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Comparative Study of Laparoscopic Transperitoneal Retrorectus Rives-Stoppa Repair Versus Intraperitoneal Onlay Mesh Repair in Umbilical and Paraumbilical Hernia

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ABSTRACT

Background: Umbilical and paraumbilical hernias are common ventral hernias requiring surgical repair. Laparoscopic intraperitoneal onlay mesh (IPOM) repair is widely practiced but is associated with higher cost and mesh-related complications. Laparoscopic transperitoneal retrorectus Rives-Stoppa repair has emerged as a potential alternative.
Objectives: To evaluate and compare the outcomes of laparoscopic retrorectus Rives-Stoppa repair and IPOM repair in patients with umbilical and paraumbilical hernia.
Materials and Methods: This prospective observational cohort study was conducted at a tertiary care center over one year and included 50 patients, divided equally into laparoscopic sublay (retrorectus) and IPOM groups. Patients were evaluated for operative duration, postoperative pain using Visual Analog Scale (VAS), complications, and cost-effectiveness. Statistical analysis was performed using independent and paired t-tests, chi-square test, and z-test, with $p < 0.05$ considered significant.
Results: The mean age of patients was 44.06 ± 12.24 years, with comparable baseline characteristics between groups. The operative duration was significantly longer in the sublay group (137.2 ± 12.25 min) compared to the IPOM group (65.7 ± 9.31 min) ($p < 0.001$). Postoperative pain scores were significantly lower in the sublay group at all time points ($p < 0.001$). Complications such as seroma and hematoma were significantly higher in the IPOM group (20% each, $p = 0.02$). The sublay technique was more cost-effective due to the use of polypropylene mesh.
Conclusion: Laparoscopic retrorectus Rives-Stoppa repair is a safe, cost-effective alternative to IPOM repair, offering lower postoperative pain and fewer complications, despite a longer operative time.

Keywords: *Umbilical hernia, Paraumbilical hernia, Laparoscopic repair, IPOM, Rives-Stoppa repair, Retrorectus repair, Mesh repair.*

INTRODUCTION

Umbilical and paraumbilical hernias are common ventral hernias resulting from weakness in the abdominal wall, particularly at the umbilical region, which is inherently prone to structural defects. In adults, these hernias are typically acquired and are associated with conditions that increase intra-abdominal pressure such as obesity, multiparity, ascites, and chronic respiratory disorders (1,2). Unlike pediatric cases where spontaneous closure may occur, adult hernias rarely

resolve without intervention and carry a significant risk of complications including incarceration, obstruction, and strangulation, thereby necessitating timely surgical repair.
Over time, hernia management has evolved from primary tissue repair to mesh-based techniques, which have significantly reduced recurrence rates (3,4). The Rives-Stoppa repair, an open retrorectus mesh technique, is widely regarded as a reliable method due to its tension-free nature and favorable anatomical placement of mesh (5,6). However, open procedures are associated with increased postoperative pain, longer recovery periods, and higher rates of wound-related complications.

The advent of minimally invasive surgery has transformed the management of ventral hernias. Laparoscopic intraperitoneal onlay mesh (IPOM) repair is widely practiced due to its advantages of reduced postoperative pain, shorter hospital stay, and improved cosmetic outcomes (7). Despite these benefits, IPOM has certain limitations, including the requirement for expensive composite meshes to prevent visceral adhesions and the risk of complications such as bowel injury, adhesion formation, and chronic pain related to fixation methods (7,8) .

Laparoscopic transperitoneal retrorectus (Rives-Stoppa) repair has emerged as a promising alternative technique. By placing the mesh in the retromuscular plane, it avoids direct contact with intra-abdominal viscera, promotes better mesh incorporation, and reduces the risk of adhesions and infection (5,6). Additionally, the use of polypropylene mesh and reduced reliance on fixation devices make it a more cost-effective option, particularly in resource-limited settings. Although technically more demanding and associated with longer operative time, it has demonstrated favorable outcomes with reduced postoperative pain and complications compared to IPOM (8,9) .

Therefore, the present study was undertaken to compare laparoscopic transperitoneal retrorectus (Rives-Stoppa) repair with laparoscopic IPOM repair in patients with umbilical and paraumbilical hernias, focusing on operative outcomes, postoperative pain, complications, and cost-effectiveness.

