# Assessment of Mesh Fixation by Dual Use of Trans-Fascial Sutures and Tacks in The Outcome of Laparoscopic Ventral Hernia Repair "Case-Series"

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## ABSTRACT

**Background:** In laparoscopic ventral hernia repair (LVHR) there are many modifications related to the methods of mesh fixation. Using trans-fascial sutures decrease the chance of mesh shrinkage and migration and subsequent hernia recurrence but it is still controversial in comparison with tackers alone. **Objective:** The study goal was to assess the effect of adding four corners trans-fascial sutures to double crown tackers for mesh fixation. **Patients and Methods:** A total of 50 patients with different types of abdominal wall hernias were subjected to LVHR. Patients were randomized into two groups: Group A where mesh was fixed using double crown of tackers only and group B where mesh was fixed using both tackers and four corners trans-fascial sutures. Mesh fixation duration, postoperative pain score and recurrence rate were recorded. **Results:** Males and females were 21 and 29, respectively. The mean age was 48 years. Types of hernias were 29 para umbilical hernias (PUH), 17 incisional hernias and 4 epigastric hernias. In Group A, the median operative time for mesh fixation was 15 mins. In group B, the duration was 24 minutes. The median Visual Analogue Scale (VAS) for pain was 1 at 24 hours post-operative. The average hospital stay post-surgery was between 1 to 3 days. Within 12 months, three patients from group A experienced a recurrence of their hernia. **Conclusions:** LVHR with tackers was an easy and time saving procedure. However, adding trans-fascial sutures decreased the chance of mesh shrinkage/migration and gave less recurrence rate.

**Keywords:** Laparoscopic ventral hernia repair, Mesh fixation, Trans-fascial sutures, Sutures versus tacks.

## INTRODUCTION

Laparoscopic ventral hernia repair (LVHR) is relatively straightforward in technique, yet complications can arise. Literature suggests that LVHR recurrence rates vary between 4.7% and 29% [1, 2]. A significant reduction in recurrence rates is theoretically possible by adhering to core surgical principles, such as ensuring ample mesh overlap and robust mesh fixation. Recurrences most commonly occur due to overlooked hernial defects, insufficient mesh size or improper mesh fixation, leading to inadequate defect coverage or mesh shrinkage/migration. While some surgeons argue against the need for trans-fascial sutures in mesh fixation, there have been reports of mesh migration and contraction or shrinkage with various mesh types [3]. Post-LVHR complications can increase the risk of hernia recurrence. An ideal mesh should prevent adhesion on one side while promoting fibrous integration on the other. Double face meshes are crafted to allow tissue growth on the parietal surface and prevent visceral adhesions [4, 5]. Trans-fascial sutures are believed to heighten post-operative pain, as they pierce through various muscle and fascia layers [6], and may potentially cause muscle fiber ischemia [5] or entrap the intercostal nerve, leading to chronic neuropathic pain [7]. However, they offer the benefit of increased tensile strength, significantly reducing recurrence rates [8]. Tack fixation, on the other hand, is associated with a notable reduction in surgery time [9], but can lead to severe post-operative issues such as bowel obstruction and perforation [10, 11], chronic neuropathic pain [12], and complications from tack displacement [13]. Recent evaluations of both trans-fascial sutures and tack fixation in laparoscopic ventral hernia repairs regarding postoperative pain have shown no significant differences between the two methods [10].

## PATIENTS AND METHODS

Between January 2017 and December 2019, this comparative study was conducted. It included 50 consecutive patients undergoing LVHR. The patients were randomly divided into two comparable groups: Group A included 25 patients who were scheduled for mesh fixation using double crowns of tacks only. Group B included 25 patients who were scheduled for mesh fixation using both tacks and four corners trans-fascial sutures. All patients who enrolled in this study were followed up to 3 years.

**Inclusion criteria:** Uncomplicated ventral hernia. Hernia defect away from bony prominence. Hernial defect size of 10 cm or less at its greatest dimension.

