Section: General Surgery

Original Research Article

COMPARATIVE STUDY OF OPEN VERSUS LAPAROSCOPIC PRIMARY ANATOMICAL REPAIR WITH POLYDIOXANONE FOR SMALL UMBILICAL HERNIAS: A PROSPECTIVE HOSPITAL-BASED STUDY

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ABSTRACT

Background: Umbilical hernias, comprising 10% of all abdominal hernias, are midline hernias near the umbilicus. Although extensively researched in children, they are also common in adults, where elective surgeries are frequently conducted to prevent complications like strangulation. However, there is no definitive consensus on the optimal surgical procedure, particularly for smaller hernias. **Aim:** This study aimed to compare the outcomes of primary anatomical repair with polydioxanone for small umbilical hernias using open and laparoscopic methods. **Materials and Methods:** All patients admitted with a clinical diagnosis of umbilical hernia under general surgical care in GDMCH were included in this study. We enrolled 50 patients, of whom 35 underwent open primary repair of umbilical hernia and 15 underwent laparoscopic repair. The patient underwent a detailed clinical examination, including a thorough history of complaints, illness, treatment, and personal history. Baseline investigations included a thorough blood count, biochemical tests, serological tests, and blood grouping typing. Postoperatively, the patient was assessed on multiple occasions and followed up for six months. **Results:** The majority of patients were middle-aged, with the highest percentages in the 31-40 and 41-50 age groups for both open and laparoscopic groups. Omentum was the primary content of the hernia sac, followed by pre-peritoneal fat. The mean hernia size was larger in the open surgery group (2.19±0.99) compared to the laparoscopic group (1.55±0.73). The laparoscopic group had a slightly shorter mean operating time (1.03±0.20 hours) than the open surgery group (1.16±0.36 hours; p=0.176) and experienced significantly fewer side effects, including lower pain scores at 6- and 24-hours post-surgery (p<0.0001), no wound discharge (p=0.043), and shorter hospital stays (p=0.069). **Conclusion:** Laparoscopic primary anatomical repair of small umbilical hernias demonstrates superior outcomes compared to open repair, with reduced postoperative pain, fewer wound complications, and shorter hospital stays. Further studies with longer follow-up are warranted to assess recurrence rates.

INTRODUCTION

Umbilical hernias represent a common surgical condition encountered in clinical practice, constituting approximately 10% of all primary hernias with an estimated incidence of 2% in the adult population.[1,2] The umbilicus represents a natural anatomical weak point in the anterior abdominal wall, making it a predisposed site for herniation. While extensively studied in pediatric populations, adult umbilical hernias differ significantly, with more than 90% being acquired rather than congenital.[3] Common risk factors for adult umbilical hernias include female gender, obesity, multiparity, pregnancy, cirrhosis, chronic cough, and conditions causing increased intra-abdominal pressure.[4] In men, these hernias are frequently associated with cirrhotic liver disease, while in women, they occur more commonly in multiparous and obese individuals.[3] The lifetime risk of incarceration and

strangulation in umbilical hernias ranges between 1-3%, with reported strangulation rates around 17%.[3] According to the European Hernia Society, umbilical hernias are defined as ventral abdominal hernias located anywhere between 3 cm above and 3 cm below the umbilicus.[5] These hernias can be classified by diameter as small (<1 cm), medium (1-4 cm), and large (>4 cm).[6] Elective surgical repair has become increasingly common, with indications including pain, aesthetic concerns, discomfort, and prevention of strangulation.[7]

Current surgical approaches include both open and laparoscopic techniques, with ongoing debate regarding the use of mesh reinforcement versus primary anatomical closure, particularly for smaller hernias.[8] While mesh placement is standard for large hernias, its necessity for smaller defects remains controversial, with many surgeons achieving favorable outcomes using anatomical closure alone.[9]

Despite advances in surgical techniques, no uniform consensus exists regarding the optimal procedure for small umbilical hernias. Both open and laparoscopic anatomical repairs are widely practiced based on surgeon preference and available facilities, with seemingly equivalent results.[10] This study aimed to compare patient outcomes following open versus laparoscopic primary anatomical repair with polydioxanone for small umbilical hernias.

