



## CLINICAL STUDY AND MANAGEMENT OF UMBILICAL AND PARAUMBILICAL HERNIAS COMPARATIVE STUDY BETWEEN MAYO'S REPAIR AND MESH HERNIOPLASTY IN ADULTS

**Dr Chinky Garg\***

Department of Surgery, Index Medical College, Indore, Madhya Pradesh  
\*Corresponding Author

**Dr Priyanka Gupta**

Department of Surgery, Index Medical College, Indore, Madhya Pradesh

### ABSTRACT

**Background:** The conventional choice of treatment in patients with an umbilical and paraumbilical hernia is the Mayo technique with suture repair. However, mesh repair offers lower rates of recurrence and wound complications. The present study draws a comparison between the Mayo technique and the mesh technique, also comparing the morbidities associated with the same. **Methods:** This was a prospective comparative study conducted at Index Medical College and Hospital, Indore, involving patients with umbilical and paraumbilical hernia admitted to the fellow hospital from March 2020 to September 2021. Detailed information regarding postoperative wound complications and recurrence within the study period was recorded. These findings were then compared between the different surgical procedures used. **Results:** A total of 80 patients were included in this study, among which 31 (38.7%) had an umbilical hernia, whereas the remaining 49 (61.3%) had a paraumbilical hernia. The proportion of the female population was higher than the male population in the paraumbilical group, with a significant difference between both groups (65.3% vs. 34.7%,  $p=0.034$ ). On comparing both techniques, no recurrences were observed in patients who underwent Mayo's and mesh repair during the follow-up period. **Conclusion:** Mayo's repair for paraumbilical hernias has long been the preferred method, tension-free mesh repair has the advantage of having no recurrences and can therefore be used in the presence of larger defects and weaker abdominal muscle tone, demonstrating that it is a better and more advantageous method than Mayo's repair.

**KEYWORDS :** Mayo repair, Mesh repair, Paraumbilical, Umbilical

### INTRODUCTION

Any condition that causes the stretching or thinning of the midline, such as multiple pregnancies, obesity, or ascites, can lead to the reopening of the umbilical hole, resulting in the development of an adult-type umbilical hernia.<sup>1</sup> Para-Umbilical Hernia (PUH) is a frequently encountered surgical issue that has seen a rise in the rate of repairs each year.<sup>2,3</sup>

Due to the substantial risk of complications, it is imperative to address all umbilical hernias in adults. Surgical intervention is recommended for individuals experiencing its symptoms. There are two primary surgical options available for repairing umbilical hernias: suture repair and mesh repair. Suture repair can be performed through simple primary suturing for small defects (<2 cm) or by utilizing the Mayo technique, which involves overlapping the abdominal wall fascia in a "vest-over-pants" fashion.<sup>4</sup> However, primary suture repair is associated with a recurrence rate of 10%.<sup>5</sup> Mesh repair can be conducted using either an open or laparoscopic approach. In open mesh repair, the mesh can be positioned either as an onlay or sublay. Onlay mesh placement is technically simpler but has a higher risk of complications such as seroma, hematoma, and surgical site infection in certain cases. On the other hand, preperitoneal or sublay mesh placement requires greater surgical skill and experience but offers lower rates of recurrence and wound complications.<sup>6</sup>

In a multicenter, randomized and double-blinded study by Kaufmann et al., patients with primary umbilical hernias measuring 1-4 cm in diameter were assigned intraoperatively to either suture repair or mesh repair at a 1:1 ratio. The results revealed a lower recurrence rate in the mesh repair group (4%) compared to the suture repair group (12%).<sup>7</sup> Another study by Tunio et al. also concluded that the technique of tension-free mesh repair was superior to Mayo's repair for the treatment of umbilical hernias.<sup>8</sup>

There is paucity of data comparing the Mayo technique to mesh technique, hence in the light of the above context, the present study draws a comparison between Mayo technique and mesh technique, also comparing the morbidities associated with the same.

### MATERIAL AND METHODS

This was a prospective comparative study conducted at Index Medical College and Hospital, Indore, involving patients with umbilical and paraumbilical hernia admitted to the fellow hospital, from March 2020 to September 2021.

