

A Comparative Study between Laparoscopic Versus Open Umbilical Hernia Repair

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Abstract:

Background: An umbilical hernia is an abnormal protrusion of a viscus or a part of a viscus through the umbilical cicatrix and causes a symmetrical protrusion of the umbilical skin. The incidence of umbilical hernia in the adult is largely unknown but most cases are thought to be acquired rather than congenital. In adult cases, umbilical hernia is due to risk factors like multiple pregnancies, ascites, obesity, malignancy, and raised intraabdominal pressure. The current study was done to determine the outcome of laparoscopic umbilical hernia repair and open umbilical hernia repair with various outcomes.

Methods: This was a prospective comparative study conducted on the patients admitted to the teaching hospitals of J.J.M. Medical College, Davanagere, Bapuji Hospital, and Chigateri Hospital. 40 cases of primary umbilical hernia were included, the study was carried out by history, clinical examination, and appropriate investigations for operation were conducted. 20 cases underwent laparoscopic umbilical hernia repair, and 20 underwent open onlay mesh repair.

Results: Umbilical hernias were more common in females. Abdominal swelling was the most common complaint followed by pain. 20 cases underwent laparoscopic mesh repair and 20 cases by open onlay mesh repair. The duration of surgery, postoperative pain, and hospital stay are significantly less in laparoscopic hernia repair. Post-operative complications like recurrence and seroma were not noted in both procedures. The surgical site infections and average scar length were significantly less in laparoscopic mesh repair resulting in better cosmesis.

Conclusion: Laparoscopic hernia mesh repair offers an efficient, safe, effective repair for umbilical hernia with less postoperative pain, complications, duration of hospital, and early return to normal activity.

Keywords: Laparoscopic Repair, Umbilical Hernia, Onlay Mesh, Mayo's Repair.

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Introduction

Hernia is a word derived from the Greek word herons, meaning a branch or protrusion. Hernia is the bulging of the part of the normal contents of the abdominal cavity through a weakness in the abdominal wall [1]. Most common hernias are inguinal, femoral, and ventral hernia. Ventral herniae are characterized by defects in the anterior abdomen. Umbilical hernia are acquired defects in over 90% of adults and are one of the types of ventral hernia [2] Umbilical hernia is a frequently encountered clinical problem that is infrequently discussed critically in medical literature [3]. The umbilicus is one of the potentially weak areas of the abdomen, which is a relatively common site of herniation. However, umbilical hernias in children undergo spontaneous size reduction and seldom require surgery. Hernia in adults is always

progressive and is conventionally treated by early surgery for fear of strangulation. They have the potential to develop from simple swelling, obstruction, and strangulation. If strangulation persists, the tissue can undergo gangrene due to a lack of blood supply [4]. This can cause severe pain and vomiting, leading to life-threatening situations requiring emergency surgery. Management of these hernias remains a common surgical problem. It can be repaired surgically without undue tension if the defect is small, and the recurrence rate is very low. However, large lesions with wide openings are difficult to manage by anatomical repair, which results in early recurrence owing to undue tension, resulting in tissue necrosis [5].

These hernias should be treated using prosthetic mesh repair. Surgeons searched diligently for a material to implant in the abdominal wall that could add strength while avoiding excessive tension created when large defects were bridged by a prosthetic mesh [6-10]. Several operations are currently employed in management, to achieve a permanent cure. The recurrence rate, which was high in the pre-antibiotic era, has almost nullified with safe anesthesia, antibiotics, antisepsis, and a greater understanding of anatomy, closed drains, and implants such as Prolene mesh and Marlex mesh [11, 12]. Currently, judicious use of the following three concepts in the repair of these herniae has resulted in low morbidity and recurrence rates. These include the first use of imbricated layers to reinforce surgical repair. The second is the use of synthetic prostheses for buttress repair and the third is the laparoscopic approach [5]. This study will be undertaken in patients with primary umbilical and paraumbilical hernias admitted to J.J.M. Medical College, Davangere, Bapuji Hospital, and Chigateri General Hospital, Davangere. Attention has been given to the clinical presentation, size of the defect, management, and complications in patients treated by one of these methods.

Material and Methods

This cross-sectional interventional study was done in the Department of General Surgery, Chigateri General Hospital, and Bapuji Hospital attached to JJM Medical College Davangere. Institutional Ethical approval was obtained for the study as per the protocol of Human research based on the Helsinki Declaration. Written consent was obtained from all the participants of the study after explaining the nature of the study in the vernacular language.

