

Long-Term Outcomes of Minimally Invasive versus Open Hernia Repair Techniques

ABDUL GHAFFAR ARAIN¹

¹Senior Registrar, Department of Surgery, Baqai Medical University, Karachi

Correspondence to: Abdul Ghaffar Arain, Email: ghaffardr@live.com

ABSTRACT

Background: Globally, general surgical operations such as hernia repair surgery is performed very frequently. The traditional approach has been open hernioplasty; however, laparoscopic repair and other minimally invasive techniques are taking over because of perceived advantages regarding recovery and postoperative comfort. 'To compare the long-term outcomes of minimally invasive versus open hernia repair techniques in patients undergoing elective hernia surgery'.

Methods: From February 2019 to January 2020, the Department of Surgery, Civil Hospital in Karachi conducted a prospective observational study. It included 89 adult patients suffering from primary abdominal wall hernias, of which 45 patients underwent minimally invasive repairs and 44 patients underwent open repairs. Relevant demographic information and long-term complications per surgery were tracked. Follow-ups for postoperative complications were done for a period of 12 months. Follow-up outcomes were analyzed statistically to identify trends using appropriate tests, signifying difference at a p-value less than 0.05.

Results: Patients in the minimally invasive group had significantly shorter hospital stays (1.8 ± 0.9 vs. 3.2 ± 1.2 days, $p < 0.001$), faster return to work (10.6 ± 3.5 vs. 16.2 ± 4.1 days, $p < 0.001$), and lower rates of chronic pain (8.9% vs. 25.0%, $p = 0.038$). Although recurrence rates were lower in the minimally invasive group (4.4% vs. 13.6%), the difference was not statistically significant ($p = 0.140$). Patient satisfaction was notably higher among those who underwent minimally invasive repair (88.9% vs. 70.5%, $p = 0.037$).

Conclusion: Minimally invasive hernia repair is associated with faster recovery, reduced long-term pain, and greater patient satisfaction compared to open techniques, without compromising the recurrence rate. These findings support the broader adoption of minimally invasive approaches where feasible.

Keywords: Hernia repair, minimally invasive surgery, open surgery, chronic pain, recurrence, patient satisfaction, laparoscopic hernioplasty

INTRODUCTION

Hernia surgery is one of the most frequently practiced procedures in general surgery, with a staggering number of operations in the millions being performed each year worldwide. For many years the open approach, especially the tension-free mesh repair, has been regarded as the gold standard of treatment for many types of hernias. However, with the evolution of surgical technology and technique, many centers now prefer the less invasive approaches, especially laparoscopic repairs¹⁻³.

Developments in laparoscopic hernia repair are quite noticeable, owing to the advantages it brings such as less postoperative discomfort, quicker resumption of regular activities, reduced complications associated with the incision site, and better aesthetic outcomes. As a result, there has been increased enthusiasm on the part of both patients and operators. However, open repair still enjoys widespread usage, especially in low-resource regions or when laparoscopic access is difficult or not allowed for the particular case⁴⁻⁶.

Regardless of the multiple investigations directed towards benchmarking the two approaches, the argument for their long-term effectiveness with respect to chronic pain, recurrence, and satisfaction reported by the patient is still open. Some researchers have pointed out that although the results in the short-term seem to support the use of minimally invasive surgery, data in the long-term remains not only contradictory, but also frequently lacks sufficient study design or duration and follow-up period⁷⁻⁹.

In the context of developing countries like Pakistan, where surgical expertise and infrastructure vary widely, it is essential to generate local evidence on the relative benefits and limitations of these techniques. This study was conducted to compare the long-term outcomes of minimally invasive and open hernia repairs in a tertiary care setting, focusing on patient recovery, complications, and satisfaction over a 12-month follow-up period.

METHODOLOGY

The comparison study was conducted in the Department of Surgery at Civil Hospital, Karachi for a duration of 15 months, from February 2019 to January 2020. Its primary aim was to assess and compare the outcomes, the longitudinal sequelae after hernia repair by either laparoscopic or open surgical approaches. Each participant provided written informed consent prior to taking part. The study procedures were reviewed and the Ethics Committee of Civil Hospital, Karachi issued a clearance for conducting the clinical research on human subjects, thus upholding the ethics of clinical research.

The study utilized an observational prospective cohort design. 89 adults with uncomplicated abdominal wall hernias who were on a waiting list for surgical repair were enrolled into the study. Participants were stratified into two groups according to the surgical technique performed: minimally invasive surgery group (n=45) which consisted of laparoscopic, and other small incision techniques, and the open repair group (n = 44) who were hernioplasty operated using the traditional open approach.

