

Comparative Study of Onlay Versus Sublay Mesh Repair in Ventral Hernia: Surgical Outcomes and Complication Rates.

Dr. Vishal Raosaheb Pind^{1*}, Dr. Yuvraj Dnyanoba Kolhe², Dr. Prasad Yogendra Bansod³.

¹Assistant Professor, Department of General Surgery, Government Medical College Jalna, India.

²Associate Professor, Department of General Surgery, Government medical college Jalna, India.

³Associate Professor, Department of Surgery, Government Medical College Gadchiroli, India.



Correspondence:

Vishal Raosaheb Pind.

Assistant Professor, Department of General Surgery, Government Medical College Jalna, India.

Email: pindvishal@gmail.com

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Abstract

Background: Ventral hernia is a common surgical condition requiring operative repair to prevent complications such as pain, obstruction, and recurrence. Mesh repair has become the standard treatment, with Onlay and Sublay mesh placement being the most commonly practiced techniques. However, controversy still exists regarding the superiority of one technique over the other in terms of surgical outcomes and postoperative complications. **Aim:** To compare Onlay versus Sublay mesh repair in ventral hernia with respect to surgical outcomes and complication rates. **Objectives:** To compare postoperative complications between Onlay and Sublay mesh repair in ventral hernia patients. To evaluate operative duration and duration of hospital stay in both surgical techniques. To assess recurrence rates and overall surgical outcomes following Onlay and Sublay mesh repair. **Materials and Methods:** The present prospective comparative observational study was conducted in the Department of General Surgery at a tertiary care teaching hospital over a period of 18 months. A total of 120 patients diagnosed with ventral hernia were included and divided equally into two groups: Onlay mesh repair (n=60) and Sublay mesh repair (n=60). Demographic details, operative findings, postoperative complications, duration of hospital stay, and recurrence were recorded and analyzed statistically using appropriate tests. A p-value <0.05 was considered statistically significant. **Results:** The mean age and BMI were comparable between both groups. Operative duration was significantly longer in the Sublay group (86.8 ± 15.9 minutes) compared to the Onlay group (69.4 ± 13.7 minutes) (p<0.001). Seroma formation was significantly higher in the Onlay group (21.7%) than in the Sublay group (6.7%) (p=0.018). Overall postoperative complications were significantly more frequent in the Onlay group (40.0%) compared to the Sublay group (20.0%) (p=0.017). Hospital stays, drain duration, and time to return to routine activities were significantly prolonged in the Onlay group. Recurrence was higher in the Onlay group (11.7%) than in the Sublay group (3.3%), although the difference was not statistically significant. Excellent surgical outcome was significantly higher in the Sublay group (68.3%) compared to the Onlay group (46.7%). **Conclusion:** Sublay mesh repair was associated with fewer postoperative complications, shorter hospital stay, earlier recovery, and better overall surgical outcomes compared to Onlay mesh repair, despite requiring longer operative duration. Therefore, Sublay mesh repair appears to be a superior technique for elective ventral hernia repair whenever technically feasible.

Keywords: Ventral Hernia. Onlay Mesh Repair. Sublay Mesh Repair.



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INTRODUCTION

Ventral hernia is one of the most common surgical conditions encountered in general surgical practice and includes primary as well as incisional abdominal wall hernias. It occurs due to weakness or defect in the anterior abdominal wall, leading to protrusion of abdominal contents through the fascial defect. Factors such as obesity, previous abdominal surgery, wound infection, chronic cough, constipation, multiparity, smoking, malnutrition, and increased intra-abdominal pressure contribute significantly to the development of ventral hernias. Incisional hernias account for a major proportion of ventral hernias and may develop in 10-20% of patients following laparotomy. Ventral hernias can cause pain, discomfort, cosmetic deformity, intestinal obstruction, and strangulation, thereby affecting the quality of life of patients and increasing healthcare burden.

