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A prospective study comparing the outcomes of mesh fixation with suture material versus tackers in Intra-Peritoneal Onlay Mesh (IPOM) repair

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Abstract

Background: Laparoscopic Intra-Peritoneal Onlay Mesh (IPOM) repair is widely used for ventral hernia repair due to its minimally invasive approach and favorable outcomes. However, the optimal technique for mesh fixation whether using sutures or tackers remains debated, particularly with respect to pain outcomes, cost-effectiveness, and procedural time.

Objective: To compare the clinical outcomes, postoperative pain, operative time, and complication rates between mesh fixation with non-absorbable sutures versus absorbable tackers in laparoscopic IPOM repair.

Methods: In this prospective, randomized controlled study conducted at a tertiary care center from January 2023 to June 2024, 60 adult patients with uncomplicated ventral hernias were randomly assigned to undergo mesh fixation using either sutures (N=30) or tackers (N=30). Operative time, mesh fixation time, postoperative pain (VAS scores), duration of analgesia requirement, and complication rates were assessed. Data were analyzed using SPSS v25.0 with $p<0.05$ considered statistically significant.

Results: Baseline demographic and clinical variables were statistically comparable in both groups. Mean mesh fixation time was significantly shorter in the tacker group (24.3±5.4 min) versus the suture group (39.7±9.8 min; $p<0.001$). However, VAS score and rescue analgesia requirements were significantly higher in the tacker group (66.7% vs. 26.7%; $p<0.001$). No significant differences were observed in surgical site infection or early complication rates. By 3 months, pain scores had decreased to negligible levels in both groups.

Conclusion: Tackers are associated with shorter operative times but significantly greater early postoperative pain compared to sutures. Suture fixation may be preferred for enhanced patient comfort in the early recovery phase.

Keywords: IPOM repair, VAS Scores, ventral hernia, mesh fixation, tackers

Introduction

Repairing a ventral hernia is a common surgical procedure throughout the world and is still a major part of general surgery practice in India. With the evolution of minimally invasive surgical techniques, laparoscopic ventral hernia repair has gained popularity due to its advantages such as reduced postoperative pain, faster recovery, and lower infection rates compared to open techniques. Due to its advantages over open repair, including less postoperative pain, shorter hospital stays, and lower infection rates, laparoscopic ventral hernia repair [1]. Among the various laparoscopic approaches, the Intra-Peritoneal Onlay Mesh (IPOM) technique is widely adopted owing to its technical simplicity and effectiveness in defect closure and reinforcement. It has also grown in popularity in many tertiary care centres throughout India as minimally invasive techniques gain traction [2].

Secure mesh fixation, which stops mesh migration, guarantees correct integration, and lowers the chance of recurrence, is one of the most important factors in successful IPOM repair. Because of their ease of use and short operating time, tackers both absorbable and non-absorbable are frequently utilized in laparoscopic hernia surgery among the various fixation techniques [3]. However, especially in environments with limited resources, tacker fixation has been linked to higher expenses as well as complications like seroma formation and chronic pain [4, 5].

On the other hand, trans-fascial non-absorbable suture fixation provides a more affordable option, and there is evidence that it may result in less pain following surgery and better long-term results [6]. While IPOM repair is technically the quickest and easiest way to repair an inguinal hernia, early recurrences and postoperative complications are rather common [7]. The decision between tacker and suture fixation has important practical and financial ramifications in Indian public and private hospitals, where access to cutting-edge instruments, surgical supplies, and economic considerations can differ greatly [2].

In order to compare the clinical results of mesh fixation using sutures versus tackers in laparoscopic IPOM repair, this prospective study was conducted at a tertiary care centre with aim to assess postoperative pain, operative duration and complications in both groups.

Material and methods

Study Design

This prospective, randomized controlled, comparative, hospital-based study was conducted to assess and contrast the clinical results of two mesh fixation methods used in laparoscopic Intra-Peritoneal Onlay Mesh (IPOM) repair for ventral hernias: Suture fixation and tacker fixation.

Study Duration

The study was carried out at the Department of General Surgery at BGS global institute of medical sciences, Bangalore over the course of 18 months, from January 2023 to June 2024. Ethics clearance was obtained from the Institutional Ethics Committee.

Study Population

The study population included adult patients diagnosed with uncomplicated ventral hernias (including umbilical, epigastric, and incisional types) who were scheduled for elective laparoscopic IPOM repair and were suitable for general anesthesia.

Inclusion Criteria

- Age between 18-70 years.
- Primary or incisional ventral hernias.
- Medically fit for laparoscopic surgery under general anesthesia.
- Provided written informed consent.

Exclusion Criteria

- Recurrent or complicated hernias (e.g., strangulated, obstructed).
- Intraoperative conversion to open repair.
- Severe cardiopulmonary comorbidities.
- Unwilling or unavailable for follow-up.

