared to bupivacaine, particularly in inguinal hernia repairs.[8-10] Although Aisien et al[4] evaluated this in pediatric herniotomy and orchidopexy, the findings align with adult data and support tramadol's role in improving analgesic outcomes after hernia surgery.[7]

A randomized controlled trial conducted by Niyirera et al. in 2017[9] compared the efficacy of local wound infiltration using Tramadol versus Bupivacaine in patients undergoing inguinal hernia repair under spinal anesthesia. The study enrolled 52 patients, with 26 patients in each group. The results demonstrated that patients in the Tramadol group experienced a significantly longer pain-free period postoperatively, with a mean duration of 12.0 ± 2.0 hours, compared to 4.7 ± 1.3 hours in the Bupivacaine group. Additionally, the postoperative pain scores at two hours were significantly lower in the Tramadol group (VAS 2.0 ± 0.8) than in the Bupivacaine group (VAS 3.7 ± 1.0), with p-values of 0.000 and <0.001, respectively. It suggests that the use of Tramadol may be more effective than Bupivacaine and Lignocaine while used as pre-operative infiltration.

Despite being one of the most commonly performed general surgical procedures, inguinal hernia repair is frequently associated with moderate to severe postoperative pain, especially first 24 hours of surgery. Effective pain control not only facilitates mobilization but also improves patient comfort, minimizes stay at hospital, and the risk of post-surgical chronic pain. In low- and middle-income countries like Pakistan, where healthcare resources are often limited and opioid-related adverse effects pose significant concerns, the choice of local anesthetic for infiltration plays a critical role. While Bupivacaine and Lignocaine are conventionally used in clinical practice, emerging evidence from international studies suggests that Tramadol, when used locally, may offer prolonged analgesia with favorable safety and cost-effectiveness profiles. However, data comparing these agents head-to-head in the Pakistani population are lacking.

Given the variation in patient demographics, pain thresholds, surgical practices, and resource settings, there is a pressing need to evaluate the comparative efficacy of Tramadol, Bupivacaine, and Lignocaine for postoperative pain control in our local context.

METHODS

This quasi experimental trial was conducted in the Surgical Department of Ittefaq Hospital, Lahore, over a period of four months, with an additional month allocated for statistical analysis from March 2023 to July 2023 after the approval of ethical committee (Reference No: IHT/11079/01/01, Date: 10/February/2023).

A total of 90 patients were included in the study, divided equally into three groups (30 patients per group). Sample size was calculated using data from a previously published randomized controlled trial by Niyirera et al. (2017), which reported a mean pain-free duration of 12.0 ± 2.0 hours for Tramadol and 4.7 ± 1.3 hours for Bupivacaine. For this study, a third group receiving Lignocaine was added, with an assumed pain-free duration of 3.5 ± 1.0 hours based on published literature. Using these parameters, the effect size (f) for one-way ANOVA was calculated to be 0.58. With a significance level of $\alpha = 0.05$ and power of 80%, the required sample size was determined to be 30 patients per group, totaling 90 participants.

Patients aged 18–65 years undergoing elective Lichtenstein mesh hernioplasty for primary inguinal hernia were eligible for inclusion. Patients with recurrent hernia, known hypersensitivity to local anesthetics, or those receiving chronic analgesic therapy were excluded, in accordance with the reference study. After obtaining written informed consent, eligible patients were randomly assigned to one of the three groups using a computer-generated randomization list. Blinding was maintained for both the patients and the observer assessing outcomes. Group A received Tramadol 2 mg/kg, Group B received 0.25% Bupivacaine, and Group C received 2% Lignocaine for pre-operative local infiltration at the surgical site. Infiltration was administered 5–10 minutes prior to incision under aseptic precautions. All patients underwent hernioplasty using the Lichtenstein tension-free mesh technique under standardized spinal anesthesia.

Postoperative pain was assessed using the Visual Analogue Scale (VAS) at 2, 4, 6, 12, and 24 hours after surgery. The primary outcome was duration of postoperative analgesia, defined as the time from completion of surgery to the first request for additional analgesia. Secondary outcomes included VAS pain scores at various time points and the requirement of rescue analgesics. Data were collected on a structured proforma, including demographic details, clinical history, surgical variables, and pain scores. Statistical analysis was performed using SPSS version 23. Quantitative data were expressed as mean ± standard deviation, and qualitative variables were presented as frequencies and percentages. One-way ANOVA was used to compare mean pain-free durations and VAS scores between the three groups, with a p-value of <0.05 considered statistically significant.