**Exclusion criteria:** BMI more than 45 kg/m$^2$. Hernial defect size more than 10 cm. Recurrent hernia.

**Preoperative assessment:** Every patient underwent clinical examination, abdominal and pelvic ultrasound, routine blood tests, and pre-anesthesia evaluation.

**Surgical technique:**

General anesthesia with endotracheal intubation was employed in all cases. Patients were positioned supine and securely fastened to the operating table, enabling adjustments to Trendelenburg, reverse Trendelenburg, or side positions for dissection of adhesions. The video monitor's placement was determined by the hernia's location, opposite the working ports. Pneumoperitoneum insufflation commenced using a Veress needle inserted in the left hypochondrium, under the subcostal margin, as illustrated in figure (1). The first 10 mm trocar for the optical system was introduced from the right lateral side at the anterior axillary line's intersection with the umbilical level. Two or three additional 5 mm trocars were then inserted under direct vision in the right iliac, suprapubic, and left iliac regions, as depicted in figure (2).



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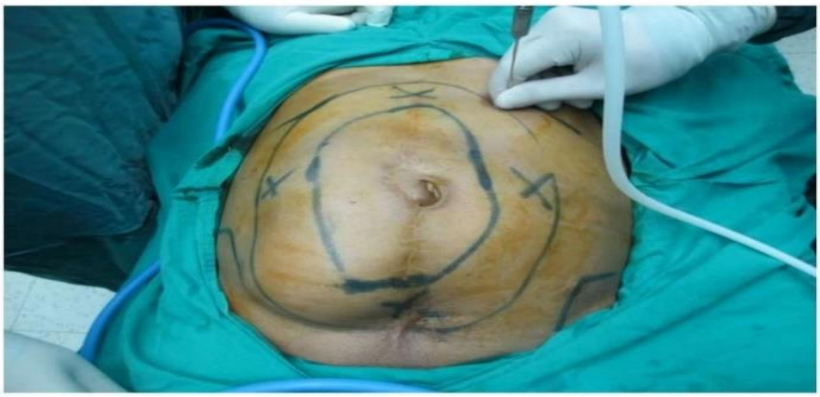

*Fig. (1): Insufflation of pneumoperitoneum was initiated through a veress needle inserted in the left hypochondrium under the subcostal margin in the case of large incisional hernia.*

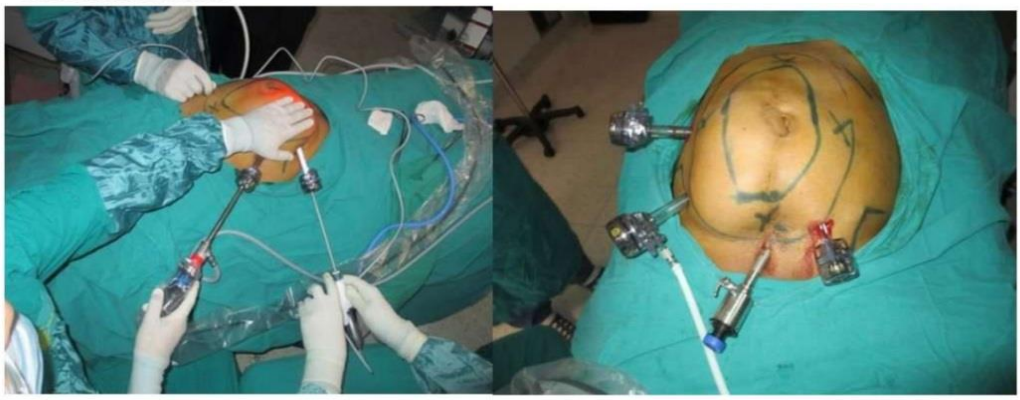

*Fig. (2): three working trocars were inserted under vision in right iliac, suprapubic, and left iliac regions, respectively.*

The peritoneal cavity was thoroughly explored to locate the defect. Adhesions on the parietal defect were detached using scissors, electrocautery, or an ultrasonic scalpel. Enough space, at least 5 cm wide, was cleared around the defect to ensure adequate mesh overlap. The sac's contents were then reduced. The mesh was cut and shaped to extend 4 to 5 cm beyond the hernial defect on all sides. Mesh sizes used were 15 x 15 cm for circular defects and 15 x 20 cm for rectangular ones. In this study, Proceed mesh [composed of polypropylene (PPM), polydioxanone (PDS), and oxidized regenerated cellulose (ORC)] was used in all cases.