MATERIALS AND METHODS:

Study Design and Setting

This was a prospective observational cohort study conducted in the Department of General Surgery at panimalar medical college hospital, Chennai over a period of one year (2024–2025). The study aimed to compare outcomes between two laparoscopic techniques for the management of umbilical and paraumbilical hernias.

Study Population

The study population consisted of patients presenting to the outpatient and inpatient departments with clinically diagnosed umbilical or paraumbilical hernia. A total of 50 patients were enrolled in the study after applying inclusion and exclusion criteria.

Sample Size and Sampling Technique

The sample size was 50 patients. Participants were allocated into two groups (25 in each group) using a probability-based allocation method (odd–even method), ensuring equal distribution between the two surgical techniques .

Inclusion Criteria

1. Patients aged between 18 and 60 years
2. Both male and female patients
3. Diagnosed cases of uncomplicated umbilical or paraumbilical hernia
4. Hernia defect size less than 5 cm
5. Patients medically fit for general anesthesia

Exclusion Criteria

1. Age less than 18 years or more than 60 years
2. Complicated hernias (incarcerated, obstructed, or strangulated)
3. Other types of ventral hernias (e.g., incisional, epigastric)
4. History of previous abdominal wall surgery
5. Patients with irradiated abdomen or collagen vascular diseases
6. Patients unfit for surgery or with significant comorbid illness
7. Patients unwilling to participate

Ethical Considerations

The study was conducted after obtaining approval from the Institutional Ethics Committee of Panimalar Medical College and Hospital. Written informed consent was obtained from all participants prior to inclusion in the study.

Preoperative Evaluation

All patients underwent a detailed clinical evaluation including history taking and physical examination. Particular attention was given to:

- Duration and characteristics of swelling

- Reducibility of hernia
- Presence of pain
- Previous surgical history
- Comorbid conditions

Baseline investigations included routine blood tests, ultrasonography of the abdomen to assess defect size and contents, and pre-anesthetic evaluation.

Study Procedure

Eligible patients were divided into two groups:

- **Group A:** Laparoscopic transperitoneal retrorectus (Rives-Stoppa) repair (Sublay group)
- **Group B:** Laparoscopic intraperitoneal onlay mesh (IPOM group)

All procedures were performed under general anesthesia by experienced laparoscopic surgeons.

Surgical Technique

Laparoscopic Intraperitoneal Onlay Mesh (IPOM) Repair

Pneumoperitoneum was created using a Veress needle at Palmer's point. After port placement and diagnostic laparoscopy, adhesiolysis was performed if required. The hernia contents were reduced, and the defect was assessed.

A composite dual-layer mesh was introduced into the peritoneal cavity and positioned to overlap the defect by at least 3–5 cm in all directions. The mesh was fixed using a combination of tackers (inner and outer crown technique) and transfascial sutures. Care was taken to prevent bowel contact with the mesh.

Laparoscopic Transperitoneal Retrorectus (Rives-Stoppa) Repair

After establishing pneumoperitoneum, a peritoneal incision was made lateral to the hernia defect. Dissection was carried out in the retrorectus (retromuscular) plane by separating the posterior rectus sheath from the rectus muscle.

The retromuscular space was developed adequately to accommodate the mesh. A polypropylene mesh was placed in this plane and secured with minimal transfascial sutures. The posterior rectus sheath and peritoneum were then closed to completely cover the mesh, thereby preventing contact with intra-abdominal viscera.

Data Collection

Data were collected using a structured proforma , which included:

- Demographic details (age, sex)
- Clinical findings (defect size, reducibility)
- Operative details (type of surgery, mesh type, fixation method, duration)
- Postoperative parameters (pain score, complications)

Follow-Up

Patients were followed up at:

- 1 month
- 3 months
- 6 months

During follow-up, patients were assessed for pain, recurrence, mesh-related complications, and overall recovery.

Statistical Analysis:

Data were entered and analyzed using IBM SPSS version 25.0. Continuous variables were expressed as mean ± standard deviation. Categorical variables were expressed as percentages. Statistical tests used included the independent t-test for comparison between groups, the paired t-test for within-group comparison, the chi-square test for categorical variables, and the z-test for proportions. A p-value <0.05 was considered statistically significant.