RESULTS

It summarizes the demographic and clinical characteristics of the 90 patients included in the study. The majority of patients (68.9%) were between 18 and 50 years of age, with a mean age of 41.39 ± 13.88 years. Males constituted two-thirds of the study population (66.7%), reflecting the higher prevalence of inguinal hernia in males. Regarding comorbidities, 17.8% of patients had diabetes mellitus, 22.2% had hypertension, and 35.6% were smokers. These baseline characteristics are consistent with the typical profile of patients undergoing elective inguinal hernia repair.

It presents the comparison of postoperative pain outcomes among the three groups receiving pre-operative local wound infiltration with either Tramadol, Bupivacaine, or Lignocaine. Each group comprised 30 patients. The pain-free duration was significantly longer in the Tramadol group (12.25 ± 1.99 hours) compared to Bupivacaine (4.88 ± 1.30 hours) and Lignocaine (3.81 ± 1.04 hours), with a p-value of <0.001, indicating statistical significance. Similarly, VAS pain scores

at 2, 4, 6, 12, and 24 hours postoperatively were consistently lower in the Tramadol group across all time points. For example, at 2 hours post-op, the VAS score in the Tramadol group was 2.09 ± 0.79, compared to 3.68 ± 0.96 in the Bupivacaine group and 3.99 ± 1.26 in the Lignocaine group ($p < 0.001$). At each subsequent time point (4h, 6h, 12h, and 24h), this trend continued, showing superior and statistically significant pain control in patients receiving Tramadol. These findings suggest that Tramadol provides more prolonged and effective postoperative analgesia than both Bupivacaine and Lignocaine when used for pre-operative infiltration in Lichtenstein mesh hernioplasty.

Variable	Group	Count	Percent
Age (years)	18–50	62	68.9%
	51–65	28	31.1%
	Mean+SD	41.39 ± 13.88	
Gender	Male	60	66.7%
	Female	30	33.3%
Diabetes	Yes	16	17.8%
	No	74	82.2%
Hypertension	Yes	20	22.2%
	No	70	77.8%
Smoker	Yes	32	35.6%
	No	58	64.4%

Table-I. Demographics of the patients undergoing lichtenstein mesh hernioplasty (N=90)

DISCUSSION

This study evaluated the comparative effectiveness of pre-operative local infiltration of tramadol, bupivacaine, and lignocaine in postoperative pain control among patients undergoing Lichtenstein mesh hernioplasty. The findings revealed that tramadol provided significantly longer pain-free duration and consistently lower VAS scores across all postoperative time points. These results reinforce the analgesic superiority of tramadol over traditional local anesthetics like bupivacaine and lignocaine. In terms of demographics, our study population had a mean age of 41.39 ± 13.88 years, with the majority (68.9%) between 18–50 years, and a clear male predominance (66.7%). This demographic distribution is consistent with the known epidemiology of inguinal hernia, which is significantly more common in males due to anatomical factors. Similar male predominance was observed in the studies by Sheraz et al[11] and Niyirera et al[9] both of which also focused on adult patients undergoing elective inguinal hernia repair. Sheraz et al[11] did not report mean age in detail, but their inclusion criteria and patient profile align closely with ours. Meanwhile, Niyirera's[9] study reported a mean age of approximately 40 years, again reflecting a comparable adult male population.

Comorbidities in our sample, including diabetes (17.8%), hypertension (22.2%), and smoking (35.6%), are relevant as potential modifiers of pain perception and wound healing. Although these variables were not directly stratified in our outcome analysis, their frequencies match the typical profile of general surgical patients in Pakistan. Akhtar et al[12] in their study comparing local versus general anesthesia, also included patients with similar age ranges and comorbidity profiles, which may influence postoperative recovery but did not significantly alter pain outcomes in either study.

Regarding pain outcomes, our results are in strong agreement with multiple studies supporting tramadol's superior analgesic effects. Sheraz et al[11] found tramadol infiltration significantly reduced pain and accelerated mobilization compared to bupivacaine. Niyirera et al[9] reported a nearly three-fold increase in pain-free duration with tramadol over bupivacaine (12.0 vs. 4.7 hours), findings that closely match our values (12.25 vs. 4.88 hours). Additionally, Kaki et al[13] emphasized tramadol's effectiveness in reducing movement-related pain without added side effects—mirroring our observation of better pain control with tramadol without any documented increase in complications.

The role of lignocaine in this study, although conventionally used in surgical infiltration, proved to be inferior in both pain duration and VAS scores.