In group B, four polypropylene sutures were placed at the 4 corners of the mesh and tied to allow easy fixation of the mesh intra-abdominally (Figure 3). The mesh was then rolled tightly in a cigar shape and then introduced through the port. Inside the abdomen the mesh was unfolded, oriented and spread. The mesh was then centered on the defect. A 2 mm skin incision was performed over the 4 corners to allow the 4 pre-tied sutures to be withdrawn through the abdominal wall using a Berci fascial closure instrument (Figure 3). The two threads were then pulled out from a separate opening in the aponeurosis and through the same skin incision and then tied subcutaneously anterior to the aponeurosis. A row of tacks was applied to the four sides of the mesh near to its edge about 1 – 3 cm apart in a crowning manner. The whole peritoneal cavity was then explored and good hemostasis was done, then wounds closure without usage of any type of drains.

*Fig. (3): four polypropylene sutures were placed at the 4 corners of the mesh and tied before introduction of the mesh and then pulled out using berci fascial closure.*

Patients were mobilized between 2 to 4 hours post-surgery. Pain levels were assessed using the Visual Analogue Scale (VAS) at 6, 12, and 24 hours post-operation. After the first 24 hours, post-operative analgesics were administered only upon request. According to the protocol, patients received intravenous antibiotics with one prophylactic dose before the surgery and two doses following it. They were discharged from the hospital on either the 2nd or 3rd day after the operation, provided with an abdominal binder. Follow-up visits were scheduled at 1 week (for stitch removal), 1 month, 6 months, 12 months, 24 months, and 36 months. Each visit included a history and clinical examination, with CT scans of the abdomen conducted in selected cases. Post-operative complications such as pain, wound infection, seroma, and hernia recurrence were documented and reported.

**Ethical Considerations: The study received approval from The Ethics Board of Al-Azhar University, and informed written consent was obtained from each participant. The research was conducted in compliance with the World Medical Association's Code of Ethics (Declaration of Helsinki) for studies involving human subjects.**

***Statistical analysis***

Quantitative data were expressed as mean ± standard deviation (SD), while qualitative data were presented in the form of numbers and percentages. A p-value ≤ 0.05 was deemed statistically significant. All statistical analyses were conducted using IBM SPSS Statistics for Windows (Armonk, NY: IBM Corp, specifically Version 20).

## RESULTS

In the group of 50 patients (comprising 21 men and 29 women) who underwent Laparoscopic Ventral Hernia Repair (LVHR), the median age was 48 years, with a range of 24 to 65 years. The median Body Mass Index (BMI) of these patients was 26, with a range from 20 to 35 (Table 1).

**Table 1:** Demographic data

| **Parameters** | Values |
|---|---|
| ***Age (median - 48)*** | |
| 20-30 | 5 |
| 31-40 | 13 |
| 41-50 | 17 |
| 51-60 | 12 |
| 61-70 | 3 |
| ***Sex*** | |
| Male | 21 |
| Female | 29 |
| ***Body Mass Index (median - 26)*** | |
| 20 – 25 | 21 |
| 26 – 30 | 24 |
| 31 – 35 | 5 |

The types of hernias treated in this study included 29 paraumbilical hernias, 17 incisional hernias, and 4 epigastric hernias. The median size of the hernia defects was 5 cm, with a range of 3 to 10 cm. In all cases, proceed composite mesh was utilized, with mesh sizes being 15 x 15 cm circular for 43 cases, and 15 x 20 cm rectangular for 7 cases (Table 2).