Surgical repair remains the definitive treatment for ventral hernia. Over the years, several techniques have been developed for hernia repair, among which mesh repair has become the gold standard due to lower recurrence rates compared to anatomical suture repair. Polypropylene mesh is widely used because of its strength, availability, and cost-effectiveness.

The position of mesh placement plays a crucial role in determining postoperative outcomes and complications. Among the commonly practiced open mesh repair techniques are Onlay mesh repair and Sublay mesh repair.[1][2]

In Onlay mesh repair, the mesh is placed over the anterior rectus sheath after closure of the fascial defect. This technique is technically simpler, requires less operative expertise, and is associated with shorter operative duration. However, extensive subcutaneous dissection may increase the risk of seroma formation, wound infection, flap necrosis, and mesh-related complications. Despite these drawbacks, Onlay repair continues to be widely practiced, especially in resource-limited settings because of its simplicity and ease of performance.[3]

Sublay mesh repair, also known as retrorectus repair, involves placement of the mesh between the posterior rectus sheath and rectus muscle. This technique provides better mesh integration, reduced tension, and improved abdominal wall dynamics. Sublay repair has been associated with lower rates of recurrence, surgical site infection, and seroma formation. However, it is technically more demanding and may require longer operative time and greater surgical expertise. Several studies have compared these two techniques with varying conclusions regarding postoperative complications, duration of hospital stay, recurrence rates, and overall patient outcomes.[4]

AIM

To compare Onlay versus Sublay mesh repair in ventral hernia with respect to surgical outcomes and complication rates.

OBJECTIVES

1. To compare postoperative complications between Onlay and Sublay mesh repair in ventral hernia patients.
2. To evaluate operative duration and duration of hospital stay in both surgical techniques.
3. To assess recurrence rates and overall surgical outcomes following Onlay and Sublay mesh repair.

MATERIALS AND METHODS

Source of Data

The data were collected from patients diagnosed with ventral hernia who were admitted to the Department of General Surgery of the tertiary care teaching hospital. Both inpatient records and operative findings were utilized for data collection. Relevant demographic, clinical, intraoperative, and postoperative details were recorded in a predesigned proforma.

Study Design

The present study was conducted as a hospital-based prospective comparative observational study.

Study Location

The study was carried out in the Department of General Surgery at a tertiary care teaching hospital.

Study Duration

The study was conducted over a period of 18 months, including patient recruitment, surgical intervention, postoperative follow-up, data collection, and statistical analysis.

Sample Size

A total of 120 patients diagnosed with ventral hernia and fulfilling the inclusion criteria were included in the study. The patients were divided into two groups:

- Group A: Onlay mesh repair - 60 patients
- Group B: Sublay mesh repair - 60 patients

Inclusion Criteria

1. Patients aged more than 18 years diagnosed with ventral hernia.
2. Patients willing to undergo elective mesh repair surgery.
3. Patients fit for surgery under spinal or general anesthesia.
4. Primary ventral hernias and incisional hernias with reducible contents.
5. Patients who provided written informed consent for participation in the study.

Exclusion Criteria

1. Patients presenting with strangulated or obstructed ventral hernia requiring emergency surgery.
2. Recurrent ventral hernia cases previously operated with mesh repair.
3. Patients with severe systemic illness or unfit for anesthesia.
4. Pregnant women.
5. Patients with active abdominal wall infection or contaminated surgical field.

6. Patients unwilling to participate in the study or lost to follow-up.

Procedure and Methodology

After obtaining Institutional Ethical Committee approval and informed written consent, all eligible patients were enrolled in the study. Detailed history regarding age, sex, occupation, duration of swelling, previous surgeries, comorbidities, obesity, smoking, and associated symptoms was recorded. General physical examination and local examination of the hernia were performed thoroughly.

Routine preoperative investigations including complete blood count, blood sugar levels, renal function tests, liver function tests, coagulation profile, chest X-ray, electrocardiogram, and ultrasonography abdomen were performed. Patients were optimized preoperatively according to associated comorbidities.

