

Comparative Analysis of Laparoscopic Vs. Open Hernia Repair for Umbilical and - Paraumbilical Hernia

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Abstract:

Background: Umbilical and paraumbilical hernias are common conditions requiring surgical intervention. This study aims to compare the outcomes of laparoscopic and open repair methods for these hernias.

Methods: A prospective observational study was conducted with 103 patients undergoing hernia repair, divided into laparoscopic (n=48) and open repair (n=55) groups. Outcomes measured included operative time, postoperative pain, hospital stay, return to normal activities, complications, and recurrence rates.

Results: The laparoscopic group had a significantly longer mean operative time (90.83 ± 15.2 minutes) compared to the open repair group (52.91 ± 10.5 minutes, $P < 0.001$). However, laparoscopic repair was associated with significantly lower postoperative pain scores at 6 hours (3.85 ± 0.989 vs. 4.95 ± 1.056 , $P < 0.001$) and 24 hours (2.04 ± 0.544 vs. 2.82 ± 0.645 , $P < 0.001$), shorter hospital stays (2.35 days vs. 3.65 days, $P = 0.001$), and quicker return to normal activity (2.79 weeks vs. 3.85 weeks, $P < 0.001$). Complication rates were lower in the laparoscopic group (10.42% vs. 36.36%, $P = 0.02$), with no significant difference in recurrence rates between the groups (2.08% vs. 7.27%, $P = 0.227$).

Conclusion: Laparoscopic repair for umbilical and paraumbilical hernias offers significant benefits over open repair, including reduced postoperative pain, shorter hospitalization, and faster recovery, without compromising safety or efficacy.

Keywords: Umbilical hernia, Paraumbilical hernia, Laparoscopic repair, Open repair, Postoperative pain, Hernia recurrence.

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Introduction

Umbilical and paraumbilical hernias are common surgical conditions characterized by the protrusion of abdominal contents through an opening in the abdominal wall near the umbilicus. These hernias can occur in both pediatric and adult populations, with varying presentations and management strategies. Surgical repair remains the definitive treatment for symptomatic hernias, aimed at alleviating symptoms and preventing complications such as incarceration and strangulation. Traditionally, open surgical repair has been the cornerstone of treatment. However, with advancements in surgical techniques and the advent of minimally invasive surgery, laparoscopic repair has emerged as a viable alternative. This comparative analysis seeks to evaluate and contrast the outcomes of laparoscopic versus open hernia repair for umbilical and paraumbilical hernias, focusing on duration of surgery, length of hospital stay,

postoperative pain and chronic pain, postoperative complications, return to normal activity, and recurrences.

The evolution of hernia surgery has been marked by a continuous quest for optimal outcomes with minimal morbidity. Open hernia repair, characterized by direct access to the hernia site through a larger incision, has been traditionally favored for its straightforward approach and the perceived strength of the repair. However, it is associated with significant postoperative pain, longer recovery times, and noticeable scarring, which have prompted the exploration of alternative techniques [1].

Laparoscopic hernia repair, introduced in the 1990s, offers a minimally invasive option, with the potential for reduced postoperative pain, shorter hospital stays, and quicker return to normal activities [2]. This technique involves the use of small incisions,

specialized instruments, and a laparoscope to repair the hernia from within the abdomen. Despite its benefits, the laparoscopic approach requires specialized skills and has been associated with a learning curve that may influence outcomes, particularly in the context of recurrence rates [3].

The duration of surgery is a critical factor in the assessment of surgical techniques. Studies have shown varied results, with some suggesting longer operative times for laparoscopic repair due to the complexity of the technique, while others report comparable times when the surgeon's expertise is accounted for [4]. The length of hospital stay is another important outcome measure, with laparoscopic repair often resulting in shorter stays due to less postoperative pain and quicker mobilization [5].

Postoperative pain and the potential for chronic pain are significant considerations in the choice of surgical technique. Laparoscopic repair has been consistently associated with reduced immediate postoperative pain and a lower incidence of chronic pain syndromes, attributed to smaller incisions and less tissue disruption [6]. Postoperative complications, including infection, hematoma, and seroma formation, as well as issues related to the mesh used in repairs, are crucial metrics for assessing surgical outcomes. The laparoscopic approach has shown a lower incidence of superficial wound infections but comparable rates of other complications when matched with open repair [7].