**Table 2:** Hernia characteristics and mesh used.

| **Sizes (n=100)** | **Para umbilical (29)** | **Incisional (17)** | **Epigastric (4)** | **Mesh size (cm)** |
|---|---|---|---|---|
| 3 cm (13) | 11 | - | 2 | 15x15 |
| 4 cm (11) | 7 | 3 | 1 | 15x15 |
| 5 cm (13) | 8 | 4 | 1 | 15x15 |
| 6 cm (2) | 1 | 1 | - | 15x15 |
| 7 cm (4) | 2 | 2 | - | 15x15 |
| 8 cm (4) | - | 4 | - | 15x20 |
| 10 cm (3) | - | 3 | - | 15x20 |

The median operative time for mesh fixation In Group A, was 15 mins with a range of 12 to 18 min. and in Group B, was 24 min. with a range of 20 to 30 min. The median Visual Analogue Scale (VAS) for pain was 1 at 24 hours post-operative. The average hospital stay post-surgery was between 1 to 3 days.

**Table 3:** Intra and postoperative data

| **Parameters** | **N=50** | **Range** | **Median** |
|---|---|---|---|
| Mesh fixation time | Group A | 12-18 mins | 15 mins |
| | Group B | 20-30 mins | 24 mins |
| Hospital stay post operation | Group A | 1-3 days | 2 days |
| | Group B | 1-3 days | 2 days |
| Visual analogue score (Pain) | Group A | 0-2 | 1 |
| | Group B | 0-2 | 1 |

In relation to postoperative complications, paralytic ileus occurred in 1 case in group A and 2 cases in group B, two cases developed seroma in each group, 2 cases had wound infection in group A and 3 cases in group B, and only 1 patient had urinary retention in group A. Within 12 months, three patients from group A experienced a recurrence of their hernia, and no recurrence was recorded in group B.

**Table 4:** Post-operative complications

| **Parameters** | Group A | Group B |
|---|---|---|
| Paralytic ileus | 1 | 2 |
| Seroma | 2 | 2 |
| Wound infection | 2 | 3 |
| Recurrence | 3 | - |
| Urine retention | 1 | - |

## DISCUSSION

The method of mesh fixation in Laparoscopic Ventral Hernia Repair (LVHR) remains a topic of debate and discussion, more than two decades since its introduction by **LeBlanc and Booth in 1993** [14]. There have been several comparative studies evaluating tacks versus trans-fascial sutures for mesh fixation. For instance, **Carbajo *et al.*** [15] reported lower recurrence rates of 1.4% with the use of trans-fascial sutures compared to 4.4% when not used. However, a major drawback of using tacks exclusively is the risk of mesh migration or shrinkage. **Beldi *et al.*** [3] found a significant reduction in the horizontal dimension of the mesh in the tacks group compared to the trans-fascial sutures group. Similarly, **Schoenmaeckers *et al.*** [16] reported a 7.5% mesh shrinkage rate after fixation with double-crown/double row tacks of expanded polytetrafluoroethylene (ePTFE) mesh, which was observed around 18 months post-operation[].

The mesh for ventral side use should have a smooth, non-eroding, and infection-resistant visceral surface, and a macro-porous ventral surface conducive to fibroblast growth and foreign body reactions. Such reactions may be crucial for the mesh's integration and high tensile strength [17]. Now available are various lightweight composite meshes that are easy to handle during surgery. It's advisable for the mesh to extend beyond the edge of the defect by at least 4-5 cm for the best outcome.

Literature details a range of mesh fixation techniques, including staplers, single crown tackers, and trans-fascial sutures, used alone or in combination [18]. No uniform agreement exists regarding the ideal suture count, the material of the suture, or the tension applied while tying the sutures. Currently, many healthcare facilities opt for a mix of tacks and trans-fascial sutures. This study reveals that this mixed approach was straightforward and safe, leading to a lower rate of hernia recurrence and no noticeable increase in post-surgical pain.

## CONCLUSION

Laparoscopic Ventral Hernia Mesh Repair by using a combination of tacks and trans-fascial sutures is an easy and feasible approach. Although, there was slight increase in the procedure time, but it was beneficial for easy handling and good orientation of the mesh during fixation. Furthermore, this technique played a major role in prevention of mesh migration/shrinkage and marked reduction recurrence rate.

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