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Original Article

Comparison of Mesh Fixation Using Sutures and Tacks on Postoperative Pain After Laparoscopic Ventral Hernia Repair

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ABSTRACT

Background: Laparoscopic ventral hernia repair (LVHR) is a commonly performed surgical procedure. The optimal method of mesh fixation is a matter of disagreement. Transfacial sutures are used because they provide strong anchorage. However, it is associated with increased postoperative pain. The tracker fixation can be applied quickly with less discomfort. This study was done to compare the perioperative outcomes and postoperative pain after using two fixation techniques for LVHR.

Methods: This prospective study was conducted on a cohort of 60 patients undergoing elective LVHR. They were randomly allocated to two groups: Group S (transfascial sutures, n = 30) and Group T (tacks, n = 30). The postoperative pain was assessed using the Visual Analogue Scale (VAS), and follow-up was done for 3 months. Assessment of secondary outcomes included operative time, analgesics used, postoperative complications, and hospital stay. Values were analyzed by appropriate statistical software.

Results: The results showed that the demographic distribution of the cohort was equal for comparison. Early postoperative pain scores were found to be significantly higher in the suture group ($p < 0.001$). Overall, opioid consumption within 48 hours was found to be higher in the suture group. The tacker group demonstrated significantly shorter operative times and slightly shorter hospital stay. Complication rates, including seroma, hematoma, and wound infection, were low and similar between groups.

Conclusion: Both fixation methods are safe and effective; however, tacker fixation provides superior early postoperative comfort and operative efficiency without compromising long-term outcomes. The fixation technique may be individualized based on patient factors and surgeon preference.

Keywords: *Laparoscopic ventral hernia repair (LVHR), Transfascial Suture fixation, Tracker mesh fixation, postoperative pain.*

INTRODUCTION

Ventral hernias are a common clinical presentation in general surgical practice and are usually caused by prior abdominal surgeries, trauma, or abdominal wall defects. Laparoscopic ventral hernia repair (LVHR) has become a common practice with developments in the field of minimally invasive surgery based on the fact that it offers many benefits over open repair, such as wound complications, shortened hospital stays, faster than normal recovery rate, and better cosmetic results [1, 2]. Intraperitoneal mesh placement has still been one of the cornerstones of LVHR because it strengthens the abdominal wall and lowers the rates of recurrence. Nevertheless, postoperative pain is one of the primary issues in the postoperative period of LVHR, often impacting the recovery of patients, mobility, and their overall satisfaction [3]. The causes of the postoperative pain in LVHR are varied, and they encompass the size of the hernia defect, type of mesh, extent of tissue dissection, pressure in the pneumoperitoneum, and, significantly, the mode through which the mesh is fixed [4]. Mesh fixation is needed to prevent displacement, folding, or recurrence of hernia; the method used can have a considerable impact on the magnitude of pain postoperatively, in the short term after surgery, and in the long term. The most popular fixation techniques are transfascial sutures as well as titanium or absorbable tacks. There are both advantages and disadvantages inherent to each technique, and therefore, the question of the choice is controversial among

surgeons. Transfacial sutures are characterized by good fixation of the mesh to the abdominal wall of full-thickness, which theoretically reduces the likelihood of hernia recurrence. But sutures can also result in severe tension of the fascia, which is likely to cause acute postoperative pain or chronic pain, particularly when knotted closely or used in the vicinity of neurovascular [5]. Contrarily, tacks provide a faster and technically less complex mode of fixation, less operative time, and low tissue penetration. The drawbacks in the wake of these advantages have been noted, which include the strength with tacks, the possibility of mesh migration, and the development of neuropathic pain due to tack penetration [6].

Previous studies comparing sutures and tacks have not given any conclusive evidence. According to a few studies, tacks can be linked to the reduction of immediate postoperative pain, and according to some other research reports, there is no essential difference and even a higher level of discomfort based on the anatomical location and the number of fixation points [7, 8]. Additionally, there is a possibility that the type of tacks, such as permanent or absorbent, could also impact pain outcomes. Since postoperative pain significantly influences the recovery of patients, analgesic needs, duration of hospitalization, and recovery to normal functioning, it is of clinical importance to know the effects of various fixation methods on pain [9]. Because of variable outcomes, we decided to determine the techniques in relation to patient-centered endpoints such as postoperative pain. This study was done to compare the postoperative pain following LVHR using two commonly practiced fixation methods: transfascial sutures and tacks.

MATERIALS AND METHODS

This prospective study was conducted in the Department of General Surgery, Prathima Institute of Medical Sciences, Naganoor, Karimnagar. Institutional Ethical approval was obtained for the study after following the institutional protocol. Written consent was obtained from all the participants of the study after explaining the nature of the study in the vernacular language.

