

# A STUDY OF INTRA-CORPOREAL SUTURING OF PERITONEAL FLAP AND SUTURE FIXATION OF MESH VERSUS USE OF TACKER IN LAPAROSCOPIC TRANS ABDOMINAL PREPERITONEAL (TAPP) REPAIR OF INGUINAL HERNIA: A COMPARATIVE STUDY

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## ABSTRACT

**Background:** Inguinal hernia repair is a prevalent surgical procedure worldwide, particularly in developing countries where factors such as heavy labor contribute to its high incidence. Laparoscopic techniques, including the Laparoscopic Transabdominal Preperitoneal (TAPP) repair, have gained traction due to their minimally invasive nature, leading to reduced postoperative pain and faster recovery compared to open surgery. This study aimed to evaluate these two fixation methods in patients undergoing TAPP repair, focusing on operative time, postoperative pain, complications, and recurrence rates. **Materials and Methods:** This prospective, randomized study was conducted at Government Doon Medical College and Hospital, Dehradun, India, over an 18-month period. We compared intracorporeal suturing and tacker fixation methods in TAPP repair. A total of 112 patients aged 18 to 60 years with unilateral or bilateral inguinal hernia were enrolled, randomly assigned to either the suturing or tacker group, and underwent TAPP repair performed by experienced laparoscopic surgeons. Outcome measures included postoperative pain assessed via Visual Analog Scale (VAS) at multiple time points, operative time, hernia recurrence, and complications such as seroma and chronic pain. **Result:** The study involved 112 participants, predominantly male (89.3%) and aged 51-60 years (50.9%). Most hernias were indirect (63.4%) and complete (57.1%), with a higher incidence on the right side (72.3%). Comparing the suture and tacker groups (56 each), the suture group had a significantly longer operative time ( $98.84 \pm 3.81$  minutes) compared to the tacker group ( $74.29 \pm 2.22$  minutes,  $p < 0.0001$ ). Hospital stays were longer for the tacker group as compared to suture group. But postoperative pain levels at 12, 24 and 48 hours was more in for the tacker group as compared to suture group. But seroma formation was comparable between the groups, with no significant differences in pain levels or seroma presence at any follow-up point. **Conclusion:** In conclusion, our study demonstrates that suture fixation offers advantages in terms of lesser postoperative pain levels at 12, 24 and 48 hours and reduced hospital stays without compromising postoperative outcomes compared to intracorporeal tacker.

## INTRODUCTION

Inguinal hernia repair is one of the most common surgical procedures performed globally, with a significant prevalence in developing countries due to factors such as heavy labor and increased intra-abdominal pressure. In India, inguinal hernias

account for a substantial portion of elective surgeries, with an estimated incidence of 1.7% in the general population and higher rates observed among men.<sup>[1]</sup> Laparoscopic techniques have gained popularity in developing countries over the past two decades due to their minimally invasive nature, which leads to reduced postoperative pain, faster recovery, and

lower infection rates compared to open surgery.<sup>[2]</sup> Among these, Laparoscopic Transabdominal Preperitoneal (TAPP) repair has become a preferred method in many surgical centers. This technique involves accessing the preperitoneal space via the peritoneal cavity, placing a synthetic mesh to reinforce the abdominal wall, and closing the peritoneal flap.<sup>[3]</sup>

Mesh fixation and peritoneal flap closure are critical steps in TAPP repair, influencing postoperative outcomes and hernia recurrence. Traditionally, tackers are used for mesh fixation in developing countries, given their ease of use and shorter learning curve.<sup>[4]</sup> However, tacker use has been linked to complications such as chronic pain, with studies indicating that up to 15% of patients experience significant postoperative discomfort. Additionally, tackers may not provide adequate mesh fixation in all cases, potentially leading to recurrence rates of 1-3%.<sup>[5]</sup>

As an alternative, intracorporeal suturing of the mesh and peritoneal flap offers a more secure fixation, potentially reducing postoperative pain and improving patient outcomes.<sup>[6]</sup> This technique, while technically demanding and requiring greater laparoscopic expertise, has shown promise in reducing chronic pain and recurrence rates in some studies.<sup>[7,8]</sup> However, the adoption of intracorporeal suturing has been limited by the need for specialized training and increased operative time.<sup>[9]</sup>