RESULTS

The majority of patients (64%) were in the 30–50 years age group. Only 10% were below 30 years, indicating that umbilical/paraumbilical hernia is more common in middle-aged individuals. (Table 1)

Table 1: Age Distribution

Age Group (years)	No. of Cases	Percentage
< 30	5	10%
30–50	32	64%
> 50	13	26%
Total	**50**	**100%**

Males constituted a slightly higher proportion (54%) compared to females (46%), with no significant gender predominance. (Table 2)

Table 2: Sex Distribution

Sex	No. of Cases	Percentage
Male	27	54%
Female	23	46%
Total	**50**	**100%**

Most patients (72%) had defect sizes between 2–5 cm, indicating that moderate-sized hernias were more common in the study population. (Table 3)

Table 3: Defect Size Distribution

Defect Size (cm)	No. of Cases	Percentage
< 2 cm	14	28%
2–5 cm	36	72%
Total	**50**	**100%**

Equal distribution of mesh types was observed, with 50% of patients receiving composite mesh (IPOM) and 50% receiving polypropylene mesh (sublay). (Table 4)

Table 4: Mesh Type

Mesh Type	No. of Cases	Percentage
Composite Dual Mesh	25	50%
Polypropylene Mesh	25	50%
Total	**50**	**100%**

The most commonly used mesh size was 12 cm circular mesh (32%), followed by 10 × 15 cm mesh (26%). (Table 5)

Table 5: Mesh Size

Mesh Size	No. of Cases	Percentage
10 × 15 cm (polypropylene)	13	26%
12 × 15 cm (polypropylene)	12	24%
12 cm circular (dual mesh)	16	32%
15 × 10 cm (dual mesh)	9	18%
Total	**50**	**100%**

There was no statistically significant difference in mean age between the two groups ($p = 0.405$), indicating comparability. (Table 6)

Table 6: Relation Between Age and Surgery

Surgery	N	Mean Age	SD	p-value
Lap Sublay	25	42.60	10.18	
IPOM	25	45.52	14.06	0.405

No significant association was found between sex and type of surgery, confirming equal distribution between groups. (Table 7

Table 7: Sex vs Surgery

Sex	Sublay	IPOM	Total
Male	15	12	27
Female	10	13	23

Statistical Test: $\chi^2 = 0.725$, $p = 0.395$

A statistically significant correlation was observed between defect size and mesh size ($p = 0.012$), indicating appropriate surgical planning. (Table 8)

Table 8: Defect Size vs Mesh Size

Defect Size	10×15	12×15	12 cm circular	15×10	Total
<2 cm	4	0	7	0	11

2–5 cm	9	12	9	9	39

Statistical Test: $\chi^2 = 10.916$, $p = 0.012$
The duration of surgery was significantly longer in the sublay group compared to IPOM ($p < 0.001$). (Table 9)

Table 9: Duration of Surgery

Surgery	Mean (min)	SD	t-value	p-value
Sublay	137.2	12.25		
IPOM	65.7	9.31	6.425	<0.001*

Pain scores were significantly lower in the sublay group at all postoperative intervals ($p < 0.001$). (Table 10)

Table 10: Comparison of Pain Scores (VAS)

POD	Sublay (Mean ± SD)	IPOM (Mean ± SD)	t-value	p-value
0	2.44 ± 0.50	4.24 ± 0.43	-13.466	<0.001*
1	1.12 ± 0.33	2.16 ± 0.37	-10.4	<0.001*
3	0.12 ± 0.33	1.00 ± 0.00	-13.266	<0.001*
7	0.00 ± 0.00	0.52 ± 0.51	-5.099	<0.001*

The sublay technique was more cost-effective than IPOM, although the difference was not statistically significant. (Table 11)

Table 11: Cost Analysis

Group	Mean Cost (₹)	p-value
Sublay	15,000	
IPOM	35,000	0.841

Hematoma and seroma were significantly more common in the IPOM group ($p = 0.02$), while no complications were observed in the sublay group. (Table 12)

Table 12: Postoperative Complications

Complication	Sublay (n=25)	IPOM (n=25)	p-value
Hematoma	0	5 (20%)	0.02*
Seroma	0	5 (20%)	0.02*
Infection	0	0	—

DISCUSSION:
Umbilical and paraumbilical hernias are common surgical conditions requiring effective and durable repair. With the advancement of minimally invasive techniques, laparoscopic approaches such as intraperitoneal onlay mesh (IPOM) repair and transperitoneal retrorectus (Rives-Stoppa) repair have gained significant attention. The present study was conducted to compare these two techniques in terms of operative parameters, postoperative pain, complications, and cost-effectiveness.