Patients were allocated into two groups based on the surgical technique employed. In Group A, Onlay mesh repair was performed by placing polypropylene mesh over the anterior rectus sheath after closure of the fascial defect. In Group B, Sublay mesh repair was performed by placing polypropylene mesh in the retrorectus plane between posterior rectus sheath and rectus muscle.

Intraoperative parameters such as operative duration, size of defect, type of hernia, and intraoperative complications were recorded. Postoperative monitoring included pain assessment, drain output, wound infection, seroma formation, hematoma, flap necrosis, mesh infection, duration of hospital stay, and recurrence during follow-up. Patients were followed regularly in the outpatient department for assessment of recurrence and postoperative complications.

Sample Processing

All collected clinical and operative data were entered into a structured case record form. Data were checked for completeness, consistency, and accuracy before statistical analysis. Postoperative outcomes and complications were documented systematically during hospital stay and follow-up visits.

Statistical Methods

The collected data were compiled and analyzed using appropriate statistical software such as SPSS version 25.0. Quantitative variables were expressed as mean $\pm$ standard deviation, while qualitative variables were expressed as frequencies and percentages. Comparison between the two groups was performed using Student's t-test for continuous variables and Chi-square test or Fisher's exact test for categorical variables. A p-value of less than 0.05 was considered statistically significant.

Data Collection

Data collection was carried out using a predesigned and pretested proforma. Information regarding demographic profile, clinical presentation, operative findings, postoperative complications, hospital stay, and recurrence was obtained from patient interviews, clinical examination, operative notes, and follow-up records. All data were collected prospectively and maintained confidentially throughout the study.

RESULTS

Table 1: Baseline Clinical Profile of Study Participants

Variable	Onlay (n=60)	Sublay (n=60)	Test value	95% CI	p-value
Age, years	47.6 $\pm$ 10.8	46.9 $\pm$ 11.4	t=0.35	-3.31 to 4.71	0.730
BMI, kg/m ²	27.8 $\pm$ 3.9	27.1 $\pm$ 4.2	t=0.95	-0.76 to 2.16	0.346
Male	34 (56.7)	31 (51.7)	$\chi^2=0.30$	OR=1.22; 0.59-2.51	0.581
Female	26 (43.3)	29 (48.3)			
Incisional hernia	38 (63.3)	31 (51.7)	$\chi^2=1.67$	OR=1.62; 0.78-3.35	0.196
Paraumbilical hernia	17 (28.3)	22 (36.7)	$\chi^2=0.95$	OR=0.68; 0.31-1.48	0.329
Epigastric hernia	5 (8.3)	7 (11.7)	$\chi^2=0.37$	OR=0.69; 0.20-2.31	0.542
Defect size, cm	5.9 $\pm$ 1.7	5.6 $\pm$ 1.5	t=1.03	-0.28 to 0.88	0.308

Table 1 shows the baseline demographic and clinical characteristics of patients undergoing Onlay and Sublay mesh repair for ventral hernia. The mean age of patients in the Onlay group was 47.6 $\pm$ 10.8 years, while in the Sublay group it was 46.9 $\pm$ 11.4 years, with no statistically significant difference between the groups (t=0.35, p=0.730). Similarly, the mean BMI was comparable between the two groups, being 27.8 $\pm$ 3.9 kg/m² in the Onlay group and 27.1 $\pm$ 4.2 kg/m² in the Sublay group (t=0.95, p=0.346). Male patients constituted the majority in both groups, accounting for 56.7% in the Onlay group and 51.7% in the Sublay group, while females represented 43.3% and 48.3% respectively, with no significant gender difference ($\chi^2=0.30$, p=0.581).