MATERIALS AND METHODS

Type of Study: Observational Study

Study Design: Hospital-based Prospective Randomized Trial

Place of the Study: Department of General Surgery, GDMCH, Dharmapuri.

PERIOD OF STUDY: 18 MONTHS

Study Population: All patients admitted with a clinical diagnosis of umbilical hernia under general surgical care in GDMCH were included in this study.

Sample Size: All patients attending General Surgery OPD in the study period for umbilical hernia shall be encouraged to participate in the study, and based on the previous year's statistics, the estimated prevalence of patients with umbilical hernia (p) as 15%, with a precision (d) of 10%, at 95% confidence interval ($Z_{1-\alpha/2}$ = 1.96), the sample size was calculated as

$N = Z^2_{1-\alpha/2} * p * (1 - p) / d^2$

$N = 1.96^2 * 0.15*(1 - 0.15) / 0.1^2 = 50$

Thus, the total sample size taken for the study was 50 patients.

Inclusion Criteria

- Patients who were admitted and planned for elective umbilical hernia repair
- Umbilical hernia defect size <4 cm
- Patients requiring only primary closure of the defect
- Patients who provided written informed consent for participation in the study.

Exclusion Criteria

- Patients with deranged coagulopathy, Cardiopulmonary disease, Ascites and Renal failure
- Patients requiring mesh placement or abdominoplasty for umbilical hernia repair
- Patients with obstructed or strangulated hernia
- Patients with recurrent umbilical hernia

Materials and Methods

- Patients who underwent General Surgery OPD were included in the study based on inclusion and exclusion criteria.
- Informed written consent was obtained regarding participation before the patients were included in the study.
- The subjects were then assigned to either group A or B in a randomised manner.
- Detailed history: Presenting complaints, history of presenting illness, history, history of any treatment undertaken, and personal history were obtained, and a detailed clinical examination was undertaken.
- Baseline investigations: Haematological (complete blood count with coagulation profile), biochemical (liver function tests, renal function tests, serum electrolytes), serological, and blood grouping typing will be performed.
- USG Abdomen or CT abdomen findings regarding the size of the hernia defect and content noted
- Anaesthetic fitness was obtained, and the patient was posted for the assigned procedure. Patients in Group A underwent Open Anatomical Repair and patients in Group B underwent Laparoscopic Anatomical Repair
- Preoperative complications, including infection, bleeding, recurrence, and wound dehiscence, were explained to the patient, and written informed consent was obtained.
- Postoperatively, the patient was assessed on POD 0, 2, and 7 and then followed up for 6 months.
- In the immediate postoperative period, any complications or return to normal life were noted.
- Pain was recorded on the VAS (Visual Analogue Score) as per exisiting standards.
- **Parameters Analysed**

- duration of surgery
- post-op complications
- length of hospital stay

The results data were analysed using descriptive statistical analysis.

RESULTS

Fifty patients were enrolled in the study, of whom 35 underwent open repair and 15 underwent laparoscopic repair of umbilical hernia.

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Of these, 37.1% of patients in the open group and 20% of patients in the laparoscopic group were in the 31-40 age group, and 22.9% and 33.3%, respectively, in the 41-50 age group.

Table 1: Comparison of age distribution

		Procedure Type				P value
		Open		Laparoscopic		
		Count	Column N %	Count	Column N %	
Age	<30	3	8.6%	4	26.7%	0.32
	31 – 40	13	37.1%	3	20.0%	
	41 - 50	8	22.9%	5	33.3%	
	51 – 60	5	14.3%	2	13.3%	
	>61	6	17.1%	1	6.7%	

Among the patients in the open group, 51.4% and 53.3% were in the open and laparoscopic groups, respectively.