Despite the prevalence of both techniques, there is limited data comparing their outcomes in the Indian context.<sup>[10]</sup> Understanding the efficacy and safety of intracorporeal suturing versus tacker fixation in TAPP repair is crucial for optimizing surgical practice, where access to advanced surgical training and resources can vary widely. This study aimed to evaluate these two fixation methods in patients undergoing TAPP repair, focusing on operative time, postoperative pain, complications, and recurrence rates.

## MATERIALS AND METHODS

**Study Design:** This study is a prospective, randomized study conducted at Government Doon Medical College and Hospital, Dehradun, India, over an 18-month period. The objective was to compare the outcomes of intracorporeal suturing versus tacker fixation of the mesh and peritoneal flap in laparoscopic transabdominal preperitoneal (TAPP) repair of inguinal hernia.

**Study Population:** The study included patients aged 18 to 60 years diagnosed with unilateral or bilateral inguinal hernia. Patients were recruited from the outpatient department of Government Doon Medical College and Hospital. Exclusion criteria included patients with recurrent hernias, those with previous abdominal surgeries, and patients with comorbid conditions that contraindicated laparoscopic surgery.

**Sample Size:** The sample size was calculated to detect a significant difference between the two groups with a minimum detectable difference (d) of 3.2 and a population variance of 36.35 as mentioned in study by Kumar et al.<sup>[11]</sup> This calculation resulted in a requirement of 28 participants per group. To account for an estimated dropout rate of 20%, the initial sample size was increased to 35 participants per group. Therefore, a total of 112 patients were enrolled in the study, with 56 patients in each group.

**Randomization:** Participants were randomly assigned to either the intracorporeal suturing group or the tacker fixation group using a computer-generated randomization sequence. Allocation concealment was maintained using sealed opaque envelopes to ensure blinding.

**Surgical Procedure:** All surgeries were carried out under general anesthesia by a team of experienced laparoscopic surgeons at the institution. The Transabdominal Pre-Peritoneal (TAPP) repair was performed following established protocols for each group. In the Intracorporeal Suturing Group, the procedure involved the fixation of the mesh to the abdominal wall using 2-0 non-absorbable polypropylene sutures, which were placed through the mesh and abdominal wall to ensure stable anchorage. The peritoneal flap was then meticulously closed with a continuous suturing technique using the same 2-0 non-absorbable sutures, ensuring a secure and tension-free closure.

In the Tacker Fixation Group, the mesh was secured using absorbable tackers, which were strategically placed around the perimeter of the mesh to attach it firmly to the abdominal wall. The peritoneal flap was also closed using the absorbable tackers, which were applied to the edges of the flap to ensure a complete and secure closure. This technique aimed to minimize the need for additional suturing and streamline the closure process.

**Outcome Measures:** The outcome measures for the study were categorized into primary and secondary outcomes. Primary outcomes included postoperative pain, which was assessed using a Visual Analog Scale (VAS) at 12 hour, 24 hours, 48 hours, 1 week, 1 month, 3 months and 6 months after surgery. Hernia recurrence was evaluated both clinically and via ultrasonography during a 6-month follow-up. Secondary outcomes comprised operative time, measured from the initial incision to the closure of the peritoneal flap. Intraoperative complications, such as bleeding or bowel injury, were noted. Additionally, postoperative complications including seroma, hematoma, and chronic pain were assessed at 3 and 6 months following the procedure.

**Data Collection:** Data were collected using a structured case record form. Preoperative, intraoperative, and postoperative data were documented by a dedicated research assistant who was blinded to the group allocation to maintain objectivity.

**Statistical Analysis:** Data were analyzed using SPSS software version 26.0. Continuous variables were

expressed as mean  $\pm$  standard deviation and compared using the Student's t-test. Categorical variables were expressed as frequencies and percentages and compared using the chi-square test. A p-value of  $<0.05$  was considered statistically significant.

