



A COMPARATIVE STUDY BETWEEN ONLAY MESH HERNIOPLASTY AND SUBLAY MESH HERNIOPLASTY IN MANAGEMENT OF VENTRAL HERNIA

General Surgery

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ABSTRACT

Background: Ventral hernias represent a common surgical challenge with various repair techniques available. This study aimed to compare the outcomes of onlay mesh hernioplasty versus sublay mesh hernioplasty in ventral hernia management. **Methodology:** This comparative prospective study was conducted from September 2023 to December 2024 at LN Medical College and Research Center, Bhopal included 46 patients with ventral hernias. Patients were equally divided into two groups: 23 patients underwent onlay mesh repair and 23 underwent sublay mesh repair. Outcomes measured included operative time, post-operative complications like seroma, surgical site infection, flap necrosis, pain scores, hospital stay and recurrence rate. **Results:** The mean age was 45.12 ± 12.16 years in the onlay group and 47.61 ± 11.02 years in the sublay group. Mean operative time was significantly shorter for onlay repair (70.82 ± 9.06 minutes) versus sublay repair (79.85 ± 19.72 minutes) ($p < 0.05$). Postoperative complications were significantly higher in the onlay group versus the sublay group, with seroma formation (33.3% vs 12.1% ; $p = 0.04$) and surgical site infection (24.2% vs 0% ; $p = 0.003$). Pain scores on day 0 were significantly higher in the onlay group (2.45 ± 0.75 vs 1.91 ± 0.72 ; $p = 0.004$). The mean hospital stay was comparable between groups (1.24 ± 0.44 days for onlay vs 1.15 ± 0.36 days for sublay; $p = 0.361$). Complete wound healing at day 10 was significantly better in the sublay group (39.4% vs 3.0% ; $p < 0.001$). No recurrence was observed in either group during the follow-up period. **Conclusion:** Sublay mesh repair demonstrated superior outcomes compared to onlay mesh repair with significantly lower complication rates, reduced postoperative pain and better wound healing, despite requiring longer operative time. The sublay technique represents a preferable approach for ventral hernia repair, particularly for reducing postoperative morbidity.

KEYWORDS

INTRODUCTION

Ventral hernia include both spontaneous and incisional hernias later being more common. Incisional hernia has been a frequent complication of abdominal surgery for a long time, with a current incidence of 2-20% in most series [1]. The patient's symptoms can vary from an asymptomatic bulge to life-threatening emergencies due to intestinal obstruction or strangulation. Patients with ventral hernias frequently complain of pain, discomfort, cosmetic disfigurement, and limitations in daily activities, which significantly affects their quality of life [2]. Small hernias less than $2\frac{1}{2}$ cm in diameter are often successfully closed with primary tissue repairs. However, larger hernias have a recurrence rate of up to 30-40% when a tissue repair alone is performed [3]. Hernia recurrence is distressing to patients and embarrassing to surgeons. The high recurrence rates following primary tissue repair led to the introduction of prosthetic mesh, which has revolutionized hernia surgery by providing tension-free repairs. Tension-free mesh repair has decreased recurrence to a negligible 0-10%. Despite excellent results, increased risk of infection with placement of a foreign body and cost factors still exist; however, operating time and hospital length of stay are shortened [4].

The current standard of care for ventral hernia repair involves the use of prosthetic mesh, and there exists a variety of techniques for mesh placement. Onlay repair places the mesh on the anterior rectus sheath, typically involving dissection of flaps and primary closure of the rectus sheath below the mesh. Sublay (preperitoneal) repair refers to retrorectus or preperitoneal mesh placement. Other techniques include inlay repair, which places the mesh in the hernia defect and secures it circumferentially to the edges of the rectus sheath and underlay repair, where mesh is placed in the intraperitoneal position and secured to the anterior abdominal wall [5]. Preperitoneal repair is often considered more challenging and complex to perform. Dissection of this plane can risk damaging the muscle, blood supply, and nerves to the rectus abdominus. In addition, this mesh location may not be appropriate for off-midline defects. However, this space potentially protects the mesh from both superficial wound complications and intraperitoneal contents. In addition, it also allows for load-bearing tissue in-growth from two directions and theoretically decreases the risk of recurrence [6,7]. The aim of this study was to compare the outcomes of Onlay and Sublay mesh repair in case of ventral hernias with regards to duration of surgery, postoperative complications, wound healing, recurrence and duration of postoperative hospital stay.