The patients in the age group of >18 years, either sex, and with a diagnosis of umbilical or paraumbilical hernia were included in this study. The patients with other comorbidities like ascites, cirrhosis, strangulated hernias, and abdominal malignancies were excluded from this study.

The demographic characteristics of the patients including age, clinical records were compiled to obtain data pertaining to the hernia's duration, progressive enlargement, and accompanying symptoms such as localized or abdominal pain, vomiting, reducibility (ability to be pushed back), chronic cough, constipation, difficulty with urination, and abdominal distension. Additionally, the patient's medical history was assessed to identify indications of ascites (abdominal fluid accumulation) or alternative causes of abdominal distension, along with information regarding the number of pregnancies and any prior surgeries for the same issue. During the physical examination, special emphasis was placed on examining the hernia's position, size, shape, composition, presence of a cough impulse, reducibility, condition of the skin covering the swelling, size of the defect in the Linea alba (central abdominal line), and the tone of the abdominal muscles.

### Preoperative Procedure

Prior to the surgery, a series of preoperative investigations were conducted, including measuring the hemoglobin level (Hb%), bleeding time (BT), clotting time (CT), fasting blood sugar (FBS), postprandial blood sugar (PPBS), blood urea, serum creatinine, urine analysis for albumin, sugar, and microscopic examination, electrocardiogram (ECG), and chest X-ray. The patients were prepared for surgery after addressing preoperative issues such as anemia, hypertension, obesity, diabetes, and local skin conditions. Following the preoperative preparation, all patients underwent the surgical procedure. Informed written consent was obtained from the patients after explaining the surgical procedure and its potential outcomes. Patients were instructed not to consume any food or drink after 12:00 pm the night

before the surgery (nil per os). A tetanus toxoid injection of 0.5 ml was administered intramuscularly. A test dose of xylocaine (local anesthetic) injection was given. The surgical site was prepared by shaving the area.

All patients received a single dose of intravenous preoperative antibiotic, specifically 1 gm of a third-generation cephalosporin, either during or immediately after the administration of anesthesia. The patients were operated on under either spinal anesthesia or general anesthesia. Prior to the surgical procedure, the anterior abdominal wall was cleaned with a betadine scrub on the operating table.

### Operative Procedure

Two surgical procedures, Mayo's anatomical repair and prosthetic mesh repair, were performed randomly for each specific procedure, taking into account factors such as the size of the defect and the tone of the abdominal wall.

### Mayo's repair

The patient was placed in a supine position under anesthesia. The surgical site was prepared, and drapes were applied to provide access to the umbilical area and the abdomen if needed. An incision in the shape of a transverse ellipse was made, encompassing the umbilicus and the skin covering the hernia. The incision extended laterally on both sides, around 5cm beyond the protruding hernia. It was then deepened through the subcutaneous fat until the glistening surface of the aponeurosis was revealed. The neck of the hernia sac, usually free from adhesions, was the first area opened. Prior to opening it, the surrounding aponeurosis (connective tissue) was cleared to expose the neck of the hernia where it emerges through the linea alba. A small incision was made in the fibrous covering of the neck, carefully deepened to open the sac. A finger was used to assess any adhesions inside the sac, and the remaining circumference of the neck was divided using scissors while protecting the contents with the finger. The central part of the hernia sac, along with the attached skin and fat, was examined while still connected to the abdomen. If the contents were unhealthy omentum, it was removed, and if they were healthy, they were pushed back into the peritoneal cavity. In the case of bowel being present, the sac was fully opened. The sac was then turned inside out, and its contents were carefully removed. Adherent omentum was excised along with the sac, and any adhesions between adjacent intestine coils were separated. The hernial contents were returned to the abdominal cavity. The opening was enlarged on both sides, allowing for proper overlapping of tissues, and deep sutures were placed for closure.

Polypropylene, a strong non-absorbable material, was used for suturing. A round body needle was employed to insert the suture between 3 cm and 4 cm from the margin of the upper flap. The needle was then passed across the defect and through the lower flap, 1 to 2 cm from its margin. This process was repeated to secure all the sutures in place. The upper flap was brought over the lower flap, and the sutures were tied firmly using a triple layer, double throw knot. The ends of the sutures were cut short, and a suctioned drain was placed over the repaired area. Subcutaneous tissue was sutured with plain catgut, and the skin was closed using ethilon.