**Ethical Considerations:** The study was approved by the Institutional Ethics Committee of Government Doon Medical College and Hospital. Informed consent was obtained from all participants prior to enrollment. The study adhered to the principles of the Declaration of Helsinki and Good Clinical Practice guidelines.

## RESULTS

The study included a total of 112 participants with a majority in the age group of 51-60 years (50.9%), followed by those aged 41-50 years (21.4%). The distribution of participants by gender showed a predominance of males (89.3%), with females accounting for only 10.7% of the study population. In terms of socio-economic status, 42.9% of participants were from the lower-middle class, 35.7% were classified as poor, and 21.4% belonged to the middle class. The type of hernia observed among participants was predominantly indirect (63.4%), compared to direct hernias (36.6%). Additionally, complete hernias were more common, representing 57.1% of cases, while incomplete hernias accounted for 42.9%. The hernia was more frequently located on the right side (72.3%) compared to the left side (27.7%) [Table 1].

In the study comparing the suture and tacker groups (each with 56 participants), the operative time was significantly longer for the suture group ( $98.84 \pm 3.81$  minutes) compared to the tacker group ( $74.29 \pm 2.22$  minutes), with a p-value of  $<0.0001$ . Nyhus classification showed that Type I hernias occurred in 35.7% of the suture group and 25.0% of the tacker group, while Type II hernias were equally distributed (3.6%) in both groups. Type III A hernias were more frequent in the tacker group (71.4%) than in the suture group (60.7%), but these differences were not statistically significant ( $p = 0.462$ ). Regarding hospital stays, 25.0% of the suture group and 21.4% of the tacker group were discharged after 2 days. A 3-day stay was observed in 75.0% of the suture group

compared to 51.8% of the tacker group, while no patients in the suture group had a 4-day stay, in contrast to 26.8% in the tacker group. So, longer hospital stays are connected with tacker materials on 4 days, whereas shorter stays are associated with suture materials, and the differences in hospital stay durations were statistically significant ( $p < 0.0001$ ) [Table 2].

The study assessed postoperative pain levels using the Visual Analog Scale (VAS) at various time points for both the suture and tacker groups, each consisting of 56 participants. At 12 hours post-surgery, pain levels of 3 were reported by 23.2% of the suture group and 37.5% of the tacker group, while higher pain levels (6 and 7) were reported by a similar proportion in both groups ( $p = 0.435$ ), so tacker materials are connected with a longer pain score on a 12-hour basis compared to suture materials. At 24 hours, pain levels decreased, with 23.2% of the suture group and 25.0% of the tacker group reporting a pain level of 1, and a significant portion experiencing levels 2 and 3, with no significant differences between groups ( $p = 0.423$ ), so tacker materials are related with a longer pain score than suture materials in the beginning period of the 24-hour pain distribution. At 48 hours, 41.1% of the suture group and 37.5% of the tacker group reported a pain level of 1, with pain scores continuing to decline and no significant differences between groups ( $p = 0.928$ ), so at 48 hours, tacker material caused the most discomfort compared to sutures. By 1 week, 1 month, 3 months, and 6 months, all participants in both groups reported a pain level of 1, indicating complete resolution of pain, with a p-value of 1.000 at each of these time points [Table 3].

In our study, the no mess infection was observed at 1 week, 1 month, 3 months, and 6 months.

The incidence of seroma formation was assessed in both the suture and tacker groups, each with 56 participants. At 1 week post-surgery, seroma was absent in 91.1% of the suture group and 92.9% of the tacker group, with 8.9% and 7.1% experiencing seroma formation, respectively ( $p = 1.000$ ). By 1 month, 3 months, and 6 months post-surgery, seroma formation was absent in all participants in both groups, indicating complete resolution of seroma with no significant differences between the groups at any of these time points ( $p = 1.000$ ) [Table 4].