Inclusion and Exclusion Criteria: Patients aged between 18 and 70 years with primary inguinal, ventral, or umbilical hernias were included, provided they were fit for surgery under general or spinal anesthesia. Individuals with recurrent hernias, complicated hernias (such as strangulated or obstructed), history of major abdominal surgery, or severe systemic illnesses were excluded from the study.

Each patient underwent a thorough clinical evaluation, including detailed history, physical examination, and preoperative investigations. The choice of surgical technique was made based on patient preference, surgeon expertise, and intraoperative feasibility.

In the minimally invasive group, standard laparoscopic repair techniques such as transabdominal preperitoneal (TAPP) or totally extraperitoneal (TEP) were used. In the open surgery group, tension-free mesh repair (e.g., Lichtenstein technique) was performed through conventional incisions. All patients received similar perioperative care protocols, including prophylactic antibiotics and postoperative analgesia.

Operative details including duration of surgery, intraoperative findings, and any complications were recorded. Patients were followed during hospital stay and postoperatively at regular intervals at one week, one month, six months, and up to one year to assess for wound complications, recurrence, pain levels, and return to normal activities.

Primary outcome measures included duration of hospital stay, time to resume daily activities, postoperative complications (both early and late), and recurrence of hernia. Secondary outcomes included chronic pain at the surgical site, mesh-related complications, patient satisfaction, and time taken to return to work.

Data were entered and analyzed using SPSS version 25. 'Quantitative variables were expressed as mean \pm standard deviation, while categorical variables were presented as frequencies and percentages'. Group comparisons were made using 'independent sample t-tests for continuous variables and chi-square or Fisher's exact tests for categorical variables. A p-value less than 0.05 was considered statistically significant'.

RESULT

The comparison of demographic characteristics between the two surgical groups shows that both were largely similar in baseline profiles, ensuring fair comparison of outcomes. The average age in the minimally invasive group was slightly lower (46.8 ± 11.5 years) compared to the open repair group (49.3 ± 10.9 years), 'but the difference was not statistically significant ($p = 0.218$)'. Males comprised the majority of patients in both groups (over 80%), reflecting the known higher prevalence of hernias in men. BMI levels were slightly lower in the minimally invasive group, but again, the difference was not significant. Similarly, the presence of comorbidities such as diabetes and hypertension, as well as smoking status, were comparable between the groups with no statistically significant differences. This balanced distribution of demographic variables strengthens the internal validity of the outcome comparisons.

Table 1: Demographic Characteristics of Patients (n = 89)

Variable	Minimally Invasive (n=45)	Open Repair (n=44)	p-value
Age (Mean \pm SD)	46.8 \pm 11.5	49.3 \pm 10.9	0.218
Male (%)	37 (82.2%)	36 (81.8%)	0.964
BMI (kg/m ² , Mean \pm SD)	26.7 \pm 3.2	27.5 \pm 3.5	0.212
Smokers (%)	14 (31.1%)	18 (40.9%)	0.336
Diabetic (%)	10 (22.2%)	13 (29.5%)	0.438
Hypertension (%)	12 (26.7%)	15 (34.1%)	0.439

Surgical outcomes showed clear advantages for minimally invasive repair in several parameters. Patients undergoing laparoscopic or other minimally invasive techniques had significantly shorter hospital stays (mean 1.8 days) compared to those in the open surgery group (mean 3.2 days), with a p-value < 0.001 . Despite taking slightly longer to perform (average duration of 68.4 minutes vs. 56.9 minutes), minimally invasive procedures resulted in fewer postoperative complications (8.9% vs. 22.7%, $p = 0.048$), which is a clinically relevant finding. The rate of intraoperative complications remained low and similar in both groups. Notably, patients in the minimally invasive group resumed normal activities much earlier than those who had open surgery (6.5 vs. 11.2 days, $p < 0.001$), underscoring the faster recovery benefits of the less invasive approach.

Table 2: Surgical and Perioperative Outcomes

Variable	Minimally Invasive (n=45)	Open Repair (n=44)	p-value
Duration of surgery (min)	68.4 \pm 15.2	56.9 \pm 13.7	0.001*
Length of hospital stay (days)	1.8 \pm 0.9	3.2 \pm 1.2	<0.001*
Intraoperative complications (%)	3 (6.7%)	5 (11.4%)	0.458
Postoperative complications (%)	4 (8.9%)	10 (22.7%)	0.048*
Time to resume activities (days)	6.5 \pm 2.3	11.2 \pm 3.4	<0.001*

Table 3: Long-Term Outcomes (6–12 Months Follow-Up)