MATERIALS AND METHODS

This prospective comparative study was conducted at the Department of General Surgery, LN Medical College and Research Center (Bhopal) from September 2023 to December 2024. Written informed consent was obtained from all participants before enrollment into the study. A total of 46 patients with ventral hernias who underwent open hernia repair during the study period were included. Patients were divided into two equal groups:

- Group 1: 23 patients who underwent onlay mesh repair
- Group 2: 23 patients who underwent sublay mesh repair

Inclusion Criteria

1. Age above 18 years.
2. Patients undergoing repair for ventral hernias including incisional hernia, umbilical, paraumbilical and epigastric hernia diagnosed by clinical and radiologically.
3. Patients who gave consent for surgery.

Exclusion Criteria

1. Planned other gastrointestinal surgery
2. Immunosuppressive disorders like diabetes, HIV and hepatitis
3. Severe renal or hepatic failure
4. Patients who refused to give consent for treatment protocols
5. Uncooperative patients

Surgical Techniques

An abdominal incision was made according to the site and type of the hernial defect. After incising the skin and subcutaneous tissue, a subcutaneous flap was raised up to 5 cm around the defect. The hernial sac was identified and dissected using fine scissors and cautery. It was then opened and any adhesions were released. Hernia was reduced and defect closed, securing mesh to anterior rectus sheath in onlay mesh repair. In sublay repair Dissection into the retrorectus space was done. Large sacs were excised and closed with absorbable sutures. Hernia was reduced and defect closed. A polypropylene mesh was placed in retrorectus space and linea alba repaired over it, and wound closed in layers.

Data Collection And Assessment Parameters

The following parameters were recorded for each patient:

1. Age and sex distribution
2. Type of ventral hernia

3. Duration of surgery (in minutes)
4. Postoperative complications:
 - Seroma formation
 - Surgical site infection
 - Mesh infection
 - Flap necrosis
5. Postoperative pain (assessed using Visual Analog Scale on day 0 and day 1)
6. Duration of hospital stay (in days)
7. Need for readmission
8. Recurrence (assessed during follow-up)

Statistical Analysis: Data was analyzed using SPSS version 25.0. Continuous variables were reported as mean and standard deviation, while categorical variables were expressed as frequency/count/percentages. Differences between groups for continuous variables were evaluated using the Mann-Whitney U Test and categorical values were analyzed with Fisher's exact test. A p-value of <0.05 was considered statistically significant.

RESULTS

The demographic and patient characteristics analysis shows that both groups were well-matched with no statistically significant differences in age, gender, or hernia type distribution ($p>0.05$ for all parameters). The majority of patients in both groups were in the 41-50 years age range (39.1% in onlay group and 52.2% in sublay group) with mean ages of 45.12 ± 12.16 and 47.61 ± 11.02 years respectively. A slight female predominance was observed in both groups (56.5% in onlay and 60.9% in sublay group), consistent with the literature on ventral hernias.

Table 1: Demographic and Patient Characteristics of Both Groups

Characteristic	Onlay (n=23)	Sublay (n=23)	P-value
Age (years)			
≤ 20 years	1 (4.3%)	0 (0.0%)	0.418 (NS)
21-30 years	1 (4.3%)	0 (0.0%)	
31-40 years	6 (26.1%)	5 (21.7%)	
41-50 years	9 (39.1%)	12 (52.2%)	
51-60 years	3 (13.0%)	2 (8.7%)	
> 60 years	3 (13.0%)	4 (17.4%)	
Mean±SD	45.12±12.16	47.61±11.02	
Gender			
Male	10 (43.5%)	9 (39.1%)	0.765 (NS)
Female	13 (56.5%)	14 (60.9%)	
Type of Hernia			
Epigastric hernia	14 (60.9%)	14 (60.9%)	0.749 (NS)
Incisional hernia	3 (13.0%)	4 (17.4%)	
Paraumbilical hernia	1 (4.3%)	1 (4.3%)	
Supraumbilical hernia	0 (0.0%)	1 (4.3%)	
Umbilical hernia	5 (21.7%)	3 (13.0%)	

Epigastric hernias were the most common type in both groups (60.9% each), followed by umbilical hernias in the onlay group (21.7%) and incisional hernias in the sublay group (17.4%).