### Mesh Repair

The surgical procedure followed the principles of Mayo's repair until the management of the hernial sac and its contents. Polypropylene mesh was used for the repair, with the most commonly used size being 6" x 3". If the defect was larger, a larger-sized mesh was used.

For the inlay mesh repair (preperitoneal), after reducing the sac and its contents, the peritoneum was closed with vicryl 1-0 sutures in a continuous manner. The prosthetic mesh was placed between the peritoneum and rectus sheath and

secured with polypropylene sutures. A suction drain was inserted, and the wound was closed in layers.

For the onlay mesh repair, after managing the hernial sac and its contents according to Mayo's repair, the sac was approximated using polypropylene sutures. The prosthetic mesh was placed over the aponeurosis and fixed with polypropylene sutures. A suction drain was inserted, and the subcutaneous tissue and skin were sutured. After the surgery, the patients were kept on a nil orally (NPO) diet for 24-36 hours and received intravenous fluids, 3rd generation cephalosporin injections, Diclofenac, and Ranitidine. They were allowed to consume oral liquids after 24-36 hours and gradually transitioned to a soft diet. The quantity and nature of the suction drain were monitored, and it was removed after 48 hours. The sutures of the operative wound were removed approximately 8-10 days after the surgery. On the 4th day post-surgery, the operative wound was examined for signs of inflammation or discharge. If a soft swelling was present, it was aspirated and the collected material was noted. Serous or bloody collections were aspirated completely, while purulent collections required the removal of stitches and sending the pus for culture and sensitivity testing. In the study, postoperative infection was defined as the presence of erythema, tenderness upon palpation, and the presence of seropurulent or purulent discharge. Seroma was defined as the collection of clear serous fluid. Recurrence was defined as the reappearance of symptoms and signs of a paraumbilical hernia after the surgical wound had completely healed. The patients were followed up for a period of 2 months to 1.5 years. After the surgical wound had completely healed, patients were advised to have follow-up appointments every two or three months. During these follow-up visits, patients were examined for any new symptoms or signs related to the surgical procedure.

Detailed information regarding postoperative wound complications and recurrence within the study period was recorded. These findings were then compared between the different surgical procedures used.

### Endpoints

The primary endpoint of this study was to assess the efficacy of mesh repair in comparison to Mayo Repair and to analyses the morbidity associated with the management.

The secondary endpoint was to assess the prevalence, clinical features, risk factors, operative techniques and postoperative course of umbilical and paraumbilical hernia in adults.

### Statistical Analysis

All the quantitative variables in the present study such as age and sex distribution of patients with Umbilical and paraumbilical hernias are expressed in terms of frequency and percentage. Data analysis was performed by using SPSS (Statistical package for social sciences) version 20.

### RESULTS

A total of 80 patients were included in this study, among which 31 (38.7%) had umbilical hernia whereas the remaining 49 (61.3%) had paraumbilical hernia. The mean age of the patients was 48.7 years. The majority of the patients belonged to the age group of 45-60 years, there was a significant difference in the age groups between the patients with Mayo repair and mesh repair,  $p=0.025$ . The proportion of the female population was higher than the male population in paraumbilical group, with a significant difference between both the groups (65.3% vs. 34.7%,  $p=0.034$ ). The mean defect size in umbilical hernia and paraumbilical hernia was 2.9 cm and 2.4 cm, respectively. The majority of patients (62.5%) presented with swelling followed by 12.5% of patients with pain. However, there were no significant difference between both the groups. The majority of patients had a history of

diabetes mellitus (7.5%) followed by a combination of diabetes and hypertension (5.0%). When the contents of the sac were compared, majority of patients showed presence of omentum (45.0%) followed by omentum and small intestine (37.5%). There was a significant difference between both the groups (p=0.012) (Table 1).

