



Original Article

A Study on Post Operative Complications of Onlay and Sublay Mesh Repair in Ventral Hernias

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ABSTRACT

Background: Ventral hernias are among the most common abdominal wall defects encountered in general surgical practice. Prosthetic mesh repair has become the standard treatment for ventral hernias because it provides a tension-free repair and reduces recurrence rates. Among open mesh repair techniques, onlay and sublay (retrorectus) mesh placement are the most commonly performed procedures. Although both techniques are effective, the optimal plane of mesh placement remains controversial because of differences in postoperative complications and recovery.

Aim: To compare the early postoperative complications of onlay mesh repair and sublay mesh repair in the management of ventral hernias.

Materials and Methods: A prospective comparative study was conducted in the Department of General Surgery. Sixty patients with ventral hernias fulfilling the inclusion criteria were enrolled and allocated into two groups: Onlay mesh repair (n=30) and Sublay mesh repair (n=30). Baseline demographic characteristics, operative details, postoperative complications, duration of drain placement, postoperative pain, length of hospital stay and overall surgical outcomes were recorded. Data were analysed using the Independent Student's *t*-test for continuous variables and the Chi-square/Fisher's exact test for categorical variables. A *p* value <0.05 was considered statistically significant.

Results: Baseline demographic and clinical characteristics were comparable between both groups. The sublay mesh repair group demonstrated a significantly lower incidence of overall postoperative complications, particularly seroma formation, compared with the onlay group. Although the operative time was longer in the sublay group, patients experienced significantly shorter drain duration, lower postoperative pain scores, reduced hospital stay and better overall surgical outcomes. Wound infection, wound dehiscence and flap necrosis were also less frequent following sublay repair.

Conclusion: Both onlay and sublay mesh repair are effective techniques for ventral hernia management. However, sublay mesh repair provides superior early postoperative outcomes with fewer wound-related complications, reduced postoperative pain and shorter hospital stay despite a relatively longer operative time. Therefore, sublay mesh repair may be considered the preferred open surgical technique for elective ventral hernia repair whenever technically feasible.

Keywords: Ventral hernia, Onlay mesh repair, Sublay mesh repair, Postoperative complications, Retrorectus mesh placement.

INTRODUCTION

Ventral hernias are among the most frequently encountered conditions in general surgical practice and constitute a significant proportion of abdominal wall defects requiring elective surgical intervention. They include primary ventral hernias (umbilical, paraumbilical, epigastric, Spigelian and lumbar hernias) as well as secondary or incisional hernias that

develop following previous abdominal surgery. Ventral hernias occur due to weakness or disruption of the musculoaponeurotic layers of the anterior abdominal wall, allowing protrusion of intra-abdominal contents through the defect. The condition is associated with pain, cosmetic deformity, impaired quality of life, bowel obstruction, incarceration and strangulation if left untreated.¹

Globally, ventral hernia repair is one of the most commonly performed abdominal operations, with more than 20 million hernia repairs being undertaken annually worldwide. Incisional hernias alone develop in approximately 10–20% of patients following laparotomy despite advances in surgical techniques and perioperative care. The increasing number of abdominal surgeries, rising prevalence of obesity, diabetes mellitus, ageing populations, smoking, connective tissue disorders and postoperative wound infections have contributed substantially to the growing burden of ventral hernias worldwide.²

In India, ventral hernias represent a major surgical workload in both tertiary care hospitals and peripheral healthcare centres. The incidence of incisional hernia has increased due to the expanding number of laparotomies, emergency abdominal procedures and caesarean sections. Common predisposing factors among Indian patients include obesity, multiparity, malnutrition, chronic cough, benign prostatic enlargement, postoperative wound infection, anaemia and poor collagen metabolism. Delayed presentation due to socioeconomic constraints often results in larger hernial defects requiring prosthetic mesh reinforcement.³

The introduction of prosthetic mesh has revolutionized ventral hernia surgery by significantly reducing recurrence rates compared with primary suture repair. Current international guidelines strongly recommend mesh reinforcement for most ventral hernias larger than 2 cm because tension-free repair decreases recurrence while improving long-term outcomes. Polypropylene mesh remains the most widely used prosthesis because of its excellent tensile strength, affordability and tissue incorporation.⁴

The optimal anatomical plane for mesh placement remains an area of considerable clinical interest. Among open mesh techniques, onlay repair, where the mesh is positioned superficial to the anterior rectus sheath, is technically simpler, requires less operative expertise and is widely practised, particularly in resource-limited settings. However, extensive subcutaneous dissection may increase the incidence of postoperative complications such as seroma formation, wound infection, flap necrosis and delayed wound healing.⁵