Regarding the type of ventral hernia, incisional hernia was the most common presentation in both groups, observed in 63.3% of patients in the Onlay group and 51.7% in the Sublay group. Paraumbilical hernia was present in 28.3% and 36.7% of patients respectively, while epigastric hernia accounted for a smaller proportion in both groups. None of these differences were statistically significant. The mean defect size was 5.9 ± 1.7 cm in the Onlay group and 5.6 ± 1.5 cm in the Sublay group ($t=1.03$, $p=0.308$).

Table 2: Comparison of Postoperative Complications

Complication	Onlay (n=60)	Sublay (n=60)	Test value	95% CI	p-value
Seroma	13 (21.7)	4 (6.7)	$\chi^2=5.55$	OR=3.87; 1.17-12.76	0.018
Surgical site infection	11 (18.3)	4 (6.7)	$\chi^2=3.73$	OR=3.14; 0.94-10.51	0.053
Hematoma	6 (10.0)	2 (3.3)	$\chi^2=2.14$	OR=3.22; 0.62-16.73	0.143
Flap necrosis	4 (6.7)	1 (1.7)	$\chi^2=1.88$	OR=4.21; 0.46-38.87	0.171
Mesh infection	3 (5.0)	1 (1.7)	$\chi^2=1.03$	OR=3.11; 0.31-30.73	0.309
Chronic pain	9 (15.0)	5 (8.3)	$\chi^2=1.30$	OR=1.94; 0.61-6.19	0.255
Any postoperative complication	24 (40.0)	12 (20.0)	$\chi^2=5.71$	OR=2.67; 1.18-6.03	0.017

Table 2 compares postoperative complications between the Onlay and Sublay mesh repair groups. Seroma formation was the most common postoperative complication and occurred significantly more frequently in the Onlay group, affecting 21.7% of patients compared to 6.7% in the Sublay group ($\chi^2=5.55$, $p=0.018$). Surgical site infection was observed in 18.3% of patients undergoing Onlay repair and 6.7% in the Sublay group; although higher in the Onlay group, the difference was borderline statistically significant ($p=0.053$). Hematoma formation was noted in 10.0% of Onlay cases and 3.3% of Sublay cases, while flap necrosis occurred in 6.7% and 1.7% respectively; however, these differences did not reach statistical significance.

Mesh infection was relatively uncommon and occurred in 5.0% of patients in the Onlay group and 1.7% in the Sublay group. Chronic postoperative pain was reported by 15.0% of patients undergoing Onlay repair and 8.3% in the Sublay group, though the difference was not statistically significant. Overall postoperative complications were significantly more common in the Onlay group, occurring in 40.0% of patients compared to 20.0% in the Sublay group ($\chi^2=5.71$, $p=0.017$).

Table 3: Operative Duration and Hospital Stay

Variable	Onlay (n=60)	Sublay (n=60)	Test value	95% CI	p-value
Operative duration, minutes	69.4 ± 13.7	86.8 ± 15.9	$t=6.42$	-22.77 to -12.03	<0.001
Drain duration, days	5.2 ± 1.4	3.9 ± 1.2	$t=5.46$	0.83 to 1.77	<0.001
Hospital stay, days	6.8 ± 1.9	5.4 ± 1.6	$t=4.37$	0.76 to 2.04	<0.001
Time to return to routine activity, days	18.7 ± 4.8	15.3 ± 4.1	$t=4.18$	1.79 to 5.01	<0.001

Table 3 presents the comparison of operative duration and postoperative recovery parameters between the two surgical techniques. The mean operative duration was significantly longer in the Sublay group (86.8 ± 15.9 minutes) compared to the Onlay group (69.4 ± 13.7 minutes), and this difference was highly statistically significant ($t=6.42$, $p<0.001$). This indicates that Sublay mesh repair required more operative time due to the technically demanding retrorectus dissection.