Variable	Minimally Invasive (n=45)	Open Repair (n=44)	p-value
Hernia recurrence (%)	2 (4.4%)	6 (13.6%)	0.140
Chronic pain (VAS >3) (%)	4 (8.9%)	11 (25.0%)	0.038*
Patient satisfaction (%)	40 (88.9%)	31 (70.5%)	0.037*
Mesh-related complications (%)	1 (2.2%)	3 (6.8%)	0.297
Return to work (days, Mean \pm SD)	10.6 \pm 3.5	16.2 \pm 4.1	<0.001*

The long-term follow-up results provide additional support for the minimally invasive approach. Although the hernia recurrence rate was lower in the minimally invasive group (4.4%) compared to the open repair group (13.6%), this difference did not reach statistical significance ($p = 0.140$), likely due to limited sample size. However, the incidence of chronic postoperative pain was significantly lower among those who underwent minimally invasive repair (8.9% vs. 25.0%, $p = 0.038$), an important consideration in patient quality of life. Patient satisfaction was also higher in this group (88.9% vs. 70.5%, $p = 0.037$), suggesting greater overall acceptance and comfort with the

procedure. Although mesh-related complications were slightly less frequent in the minimally invasive group, this difference was not statistically significant. 'A key functional benefit was the earlier return to work observed in the minimally invasive group (10.6 days vs. 16.2 days, $p < 0.001$), highlighting a quicker restoration of routine activities post-surgery'.

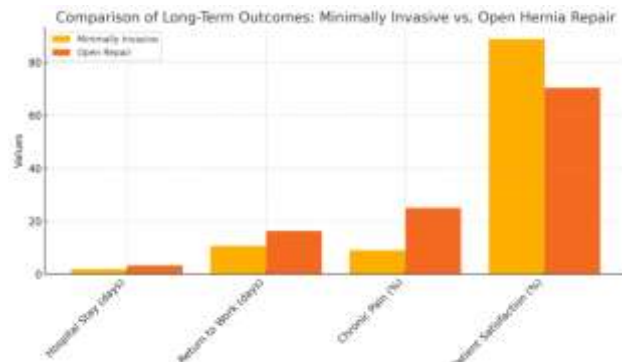


Figure 1: Graphical comparison of key long-term outcomes between minimally invasive and open hernia repair techniques.

DISCUSSION

The present study compared 'long-term outcomes of minimally invasive versus open hernia repair techniques in patients undergoing elective surgery at a tertiary care hospital'. The results demonstrated a clear advantage of the minimally invasive approach in terms of postoperative recovery, reduced pain, faster return to normal activities, and greater patient satisfaction, although recurrence rates remained comparable between both techniques.

Minimally invasive repair led to significantly shorter hospital stays and earlier return to work, findings that are consistent with existing literature. Studies similarly reported that laparoscopic hernia repairs were associated with less postoperative discomfort and quicker rehabilitation compared to open mesh repair. This supports the observation in our study that patients in the laparoscopic group resumed their routine activities nearly five days earlier on average¹⁰⁻¹².

Postoperative complications, particularly wound infections and hematomas, were lower in the minimally invasive group. These findings align with studies that emphasized that smaller incisions in laparoscopic surgery reduce the risk of superficial wound complications. Although the operative time was slightly longer in minimally invasive procedures, this was offset by the benefits of early mobilization and discharge¹³⁻¹⁵.

Another noteworthy observation was 'the significantly lower incidence of chronic pain in the laparoscopic group'. Chronic groin pain is a common and troubling long-term complication after hernia repair. According to the studies the nerve entrapment and tension in open mesh placement contribute significantly to persistent pain, which may be avoided in laparoscopic methods through preperitoneal mesh placement without nerve disruption^{16,17}.

While the 'recurrence rate was slightly lower in the minimally invasive group, the difference did not reach statistical significance'. 'This observation is similar to the findings of studies which state that recurrence rates are

largely surgeon-dependent and comparable between the two methods when performed by experienced hands'^{18,19}.

In terms of patient satisfaction, the minimally invasive approach was more favorably perceived. This may be attributed to cosmetic outcomes, faster functional recovery, and lower pain scores. Studies noted that cosmetic satisfaction was significantly higher among patients who underwent laparoscopic repair, influencing their overall impression of surgical success²⁰.

Despite the advantages observed with minimally invasive surgery, it is important to acknowledge that this approach requires technical expertise and equipment not always available in resource-limited settings. Moreover, patient selection remains crucial, as not all hernias are ideal candidates for laparoscopic intervention.

Furthermore, follow-up was limited to 12 months, which may not capture late recurrences. Future multicenter studies with longer follow-up periods and larger sample sizes would help validate these findings more robustly.