Inclusion criteria

1. Patients undergoing elective Laparoscopic ventral hernia repair
2. Aged 18 years and above
3. Primary or incisional ventral hernia with defect size ≤10 cm
4. ASA physical status 1 & II
5. Signed informed consent

Exclusion criteria

1. strangulated or incarcerated hernia requiring emergency surgery.
2. Recurrent hernia after previous mesh repair.
3. Active intra-abdominal infection
4. Coagulation disorders
5. Obesity

Depending on the inclusion and exclusion criteria, n=60 patients were selected for elective laparoscopic ventral hernia repair (LVHR) and were recruited and randomly assigned to two parallel groups (n=30 each): Group S (mesh fixation with transfascial sutures) and Group T (mesh fixation with tacks).

Preoperative conditions: The demographics, comorbid conditions, nature of hernia, and intraoperative particulars were captured in a standardized case report form. Standardized preoperative evaluation of all patients included history, physical examination, blood tests, and imaging. Single-dose cephalosporin (unless contraindicated) was given 30-60 minutes before incision. The use of thromboembolic prophylaxis and perioperative fluid management was institutional.
Surgical procedure for LVHR was done under general anesthesia, and the patient was in the supine position. Pneumoperitoneum was introduced to a 12-14 mmHg CO_2 pressure. Three standard ports were used (one 10–12 mm camera port and two 5–12 mm working ports), placed depending on the defect location. Adhesiolysis was performed as necessary to reduce contents and fully expose the hernia defect. The hernia defect was measured intra-abdominally, and a composite intraperitoneal mesh of appropriate size (mesh overlap ≥3–5 cm beyond the defect margins) was selected for all patients to maintain consistency of mesh material.

In Group S (transfacial sutures): Four to six evenly spaced transfascial polypropylene sutures were placed using a suture passer, anchoring the mesh at cardinal points. Sutures were tied extracorporeally and adjusted to achieve secure apposition without excessive tension.

In Group T (tacks): The mesh was positioned similarly and secured with a circular pattern of absorbable or non-absorbable tacks (as per surgeon preference and device availability) placed at 1–1.5 cm intervals around the periphery and across the mesh as needed. The total number and type of tacks applied were recorded.
Operative time (skin incision to closure), intraoperative complications, and estimated blood loss were documented.

Postoperative management: Postoperative care was standardized. All patients received the same multimodal analgesic regimen: paracetamol 1 g IV every 6–8 hours and a non-steroidal anti-inflammatory drug (unless contraindicated). A short course of opioid (e.g., tramadol) was available as rescue analgesia, and usage (dose and frequency) was recorded. Early ambulation and a graduated diet were encouraged per protocol.

Outcome measurements: The primary outcome was postoperative pain measured using the visual analogue scale (VAS; 0 = no pain, 10 = worst imaginable pain). VAS scores were recorded at rest and on coughing by a blinded assessor at 6, 12, 24, 48 hours, and at 1 week, 1 month, and 3 months postoperatively. Secondary outcomes included total opioid consumption in the first 48 hours, length of hospital stay, postoperative complications (seroma, hematoma, wound infection, mesh migration), and chronic pain at 3 months (defined as pain persisting beyond 3 months and affecting daily activities).

Follow-up: Patients were followed in the hospital until discharge and seen in the outpatient clinic at 1 week, 1 month, and 3 months. Any adverse events were recorded and graded according to standard criteria.

Statistical analysis: All the available data were refined, segregated, uploaded to an MS Excel sheet, and analyzed by SPSS version 25 in Windows format. The continuous variables were recorded as mean ± standard deviation or median (interquartile range) and percentages. The categorical variables were calculated by ANOVA to compare VAS scores over time between groups. A two-sided p-value <0.05 was considered statistically significant.

RESULTS

The baseline characteristics of the study cohort are given in Table 1. A critical analysis of the table showed that both groups were comparable with respect to age, gender distribution, BMI, ASA physical status, and type of hernia. The mean age was similar between the suture group (47.3 ± 12.1 years) and the tack group (46.1 ± 11.8 years). The male-to-female distribution showed no significant variation between the two groups. BMI values and ASA grades also did not differ significantly. The proportion of primary versus incisional hernias was almost identical in both groups. Likewise, the mean hernia defect size was similar. This even distribution of the population ensures that there is no effect of confounding factors on the results of the study.