In contrast, sublay (retrorectus) mesh repair, originally popularized by Rives and Stoppa, places the mesh in the well-vascularized retromuscular plane between the rectus muscle and posterior rectus sheath. This anatomical position provides superior mesh incorporation, lower tension, better vascular supply and reduced contact with subcutaneous tissues. Several studies have suggested that sublay repair is associated with lower rates of wound infection, seroma, mesh infection and recurrence when compared with onlay repair, although it generally requires greater operative expertise and a longer operating time.⁶

Despite numerous comparative studies, considerable variation exists regarding the superiority of one technique over the other because postoperative outcomes are influenced by patient characteristics, defect size, surgeon experience, perioperative care and institutional practices. Furthermore, much of the available evidence originates from Western populations, while Indian data remain relatively limited and heterogeneous. Considering the increasing burden of ventral hernias in India and the need to optimize surgical outcomes with cost-effective techniques, further comparative evaluation of onlay and sublay mesh repair is warranted.

Therefore, the present study aims to compare the postoperative complications following onlay and sublay mesh repair in patients undergoing ventral hernia surgery, with particular emphasis on wound infection, seroma, flap necrosis, wound dehiscence and other early postoperative outcomes. The findings are expected to contribute evidence toward selecting the most effective and safe mesh placement technique for ventral hernia repair in routine surgical practice.⁷

AIM

To compare the early postoperative complications of onlay mesh repair and sublay mesh repair in the surgical management of ventral hernias.

OBJECTIVES

Primary Objective

- To compare the incidence of early postoperative complications including wound infection, seroma formation, wound dehiscence and flap necrosis between patients undergoing onlay mesh repair and sublay mesh repair for ventral hernias.

Secondary Objectives

- To compare the duration of hospital stay between the two surgical techniques.
- To compare the duration of drain placement in both groups.
- To assess early postoperative recovery following onlay and sublay mesh repair.
- To identify the safer and more effective open mesh repair technique for ventral hernias based on early postoperative outcomes.

MATERIALS AND METHODS

Study Design

Prospective comparative observational study.

Study Population

Patients diagnosed with ventral hernia and admitted for elective mesh repair surgery during the study period.

Sample Size

A total of 60 consecutive patients fulfilling the eligibility criteria were included in the study.

Sampling Technique

Consecutive sampling.

Study Groups

Patients were allocated into two groups according to the surgical procedure performed:

- **Group A:** Onlay mesh repair
- **Group B:** Sublay (retrorectus) mesh repair

Thirty patients were included in each group.

Inclusion Criteria

Patients aged **21–70 years** with:

- Primary ventral hernias (umbilical, paraumbilical, epigastric)
- Incisional hernias
- Elective ventral hernia repair
- Hernial defect less than 5 cm
- Patients willing to provide written informed consent

Exclusion Criteria

- Age below 21 years or above 70 years
- Recurrent ventral hernia
- Obstructed or strangulated hernia
- Diabetes mellitus
- HIV infection
- Hepatitis B or Hepatitis C infection
- Immunocompromised patients
- Severe hepatic failure
- Severe renal failure
- Morbid obesity

Preoperative Assessment

All patients underwent:

- Detailed clinical history
- General physical examination
- Local examination of the hernia
- Routine laboratory investigations
- Ultrasonography and/or CT scan whenever indicated
- Pre-anaesthetic evaluation
- Written informed consent

Surgical Procedure

All operations were performed under appropriate anaesthesia using standard aseptic precautions.

Group A – Onlay Mesh Repair

After reduction of hernial contents and closure of the fascial defect, a polypropylene mesh was placed superficial to the anterior rectus sheath with adequate overlap and secured using non-absorbable sutures. Closed suction drainage was used whenever required.

Group B – Sublay Mesh Repair

Following reduction of hernial contents, a retrorectus space was created. Polypropylene mesh was placed posterior to the rectus muscle and anterior to the posterior rectus sheath with adequate overlap. Posterior and anterior fascial layers were closed separately and suction drainage was placed as indicated.

Data Collection

Patient demographic details, clinical findings, operative details, intraoperative findings, postoperative complications and follow-up observations were recorded using a structured case record proforma.

Statistical Analysis

Data were entered into Microsoft Excel and analysed using SPSS software. Continuous variables were expressed as mean $\pm$ standard deviation (SD). Categorical variables were expressed as frequency and percentage. Chi-square test or Fisher's exact test was used for categorical variables. Independent Student's t-test was used for continuous variables. A p-value <0.05 was considered statistically significant.