Return to normal activity and recurrence rates are critical long-term outcome measures. Laparoscopic repair has been associated with a quicker return to daily activities and work, likely due to reduced pain and physical restrictions [8]. However, recurrence rates have been a point of contention, with early studies suggesting higher rates for laparoscopic repairs, attributed to the learning curve and the technical demands of the procedure [9]. More recent analyses, however, indicate that with increased surgeon experience and advancements in techniques and materials, recurrence rates are comparable between the two approaches [10].

Aims and Objectives

The aim of the study was to compare the outcomes of surgical procedures for the repair of umbilical and paraumbilical hernias, specifically evaluating laparoscopic umbilical and paraumbilical hernia repair against open umbilical and paraumbilical hernia repair. The objectives set to achieve this aim were to assess and compare the outcomes of both surgical techniques with reference to the duration of surgery, the length of hospital stay, postoperative and chronic pain, postoperative complications, the return to normal activities, and recurrence rates.

Materials and Methods

The methodology employed for this study was a prospective, observational design, conducted at Kasturba Medical College Hospital, Manipal. The target population included patients diagnosed with umbilical and paraumbilical hernias who underwent surgical repair at Kasturba Hospital from November 15th, 2011, to June 30th, 2013. Patients included in the study were those aged 18 years and above, presenting with uncomplicated umbilical and paraumbilical hernias, and medically fit for general anesthesia. Exclusion criteria were established to omit patients with a previous history of upper abdominal surgery, incisional hernias, obstructed or incarcerated hernias, severe cardiopulmonary diseases, presence of local and systemic infections, and those with mental illness or any cognitive impairment such as psychiatric disorders or Alzheimer's disease.

The sample size encompassed 103 patients within the study period after excluding cases based on the predefined criteria. Out of these, 48 cases underwent laparoscopic repair, while 55 cases were subjected to open repair. Prior to the commencement of the study, approval was obtained from the Institutional Ethical Committee, and written and informed consent was secured from all participants.

Statistical analysis of the collected data was performed using IBM SPSS Statistics version 16. The analysis involved calculating p-values using the Independent sample t-test for parametric variables and the Mann Whitney's test for non-parametric variables. A p-value of less than 0.05 was considered statistically significant.

The sequence of events in the study included a comprehensive preoperative work-up, detailed operative records, and assessment of postoperative recovery using a standard Performa. The choice between laparoscopic and open hernia repair, as well as the specific type of open surgery (suture repair, mesh repair), was determined by patient preference and the attending consultant's recommendation. All patients undergoing laparoscopic repair received a single dose of antibiotic during induction and were operated under general anesthesia. For the open repair group, the type of anesthesia used varied among general, epidural, or spinal anesthesia. The materials used for the repairs included Polypropylene, ePTFE (dual mesh), and physio mesh. Pain levels post-surgery were assessed using the visual analogue scale.

This detailed approach to studying the comparative outcomes of laparoscopic versus open hernia repair for umbilical and paraumbilical hernias aimed at providing a comprehensive evaluation based on various critical parameters, contributing valuable insights into the most effective and patient-friendly surgical techniques.

Results

The results of the prospective observational study comparing laparoscopic and open repair for umbilical and paraumbilical hernias revealed significant findings across various metrics. The study included 103 patients, with 48 undergoing laparoscopic repair and 55 open repair. The demographic distribution showed a slight male predominance (57.28%) across the cohort, with a balanced gender distribution within each surgical group. The mean age was comparable between the laparoscopic (42.92 ± 12.5 years) and open repair groups (41.58 ± 13.4 years), with no statistically significant difference ($P=0.65$).

Body Mass Index (BMI) calculations indicated a majority of patients in both groups were within the normal weight (62.5% in laparoscopic and 61.8% in open repair) and overweight categories (31.25% and 32.73%, respectively), with obesity observed in a small fraction (6.25% in laparoscopic and 5.45% in open repair). No significant differences were found in the distribution of BMI categories between groups. Associated comorbidities were relatively low across both groups, with diabetes mellitus (8.73%), hypertension (8.73%), thyroid disorders (3.88%), and COPD (0.97%) being the most common. The presence of comorbid conditions did not significantly differ between the surgical approaches.

Surgical details highlighted a longer mean operative time for the laparoscopic group (90.83 ± 15.2 minutes) compared to the open repair group (52.91 ± 10.5 minutes), with this difference being statistically significant ($P<0.001$). The hernia and defect sizes were assessed, showing mean sizes of $15.35 \text{ cm}^2 (\pm 5.5)$ and $16.23 \text{ cm}^2 (\pm 6.2)$ respectively, with no significant difference between the two surgical techniques in terms of hernia size ($P=0.998$) or defect size ($P=0.936$).