Inclusion Criteria

1. All patients above the age of 18 years were admitted with uncomplicated primary umbilical hernia.
2. Males and females
3. Willing to participate in the study voluntarily
4. Available for post-operative evaluations.

Exclusion Criteria:

1. All the patients below 18 years
2. Patients with complicated umbilical hernia
3. Paraumbilical hernia
4. Patients with associated abdominal pathology

A total of 40 patients diagnosed with primary umbilical hernia admitted for surgery were included in this prospective study. Of which 20 patients underwent laparoscopic repair with intraperitoneal mesh placement and 20 patients

underwent open repair with onlay mesh placement. Direct interviews and clinical examination of patients admitted to the above-mentioned hospitals had been adapted as a method of collection of data. Using a pretested proforma relevant information (patient data, clinical findings, lab investigations) had been collected from all the selected patients. A detailed clinical history from the patients or their attendees on various aspects like age, sex, clinical presentation, and duration of the presenting symptoms. Clinical history regarding the duration of hernia, progression in size, associated complaints like pain in the swelling or abdomen, vomiting, reducibility, chronic cough, constipation, difficulty in micturition, abdominal distension-history suggestive of ascites and other causes of abdominal distension, number of pregnancies, previous surgery for the same problem was collected. In the local examination, special attention was given to the site, size, shape, composition, cough impulse, reducibility, skin over the swelling, size of the defect in linea alba, and tone of abdominal muscles.

In routine general physical examination, attention was given to obesity hypertension, in finding the cause of abdominal distension, per-rectal examination to look for mass (malignant) in the rectum, benign prostatic enlargement, examination to look for external meatal stenosis and stricture urethra in males. Respiratory system examination to look for rhonchi, and crepitations suggestive of COPD. While presenting the case, only relevant positive findings were recorded in the proforma case sheet and a master chart dealing with all the aspects was designed and presented.

All cases were clinically diagnosed, and all patients included in the study underwent surgery following a preoperative investigation in the form of Hb%, BT, CT, FBS, PPBS, Blood urea, serum creatinine, urine for albumin, sugar, and microscopy, ECG, chest X-ray and ultrasound abdomen & pelvis. Cases were prepared for surgery after preoperative correction of anemia, hypertension, obesity, diabetes, and local skin conditions. All patients underwent surgical procedures after following preoperative preparation.

1. Nil by mouth after 10:00 pm from the previous night of surgery
2. Injection tetanus toxoid 0.5 ml IM.
3. Injection of xylocaine test dose.
4. Preparation of the parts by shaving.

All patients received one dose of preoperative antibiotic iv 1 gm of 3rd generation cephalosporins during or immediately after induction of anesthesia. Patients were operated on either under spinal anesthesia or general anesthesia. On the operative table betadine scrub was given to the anterior abdominal wall.

For Onlay Mesh Repair, after preparation of the abdominal wall, an infraumbilical incision was made. The neck hernia sac was exposed and carefully opened because it is generally free from adhesions. A finger was introduced and passed around the inside of the sac to determine the presence of any adhesions. Adhesions if present were freed, and the hernial contents were returned to the abdomen. The incision was closed in two layers of non-absorbable polypropylene sutures and a mesh was applied over the aponeurosis. A suction drain was placed in the area and removed after 48 hours. Postoperative management was done with IV fluids, antibiotics, and pain management with appropriate analgesics. Wounds were inspected for any signs of infection or discharge. If required any serious or bloody swelling was aspirated and purulent collections were cultured. Sutures were removed after 8 – 10 days after surgery and patients were discharged. Follow-up visits were conducted at 1, 3, 6 months and one year. Recurrence was defined as the return of hernia symptoms after complete wound healing.

Laparoscopic Intraperitoneal Mesh Repair: After general anesthesia a 10 x 10 inches polypropylene mesh is prepared with four sutures of vicryl No-1 at the four corners and skin marking is done by placing the center of mesh over the center of the umbilicus. Pneumoperitoneum is achieved by the open method. A 30° laparoscope was placed through a 10mm port and a laparoscopic examination of the abdominal cavity was performed to notice any abnormalities including hernias if present. The incarcerated contents and fatty deposits on the undersurface of the abdominal wall are removed by using blunt and sharp dissection. A 10 x10 inches polypropylene mesh is rolled and inserted through the 10mm port into the abdominal cavity, which is unrolled inside the abdominal cavity. The mesh is positioned

horizontally. The pneumoperitoneum is again decreased to 10mm Hg and with a suture passing instrument, the corresponding pairs of sutures are individually pulled transabdominal through the appropriately placed 2mm skin incisions made over the previous skin marking. The sutures are pulled tight, and the mesh is raised to the abdominal wall and the anchoring sutures are tied in the subcutaneous tissue. The pneumoperitoneum is released, and port sites are closed. Postoperatively patients were orally allowed after 6-12hrs. Patients were discharged on Pod-2 and suture removal was done on Pod 5