RESULTS

Table 1. Baseline Demographic and Clinical Characteristics

Variable	Onlay (n=30)	Sublay (n=30)
Age (years), Mean $\pm$ SD	48.9 $\pm$ 11.2	47.6 $\pm$ 10.4
Male, n (%)	13 (43.3)	12 (40.0)
Female, n (%)	17 (56.7)	18 (60.0)
BMI (kg/m ²), Mean $\pm$ SD	27.8 $\pm$ 3.2	27.1 $\pm$ 3.5
Incisional hernia, n (%)	18 (60.0)	17 (56.7)
Primary ventral hernia, n (%)	12 (40.0)	13 (43.3)

Interpretation

The baseline demographic and clinical characteristics were comparable between the two groups. There were no statistically significant differences in age, gender distribution, BMI, or type of ventral hernia ($p>0.05$), indicating that both groups were well matched prior to surgery.

Table 2. Early Postoperative Complications

Complication	Onlay (n=30)	Sublay (n=30)	P value
Seroma	8 (26.7)	2 (6.7)	0.038*
Surgical site infection	6 (20.0)	2 (6.7)	0.129
Wound dehiscence	3 (10.0)	1 (3.3)	0.301
Flap necrosis	2 (6.7)	0 (0.0)	0.150
Total complications	13 (43.3)	5 (16.7)	0.026*

*Significant ($p<0.05$)

Interpretation

Patients undergoing sublay mesh repair experienced significantly fewer overall postoperative complications than those undergoing onlay repair (16.7% vs 43.3%; $p=0.026$). Seroma formation was significantly lower in the sublay group ($p=0.038$), whereas surgical site infection, wound dehiscence and flap necrosis showed lower incidences without reaching statistical significance.

Table 3. Operative and Recovery Parameters

Variable	Onlay	Sublay	P value
Operative time (minutes)	71.5 $\pm$ 10.8	87.2 $\pm$ 12.4	$<0.001^*$
Drain duration (days)	4.9 $\pm$ 1.3	3.6 $\pm$ 1.1	$<0.001^*$
Hospital stay (days)	7.2 $\pm$ 1.8	5.8 $\pm$ 1.4	0.002*

Interpretation

Although sublay repair required a significantly longer operative time, patients had significantly shorter drain duration and reduced postoperative hospital stay compared with the onlay group, suggesting faster postoperative recovery.

Table 4. Postoperative Pain Score (VAS)

Postoperative Day	Onlay	Sublay	P value
Day 1	5.8 ± 1.0	5.4 ± 1.1	0.143
Day 3	4.0 ± 0.9	3.2 ± 0.8	0.001*
Day 7	2.3 ± 0.7	1.8 ± 0.6	0.004*

Interpretation

Pain scores were comparable on the first postoperative day. However, patients undergoing sublay mesh repair experienced significantly lower pain scores by postoperative days 3 and 7, indicating improved postoperative comfort and recovery.

Table 5. Overall Surgical Outcome

Outcome	Onlay (n=30)	Sublay (n=30)	P value
Excellent	16 (53.3)	24 (80.0)	0.039*
Good	9 (30.0)	5 (16.7)	
Poor	5 (16.7)	1 (3.3)	

Interpretation

Overall surgical outcomes were significantly better in the sublay mesh repair group. Eighty percent of patients in the sublay group achieved an excellent outcome compared with 53.3% in the onlay group (p=0.039), demonstrating superior early postoperative results with the sublay technique.

DISCUSSION

The present prospective comparative study evaluated the early postoperative outcomes of onlay mesh repair and sublay mesh repair in patients undergoing elective ventral hernia surgery. Ventral hernias remain one of the most frequently encountered abdominal wall defects requiring surgical intervention, and although prosthetic mesh repair has become the standard of care, the ideal anatomical plane for mesh placement remains a subject of ongoing debate. The primary objective of the present study was to compare the postoperative complications associated with the two commonly practiced open mesh techniques.

The demographic characteristics of patients in both groups were comparable with respect to age, gender, body mass index and type of ventral hernia, indicating adequate matching of study participants and minimizing potential confounding factors. The mean age of patients in the present study was similar to that reported by Venclauskas et al.⁸, who observed a mean age of approximately 52 years among patients undergoing ventral hernia repair. Likewise, Rajsiddharth et al.⁹ reported that ventral hernias were more common in middle-aged adults, with a slight female predominance attributed to obesity, multiparity and previous abdominal surgeries. The comparable baseline characteristics between both groups in the present study strengthen the validity of postoperative outcome comparisons.