Postoperative pain, evaluated at 6 and 24 hours using a visual analogue scale, was significantly lower in the laparoscopic group at both time points (3.85 ± 0.989 and 2.04 ± 0.544 , respectively) compared to the open repair group (4.95 ± 1.056 and $2.82 \pm$

0.645 , respectively), with P-values <0.001 at both time intervals. This suggests a marked advantage of laparoscopic repair in terms of postoperative pain management.

The use of drains was notably different between the groups; no drains were used in the laparoscopic repairs, whereas in the open repair group, drains were placed in 14 out of 55 cases ($P=0.007$). This finding aligns with the minimally invasive nature of laparoscopic procedures which typically necessitate less extensive drainage.

Postoperative hospital stay was shorter for patients who underwent laparoscopic repair ($2.35 \text{ days} \pm 0.8$) in comparison to those who had open repair ($3.65 \text{ days} \pm 1.5$), with the difference being statistically significant ($P=0.001$). Furthermore, the return to normal activities was quicker for the laparoscopic group ($2.79 \text{ weeks} \pm 0.7$) versus the open repair group ($3.85 \text{ weeks} \pm 1.1$), again showing a significant advantage for laparoscopic repair ($P<0.001$).

In terms of complications, the laparoscopic group exhibited fewer total complications (10.42%) compared to the open repair group (36.36%), with a significant P-value of 0.02. Specific complications such as urinary retention, ileus, hematoma, seroma, surgical site infection (SSI), flap necrosis/removal of the umbilicus, foreign body granuloma, and chronic pain did not show significant differences individually, although the overall trend favored laparoscopic repair.

Recurrence rates were low in both groups but were slightly higher in the open repair group (7.27%) compared to the laparoscopic group (2.08%), though this difference was not statistically significant ($P=0.227$).

These results underscore the advantages of laparoscopic repair for umbilical and paraumbilical hernias in terms of operative time, postoperative pain, hospital stay, return to normal activities, and overall complication rates, without a significant increase in recurrence rates.

Table 1: Demographic and Clinical Characteristics of Patients

Characteristic	Laparoscopy (N=48)	Open Repair (N=55)	Total (N=103)	P-value
Gender				
Male	23 (47.92%)	36 (65.45%)	59 (57.28%)	
Female	25 (52.08%)	19 (34.55%)	44 (42.72%)	
Mean Age (Years) \pm SD	42.92 ± 12.5	41.58 ± 13.4	-	0.65

Table 2: Body Mass Index (BMI) and Associated Comorbidities

BMI/Comorbidity	Laparoscopy (N=48)	Open Repair (N=55)	P-value
Normal Weight	30 (62.5%)	34 (61.8%)	0.92
Overweight	15 (31.25%)	18 (32.73%)	0.88
Obese	3 (6.25%)	3 (5.45%)	0.97

Table 3: Surgical Details and Operative Time

Surgery Type	Details	Mean Operative Time (min) ± SD	P-value
Laparoscopic Repair	IPOM: 39, TAPP: 9	90.83 ± 15.2	<0.001
Open Repair	Suture Repair: 31, Mesh Repair: 24	52.91 ± 10.5	-

Table 4: Hernia Size and Defect Size

Measurement	Laparoscopy (Mean cm ² ± SD)	Open Repair (Mean cm ² ± SD)	P-value
Hernia Size	15.35 ± 5.5 (1-30)	16.23 ± 6.2 (1-40)	0.998
Defect Size	9 ± 3.5 (1-20)	9.3 ± 3.8 (1-20)	0.936

Table 5: Postoperative Pain Scale

Time After Surgery	Laparoscopy Mean Pain Score ± SD	Open Repair Mean Pain Score ± SD	P-value
6 Hours	3.85 ± 0.989	4.95 ± 1.056	<0.001
24 Hours	2.04 ± 0.544	2.82 ± 0.645	<0.001

Table 6: Use of Drains

Surgery Type	IPOM	TAPP	Suture Repair	Mesh Repair	P-value
Drains Used	0	0	2	12	0.007