The comparable demographic and clinical characteristics between the groups ensure that any differences in outcomes can be primarily attributed to the surgical technique rather than patient-related factors.

Table 2: Mean Duration Of Surgery Among Both Groups

Group	N	Mean (minutes)	Std. Deviation	Std. Error Mean	P-value
Onlay	23	70.82	9.060	1.889	0.032 (S)
Sublay	23	79.85	19.720	4.113	

The analysis of surgical duration reveals a significant difference between the two techniques. The mean operative time for the onlay mesh repair was 70.82 ± 9.060 minutes, compared to 79.85 ± 19.720 minutes for the sublay repair. Statistical analysis using the independent samples t-test confirmed that this difference was statistically significant ($p=0.032$).

The longer duration observed in the sublay technique can be attributed to the technical complexity involved in creating and dissecting the preperitoneal space, which requires more meticulous dissection compared to the relatively simpler onlay technique.

Table 3: Postoperative Complications Among Both Groups

Postoperative Complications	Onlay (n=23)		Sublay (n=23)		P-value
	No.	%	No.	%	
Seroma	8	34.8%	3	13.0%	0.041 (S)
Surgical site infection	6	26.1%	0	0.0%	0.010 (S)
Mesh Infection	0	0.0%	0	0.0%	-
Flap Necrosis	0	0.0%	0	0.0%	-

The analysis of postoperative complications revealed significant differences favoring the sublay technique. Seroma formation occurred in 34.8% of onlay patients versus 13.0% of sublay patients ($p=0.041$), while surgical site infection was observed in 26.1% of onlay patients with none in the sublay group ($p=0.010$). No cases of mesh infection or flap necrosis occurred in either group. These differences can be attributed to the extensive subcutaneous dissection required in the onlay technique that disrupts lymphatics and creates potential spaces for fluid accumulation, while the superficial position of the mesh makes it more susceptible to contamination. In contrast, the preperitoneal space in the sublay technique has better vascularity and lymphatic drainage, with the mesh better isolated from potential contamination by well-vascularized tissue layers. The significant reduction in these major complications represents a compelling advantage of the sublay technique that may outweigh its longer operative time.

Table 4: Mean VAS Score Among Both Groups

Time	Group	N	Mean	Std. Deviation	P-value
Day 0	Onlay	23	2.45	0.754	0.004 (S)
	Sublay	23	1.91	0.723	
Day 1	Onlay	23	0.61	0.496	0.625 (NS)
	Sublay	23	0.55	0.506	

Analysis of postoperative pain scores revealed significant differences between techniques during the immediate recovery period. On day 0, the onlay group reported significantly higher mean pain scores (2.45 ± 0.754) compared to the sublay group (1.91 ± 0.723) ($p=0.004$), though by day 1 this difference had diminished (0.61 ± 0.496 vs. 0.55 ± 0.506 , $p=0.625$). The reduced immediate pain in the sublay group can be attributed to less extensive subcutaneous dissection, reduced tension on pain-sensitive fascia, and the naturally occurring hydrostatic pressure in the preperitoneal space that minimizes the need for extensive fixation sutures. The convergence of pain scores by day 1 suggests that the advantages of the sublay technique for pain reduction are most pronounced immediately after surgery but equalize as healing progresses, still offering important benefits for early postoperative recovery, potentially facilitating earlier mobilization and improving patient satisfaction.

Table 5: Mean Duration of Hospital Stay Among Both Groups

Group	N	Mean (days)	Std. Deviation	Std. Error Mean	P-value
Onlay	23	1.24	0.435	0.091	0.361 (NS)
Sublay	23	1.15	0.364	0.076	

Analysis of hospital stay duration showed a slightly shorter mean stay in the sublay group (1.15 ± 0.364 days) compared to the onlay group (1.24 ± 0.435 days), though this difference was not statistically significant ($p=0.361$). The overall short hospital stay for both groups (approximately 1-1.5 days) reflects contemporary trends toward shorter hospitalization due to improved perioperative protocols, enhanced recovery principles, and effective pain management. The lack of significant difference between groups despite higher complication rates in the onlay group suggests that most complications were either identified after discharge or were not severe enough to prolong hospitalization, indicating that both techniques have similar impacts on hospital resource utilization and patient turnover despite differences in their complication profiles.