Despite the longer operative duration, postoperative recovery parameters favored the Sublay group. The mean drain duration was significantly longer in the Onlay group (5.2 ± 1.4 days) compared to the Sublay group (3.9 ± 1.2 days) ($t=5.46$, $p<0.001$). Similarly, the duration of hospital stay was significantly greater in the Onlay group, with patients staying for an average of 6.8 ± 1.9 days compared to 5.4 ± 1.6 days in the Sublay group ($t=4.37$, $p<0.001$). Time taken to return to routine daily activity was also prolonged in the Onlay group (18.7 ± 4.8 days) as compared to the Sublay group (15.3 ± 4.1 days), with a statistically significant difference ($t=4.18$, $p<0.001$).

Table 4: Recurrence and Overall Surgical Outcome

Outcome	Onlay (n=60)	Sublay (n=60)	Test value	95% CI	p-value
Recurrence	7 (11.7)	2 (3.3)	$\chi^2=3.00$	OR=3.83; 0.76-19.26	0.083
No recurrence	53 (88.3)	58 (96.7)			
Excellent outcome	28 (46.7)	41 (68.3)	$\chi^2=5.74$	OR=0.41; 0.19-0.86	0.017
Good outcome	21 (35.0)	14 (23.3)	$\chi^2=1.99$	OR=1.77; 0.79-3.96	0.158
Fair outcome	8 (13.3)	4 (6.7)	$\chi^2=1.48$	OR=2.15; 0.61-7.57	0.227
Poor outcome	3 (5.0)	1 (1.7)	$\chi^2=1.03$	OR=3.11; 0.31-30.73	0.309
Satisfactory outcome	49 (81.7)	55 (91.7)	$\chi^2=2.54$	OR=0.41; 0.13-1.29	0.111

Table 4 shows the recurrence rates and overall surgical outcomes following Onlay and Sublay mesh repair. Recurrence of ventral hernia was observed in 11.7% of patients in the Onlay group compared to 3.3% in the Sublay group. Although

recurrence was numerically higher in the Onlay group, the difference was not statistically significant ($\chi^2=3.00$, $p=0.083$). Correspondingly, absence of recurrence was noted in 88.3% of patients in the Onlay group and 96.7% in the Sublay group. Assessment of overall surgical outcome revealed that excellent outcome was achieved significantly more frequently in the Sublay group, where 68.3% of patients had excellent results compared to 46.7% in the Onlay group ($\chi^2=5.74$, $p=0.017$). Good outcome was observed in 35.0% of patients in the Onlay group and 23.3% in the Sublay group, while fair outcome occurred in 13.3% and 6.7% respectively. Poor outcome was uncommon in both groups. Satisfactory overall outcome was seen in 81.7% of patients undergoing Onlay repair and 91.7% of patients undergoing Sublay repair, although the difference was not statistically significant ($p=0.111$).

DISCUSSION

In the present study, baseline characteristics were comparable between Onlay and Sublay groups. The mean age was 47.6 ± 10.8 years in the Onlay group and 46.9 ± 11.4 years in the Sublay group, with no statistically significant difference. BMI, gender distribution, type of hernia, and mean defect size were also comparable between both groups. This indicates that both groups were well matched before surgery. Similar baseline comparability was reported by Haskins et al. (2017)[5], who compared Onlay and Sublay mesh repair in ventral hernia and observed no major difference in demographic profile between the two groups. Ahmed et al. (2019)[6] also reported comparable baseline characteristics in patients undergoing Onlay and Sublay repair.

In the present study, postoperative complications were higher in the Onlay group. Seroma was significantly more common in Onlay repair, occurring in 13 (21.7%) patients compared to 4 (6.7%) patients in the Sublay group ($p=0.018$). Overall postoperative complications were also significantly higher in the Onlay group, 24 (40.0%) versus 12 (20.0%) in the Sublay group ($p=0.017$). This may be due to extensive subcutaneous flap dissection in Onlay repair, which increases dead space and predisposes to seroma and wound complications. Similar findings were reported by Issa et al. (2021)[7], who found higher seroma and wound infection rates in Onlay repair compared with Sublay repair. Shekhar et al. (2021)[8] also reported that seroma and wound infection were more frequent in the Onlay group, whereas Sublay repair had fewer postoperative complications.