Statistical Methods: All the available data was refined and uploaded to an MS Excel spreadsheet and analyzed by SPSS version 21 in Windows format. The continuous variables were represented as mean, standard deviation, and percentages. The categorical variables were calculated by Chi-square test to determine differences between the two groups. The values of p (<0.05) were considered as significant.

Results

Table 1 presents the age distribution of 40 patients undergoing umbilical hernia repair, divided into two groups. Both Group A and Group B had similar age distributions, with the majority of patients falling within the 26-45 age range. This table shows the distribution of umbilical hernia age. The mean age in Group A was 44.8yrs and in Group B was 49 yrs. There was no statistically significant difference in age between the two groups (p -value = 0.371), suggesting that age was not a confounding factor in the study. The study included two groups of patients with similar age characteristics, ensuring a balanced comparison between the laparoscopic and open repair techniques.

Table 1: Shows the demographic profile of the cases included in the study

Age (in years)	Group		Total	p-value
	Group A	Group B		
26-35	7	3	10	0.371
	35.0%	15.0%	25.0%	
36-45	3	7	10	
	15.0%	35.0%	25.0%	
46-55	6	4	10	
	30.0%	20.0%	25.0%	
56-65	2	4	6	
	10.0%	20.0%	15.0%	
66-75	2	2	4	
	10.0%	10.0%	10.0%	
Total	20	20	40	
	100.0%	100.0%	100.0%	

The overall incidence of umbilical hernia in females is 62.5% and in males as 37.5% in males.

The distribution in group A and group B (table 2) shows that 75% of females underwent

laparoscopic intraperitoneal mesh repair and 50% of males underwent open onlay mesh repair.

However, the p values were not found to be significant.

Table 2: Incidence and distribution of umbilical hernia

Sex	Group		Total	p-value
	Group A Laparoscopic repair	Group B Open repair		
Male	5	10	15	0.102
	25.0%	50.0%	37.5%	
Female	15	10	25	
	75.0%	50.0%	62.5%	
Total	20	20	40	
	100.0%	100.0%	100.0%	

The incidence of seroma formation in the two groups was analyzed in the study. There were no cases of seroma formation in either Group A or Group B cases of the study. The absence of seroma

formation in both groups suggests that both open and laparoscopic umbilical hernia repair techniques have a low risk of this complication

Table 3: Surgical site infection reported in the cases of the study

Surgical site infection	Group		Total	p-value
	Group A	Group B		
No	10	12	22	0.002*
	50%	60%	55%	
Yes	10	8	18	
	50%	40%	45%	
Total	20	20	40	
	100%	100%	100.0%	

*Significant

Table 3 presents the incidence of surgical site infection (SSI) in both groups. A significantly higher number of patients in Group B (Open repair) experienced SSIs compared to Group A (Laparoscopic repair). The difference in SSI rates

between the two groups was statistically significant (p-value = 0.002). The results shows that laparoscopic umbilical hernia repair may be associated with a higher risk of SSI compared to open repair.

Table 4: Showing the incidence of recurrence in the cases of the study

Recurrence	Group		Total	p-value
	Group A	Group B		
No	20	19	39	1.000
	100.0%	95.0%	97.5%	
Yes	0	1	1	
	0.0%	5.0%	2.5%	
Total	20	20	40	
	100.0%	100.0%	100.0%	

Table 4 shows the recurrence rates in the two groups. Overall, the recurrence rates were low in both groups, with only 1 case of recurrence out of 40 patients. There was no statistically significant difference in recurrence rates between Group A and Group B (p-value = 1.000). Both open and laparoscopic repair appear to be effective in

preventing hernia recurrence, with low rates observed in both groups. The data does not suggest any significant difference in recurrence rates between the two techniques, indicating that both may be equally effective in achieving long-term outcomes.