Table 1: Demographic profile of the population groups included in the study

Variable	Group S (Sutures) n = 30	Group T (Tacks) n = 30	p-value
Age (years), mean ± SD	47.3 ± 12.1	46.1 ± 11.8	0.68
Gender (M/F)	18 / 12	17 / 13	0.79
BMI (kg/m²), mean ± SD	28.9 ± 3.4	29.2 ± 3.1	0.71
ASA I / II / III	10 / 15 / 5	9 / 17 / 4	0.87
Type of hernia (Primary/Incisional)	17 / 13	16 / 14	0.79
Hernia defect size (cm), mean ± SD	4.2 ± 1.1	4.1 ± 1.0	0.81

The Intraoperative parameters recorded in the cases are given in Table 2. The mean operative time was significantly longer in the suture group (82.5 ± 14.6 minutes) compared to the tack group (68.7 ± 12.4 minutes), with significant p values. Estimated blood loss did not differ significantly between the two groups. As expected, the number of fixation points varied markedly due to the nature of each technique (mean 5.8 sutures vs. 22.4 tacks). The incidence of peritoneal breach was low and comparable (6.7% vs. 3.3%). No cases required conversion to open surgery. This showed that the track system performed in shorter operative time due to faster mesh deployment and mesh fixation. Both techniques were similar in safety profile.

Table 2: Intraoperative parameters recorded in both groups

Parameter	Group S (Sutures)	Group T (Tacks)	p-value
Operative time (min), mean ± SD	82.5 ± 14.6	68.7 ± 12.4	<0.001
Intraoperative blood loss (ml), mean ± SD	38.4 ± 10.2	35.7 ± 9.8	0.28
Number of fixation points (mean ± SD)	5.8 ± 1.2 sutures	22.4 ± 4.3 tacks	—
Peritoneal breach (n, %)	2 (6.7%)	1 (3.3%)	0.55
Conversion to open surgery	0	0	—

Table 3 shows VAS scores at different intervals postoperatively. A critical analysis of the table showed that the level of pain was greater in the suture group within the initial days of the postoperative period. The suture group also had much higher VAS scores (6.8 ± 1.1) at 6 hours than did the tack group (5.4 ± 1.0). The p-values were found to be significant. This was still substantial at 12 hours, 24 hours, and 48 hours. This difference remained significant at 12 hours, 24 hours, and 48 hours. By the end of the first week, pain levels decreased in both groups, with no statistically significant

difference at later intervals (1 week, 1 month, and 3 months). Chronic pain at 3 months was mild and comparable. In patients who have undergone transabdominal sutures, early postoperative pain was always greater. But the results of long-term pain were similar, with no clinically significant differences at 1 month. This shows that the fixation method only affects early recovery but does not affect long-term pain.

Table 3: The mean VAS scores in both groups of the study

Time Point	Group S (Sutures) Mean ± SD	Group T (Tacks) Mean ± SD	p-value
6 hours	6.8 ± 1.1	5.4 ± 1.0	<0.001*
12 hours	6.1 ± 1.0	5.0 ± 0.9	<0.001*
24 hours	5.3 ± 1.2	4.2 ± 1.0	0.001*
48 hours	4.1 ± 0.9	3.5 ± 0.8	0.01*
1 week	2.3 ± 0.7	2.0 ± 0.6	0.09
1 month	1.1 ± 0.4	1.0 ± 0.4	0.36
3 months	0.6 ± 0.3	0.5 ± 0.2	0.18
*Significant			

Table 4 depicts the postoperative complications and analgesic needs in the cohort. There were low rates of seroma formation, wound infection, and hematoma that were comparable in the groups. At 3 months, chronic pain was experienced in 10% of the suture group as well as 3.3% of the tack group. However, the amount of opioids used in total in 48 hours was compared. It showed that the suture group (140 ± 32 mg) had a greater demand for opioids than that used in the tack group (110 ± 28 mg) ($p = 0.001$). The duration of stay in hospital was a bit longer in the suture group (2.4 ± 0.6 days vs. 2.1 ± 0.5 days), and p-values were found to be significant.

Table 4. Postoperative Complications and Analgesic Use

Outcome	Group S (n = 30)	Group T (n = 30)	p-value
Seroma formation	3 (10%)	2 (6.7%)	0.64
Wound infection	1 (3.3%)	1 (3.3%)	1.00
Hematoma	1 (3.3%)	0	0.31
Mesh migration	0	0	—
Chronic pain at 3 months	3 (10%)	1 (3.3%)	0.29
Opioid use (mg tramadol/48h), mean ± SD	140 ± 32	110 ± 28	0.001
Length of hospital stay (days), mean ± SD	2.4 ± 0.6	2.1 ± 0.5	0.04

Table 5 gives a comparison of key outcomes of the cohort in the study groups. Early postoperative pain, more opioid consumption, and even shortened hospitalization were more evident in the suture group. In the task group, there was a shorter time of operation. There was no difference in complication rates and chronic pain; however, there was a tendency towards tacks with chronic pain (3.3% vs. 10%). Comprehensively, both methods were safe, although the early recovery seemed more comfortable with tack fixation. Tack fixation proved to have benefits when it comes to the efficiency of the operation and the alleviation of early postoperative pain. The two approaches were equally helpful in avoiding complications and chronic pain, indicating that the fixation can be personalized through the preference of a surgeon and the characteristics of the patient.