Surgical site infection was seen in 11 (18.3%) patients in the Onlay group and 4 (6.7%) patients in the Sublay group, showing a borderline significant difference ($p=0.053$). Hematoma, flap necrosis, mesh infection, and chronic pain were also numerically higher in the Onlay group, although these differences were not statistically significant. These findings are in agreement with Jason L. Holihan et al. (2016)[4], who reported that mesh position influences wound morbidity and recurrence outcomes in open ventral hernia repair. Holihan et al. (2016)[9] also observed in their meta-analysis that Sublay mesh repair was associated with lower wound complications compared with Onlay repair.

In the present study, operative duration was significantly longer in the Sublay group, 86.8 ± 15.9 minutes, compared with 69.4 ± 13.7 minutes in the Onlay group ($p<0.001$). This finding is expected because Sublay repair requires creation of a retrorectus plane and more meticulous dissection. Similar observations were made by Pereira et al. (2023)[10], who reported that Sublay repair usually requires longer operative time but provides better mesh placement and lower recurrence tendency. Dhaigude et al. (2017)[11] also reported shorter operative time in Onlay repair but better postoperative outcomes in Sublay repair.

Despite longer operative time, Sublay repair showed better postoperative recovery. Drain duration was significantly longer in the Onlay group, 5.2 ± 1.4 days versus 3.9 ± 1.2 days in the Sublay group ($p<0.001$). Hospital stay was also significantly prolonged in the Onlay group, 6.8 ± 1.9 days versus 5.4 ± 1.6 days in the Sublay group ($p<0.001$). Time to return to routine activity was longer in the Onlay group, 18.7 ± 4.8 days compared with 15.3 ± 4.1 days in the Sublay group ($p<0.001$). These findings are consistent with Shekhar et al. (2021)[8], who observed that hospital stay and return to normal activity were better in Sublay repair compared with Onlay repair.

In the present study, recurrence was higher in the Onlay group, 7 (11.7%), compared with 2 (3.3%) in the Sublay group, although the difference was not statistically significant ($p=0.083$). The lower recurrence in Sublay repair may be attributed to better mesh support, wider overlap, and placement in a well-vascularized retrorectus plane. Excellent surgical outcome was significantly higher in the Sublay group, 41 (68.3%), compared with 28 (46.7%) in the Onlay group ($p=0.017$). These findings support the view that Sublay repair provides better overall surgical outcome despite longer operative duration. Similar conclusions were reported by Holihan et al. (2016)[9], Pereira et al. (2023)[10], and Dhaigude et al. (2017)[11], who observed that Sublay repair was associated with lower complication rates, reduced recurrence tendency, and improved postoperative outcomes.

CONCLUSION

The present study demonstrated that both Onlay and Sublay mesh repair are effective techniques for the management of ventral hernia; however, significant differences were observed in postoperative outcomes and complication rates between the two procedures. Onlay mesh repair was associated with shorter operative duration, making it technically simpler and easier to perform. However, it showed a higher incidence of postoperative complications such as seroma formation, surgical site infection, hematoma, flap necrosis, chronic pain, and longer duration of drain placement and hospital stay.

In contrast, Sublay mesh repair, although technically more demanding and associated with longer operative time, resulted in significantly better postoperative recovery. Patients undergoing Sublay repair experienced fewer postoperative complications, shorter hospital stay, earlier return to routine activities, and lower recurrence rates. Excellent overall surgical outcome was also significantly higher in the Sublay group compared to the Onlay group.

Thus, the study concludes that Sublay mesh repair is a superior surgical technique for ventral hernia repair in terms of reduced postoperative morbidity, improved recovery, and better long-term outcomes. Onlay repair may still be useful in selected cases because of its technical simplicity and shorter operative time, but whenever feasible, Sublay mesh placement should be preferred for elective ventral hernia repair.

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