Based on the study by Kitamura *et al*., [8] which reported a mean pain score difference of 0.7 and an expected 30% incidence of postoperative pain, the required sample size was calculated as 57 patients (α = 0.05, power = 80%). To allow for dropouts and balanced grouping, 60 patients were enrolled 30 in each group. A randomized alternate allocation method was employed to assign participants to either group in a 1:1 ratio.

- **Group A (N=30):** Mesh fixation using non-absorbable sutures (trans-fascial).
- **Group B (N=30):** Mesh fixation using absorbable tackers.

Surgical procedure

After port placement and pneumoperitoneum (10-12 mmHg), adhesiolysis was performed to assess the defect. Mesh size was selected ensuring a 5 cm overlap around the hernia. Commonly used mesh sizes included 15×15 cm, 20×15 cm, and 20×20 cm. The mesh was introduced through a 10 mm port and oriented with the biocompatible side facing viscera. Transfascial sutures were placed using a suture passer at four marked points.

Tacker Group

Mesh was fixed using absorbable helical tackers at 1.5-2 cm intervals using either Single Crown (SC) for defects <4 cm or Double Crown (DC) for ≥ 4 cm defects. No additional ports were needed.

Suture Group

Mesh was fixed using V-Loc 180 barbed sutures with continuous or interrupted bites placed 1.5-2 cm apart. For larger defects, additional simple sutures were taken to prevent sagging. Extra 5 mm ports were used as required for corner fixation. The time taken for mesh fixation was recorded.

Postoperative care

The WHO pain ladder's standard analgesia was adhered to. For the first twenty-four hours, injections of paracetamol were administered intravenously at intervals of six to eight hours. Rescue analgesia was achieved using a 50 mg/100 mg diclofenac suppository based on weight. After the first 24 hours, oral analgesics, such as tablets of tramadol and paracetamol, were administered.

All collected data were entered in Microsoft Excel and analyzed using SPSS software version 25.0. Continuous variables (e.g., operative time, pain scores) were expressed as mean ± Standard Deviation (SD) and compared using the independent t-test. Categorical variables (e.g., presence of complications) were reported as frequencies and percentages, and analyzed using the Chi-square test or Fisher's exact test, as appropriate. A p-value of less than 0.05 was considered statistically significant.

Results

Clinical variables and baseline demographics were well matched between the two groups (tackers and sutures). Male patients were more common in both arms, and the mean age was comparable for tackers and sutures (41.25±6.98 vs. 44.87±8.34 years, respectively). The majority of patients in both groups had normal BMIs, and the underweight and overweight subgroups were similar as well. The distribution of hernia characteristics (defect location, type, size, and urgency of surgery) and comorbidities (hypertension, diabetes, and COPD) did not differ statistically, indicating that the two groups were homogeneous at baseline. The sutures group experienced longer mesh fixation and overall operative times. (Table 1)

Age, BMI, and defect size did not significantly differ between groups on multivariate analysis of continuous variables (Table 2), (All $p > 0.05$). However, tackers offered a procedural efficiency advantage, as evidenced by the significantly shorter mesh fixation time (mean 24.3±5.4 min) compared to sutures (39.7±9.8 min; $p<0.001$).

Table 3 compares various intraoperative and post-operative variables between the tackers and sutures groups in IPOM repair. It shows that factors like type of surgery (elective or emergency), entry technique (Hasson or Veress) and surgical site infections were similarly distributed between the two groups, with no statistically significant differences. The need for rescue analgesia was markedly higher in the tackers group (66.7%) compared to the sutures group (26.7%), with a p-value of < 0.001. This significant difference indicates that patients who underwent mesh fixation with tackers experienced more postoperative pain requiring additional pain relief. There was a significant variation in the mesh sizes used between the two groups (p-value = 0.041). Specifically, the distribution for mesh sizes (10×10, 10×15, 15×15, and 20×15 cm) differed between tackers and sutures, which may relate to underlying hernia characteristics or surgeon preference.

With the tackers group reporting consistently higher VAS scores at all-time points, the figure 1 clearly shows a trend in postoperative pain levels. By three months after surgery, the pain in both groups had gradually subsided to negligible levels (mean VAS: 1.9 for tackers vs. 0.37 for sutures). The tackers group had a mean VAS of 7.8 compared to 5.53 in the barbed sutures group, which was the most noticeable difference in pain during the early postoperative phase, especially at 6 hours. This difference lasted for two weeks before starting to lessen as the patient recovered, and by three months, it was no longer as noticeable (Figure 1).