Table 5: Post-operative pain (VAS) reported in the cases of the study

Pain	Group A		Group B		p-value
	Mean	SD	Mean	SD	
At 2 Hours	5.20	1.642	6.40	1.392	0.017
At 6 Hours	3.05	1.432	4.10	1.373	0.023
At 24 Hours	1.90	1.373	2.45	1.669	0.262
At 48 Hours	0.75	0.967	1.55	1.395	0.042
p-value	0.000		0.000		

Table 5 presents the mean visual analog scale (VAS) scores for postoperative pain in two groups. At all-time points, Group B (open repair) reported significantly higher VAS scores for pain compared to Group A (Laparoscopic repair). The differences

in pain scores were statistically significant at 2, 6, and 48 hours postoperatively (p-values < 0.05). The data suggests that laparoscopic umbilical hernia repair may be associated with lower levels of postoperative pain compared to open repair.

Table 6: clinical profile of the cases included in the study

	Group A		Group B		p-value
	Mean	SD	Mean	SD	
Total dose of analgesia given (mg)	225.00	55.012	645.00	241.650	0.000
Duration of hospital stay (days)	2.25	0.550	6.45	2.417	0.000
Average length of Scar (cm)	1.75	0.62	7.25	1.65	0.000
Duration of Surgery (in mins)	43.00	13.61	65.00	12.25	0.000

Table 6 presents the clinical profile of 40 patients undergoing umbilical hernia repair, divided into two groups. Group B (open repair) required significantly higher total doses of analgesia compared to Group A (laparoscopic repair) (p-value = 0.000). Patients in Group B (open repair) had a significantly longer duration of hospital stay compared to Group A (laparoscopic repair) (p-

value = 0.000). Group B (open repair) had significantly longer average scar lengths compared to Group A (laparoscopic repair) (p-value = 0.000). The significantly lower total dose of analgesia required in Group A suggests that laparoscopic repair may be associated with less postoperative pain compared to open repair.

Table 7: Cosmetic outcome of the patients included in the surgery

Cosmesis	Group		Total	p-value
	Group A	Group B		
Good	20	14	34	0.020
	100.0%	70.0%	85.0%	
Poor	0	6	6	
	0.0%	30.0%	15.0%	
Total	20	20	40	
	100.0%	100.0%	100.0%	

Table 7 shows the cosmetic outcomes of the patients included in the study. A significantly higher number of patients in Group A (laparoscopic repair) reported a "good" cosmetic outcome compared to Group B (open repair) (p-value = 0.020). The average length of the scar was Group A i.e. 1.75cm when compared to that of Group B i.e. 7.25cm. A higher percentage of patients in Group B experienced a "poor" cosmetic outcome, with 30% reporting dissatisfaction compared to 0% in Group A. The data suggests that laparoscopic umbilical hernia repair may result in significantly better cosmetic outcomes compared to open repair. This could be attributed to the smaller incisions and reduced tissue trauma associated with laparoscopic surgery.

Discussion

This prospective comparative surgical study included 40 cases of primary umbilical hernia treated in both Chigateri and Bapuji hospitals. Umbilical hernia generally develops from small fascial defects because of their size, a common practice is to repair the defect with primary closure which is associated with a recurrence rate of 15% [13]. The use of prosthetic material has reduced the incidence of recurrence. The main concern surrounding the use of prosthetic material for hernia repair is its association with complications such as wound infections and seromas. Infections occur in 15-45% of patients following open hernia repair with mesh materials which is closely correlated with recurrence rate. The laparoscopic technique for hernia repair has resulted in

decreased post-operative morbidity which increases the hospital stay and cost of treatment. In the laparoscopic technique, the large surface area of mesh allows substantial tissue ingrowth for permanent mesh fixation and intra-abdominal pressure tends to hold the mesh in place against the posterior fascia. The main differences compared to the open technique are smaller incisions and minimal soft tissue dissection needed for placement of large mesh overlap which decreases the incidence of wound complications.