**Table - 1 Demographic Characteristics In Patients With Umbilical And Paraumbilical Hernia**

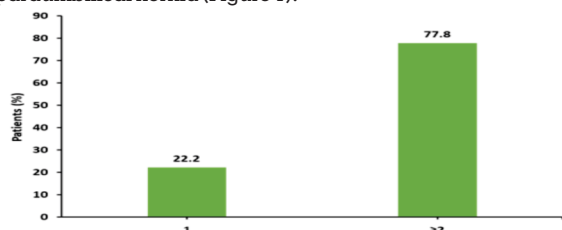
Parameters	Umbilical hernia (n=31)*	Para umbilical hernia (n=49)#	Total (N=80)	P value
Age (years), mean (SD)	49.9 (13.4)	47.9 (9.7)	48.7 (11.4)	0.443
Age group (years)				0.025
20-45, (n=30)	12 (38.7)	18 (36.7)		
45-60, (n=41)	12 (38.7)	29 (59.2)		
>60, (n=9)	7 (22.6)	2 (4.1)		
Sex				0.034
Male, (n=35)	18 (58.1)	17 (34.7)		
Female, (n=45)	13 (41.9)	32 (65.3)		
Height (cm), mean (SD)	164.7 (7.1)	161.5 (8.9)	162.7 (8.4)	0.114
Weight (kg), mean (SD)	60.4 (7.2)	61.3 (8.1)	60.9 (7.8)	0.770
BMI (kg/m2), mean (SD)	22.5 (2.2)	23.6 (3.4)	23.2 (3.1)	0.118
BMI group (kg/m2)				0.800
18-22	17 (54.8)	16 (32.7)	33 (41.3)	
22-30	14 (45.2)	30 (61.2)	44 (55.0)	
>30	0	3 (6.1)	3 (3.8)	
Defect size (cm), mean (SD)	2.9 (0.9)	2.4 (1.1)	-	0.893
Clinical features				0.677
Swelling	18 (58.1)	32 (65.3)	50 (62.5)	
Pain	5 (16.12)	5 (10.2)	10 (12.5)	
Swelling/Pain	6 (19.35)	10 (20.40)	16 (20.0)	
Swelling/Pain/Excoriation	1 (3.22)	2 (4.08)	3 (3.7)	
Vomiting	1 (3.22)	0	1 (1.2)	
Comorbidities				0.401
Diabetes mellitus	4 (12.9)	2 (4.08)	6 (7.5)	
Diabetes mellitus and hypertension	3 (9.67)	1 (2.04)	4 (5.0)	
Chronic obstructive pulmonary disease	2 (6.45)	3 (6.12)	5 (6.2)	
Hypertension	2 (6.45)	1 (2.04)	3 (3.7)	
Hypothyroidism	0	2 (4.08)	2 (2.5)	
Content of the sac				0.012
Omentum	8 (25.78)	28 (57.1)	36 (45.0)	
Omentum/small intestine	14 (45.2)	16 (32.6)	30 (37.5)	
Small intestine	9 (29.0)	5 (10.2)	14 (17.5)	

Data presented as n (%).

\*n=31, #n=49, unless otherwise specified.

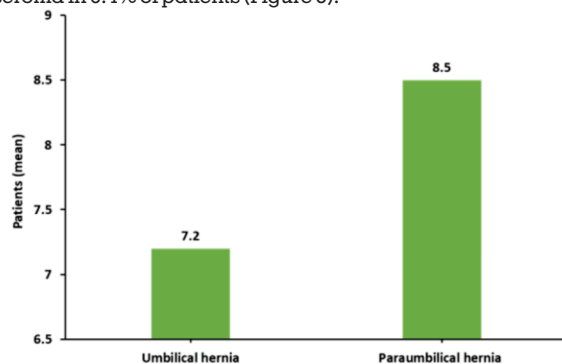
BMI, body mass index.

Among 45 females, 10 had 1 child and remaining 35 (77.8%) had 2 and more than 2 children, showing that multiparity is a predisposing factor for the development of umbilical and paraumbilical hernia (Figure 1).