Table 1: Baseline Characteristics of patients

Characteristics	Tackers (N=30)	Sutures (N=30)
Mean age (years)	41.25 ± 6.98	44.87 ± 8.34
Gender		
Male	16 (53.3%)	18 (60.0%)
Female	14 (46.7%)	12 (40.0%)
BMI (kg/m²)		
Underweight (<18.5)	2 (6.6%)	1 (3.3%)
Normal (18.5–24.99)	23 (76.7%)	22 (73.3%)
Overweight (>24.99)	5 (16.7%)	7 (23.4%)
Type of Co-morbidity		
Hypertension	5 (16.7%)	8 (26.7%)
Diabetes mellitus	3 (10.0%)	5 (16.7%)
COPD	2 (6.7%)	3 (10.0%)
No comorbidity	20(66.6%)	14(46.6%)
Defect Location		
Central	10 (33.3%)	11 (36.7%)
Lower midline	12 (40.0%)	10 (33.3%)
Upper midline	3 (10.0%)	2 (6.7%)
Others	5 (16.7%)	7 (23.3%)
Type of Hernia		
Primary ventral	17 (56.7%)	15 (50.0%)
Incisional	13 (43.3%)	15 (50.0%)
Defect Size (cm)		
1-3 cm	15 (50.0%)	14 (46.7%)
3.1-6 cm	12 (40.0%)	13 (43.3%)
>6 cm	3 (10.0%)	3 (10.0%)
Priority of Surgery		
Elective	28 (93.3%)	27 (90.0%)
Emergency	2 (6.7%)	3 (10.0%)
Mesh Fixation Time	24.3 ± 5.4 min	39.7 ± 9.8 min
Total Operative Time	65.2 ± 13.5 min	79.6 ± 19.3 min
Surgical Site Infection		
Present	3 (10.0%)	4 (13.3%)
Absent	27 (90.0%)	26 (86.7%)

Table 2: Association of variables with surgical technique used

Variables	Surgical Technique	Total Frequency (N)	Mean	Standard Deviation	P-Value*
Age (years)	Tackers	30	41.25	6.98	0.312
	Sutures	30	44.87	8.34	
BMI (kg/m²)	Tackers	30	23.1	4.95	0.558
	Sutures	30	22.45	6.02	
Defect size (cm)	Tackers	30	3.85	1.22	0.741
	Sutures	30	3.94	1.44	
Time for mesh fixation (min)	Tackers	30	24.3	5.4	<0.001
	Sutures	30	39.7	9.8	

*Independent t-test

Table 3: Association of variables with surgical technique used

Variables	Tackers (N=30)	Sutures (N=30)	P-Value*
Type of Surgery			
Emergency	5 (16.7%)	7 (23.3%)	0.512
Elective	25 (83.3%)	23 (76.7%)	
Entry Technique			
Hasson	8 (26.7%)	12 (40.0%)	0.39
Veress	22 (73.3%)	18 (60.0%)	
SSI (Site Infection)			
Yes	3 (10.0%)	5 (16.7%)	0.439
No	27 (90.0%)	25 (83.3%)	
Rescue Analgesia			
Yes	20 (66.7%)	8 (26.7%)	<0.001
No	10 (33.3%)	22 (73.3%)	
Mesh Size (cm)			
10 × 10	5 (16.7%)	7 (23.3%)	0.041
10 × 15	14 (46.7%)	15 (50.0%)	
15 × 15	8 (26.6%)	5 (16.7%)	
20 × 15	3 (10.0%)	3 (10.0%)	