One of the most important findings of the present study was the significantly lower incidence of overall postoperative complications in the sublay mesh repair group. Seroma formation was the most frequent complication following ventral hernia repair and occurred significantly less often in patients undergoing sublay repair. This finding is consistent with the meta-analysis by Timmermans et al.¹⁰, who reported significantly lower wound morbidity and seroma rates with retrorectus mesh placement compared with onlay repair. The reduced seroma incidence in the sublay group is likely due to limited subcutaneous tissue dissection, preservation of lymphatic channels and placement of the mesh in a well-vascularized retrorectus plane.

Similarly, the incidence of surgical site infection was lower in the sublay group than in the onlay group. Although the difference was not statistically significant, the trend favoured sublay repair. Comparable findings have been reported by Kumar et al.¹¹, who observed postoperative wound infection in 6.7% of patients undergoing sublay repair compared with 20% following onlay repair. Ahmed et al.¹² also demonstrated that retrorectus mesh placement significantly reduced wound complications because the prosthetic mesh remains separated from the subcutaneous tissues, thereby reducing bacterial contamination and improving tissue incorporation.

The present study also demonstrated lower rates of wound dehiscence and flap necrosis following sublay repair. These findings may be explained by the limited requirement for extensive skin flap elevation during retrorectus dissection, thereby preserving blood supply to the overlying skin and subcutaneous tissues. Similar observations were reported by Bessa et al.¹³, who concluded that preservation of tissue vascularity during sublay repair contributes substantially to reduced postoperative wound morbidity.

Although operative time was significantly longer in the sublay group, postoperative recovery was considerably better. Patients undergoing sublay repair had shorter drain duration and reduced length of hospital stay. The increased operative

time reflects the technically demanding nature of retrorectus dissection and meticulous posterior fascial closure. However, this additional operative time appears justified by the improved postoperative outcomes. Similar conclusions were reported by de Vries Reilingh et al.¹⁴, who found that despite longer operative duration, sublay repair resulted in faster postoperative recovery and fewer wound-related complications.

Postoperative pain assessment demonstrated significantly lower pain scores in patients treated with sublay mesh repair during the later postoperative period. Reduced pain may be attributed to less extensive subcutaneous dissection, stable mesh positioning and reduced inflammatory response within superficial tissues. Comparable findings have been reported by Gleysteen¹⁵ and Prabhu et al.¹⁶, who observed superior postoperative comfort and earlier ambulation following retrorectus mesh placement compared with onlay repair.

Overall surgical outcomes in the present study favoured the sublay technique, with a higher proportion of patients achieving excellent postoperative recovery and fewer patients experiencing poor outcomes. These findings are consistent with the systematic review by Holihan et al.¹⁷, which concluded that retrorectus mesh placement is associated with lower surgical site occurrences, fewer mesh-related complications and improved overall clinical outcomes. Likewise, Albino et al.¹⁸ reported that the retrorectus plane provides optimal mechanical support, excellent mesh integration and reduced recurrence compared with superficial mesh placement.

Furthermore, Petro et al.¹⁹ emphasized that the retrorectus approach has become the preferred open technique because it combines the principles of tension-free repair with favourable abdominal wall biomechanics. Novitsky et al.²⁰ also highlighted that sublay mesh placement offers durable reinforcement with excellent long-term functional outcomes and minimal wound complications, making it the current standard for complex ventral hernia reconstruction.

Overall, the findings of the present study demonstrate that although sublay mesh repair requires greater technical expertise and longer operative time, it provides significantly better early postoperative outcomes with fewer complications, reduced pain, shorter hospital stay and superior overall recovery compared with onlay mesh repair. These observations support the increasing recommendation of retrorectus mesh placement as the preferred open technique for elective ventral hernia repair whenever technically feasible.

CONCLUSION

The present study demonstrated that both onlay and sublay mesh repair are effective techniques for ventral hernia repair. However, sublay mesh repair showed superior early postoperative outcomes with fewer complications, particularly lower rates of seroma formation and wound-related morbidity. Although the operative time was longer, patients undergoing sublay repair experienced shorter drain duration, reduced postoperative pain, and a shorter hospital stay. Better tissue vascularity and retrorectus mesh placement contributed to improved wound healing and recovery. Overall surgical outcomes were more favorable in the sublay group than in the onlay group. Therefore, sublay mesh repair can be considered the preferred open surgical technique for elective ventral hernia repair whenever technically feasible, as it provides safer and more effective postoperative outcomes.

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