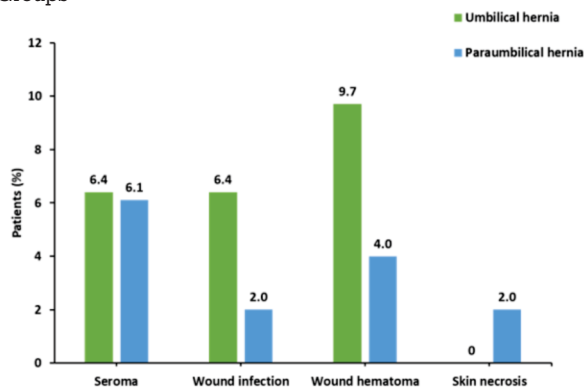


**Figure - 1 Parity In Female Population**

The mean follow up in patients with umbilical hernia was 7.2 months and in paraumbilical hernia, it was 8.5 months (Figure 2). Among the patients with umbilical hernia, 9.7% of patients reported wound hematoma followed by wound infection and seroma in 6.4% of patients (Figure 3).



**Figure - 2 Follow-up Duration In Umbilical And Paraumbilical Groups**



**Figure - 3 Incidence Of Postoperative Complications**

The mean age of patients who underwent mayo repair and mesh repair were 48.8 years and 48.5 years, respectively. The mean defect size of hernia was significantly higher in mesh group (3.8 cm) when compared to Mayo group (1.9 cm) (p<0.001). All the patients who underwent Mayo repair had defect size ≤2.5 cm and all the patients who underwent mesh repair had defect size ≤2.5 cm, which was statistically significant (p<0.001). Majority of patients who underwent mayo's repair had omentum as the content which was significantly higher than mesh group (62.5% vs. 27.5%, p=0.003) (Table 2).

**Table - 2 Demographic Characteristics In Mayo And Mesh Repair**

Parameter	Mayo repair (n=40)*	Mesh repair (n=40)#	Total (N=45)	P value
Age (Years)				0.128
20-45, (n=30)	16 (40.0)	14 (35.0)		
45-60, (n=41)	17 (42.5)	24 (60.0)		
>60, (n=9)	7 (17.5)	2 (5.0)		
Gender				0.088
Male, (n=35)	14 (35.0)	21 (52.5)		
Female, (n=45)	26 (65.0)	19 (47.5)		
Parity distribution				
1	7 (26.9)	3 (15.7)	10 (22.2)	
2	17 (65.3)	10 (52.6)	27 (60.0)	
3	2 (7.6)	5 (26.3)	7 (15.5)	
4	0	1 (5.2)	1 (2.2)	
Hernia defect size	1.9 (0.3)	3.8 (0.5)	2.8 (1.0)	<0.001
Hernia defect size ≤2.5 cm	40 (100.0)	40 (100.0)	40(100.0)	<0.001
Hernia defect size >2.5 cm	0	0	0	

Content of the sac				0.003
Omentum	25 (62.5)	11 (27.5)	-	
Omentum/small intestine	8 (20)	22 (55.0)		
Small intestine	7 (17.5)	7 (17.5)		
Type of Hernia				0.168
Umbilical hernia, (n=31)	12 (38.7)	19 (61.3)	40 (50.0)	
Para umbilical hernia, (n=49)	28 (57.1)	21 (42.9)	40 (50.0)	
Data presented as n (%).				
*n=40, #n=40, unless otherwise specified.				

Among both the groups, 10.0% of patients in Mayo's technique group reported wound hematoma, and 5.0% of patients reported wound infection, whereas in mesh repair group, 10.0% of patients reported seroma and 2.5% reported wound infection and hematoma (Table 3).

**Table – 3 Post Operative Morbidities In Both The Groups**

Parameter	Mayo repair (n=40)*	Mesh repair (n=40)#	P value
Postoperative complications, n (%)			0.177
Seroma	1 (2.5)	4 (10)	
Wound infection	2 (5)	1 (2.5)	
Wound hematoma	4 (10)	1 (2.5)	
Skin necrosis	0	1 (2.5)	
Follow-up (months), mean (SD)	7.7 (4.9)	8.4 (4.9)	0.509
Data presented as n (%).			
*n=40, #n=40, unless otherwise specified.			

The mean follow up in Mayo repair group was 7.7 months and in Mesh repair group was 8.4 months. Among 80 patients, 40 patients had mesh repair and 40 patients Mayo's repair. On comparing both the techniques, there were no recurrence observed in patients underwent Mayo's and mesh repair during follow up period.