In the current study, the mean age of patients was 44.06 ± 12.24 years, with the majority (64%) belonging to the 30–50 years age group. This finding is consistent with previous studies which report that ventral hernias are more commonly observed in middle-aged individuals due to progressive weakening of the abdominal wall and increased intra-abdominal pressure over time (10). The gender distribution in our study showed a slight male predominance (54%), although the difference was not statistically significant. Similar observations have been reported in earlier studies, suggesting that while some literature indicates higher prevalence in females due to pregnancy-related factors, overall gender distribution may vary across populations (11).

Defect size plays a crucial role in determining the type and size of mesh used. In this study, 72% of patients had defect sizes between 2–5 cm, and a statistically significant correlation was found between defect size and mesh size ($p = 0.012$). This highlights the importance of individualized surgical planning. Comparable findings were reported by other authors who emphasized adequate mesh overlap (3–5 cm beyond the defect margins) as a key factor in preventing recurrence (12). Operative duration was significantly longer in the laparoscopic sublay group compared to the IPOM group (137.2 vs 65.7 minutes, $p < 0.001$). This is expected, as the sublay technique requires meticulous dissection of the retrorectus plane and closure of the posterior rectus sheath. Similar observations were made by Prasad et al., who reported increased operative time in retrorectus repairs due to technical complexity (9). Other studies have also confirmed that although sublay repair is time-consuming, it offers better anatomical restoration (13).

Postoperative pain is an important determinant of patient recovery and satisfaction. In the present study, patients who underwent laparoscopic sublay repair experienced significantly lower pain scores at all postoperative intervals compared to those who underwent IPOM repair ($p < 0.001$). This can be attributed to reduced use of fixation devices such as tackers and avoidance of intraperitoneal mesh placement. Studies by Thota et al. and Vijay et al. have similarly demonstrated higher postoperative pain scores in IPOM procedures, mainly due to tacker-related irritation and mesh contact with visceral peritoneum (14,15).

The incidence of postoperative complications was significantly higher in the IPOM group, particularly hematoma and seroma formation (20% each, $p = 0.02$). In contrast, no such complications were observed in the sublay group. These findings are consistent with previous literature, which reports higher seroma formation rates in IPOM due to dead space and intraperitoneal mesh placement (16). Prasad et al. also reported lower complication rates in retrorectus repairs due to better tissue integration and absence of direct contact between mesh and abdominal viscera (9).

Cost-effectiveness is a critical factor, especially in developing countries. In this study, laparoscopic sublay repair was found to be more economical compared to IPOM (₹15,000 vs ₹35,000), primarily due to the use of polypropylene mesh instead of expensive composite dual mesh and reduced use of fixation devices. Similar findings were reported by Kalpesh Jani et al., who highlighted the economic advantage of retrorectus repair in resource-limited settings (17). The reduced requirement for tackers and transfascial sutures further contributes to cost reduction without compromising surgical outcomes.

Another important advantage of the retrorectus technique is the anatomical placement of mesh in a well-vascularized plane, which promotes better incorporation and reduces the risk of infection and recurrence. Additionally, the mesh is shielded from intra-abdominal contents, minimizing the risk of adhesions and fistula formation. Miserez et al. also emphasized that extraperitoneal mesh placement reduces long-term complications associated with intraperitoneal positioning (8).

Despite these advantages, laparoscopic retrorectus repair has certain limitations, including increased technical difficulty and longer learning curve. However, with increasing surgical expertise and experience, operative time can be reduced significantly. The benefits in terms of reduced postoperative pain, fewer complications, and cost-effectiveness outweigh these limitations.

Overall, the findings of the present study strongly support the use of laparoscopic transperitoneal retrorectus Rives-Stoppa repair as a superior alternative to IPOM for umbilical and paraumbilical hernia repair. The technique provides better clinical outcomes with lower morbidity and is particularly advantageous in settings where cost constraints are a major concern.

CONCLUSION:

Laparoscopic transperitoneal retrorectus Rives-Stoppa repair is a safe and effective technique for the management of umbilical and paraumbilical hernias. It is associated with significantly lower postoperative pain, fewer complications such as seroma and hematoma, and better cost-effectiveness compared to IPOM repair.

Although the procedure requires a longer operative time due to its technical complexity, the overall benefits in terms of improved patient outcomes and reduced morbidity make it a preferable alternative, particularly in resource-limited settings.

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