Variable	Group	N	Mean ± SD	95% CI	Range	P-Value
Pain Free Duration	Tramadol	30	12.25 ± 1.99	11.51 – 12.99	8.4–15.8	0.000
	Bupivacaine	30	4.88 ± 1.30	4.40 – 5.37	2.0–7.0	
	Lignocaine	30	3.81 ± 1.04	3.43 – 4.20	1.6–5.8	
VAS 2 Hrs	Tramadol	30	2.09 ± 0.79	1.80 – 2.39	0.0–3.6	0.000
	Bupivacaine	30	3.68 ± 0.96	3.32 – 4.04	1.5–5.2	
	Lignocaine	30	3.99 ± 1.26	3.52 – 4.46	1.5–7.0	
VAS 4 Hrs	Tramadol	30	2.44 ± 1.09	2.04 – 2.85	0.0–4.9	0.000
	Bupivacaine	30	3.73 ± 1.12	3.31 – 4.15	1.0–6.2	
	Lignocaine	30	5.20 ± 1.45	4.66 – 5.74	2.1–8.6	
VAS 6 Hrs	Tramadol	30	3.01 ± 1.08	2.61 – 3.42	0.3–4.8	0.000
	Bupivacaine	30	4.66 ± 1.08	4.26 – 5.06	2.2–7.1	
	Lignocaine	30	5.33 ± 1.22	4.88 – 5.79	2.7–8.5	
VAS 12 Hrs	Tramadol	30	3.23 ± 1.11	2.82 – 3.65	0.6–6.3	0.000
	Bupivacaine	30	4.66 ± 1.41	4.13 – 5.18	2.2–7.4	
	Lignocaine	30	5.79 ± 1.27	5.32 – 6.27	3.2–8.1	
VAS 24 Hrs	Tramadol	30	3.24 ± 0.99	2.87 – 3.61	1.4–5.2	0.000
	Bupivacaine	30	4.42 ± 0.97	4.06 – 4.78	2.0–5.8	
	Lignocaine	30	4.62 ± 1.13	4.20 – 5.04	2.9–7.5	

Table-II. Influence of pre-operative infiltration of local anesthetics bupivacaine vs lignocaine vs tramadol on postoperative pain control following lichtenstein mesh hernioplasty (N=90)

This aligns with results from Wang et al., who showed levobupivacaine provided better outcomes than lidocaine in hernia surgeries, highlighting the shorter duration of action and limited postoperative analgesia offered by lignocaine. Interestingly, while Durrani et al[14] explored timing of bupivacaine administration (pre-incision vs. near closure), their study found no significant impact on pain scores—further underscoring that agent selection, more than timing, may be critical in optimizing postoperative pain management.

Moreover, animal studies like Costa et al.'s[15] swine model demonstrated tramadol's efficacy comparable to lidocaine, offering further biological plausibility for tramadol's local anesthetic potential. While veterinary findings require cautious interpretation, they support the underlying pharmacodynamic rationale observed in human clinical settings. In resource-limited healthcare systems like Pakistan, the choice of a cost-effective, long-acting, and safe local anesthetic is crucial. Tramadol's dual mechanism—peripheral sodium channel blockade and central μ-opioid receptor activation—may explain its superior analgesic profile. Its use could reduce systemic opioid dependence, enhance patient recovery, and potentially lower healthcare burden by minimizing postoperative complications and hospital stays.

Nonetheless, this study is not without limitations. It was a single-center trial with a relatively small sample size. Long-term outcomes such as chronic post-herniorrhaphy pain or recurrence were not assessed. Furthermore, subgroup analysis based on comorbidities, age, or smoking status could provide deeper insights and should be considered in future multicenter studies.

In summary, our findings support existing literature demonstrating tramadol's superior efficacy in postoperative pain control compared to bupivacaine and lignocaine. Demographic comparisons reveal a consistent pattern across studies, with middle-aged male patients predominating and similar comorbidity profiles. These similarities enhance the external validity of our results and reinforce tramadol's potential role

in evidence-based analgesia protocols for hernia surgery in comparable settings.

CONCLUSION

Our study demonstrates that pre-operative local infiltration with tramadol provides significantly longer pain-free duration and lower postoperative pain scores compared to bupivacaine and lignocaine in patients undergoing Lichtenstein mesh hernioplasty. Further multicenter trials with larger sample sizes are recommended to validate these results and explore optimal dosing strategies.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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REFERENCES

1. Shakil A, Aparicio K, Barta E, Munez K. **Inguinal hernias: Diagnosis and management.** Am Fam Physician. 2020; 102(8):487-92. PMID: 33064426.