In our study, umbilical hernias are more common in females. In our study total females was 62.5% and the males were 37.5% indicating a higher incidence in females. The reason can be explained by the presence of multiple precipitating factors like multiparity, pregnancy, obesity, flabby abdominal wall, etc [5]. All the patients in the study presented with a chief complaint of swelling in the umbilicus. Around 15 patients complained of vague dull aching type of pain. No cases presented with signs of intestinal obstruction like vomiting, abdominal distension, or constipation. In group B, the average duration of surgery was 65min whereas in a study. Postoperative pain: Group A has significantly less intensity and duration of pain than Group B. Sutures penetrating through the full thickness of abdominal wall muscular and fascia which has been theorized to cause local muscle ischemia resulting in postoperative pain [13]. Surgical site infection: In our study, surgical site infection in Group A is 0%, and in Group B (40%). This is compared with a study conducted by Gonzalez R et al. [14] In his study the higher wound infection rate in the open mesh group (15%) did not reach statistically significant when compared to the laparoscopic group. The infection in our group B was treated conservatively with drainage of pus and a course of antibiotics. No patient required the removal of mesh because of infection was superficial and responded well to antibiotics. In another study conducted by Abhishek et al. [13] surgical site infections were reported at 3.1%. There was no seroma collection in the groups of our study. In a study by Abhishek et al. [13] one patient (3.1%) reported seroma formation only one patient (5%) in Group B had recurrence and no (0%) recurrence in Group A during the study period. These results were compared to the study conducted by Gonzalez R et al. [14] no recurrence was noted in the laparoscopic group and (20%) in open mesh repair. In the study conducted by Abhishek et al. [13] which also reported no recurrence in laparoscopy.

Conclusion

Within the limitations of the current study, it was found that Patients undergoing laparoscopic repair experienced significantly lower levels of postoperative pain compared to those undergoing

open repair. Laparoscopic repair was associated with a significantly shorter duration of hospital stay, allowing for faster recovery and earlier discharge. Laparoscopic repair resulted in significantly better cosmetic outcomes, with a higher percentage of patients reporting satisfaction with the appearance of their scars. Both laparoscopic and open repair demonstrated low recurrence rates, with no significant difference between the two techniques. While both techniques had low rates of surgical site infection, laparoscopic repair was associated with a slightly higher incidence compared to open repair. Overall, our results suggest that laparoscopic umbilical hernia repair is a superior surgical approach in terms of postoperative pain, hospital stay, cosmetic outcome, and recurrence rates. However, the slightly higher risk of surgical site infection in laparoscopic repair should be carefully considered when making treatment decisions.

References

1. Norman S Williams. Christopher J. K. Bulstrode. P. Ronan O Connell editors. Bailey and Love's Short Practice of Surgery 26th edition. New York; p. 948-949.
2. Morgan W W, White JJ, Stambaugh S, Haller JA. Prophylactic umbilical hernia repair in childhood to prevent adult incarceration. *Surg Clin North Am.* 1970; 50: 839-845.
3. Joaquin A. Rodriguez, Ronald A. Hinder, editors. *Operative Techniques of General Surgery*, Vol 6, Texas; 2004; p. 156-164.
4. Pastorino A, Alshuqayfi AA. Strangulated Hernia. [Updated 2022 Dec 19]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK555972/> [Accessed on May 20th 2024]
5. Kulaçoğlu H. Current options in umbilical hernia repair in adult patients. *Ulus Cerrahi Derg.* 2015 Sep 1;31(3):157-61.
6. Wright BE, Beckerman J, Cohen M. Is laparoscopic umbilical hernia repair with mesh a reasonable alternative to conventional repair? *Am J Surg.* 2002;184(6):505-8.
7. William W, Morgan J, J W, Susan Stumbough J, Haller A JR. Prophylactic umbilical hernia repair in childhood to prevent adult in correlation. *Surg Clin N Am.* 1970;50(4):839-45.
8. Skandalokis JE, Gray SW, Akin JT Jr. The surgical anatomy of hernial rings. *Surg Clin N Am.* 1974;54(6):1227-37.
9. Mair GB. Preliminary report, use of whole skin grafts as a substitute for fascial sutures in the treatment of hernia. *Br Med J Surg.* 1945; 32:381.
10. Koontz AR. Preliminary report of the use of tantalum mesh in repair of large ventral hernias. *Ann Surg.* 1948;127:1079.

11. Martis JJ, Rajeshwara KV, Shridhar MK, Jannardhanan D, Sudarshan S. Strangulated Richter's umbilical hernia - a case report. *Indian J Surg* 2011; 73: 455-457.
12. Venclauskas L, Jokubauskas M, Zilinskas J, Zviniene K, Kiudelis M. Long-term follow-up results of umbilical hernia repair. *Wideochir Inne Tech Maloinwazyjne*. 2017 Dec;12(4): 350-356.
13. V. Abhishek, M.N. Mallikarjuna, B.S. Shivaswamy. Laparoscopic Umbilical Hernia Repair: Technique paper. *ISRN Minimally Invasive Surgery* 2012; 7-8: 4.
14. Gonzalez R, Mason E, Duncan T, Wilson R, Ramshaw BJ. Laparoscopic versus open umbilical hernia repair. *JLS*. 2003 Oct-Dec; 7(4):323-28.