**Table 1: Baseline characteristics of the study participants.**

Variables	Frequency	Percent
Age group (years)		
21-30	15	13.4%
31-40	16	14.3%
41-50	24	21.4%
51-60	57	50.9%
Gender		
Female	12	10.7%
Male	100	89.3%
Socio-economic status		
Lower-middle	48	42.9%
Middle	24	21.4%
Poor	40	35.7%

Hernia type		
Direct	41	36.6%
Indirect	71	63.4%
Hernia type		
Complete	64	57.1%
Incomplete	48	42.9%
Side		
Left	31	27.7%
Right	81	72.3%

**Table 2: Comparison of Operative Time, Nyhus Classification, and Hospital Stay Between Suture and Tacker Groups in Laparoscopic TAPP Repair.**

Variables	Suture Group (n=56)	Tacker Group (n=56)	P Value
	Frequency (%)/ Mean $\pm$ SD		
Operative time (minutes)	98.84 $\pm$ 3.81	74.29 $\pm$ 2.22	<0.0001
Nyhus classification			
Type I	20 (35.7%)	14 (25.0%)	0.462
Type II	2 (3.6%)	2 (3.6%)	
Type III A	34 (60.7%)	40 (71.4%)	
Hospital stays (days)			
2 Days	14 (25.0%)	12 (21.4%)	<0.0001
3 Days	42 (75.0%)	29 (51.8%)	
4 Days	0 (0%)	15 (26.8%)	

**Table 3: Postoperative pain levels using the Visual Analog Scale (VAS) at various time points for both the suture and tacker groups.**

Pain level (VAS)	Suture Group (n=56)	Tacker Group (n=56)	P Value
	Frequency (%)		
At 12 hours			
3	13 (23.2%)	21 (37.5%)	0.435
4	19 (33.9%)	12 (21.4%)	
5	8 (14.3%)	6 (10.7%)	
6	11 (19.6%)	12 (21.4%)	
7	5 (8.9%)	5 (8.9%)	
At 24 hours			
1	13 (23.2%)	14 (25.0%)	0.423
2	13 (23.2%)	20 (35.7%)	
3	20 (35.7%)	14 (25.0%)	
4	10 (17.9%)	8 (14.3%)	
At 48 hours			
1	23 (41.1%)	21 (37.5%)	0.928
2	16 (28.6%)	17 (30.4%)	
3	17 (30.4%)	18 (32.1%)	
1 At 1 week	56 (100.0%)	56 (100.0%)	1.000
1 At 1 month	56 (100.0%)	56 (100.0%)	1.000
1 At 3 months	56 (100.0%)	56 (100.0%)	1.000
1 At 6 months	56 (100.0%)	56 (100.0%)	1.000

**Table 4: Incidence of seroma formation in both the suture and tacker groups.**

Seroma formation	Suture Group (n=56)	Tacker Group (n=56)	P Value
	Frequency (%)		
At 1 week			
Absent	51 (91.1%)	52 (92.9%)	1.000
Present	5 (8.9%)	4 (7.1%)	
Absent At 1 month	56 (100.0%)	56 (100.0%)	1.000
Absent At 3 months	56 (100.0%)	56 (100.0%)	1.000
Absent At 6 months	56 (100.0%)	56 (100.0%)	1.000

## DISCUSSION

This study compared the outcomes of intracorporeal suturing and tacker fixation of the mesh and peritoneal flap in laparoscopic transabdominal preperitoneal (TAPP) repair of inguinal hernia. The age distribution in this study showed the highest proportion in the 51-60 group, followed by the 41-50 group. The sex distribution revealed that 89.3% of cases were male. Xuan et al., reported a similar mean age of 60.4 and 96.8% male cases, while Ahmad et

al., reported a mean age of 54.6 years.<sup>[12,13]</sup> In our study, indirect hernias were more common than direct hernias. Similarly, Xuan et al., reported 11 indirect and 19 direct hernias in their study of 34 cases, while Sharma et al., observed a higher proportion of indirect hernias in their study setting.<sup>[12,14]</sup> The study found that 57.1% of cases were in the complete group, and 72.3% were right-sided. Mateska et al., also reported similar distributions.<sup>[15]</sup>