**DISCUSSION**

In the present study, the majority of the patients belonged to the age group of 45-60 years (umbilical hernia, 38.7% and paraumbilical hernia, 59.2%) which was consistent with the study by Aziz Khan et al. which reported peak occurrence of hernia in fourth to fifth decade of life.<sup>9</sup> A study by Naik et al. reported higher incidence of paraumbilical hernia in female (65%) than male (35%), this was similar to the observations of this study in which the incidence of paraumbilical hernia was higher in females than males (34.7% vs. 65.3%). The swelling next to the umbilicus with involvement of one of the umbilicus walls is the most typical manifestation of paraumbilical hernia.<sup>10</sup> This was also observed in this study where the most common presenting symptom was swelling (62.5), followed by pain (12.5). This was consistent in studies by Naik et al. which observed swelling in 100% of patients followed by pain in 82.8% of patients and Purushottam et al. which observed swelling in 100.0% of patients followed by pain in 36.5% of patients.<sup>11,12</sup>

Primary anatomical repair can be performed in cases of small defects (≤2-3 cms in diameter), while basic anatomical repair is necessary in cases of large defects (>2-3 cms in diameter). The rate of recurrence dramatically decreased with the introduction of mesh repair. Prosthetic mesh as an onlay/overlay, inlay, or underlay can be used.<sup>10</sup> In this study, mesh repair was done in larger defects of >2.5 cm, this criterion was common with another study by Sanjay et al.<sup>13</sup> The most often reported complications in the surgical management of hernias were hernia recurrence, wound infection, wound dehiscence, mesh explanation, seroma, fistula formation, and chronic discomfort. Incidence rates for complications including hematoma/bleeding and mortality

were rarely recorded.<sup>14</sup> A study by Aziz et al. compared Mayo technique and mesh repair in 50 patients and observed a significant difference between both groups. In patients with Mayo technique; majority of patients reported wound hematoma (12.0%), followed by seroma formation (8.0%) and wound infection (8.0%), whereas in patients with mesh repair; hematoma was observed in 12% of patients followed by infection in 4.0% of patients.<sup>9</sup> Similar observations were noted in this study where in patients treated with Mayo technique reported hematoma in 10% of patients followed by seroma formation in 2.5% of patients whereas the patients treated with mesh repair reported hematoma in 2.5% of patients followed by seroma formation in 10% of patients. None of the patients in this study required removal of mesh caused by infection, as the infection was superficial and responded well to the antibiotics.

In the present study, no recurrence was observed in both the groups. The mean follow-up was 6.8 months. In contrast to this study, Amin et al. reported high recurrence rate (24%) in patients with paraumbilical hernia who underwent Mayo's repair.<sup>15</sup> Previous study by Purushotham et al. reported recurrence rate of 8.3% and 9.1% in patients with paraumbilical and umbilical hernia respectively, who underwent anatomical repair. However, no recurrence was observed in patients with mesh repair.<sup>12</sup> Celdran A et al observed no recurrence in 25 cases of umbilical hernias by using technique of tension free mesh repair after follow-up of 13 months.<sup>16</sup>

When compared to open paraumbilical repair, laparoscopic paraumbilical hernia repair is a safe and efficient treatment. Due to lower postoperative morbidity, laparoscopic surgery is substantially superior to open repair. Infection, seroma, and haemorrhage from postoperative wounds occurred more frequently in the open group than the laparoscopic group.<sup>10</sup> Mesh repair technique with its better post-operative outcomes, low recurrence rate and better patient satisfaction can become a benchmark in management of adult umbilical and paraumbilical hernia repair.<sup>11</sup>

There were some limitations with this study like small sample size, non-randomized trial, and not considering the cost effectiveness. In addition to this, the follow-up period was small to show any significant difference between the two procedures.

**CONCLUSIONS**

In this study, the commonly employed surgical approaches for treating umbilical and paraumbilical hernias were evaluated in terms of their clinical characteristics, surgical methods, and associated post-operative complications. The main presenting symptoms of these are swelling and pain, and they are most frequently found in females. Six months of follow-up revealed no signs of recurrence. Although Mayo's repair for paraumbilical hernias has long been the preferred method, tension-free mesh repair has the advantage of having no recurrences and can therefore be used in the presence of larger defects and weaker abdominal muscle tone, demonstrating that it is a better and more advantageous method than Mayo's repair.

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