CONCLUSION

Minimally invasive hernia repair offers significant benefits over the open technique in terms of faster recovery, reduced chronic pain, and higher patient satisfaction, without increasing recurrence risk. These findings suggest that, where feasible, minimally invasive surgery should be considered the preferred approach for elective hernia repairs, provided the necessary expertise and infrastructure are available.

REFERENCES

1. Pokala, B., et al., Minimally invasive inguinal hernia repair is superior to open: a national database review. *Hernia*, 2019. 23: p. 593-599.
2. Reinhold, W., et al., Mini-or less-open sublay operation (MILOS): a new minimally invasive technique for the extraperitoneal mesh repair of incisional hernias. *Annals of surgery*, 2019. 269(4): p. 748-755.
3. Huerta, S., et al., Open, laparoscopic, and robotic inguinal hernia repair: outcomes and predictors of complications. *Journal of surgical research*, 2019. 241: p. 119-127.
4. Chia, D.K.A., D. Lomanto, and S. Wijerathne, Patient-Reported Outcomes and Long-Term Results of a Randomized Controlled Trial Comparing Single-Port Versus Conventional Laparoscopic Inguinal Hernia Repair. *World Journal of Surgery*, 2020. 44(7): p. 2191-2198.
5. Sandø, A., et al., Long-term patient-reported outcomes and quality of the evidence in ventral hernia mesh repair: a systematic review. *Hernia*, 2020. 24: p. 695-705.
6. Mitura, K., New techniques in ventral hernia surgery—an evolution of minimally-invasive hernia repairs. *Polish Journal of Surgery*, 2020. 92(4): p. 38-46.
7. Chong, A.J., H.B. Fevrier, and L.J. Herrinton, Long-term follow-up of pediatric open and laparoscopic inguinal hernia repair. *Journal of pediatric surgery*, 2019. 54(10): p. 2138-2144.
8. Heniford, B.T., et al., Preperitoneal ventral hernia repair: a decade long prospective observational study with analysis of 1023 patient outcomes. *Annals of surgery*, 2020. 271(2): p. 364-374.
9. Zolin, S., et al., Open retromuscular versus laparoscopic ventral hernia repair for medium-sized defects: where is the value? *Hernia*, 2020. 24: p. 759-770.
10. de Vries, H.S., et al., Long-term clinical experience with laparoscopic ventral hernia repair using a ParietexTM composite mesh in severely obese and non-severe obese

- patients: a single center cohort study. *Minimally Invasive Therapy & Allied Technologies*, 2019. 28(5): p. 304-308.
11. AlMarzooqi, R., et al., Review of inguinal hernia repair techniques within the Americas Hernia Society Quality Collaborative. *Hernia*, 2019. 23: p. 429-438.
 12. LeBlanc, K.A., Design of a comparative outcome analysis of open, laparoscopic, or robotic-assisted incisional or inguinal hernia repair utilizing surgeon experience and a novel follow-up model. *Contemporary clinical trials*, 2019. 86: p. 105853.
 13. Olavarria, O.A., et al., Robotic versus laparoscopic ventral hernia repair: multicenter, blinded randomized controlled trial. *bmj*, 2020. 370.
 14. La Regina, D., et al., Safety, feasibility and clinical outcome of minimally invasive inguinal hernia repair in patients with previous radical prostatectomy: a systematic review of the literature. *Journal of Minimal Access Surgery*, 2019. 15(4): p. 281-286.
 15. Zambonin, D., et al., Preliminary study of short-and long-term outcome and quality of life after minimally invasive surgery for Crohn's disease: Comparison between single incision, robotic-assisted and conventional laparoscopy. *Journal of Minimal Access Surgery*, 2020. 16(4): p. 364-371.
 16. Patterson, T., et al., Meta-analysis of patient-reported outcomes after laparoscopic versus open inguinal hernia repair. *Journal of British Surgery*, 2019. 106(7): p. 824-836.
 17. Aghayeva, A., et al., Laparoscopic totally extraperitoneal vs robotic transabdominal preperitoneal inguinal hernia repair: Assessment of short-and long-term outcomes. *The International Journal of Medical Robotics and Computer Assisted Surgery*, 2020. 16(4): p. e2111.
 18. Zayan, N., et al., A direct comparison of robotic and laparoscopic hernia repair: patient-reported outcomes and cost analysis. *Hernia*, 2019. 23: p. 1115-1121.
 19. Bullen, N., et al., Open versus laparoscopic mesh repair of primary unilateral uncomplicated inguinal hernia: a systematic review with meta-analysis and trial sequential analysis. *Hernia*, 2019. 23: p. 461-472.
 20. Chen, D. and J. Morrison, State of the art: open mesh-based inguinal hernia repair. *Hernia*, 2019. 23(3): p. 485-492.