*chi-square test

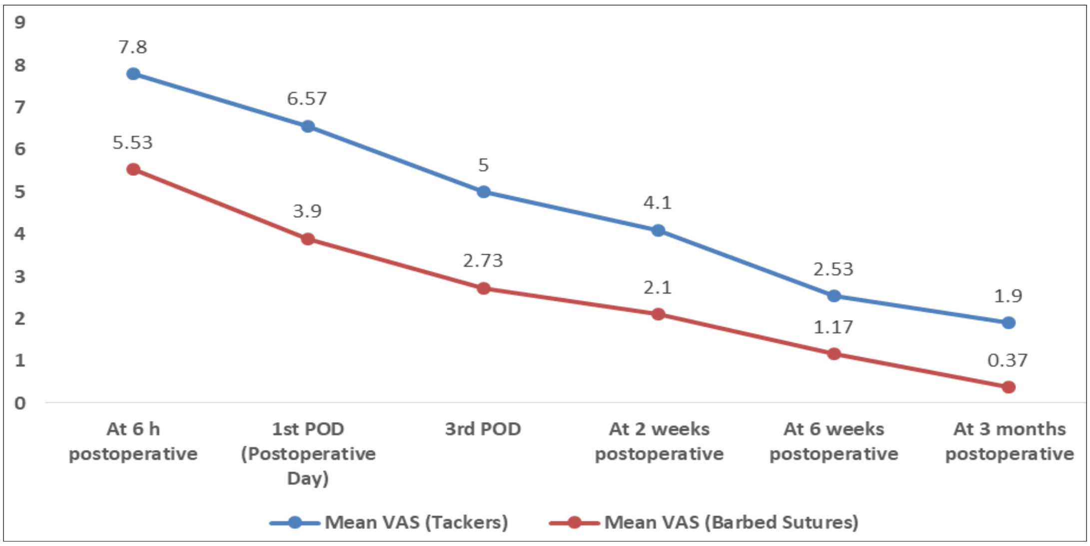

Fig 1: Mean VAS score for postoperative pain

Discussion

This prospective study examined the results of intraperitoneal onlay mesh (IPOM) repair for ventral and incisional hernias using suture material versus tackers. With no statistically significant differences in age, gender, BMI, comorbid conditions, or hernia characteristics, the analysis showed that the two groups were demographically similar, guaranteeing comparability and minimizing baseline bias.

The use of tackers for mesh fixation significantly decreased both the operative and mesh fixation times when compared to sutures (p<0.001), which is consistent with previous research that highlights the procedural effectiveness of tackers in laparoscopic and robotic IPOM repairs. Beldi, *et al*., [9] for instance, claimed that tackers had simpler and quicker deployment during mesh fixation, which resulted in shorter operative durations. Bansal *et al.* [1] found the mean operative time to be 77.5 minutes for suture fixation versus 52.6 minutes for tacker fixation in laparoscopic repair of incisional and ventral hernias (P=0.000). However, this efficiency does not translate into improved clinical outcomes with respect to pain or complications.

The study discovered that patients fixed with tackers consistently reported higher postoperative pain using the visual analogue scale (VAS) at all measured intervals, and that the need for rescue analgesia was significantly higher in the tackers group (66.7% vs. 26.7%, p<0.001). These results are consistent with those of Kumar *et al*., [10] who found that, in comparison to trans-fascial sutures, tacker fixation resulted in higher levels of early postoperative pain and a greater need for analgesics. This could be because metal tackers cause local nerve irritation and focal tissue trauma. Similarly, Shankaran *et al.* [11] randomized controlled trial showed that, although both groups eventually achieved comparable low pain levels by three months after surgery, tacker fixation was linked to higher early pain scores when compared to suture techniques.

For TAPP repair of an inguinal hernia, sutures caused significantly less pain than tackers on postoperative day 1 and at 3 months (P=0.001 and P=0.004) in a randomized controlled study.[12] At one hour, six hours, twenty-four hours, one week, one month, and three months after surgery, Bansal *et al*.[6] showed that the tacker group's pain scores were consistently higher. When mesh fixation was used for inguinal hernia repair, Abbas *et al.* [13] discovered that the suture group experienced significantly fewer complications and VAS pain scores. By three months post-surgery, pain in both groups had diminished to minimal levels (mean VAS: 1.9 for tackers, 0.37 for sutures), reinforcing that long-term pain outcomes are acceptable regardless of fixation type. However, the early postoperative period remains significantly more painful for patients in the tackers group.

There is no significant difference in early complication rates or surgical site infections between suture and tacker fixation techniques [14]. Both methods are shown to be safe and effective for hernia repair, with similar incidence of postoperative complications.

A higher variability in mesh size selection between groups (P=0.041) was observed in the study, which may reflect differences in surgical judgment, hernia characteristics, or a tendency to use larger meshes with certain techniques in more complex or larger defects. Similar variations in mesh size selection have been observed in the literature, where the choice may be influenced by the surgeon's experience and the hernia defect rather than just the fixation technique [1, 14]. Studies confirm no clear advantage of tackers over sutures in terms of chronic pain, quality of life, or recurrence, but recognize the time-saving benefits of tacker use [15]. While tackers offer a time-saving advantage, barbed sutures or conventional suturing may be preferred when early pain management and reduced need for rescue analgesia are clinical priorities.

Conclusion

Among the limitations of this single-institution study are its brief follow-up period and comparatively small sample size. Longer follow-up and larger multicentre trials are required to more accurately assess chronic pain, recurrence rates, and cost-effectiveness, even though no differences in surgical site infections or hernia recurrence were noted. Not with standing these drawbacks, this research indicates that mesh fixation with tackers in IPOM repair considerably cuts down on operating and fixation time when compared to sutures, but does so at the expense of noticeably increased early postoperative pain and a higher requirement for rescue analgesia. Both approaches resulted in positive long-term pain outcomes and were similar in terms of perioperative complications. These results highlight the importance of balancing procedural efficiency with patient comfort and suggest that the choice of fixation technique should be made collaboratively between surgeons and patients, based on individual clinical factors and postoperative recovery priorities.

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