Table 2: Comparison of gender distribution

		Procedure Type				P value
		Open		Laparoscopic		
		Count	Column N %	Count	Column N %	
Gender	female	17	48.6%	7	46.7%	0.902
	male	18	51.4%	8	53.3%	

Analysis of the content of the hernia sac revealed that the majority had omentum content (48.6% in the open group and 60% in the laparoscopic group); the rest had pre-peritoneal fat content, except for two patients in the open group who had both omentum and fat as the content of the hernia sac. Bowel or other structures were not encountered in any of the cases.

Table 3: Content of hernial sac

		Procedure Type				P value
		Open		Laparoscopic		
		Count	Column N %	Count	Column N %	
Content	Omentum	17	48.60%	9	60.00%	0.549
	Omentum and fat	2	5.70%	0	0.00%	
	preperitoneal fat	16	45.70%	6	40.00%	

Mean hernia size was 2.19±0.99 in the open surgery group, and 1.55±0.73 in the laparoscopic repair group.

Table 4: Size of hernia (cm)

➢	Procedure Type				P value
	Open		Laparoscopic		
	Mean	Standard Deviation	Mean	Standard Deviation	
Hernia size(cm)	2.19	0.99	1.55	0.73	0.029

Mean operating was 1.16±0.36 hours in the open surgery group and 1.03±0.20 hours in the laparoscopic repair group (p=0.176). [Figure 1]

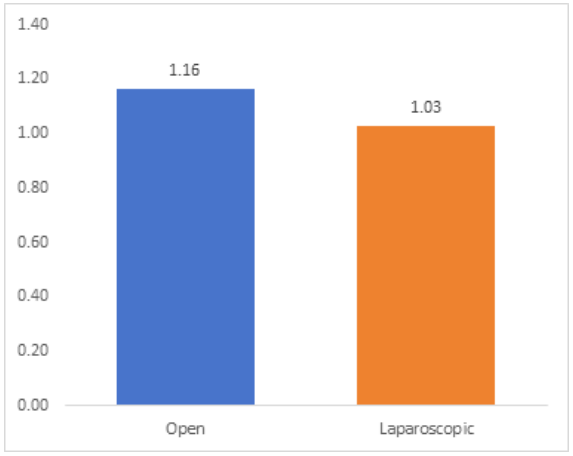

Figure 1

In the open surgery group, 62.8% of patients had an immediate postoperative VAS score of 4-5, while in the laparoscopic group, patients reported less pain, with 80% of patients having a VAS score of 3. Figure 2]

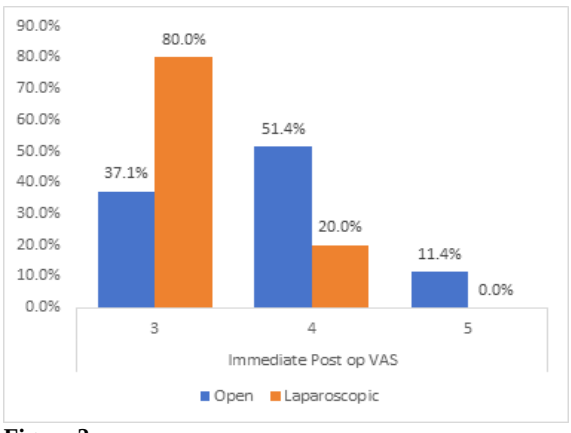

Figure 2

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The VAS scores at 6 hours (p<0.0001) and 24 hours (p<0.0001) followed suit with values of "5.37±1.24 " and "3.69±1.30" respectively for the open group and values of "3.53±1.19 " and "2.07±0.59" respectively for the laparoscopic group. [Figure 3]