This study found the highest proportion of cases in the Type IIIA category of the Nyhus classification, followed by Type I. The differences between categories were statistically non-significant ( $p > 0.05$ ). Rihan et al., reported a similar pattern, with more cases in Type IIIA followed by Type I, while Mohammad et al., observed a higher percentage in Type IIIA followed by Type II.<sup>[16,17]</sup>

Patients in the suture group had a statistically significant shorter hospital stay compared to those in the tacker group ( $p < 0.0001$ ). But, Abdalgaleil et al. reported a shorter hospital stay in the tacker group compared to the suture group ( $14.017 \pm 4.733$  hours), with a statistically significant difference ( $P=0.001$ ), consistent with the findings of this study.<sup>[18]</sup> Darwish et al., reported a mean hospital stay of 1.9 days for laparoscopic TAPP repair with a tacker.<sup>[19]</sup> Pisanu et al., noted that laparoscopic inguinal hernia repair is typically a day-case procedure due to reduced postoperative pain and wound complications.<sup>[20]</sup>

Pain levels measured by the Visual Analog Scale (VAS) showed lesser postoperative pain levels at 12, 24 and 48 hours at suture as compared to tacker groups. Both groups experienced a similar reduction in pain over time, with complete resolution by 1 week. In terms of postoperative acute pain ratings, Abdalgaleil et al.'s study, which used a VAS pain diary at various intervals, found no significant difference in pain levels between the two groups during the first week after surgery.<sup>[18]</sup> Similarly, Kleidari et al., observed no significant difference in in-hospital mean pain scores collected the morning after surgery between suture and tacker fixation.<sup>[21]</sup> However, Lepere et al., Aziz et al., and Zinner et al., found that suture fixation resulted in significantly less early postoperative pain compared to tacker fixation.<sup>[22-24]</sup> Hassan et al., used the VAS to measure postoperative pain and found no significant difference between the two groups from the first postoperative day to two months. However, from three months to one year after surgery, the suture group reported significantly more pain.<sup>[25]</sup>

The operative time was significantly shorter in the tacker group ( $74.29 \pm 2.22$  minutes) compared to the suture group ( $98.84 \pm 3.81$  minutes,  $p < 0.0001$ ). Hassan et al., reported a highly significant difference in mean operative time between the two groups, favoring the tacker group (87.5 minutes for tacker vs. 117 minutes for suture), which aligns with the findings of this study.<sup>[25]</sup> Ross et al., observed a mean operative time of 108 minutes for tacker cases and 97 minutes for suture cases.<sup>[26]</sup>

In our study, the no mess infection was observed at 1 week, 1 month, 3 months, and 6 months.

Similarly, Takata et al., Schmidt et al., and Brown et al., noted that advancements in laparoscopic surgery have increased the acceptance of inguinal hernia repair among surgeons and patients.<sup>[27-29]</sup> This is due to the procedure's association with a quicker return to activity, reduced postoperative pain, and a lower risk of wound infection. Seroma formation was low and showed no significant difference between the two

groups at 1 week and was absent in all participants by 1 month postoperatively. In the present study, seroma formation was absent in both the tacker and suture groups at 1 week, 1 month, 3 months, and 6 months. Abdalgaleil et al., reported that six patients (10%) in each group experienced seroma after one week, which resolved with inguinoscrotal support and medical therapy in 4-6 days.<sup>[18]</sup> Aziz et al., highlighted the importance of the surgeon's laparoscopic skill and meticulous surgical practice in minimizing postoperative complications such as seroma, cord edema, port site infection, chronic pain, neuralgia, and recurrence.<sup>[23]</sup>

## CONCLUSION

This study aimed to compare the clinical outcomes of suture fixation versus tacker use for closing the peritoneal flap and mesh fixation in laparoscopic transabdominal preperitoneal (TAPP) inguinal hernia repair. The findings suggest that suture fixation is superior, aligning with similar contemporary research. Early postoperative complications did not show statistically significant differences between the two methods. However, further studies with longer follow-up periods are needed to validate these findings. Additionally, evaluating both methods in terms of persistent pain, hernia recurrence, and mesh migration using broader multicentric criteria is essential for comprehensive assessment and optimizing surgical outcomes.

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