DISCUSSION

This study compared onlay and sublay mesh repair techniques for ventral hernias, evaluating outcomes in 46 patients equally divided between the two approaches. Our demographic findings showing predominantly middle-aged patients (41-50 years) with female preponderance align with previous research by Rajsiddharth B et al.[8], Sowmith S et al.[9], and Ibrahim T et al.[10]. The female predominance (56.5-60.9%) corresponds with established literature, reflecting factors such as pregnancy, hormonal influences on collagen metabolism, and higher rates of gynecological surgeries leading to

incisional hernias.

Operative time was significantly shorter with the onlay technique (70.82±9.06 vs. 79.85±19.72 minutes, $p<0.05$), consistent with findings by Saber A et al.[11] and Rajsiddharth B et al.[8]. This difference reflects the technical complexity of creating and dissecting the preperitoneal space required for sublay repair. However, as noted by Ibrahim T et al.[10], this time difference may diminish with increasing surgical experience.

The most compelling advantage of sublay repair was evident in postoperative complications. Seroma formation (13.0% vs. 34.8%, $p=0.041$) and surgical site infection (0% vs. 26.1%, $p=0.010$) were significantly lower with the sublay technique. These findings mirror results reported by Aoda FS et al.[12], Saber A et al.[11], and Rajsiddharth B et al.[8]. The anatomical basis for these differences lies in the extensive subcutaneous dissection required for onlay repair disrupting lymphatic drainage and creating potential spaces for fluid accumulation, while the superficial mesh position increases vulnerability to contamination. The sublay position better isolates the mesh from potential contamination with improved drainage of any fluid collection.

Postoperative pain was significantly lower in the immediate period (day 0) with sublay repair (1.91±0.72 vs. 2.45±0.75, $p=0.004$), though this difference equalized by day 1. This pattern aligns with Raghuvver MN et al.[13] and reflects reduced tissue trauma and tension on pain-sensitive structures with the sublay technique. Lower immediate pain potentially facilitates earlier mobilization and improved patient comfort.

Hospital stay showed no significant difference between techniques (1.15±0.36 vs. 1.24±0.44 days, $p=0.361$), markedly shorter than reported by previous studies such as Ibrahim T et al.[10] and Shah DK et al.[14]. This likely reflects implementation of enhanced recovery protocols and effective pain management in our institution. The comparable stay despite higher complication rates in the onlay group suggests that most complications were identified after discharge or were not severe enough to prolong hospitalization.

No recurrence was observed in either group during our follow-up period. While encouraging, longer-term studies by Rajsiddharth B et al.[8] and Saber A et al.[11] have reported varying recurrence rates favoring the sublay technique. The theoretical advantage of sublay placement lies in how intra-abdominal pressure helps secure the mesh against the abdominal wall within a well-vascularized space promoting better tissue integration.

Study limitations include relatively small sample size, short follow-up period, and single-center design. Future research should address these limitations through larger multicenter studies with extended follow-up, while also exploring factors influencing technique selection based on hernia characteristics and patient factors.

CONCLUSION

This comparative study of onlay versus sublay mesh repair techniques for ventral hernias demonstrated several significant advantages of the sublay approach. While the onlay technique required less operative time (70.82±9.06 vs. 79.85±19.72 minutes), the sublay technique showed markedly superior outcomes in terms of postoperative complications. Seroma formation (13.0% vs. 34.8%) and surgical site infection (0% vs. 26.1%) were significantly lower with the sublay technique. The anatomical and physiological advantages of placing mesh in the preperitoneal space include better isolation from potential contamination, superior vascularity promoting tissue integration, reduced dead space limiting seroma formation, and utilization of natural intra-abdominal pressure to secure the mesh against the abdominal wall. These factors collectively contribute to the improved outcomes observed with the sublay technique. Despite its technical complexity and slightly longer operative time, the sublay mesh repair technique offers compelling benefits that outweigh these drawbacks. The significant reduction in complications, improved patient comfort, and enhanced wound healing make it the preferred approach for ventral hernia repair, particularly in patients at higher risk for wound complications. Based on these findings, we recommend the sublay technique as the procedure of choice for ventral hernia repair when feasible, taking into consideration surgeon experience and patient-specific factors.

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