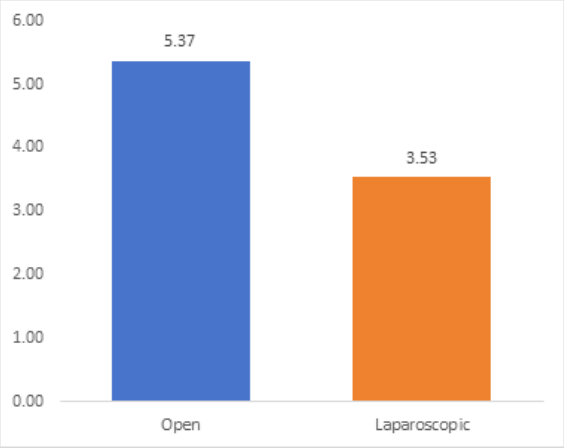

Figure 3

Table 5: Comparison of VAS Scores at 24 hours post-operatively

	Procedure Type				P value
	Open		Laparoscopic		
	Mean	Standard Deviation	Mean	Standard Deviation	
VAS at 24 hours	3.69	1.30	2.07	0.59	<0.0001

None of the patients in the laparoscopic group had wound discharge, whereas 22.9% of the patients who underwent open repair developed wound discharge (p=0.043).

The duration of in-hospital stay was significantly shorter in patients who underwent laparoscopic repair, and all patients were discharged within 5 days. In the open surgery group, by contrast, up to 28.6% of patients stayed beyond 5 days, of which half had a stay duration longer than 10 days (p=0.069).

DISCUSSION

This prospective study compared outcomes of open versus laparoscopic primary anatomical repair for small umbilical hernias. Our findings demonstrate significant advantages of the laparoscopic approach in terms of postoperative pain, wound complications, and hospital stay duration.

This study enrolled 50 patients with small umbilical hernias (<2 cm): 35 underwent open primary repair and 15 underwent laparoscopic repair. The majority of patients were middle-aged (31–50 years). The mean hernia size in our study was 2.19±0.99 cm in the open group and 1.55±0.73 cm in the laparoscopic group. The hernial sac predominantly contained omentum (48.6-60%), with pre-peritoneal fat being the second most common content, consistent with existing literature.[11,12] No bowel complications were encountered in either group, reflecting appropriate patient selection for primary repair.

Outcome	Open Repair (n=35)	Laparoscopic Repair (n=15)
Mean Operating Time	1.16 ± 0.36 hrs	1.03 ± 0.20 hrs (p=0.176)
Pain (VAS, initial)	62.8% scored 4–5	80% scored 3
VAS at 6 hours	5.37 ± 1.24 (p<0.0001)	3.53 ± 1.19 (p<0.0001)
VAS at 24 hours	3.69 ± 1.30	2.07 ± 0.59
Wound Discharge	~23% (p=0.043)	0%
Hospital Stay >5 Days	28.6% (half >10 days)	All discharged within 5 days

Multiple studies corroborate the advantages of laparoscopic hernia repair:

Operative Time

Our study showed comparable operative times between groups (open: 1.16±0.36 hours vs. laparoscopic: 1.03±0.20 hours; p=0.176), with laparoscopic repair being marginally faster. These findings align with several previous studies comparing laparoscopic and open approaches for ventral hernias. Park et al. reported longer operative times for laparoscopic repairs (95 vs. 78 minutes),[13] while Carbajo et al. found shorter operative times with laparoscopy (87 vs. 112 minutes).[14] The variability in operative times across studies likely reflects differences in surgeon experience, patient selection, and hernia complexity.

Postoperative Pain

A key finding of our study was significantly reduced postoperative pain in the laparoscopic group. VAS scores were consistently lower at all assessment points: immediate postoperative (p=0.018), 6 hours (p<0.0001), and 24 hours (p<0.0001). This advantage of minimally invasive surgery is well-documented in the literature and reflects reduced tissue trauma, smaller incisions, and less manipulation of surrounding structures.[15,16]

Heniford et al., in their extensive nine-year experience with 850 laparoscopic ventral hernia repairs, similarly reported reduced postoperative pain

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as a significant benefit of the laparoscopic approach.[17] The decreased pain translates to reduced analgesic requirements, earlier mobilization, and improved patient satisfaction.