Table 5. Summary of Primary and Secondary Outcomes

Outcome	Group S (Sutures)	Group T (Tacks)	Interpretation
Peak postoperative pain (VAS 6h)	6.8 ± 1.1	5.4 ± 1.0	Higher early pain in sutures
Operative time (min)	82.5 ± 14.6	68.7 ± 12.4	Tacks significantly faster
Opioid requirement (mg/48h)	140 ± 32	110 ± 28	Sutures required more analgesia
Complication rate (%)	20%	13.3%	Comparable
Chronic pain at 3 months	10%	3.3%	Slightly higher with sutures
Hospital stay (days)	2.4 ± 0.6	2.1 ± 0.5	Slightly longer with sutures

DISCUSSION

The current research compared postoperative pain and other clinical outcomes of the laparoscopic ventral hernia repair (LVHR) with two groups using mesh fixation techniques, namely, transfascial sutures and tacks. The results of the study showed that in both groups, there was no significant difference in baseline on the variables of demographics, hernia characteristics, and ASA status, which demonstrates good randomization and the reduction of possible confounding factors. The focus on similar baseline comparability has been prioritized in the preceding LVHR research, where the patient-based variables were depicted to affect the postoperative comfort and complication patterns [1, 4]. Among the

important observations of this study was the greater number of early postoperative pain that was recorded in the suture group. Pain VAS scores were generally higher at 6, 12, 24, and 48 hours as compared to the control group. This finding is consistent with the past evidence indicating that transfascial sutures, although they are better at anchorage, can result in greater tension at fascial penetrations, which can be irritating to the peri-neural tissue [5, 10]. The tack group instead had a lower VAS level of pain, probably because of less penetration depth and strain on the fascia. Sajid et al. reported similar results, and in a large meta-analysis, they stated that tacker fixation decreased early postoperative discomfort [8].

Interestingly, the postoperative pain score of both groups became similar during the initial postoperative week and in further assessment of the two groups (1 month and 3 months). It is in line with the literature stating that the long-term pain following LVHR is a multifactorial condition that might be affected more by the features of mesh, fixation overload, and patient factors than by the approach taken to fixation [6, 9]. The proportion of chronic pain was similar in both groups, and there was no significant difference observed, but the sutures group had a slightly higher percentage, a fact that has also been pointed out in other past studies with comparison of the fixation techniques [11]. The tack group had a greatly lesser operation time and can be more efficient in the routine practice as compared to the tranfacial suture group. These findings are seconded by previous research in this field, which indicated that tacks are easier to apply and therefore shorten the period of fixation, particularly in covering big defects [7, 12]. The operative time was different, but fortunately, there was no difference in blood loss and intraoperative complications, and this supports the idea that both procedures are safe and technically feasible. Low postoperative complications, including seroma, hematoma, wound infection, and mesh-related complications, were similar in the two groups. This is in agreement with international LVHR statistics that show that the mesh fixation option does not significantly affect the complication rates when done under the standardized surgical approach [3, 4]. Seroma formation, which is usually linked with LVHR, also exhibited a similar distribution, which is the same as that recorded internationally [13].

The consumption of analgesics during the initial 48 hours was also much higher in the suture group, which was associated with the high scores of early pain. Higher opioid demand has been reported above as a proxy measure of tissue injury caused by fixation techniques [6, 10]. However, the tack group took less opioids and had a slightly shorter hospitalization- a result that is consistent with patient-centered outcome studies in the least invasive surgery of the hernia [2, 9]. On the whole, our findings are supportive of tacker fixation in terms of early postoperative comfort and operative efficiency, and do not affect the safety or the long-term outcomes. The clinical implications of such findings should be viewed with caution, though. Although tacks seem beneficial in the initial recovery, other authors emphasize the issue of the fixation strength in the long term, particularly in large or frequent hernias [6, 14]. On the other hand, sutures could be more securely fixed, but they can enhance early pain and analgesic needs. The strengths of this study were a randomization design and the use of a standardized protocol, as well as a well-matched cohort for comparison with no confounding factors. The limitations of this study were a smaller sample size and a single-center design, which may limit its generalizability. Further studies with a larger cohort and multi-center trials will be required to ascertain the chronic pain and recurrence rates.

CONCLUSION

This current study demonstrates that while both transfascial sutures and tacks are safe and effective methods for mesh fixation in laparoscopic ventral hernia repair, tacker fixation offers distinct advantages in early postoperative recovery. Patients in the tack group experienced significantly lower early pain scores, reduced opioid requirements, shorter operative times, and slightly shorter hospital stays. Long-term pain and complication rates, however, were comparable between the two techniques. These findings suggest that tacks may be preferable when prioritizing early postoperative comfort and operative efficiency, whereas sutures remain a reliable alternative.

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Conflicts of interests: The authors declare no conflicts of interest.
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