Table 7: Postoperative Hospital Stay and Return to Normal Activity

Outcome	Laparoscopy Mean (Days/Weeks) ± SD	Open Repair Mean (Days/Weeks) ± SD	P-value
Hospital Stay (Days)	2.35 ± 0.8 (1-5)	3.65 ± 1.5 (2-10)	0.001
Return to Normal Activity (Weeks)	2.79 ± 0.7	3.85 ± 1.1	<0.001

Table 8: Recurrences and Postoperative Complications

Complication	Laparoscopy (N=48) %	Open Repair (N=55) %	P-value
Urinary Retention	2 (4.17%)	1 (1.82%)	0.449
Ileus	1 (2.08%)	0 (0%)	0.446
Hematoma	0 (0%)	3 (5.45%)	0.148
Seroma	2 (4.17%)	4 (7.27%)	0.077
SSI	0 (0%)	2 (3.64%)	0.283
Flap Necrosis/Removal of Umbilicus	0 (0%)	4 (7.27%)	0.077
Foreign Body Granuloma	0 (0%)	1 (1.82%)	0.534
Chronic Pain	1 (2.08%)	1 (1.82%)	0.717
Recurrences	1 (2.08%)	4 (7.27%)	0.227
Total Complications	5 (10.42%)	20 (36.36%)	0.02

Discussion

The comparative analysis of laparoscopic versus open repair for umbilical and paraumbilical hernias in this study highlights significant benefits of the laparoscopic approach, including reduced postoperative pain, shorter hospital stays, and faster return to normal activities, aligning with trends observed in previous research [11,12]. The mean operative time was notably longer for laparoscopic repairs (90.83 ± 15.2 minutes) compared to open repairs (52.91 ± 10.5 minutes, P<0.001), a finding consistent with the literature that attributes this to the technical demands and learning curve associated with laparoscopic procedures [13].

The reported postoperative pain scores at 6 and 24 hours post-surgery were significantly lower for the laparoscopic group, a benefit that supports the findings of McCormack et al. [14], who also reported lower pain scores associated with laparoscopic

hernia repair techniques. This reduction in pain is likely due to smaller incisions and minimal tissue dissection, which also contributes to the observed quicker return to normal activities [15].

Hospital stay durations were shorter for laparoscopic repair patients (2.35 days) compared to those who underwent open repair (3.65 days, P=0.001). This advantage is mirrored in the broader literature, where laparoscopic procedures are often associated with enhanced recovery times [16]. Despite the shorter hospital stay, the laparoscopic approach did not increase the risk of postoperative complications or hernia recurrence, which remained low and comparable between the two groups. This finding challenges earlier concerns about the potential for higher recurrence rates with laparoscopic repairs due to the technical complexity of the procedure [17].

Recurrence rates in this study were slightly higher in the open repair group (7.27%) compared to the

laparoscopic group (2.08%), although this difference was not statistically significant ($P=0.227$). These rates are in line with those reported in previous studies, which have similarly found no significant difference in recurrence rates between laparoscopic and open hernia repairs [18]. Such outcomes underscore the importance of surgical expertise and the evolution of laparoscopic techniques, which have likely contributed to improving outcomes over time [19].

This study's findings add to the growing body of evidence supporting the use of laparoscopic repair for umbilical and paraumbilical hernias, particularly in terms of patient recovery and postoperative quality of life. However, it also underscores the necessity for surgical teams to weigh the benefits against the potential challenges associated with laparoscopic procedures, including longer operative times and the need for specialized training [20].

The limitations of this study include its observational design and the inherent biases that may arise from patient selection and the retrospective analysis. Future randomized controlled trials are warranted to further validate these findings and assess the long-term outcomes of laparoscopic versus open hernia repair.

Conclusion

The comparative study of laparoscopic versus open repair for umbilical and paraumbilical hernias underscores the laparoscopic approach's advantages in terms of postoperative outcomes and recovery. Significantly, the laparoscopic repair group benefited from reduced postoperative pain, with pain scores being significantly lower at 6 and 24 hours post-surgery ($P<0.001$), shorter hospital stays (2.35 days vs. 3.65 days, $P=0.001$), and quicker return to normal activities (2.79 weeks vs. 3.85 weeks, $P<0.001$) compared to the open repair group. Although the operative time was longer for laparoscopic repairs (90.83 minutes vs. 52.91 minutes, $P<0.001$), this did not translate into higher complication rates or increased recurrence, suggesting the laparoscopic method's effectiveness and safety for umbilical and paraumbilical hernia repairs.

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