Wound Complications

Our study demonstrated a striking difference in wound complications, with 22.9% of open repair patients developing wound discharge compared to none in the laparoscopic group (p=0.043). This finding is consistent with the established benefits of minimally invasive surgery, including smaller incisions, reduced wound surface area, and decreased risk of bacterial contamination.[18]

Several comparative studies have reported similar advantages for laparoscopic repairs. Goodney et al.'s meta-analysis found lower wound infection rates with laparoscopic approaches,[19] while Zhang et al.'s systematic review confirmed reduced infection rates despite slightly higher seroma formation in laparoscopic cases.[20] The absence of wound complications in our laparoscopic group is particularly noteworthy and may reflect meticulous surgical technique and appropriate patient selection.

Hospital Stay

Hospital stay duration was significantly shorter in the laparoscopic group, with all patients discharged within 5 days compared to 28.6% of open surgery patients requiring >5 days (p=0.069). This finding aligns with multiple studies demonstrating reduced hospital stays with laparoscopic approaches.[14,21,22]

Carbajo et al. reported mean hospital stays of 2.2 days for laparoscopic repairs versus 9.1 days for open repairs,[14] while Park et al. found stays of 3.4 versus 6.5 days respectively.[13] Our results (mean stay: 2 days laparoscopic vs. 5.6 days open) fall within this range. The shorter hospitalization with laparoscopy reflects reduced pain, fewer complications, and faster recovery, with important implications for healthcare costs and patient quality of life.

Comparison with Literature

Our findings are consistent with broader literature supporting laparoscopic approaches for ventral hernia repair. LeBlanc et al., in their series of 100 patients, reported a mean hospital stay of 1 day and a 9% recurrence rate with laparoscopic repair.[23] Ramshaw et al. demonstrated that despite longer operative times, laparoscopic repair resulted in fewer perioperative complications and shorter hospital stays.[24]

The debate regarding mesh versus suture repair for small umbilical hernias remains ongoing. Arroyo et al.'s randomized trial demonstrated substantially lower recurrence rates with mesh repair compared to suture repair.[25] However, recent evidence suggests that for small, uncomplicated hernias, primary anatomical repair may be adequate. Mitura et al. concluded that mesh may not always be necessary for small umbilical hernias, with primary sutured repair providing equivalent outcomes in selected cases.[26]

The findings suggest that laparoscopic ventral hernia repair offers a reduced risk of complications and a faster recovery compared to open surgery. However, these conclusions require further validation through randomised controlled trials and studies with extended follow-up periods, particularly to establish long-term hernia recurrence rates.

Comparative research specifically examining laparoscopic versus open approaches for the primary repair of small hernias remains limited. Although several studies have demonstrated the superiority of mesh repair over suture repair alone, they have not focused exclusively on small hernias. A 2021 study indicated that in carefully selected cases of small, uncomplicated umbilical hernias, primary anatomical repair and mesh repair may yield comparable outcomes. The present study compared laparoscopic and open techniques within this subset and found the laparoscopic approach to be more favourable. Larger, prospective trials are warranted to establish long-term outcomes with greater confidence.

CONCLUSION

Laparoscopic repair of small umbilical hernias demonstrates a significantly better postoperative profile compared to open repair — with less pain, no wound discharge, and shorter hospital stays. These findings are consistently supported by the broader surgical literature. While operating times are comparable, the laparoscopic approach is associated with fewer complications and faster recovery. A minimum 3-year follow-up is recommended to monitor for recurrence.

Limitations

The study carries few limitations worth acknowledging. First, the relatively short study duration restricted the length of patient follow-up, preventing the assessment of long-term complications or hernia recurrence. Second, outcomes were not stratified by aetiology, which may be a relevant variable given that the optimal surgical approach can differ depending on the underlying cause of the hernia. Finally, a comparison between primary closure and meshplasty was not conducted, which would have added further depth to the analysis.

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