2. Bulyk I, Shkarban V, Vasyliuk S, Osadets V, Bitska I, Dmytruk O. **The history of inguinal hernia surgery.** Rozhl Chir. 2023; 102(4):149-53. doi:10.33699/PIS.2023.102.4.149-153. PMID: 37344194.

3. Patel VH, Wright AS. **Controversies in inguinal hernia.** Surg Clin North Am. 2021; 101(6):1003-16. doi:10.1016/j.suc.2021.06.005. PMID: 34774269.

4. O'Brien J, Sinha S, Turner R. **Inguinal hernia repair: A global perspective.** ANZ J Surg. 2021; 91(11):2255-60. doi:10.1111/ans.17174. PMID: 34553473.

5. Chen J, Glasgow RE. **What is the best inguinal hernia repair?** Adv Surg. 2022; 56(1):189-203. doi:10.1016/j.yasu.2022.02.007. PMID: 36096570.

6. Campanelli G. **Inguinal hernia: Why is it still a topic of debate?** Hernia. 2021; 25(5):923-25. doi:10.1007/s10029-021-02504-7. PMID: 34562155.

7. Stamenkovic DM, Bezmarevic M, Bojic S, Unic-Stojanovic D, Stojkovic D, Slavkovic DZ, et al. **Updates on wound infiltration use for postoperative pain management: A narrative review.** J Clin Med. 2021; 10(20):4659. doi:10.3390/jcm10204659.

8. Rahman UA, Iftikhar MA, Butt MJ, Miraj MZ, Ahmed K, Ahmed I. **Is tramadol better than bupivacaine in reducing postoperative pain after Lichtenstein mesh hernioplasty when administered in wound: A comparative study.** Esculapio J SIMS. 2023; 19(3):323-27. doi:10.51273/esc23.251319313.

9. Niyirera E, Kiswezi A, Ntirenganya F. **Post-operative pain control in inguinal hernia repair: Comparison of tramadol versus bupivacaine in local wound infiltration: A randomized controlled trial.** East Cent Afr J Surg. 2017; 22(1):80-83. doi:10.4314/ecajs.v22i1.11.

10. Aisien E, Chibuzom CN, Osifo DO, Evbuomwan I. **Post-operative pain control: A comparison between bupivacaine and tramadol local wound infiltration in children undergoing herniotomy and orchidopexy.** Afr J Paediatr Surg. 2024; 21(4):236-41. doi:10.4103/ajps.ajps_172_22. PMID: 38520238.

11. Sheraz M, Mehmood M, Sajid H, Mukhtar B, Haq MBU, Inam A. **Comparison of tramadol versus bupivacaine as local anesthetic in pain control in inguinal hernia surgery.** Ann Pak Inst Med Sci 2023; 19(3):272-6. doi:10.48036/apims.v19i3.885

12. Akhtar MN, Garg SK, Ilahi I, Khan TA. **Comparing the efficacy of local vs. general anesthesia in inguinal hernia repair: Postoperative pain and recovery.** Int J Acad Med Pharm 2025; 7(1):508-13. doi:10.47009/jamp.2025.7.1.98.

13. Kaki AM, Al Marakbi W. **Post-herniorrhaphy infiltration of tramadol versus bupivacaine for postoperative pain relief: A randomized study.** Ann Saudi Med. 2008; 28(3):165-70. doi:10.5144/0256-4947.2008.165.

14. Durrani HD, Kousar R, Iqbal E, Aziz MA, Naqvi SAA, Sehrish A. **Postoperative pain relief: Comparison of bupivacaine before incision and near closure of wound.** Pak J Med Health Sci. 2021; 15(10):2622. doi:10.53350/pjmhs2115102622.

15. Costa GL, Spadola F, Di Pietro S, Nava V, Licata P, Giudice E, et al. **Tramadol vs. lidocaine administered intraperitoneally and in incisional lines for pain management of swine undergoing umbilical hernia repair.** Animals (Basel). 2023; 13(2905). doi:10.3390/ani13182905.

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1	**Sheikh Abubakar:** Data collection, paper writing.
2	**Muhammad Salman Afzal:** Review of manuscript.
3	**Faiqa Nadeem:** Data collection, analysis, paper writing.
4	**Muhammad Afzal:** Discussion writing, review of manuscript.
5	**Iqra Khalid:** Data analysis, review of manuscript.
6	**Faisal Shabbir:** Literature review, data entry.