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COMPARISON OF SUBLAY VERSUS ONLAY MESH REPAIR IN PATIENTS WITH VENTRAL HERNIA

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ABSTRACT

Background: Incisional hernias are the most common long-term complication of the midline laparotomy incisions, mostly repaired by ventral repair. This study aimed to compare the frequency of wound infection and seroma formation in patients undergoing onlay versus sublay mesh repair for ventral hernia.

Methods: An Analytical cross-sectional study was conducted in the Surgical Unit of the University of Lahore Teaching Hospital from May 3, 2025 to November 3, 2025.A total of 140 patients were included and randomized into two groups: Group A (onlay mesh repair, n = 70) and Group B (sublay mesh repair, n = 70). Baseline demographics including age, gender, BMI, and socioeconomic status were recorded. All patients underwent standardized surgical procedures and were followed for 30 days postoperatively to assess wound infection and seroma formation. Data were analyzed using SPSS version 25.0. The Chi square test was applied, and a P-value of ≤ 0.05 was considered statistically significant.

Results: Seroma formation occurred in 20.0% of patients in Group A compared with 5.7% in Group B. Wound infection was observed in 14.3% of patients in Group A and 2.9% in Group B. Both complications were significantly higher in the onlay repair group.

Conclusion: Sublay mesh repair was associated with a lower incidence of wound infection and seroma formation when compared with onlay mesh repair. It may be considered a safer and more effective technique for ventral hernia repair.

Keywords: Complications,Hernia, Ventral hernia, Wound infection, Seroma

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INTRODUCTION

The intra-abdominal pressure on the abdominal wall muscles is an important factor for eventration of tissue in the abdominal wall muscles, resulting in the formation of a ventral hernia. The rate of intra-abdominal pressure ventration of abdominal muscles, when compared to inguinal region abdominal wall muscles, is from above and behind and, subsequently, about fifty percent lower. The muscles of the abdominal wall having low pressure and zone weak points as a result of the distribution of their muscular bundles, helps to explain the clinical fact that ventral hernias, in an

anatomical sense, are less common.[1] Repairing ventral hernias accounts for 15-18% of all surgical procedures, and incisional hernias are the most frequent long-term complication of the midline laparotomy incisions. In the current day, ventral hernias are one of the most prevalent issues faced by surgeons.[2, 3]

Incisional hernias are the most common long-term complication of the midline laparotomy incisions. It is estimated that between three and thirteen percent of individuals who have laparotomy will develop an incisional hernia, with the likelihood increasing to twenty-three percent.[4, 5] Because the natural history of hernia is one of progression, the therapy that is most commonly recommended is surgery. A hernia may become larger, causing pain and discomfort, or lead to problems such as blockage, imprisonment, or strangling of the colon. These symptoms can occur independently or in conjunction with one another. Surgery for hernias has progressed significantly throughout the years.[6, 7]

In 1993, Leblanc and Booth published the first description of a ventral hernia being repaired using laparoscopic techniques. As a result, the open mesh repair method is the one that is utilised the most frequently in ventral hernia repair. There have been a number of different approaches developed for the implantation of prolene mesh in ventral hernias.[8] These include the onlay repair, in which the mesh is sutured to the hernial neck, the sublay repair, in which the mesh is placed in the retromuscular layer above the posterior rectus sheath, the preperitoneal repair, in which the mesh is placed between the peritoneum and the posterior rectus sheath, and the intraperitoneal repair, in which the mesh is placed from inside the peritoneal cavity and femoral artery.[9-10]

Although previous literature supports the superiority of sublay mesh repair over onlay mesh repair in terms of lower recurrence rates and fewer complications, there remains variability in clinical practice, with some centers still opting for the simpler onlay technique due to its lower cost and ease of execution. Additionally, advancements in surgical techniques and materials may have impacted outcomes since earlier studies. This study will specifically compare short-term outcomes, including wound infection, seroma formation, and recurrence, to evaluate the effectiveness and complications associated with both techniques. The findings will provide updated evidence to guide clinical decision-making and improve patient care in ventral hernia repairs.

METHODS

The investigation was carried out in the Department of General Surgery at the University of Lahore Teaching Hospital, Lahore, over a duration of six months, subsequent to the approval of the research proposal from May 3, 2025, to November 3, 2025 by Ref/UOL/31-148 dated 27-04-2025.

This research was structured as a randomized controlled trial. The methodology employed for sampling was non-probability consecutive sampling. In total, 140 subjects were enrolled, with 70 participants allocated to each group. The sample size was determined at a significance level of 5% and a power of 80%, anticipating a seroma formation rate of 20% in the onlay group and 4.6% in the sublay group among individuals undergoing hernioplasty for ventral hernia.[11]

Patients of both genders, aged between 18 and 70 years, who were undergoing hernioplasty for ventral hernia as defined in the operational criteria, were included in the study. Patients with recurrent hernias, previous mesh repair, BMI greater than 35, defect size less than 3 cm or greater than 10 cm, and pregnant patients were excluded.

Following authorization from the hospital's ethics committee, a total of 140 patients meeting the specified inclusion criteria were recruited from the Department of Surgery. These participants were assigned to two distinct cohorts, Group A and Group B, using a random lottery method, with 70 individuals allocated to each group. Patients from Group A had onlay mesh repair while Group B had sublay mesh repair. Consent was adequately obtained from all subjects prior to participation. The other basic medical data was accompanied with demographic data such as name, age, and gender which was collected in a systematic way. After admission to the hospital, a detailed medical history was obtained while a detailed clinical examination was performed in a systematic way.

In the sublay mesh repair method, the surgeon made a hernia incision and proceeded to carefully dissect the canvas and skin layers to access the fascial defect. The mesh was positioned in the pre-peritoneal area in the subrectus space, under the rectus abdominal muscle and above the peritoneum. The mesh was then sutured to the healthy fascia covering the defect with tension to proper fill it and overlaid with sutured abdominal layers. The skin was then sutured or stapled such that all abdominal layers were covered.

During the onlay mesh repair procedure, the surgeon made an incision at the site of the hernia and dissected down to the abdominal fascia. The mesh was then placed on the fascia and covering the defect, and then sutures or staples were used to attach the mesh to the outer fascia layer. The overlying fascia was closed and the skin was finally closed either with sutures or staples. This surgical approach necessitated the elevation of skin and subcutaneous flaps, and the margins of the defect were meticulously cleared by 4–5 cm in all directions. Careful dissection was performed to prevent peritoneal opening and minimize the size of the hernia sac. In the case of sublay repair, the hernia sac was dissected and reduced intraoperatively, and the defect's borders were delineated to create a pre-peritoneal space behind the rectus muscle.

All patients were required to remain hospitalized until the removal of their drains, after which they were discharged. They returned for a follow-up appointment one month later at the outpatient department, where they were assessed for seroma development and wound infection in accordance with operational criteria. Data pertaining to age, gender, BMI, and socioeconomic status were compiled using a pre-formulated proforma.

All data were systematically entered and analyzed utilizing SPSS version 25.0. Age and BMI were reported as mean ± standard deviation; in cases of non-normal distribution, the median was computed. Outcomes such as wound infection and seroma formation, along with gender, were expressed in terms of frequencies and percentages. Comparative analyses of outcomes between groups were conducted using the Chi-square test, with a p-value of ≤ 0.05 deemed statistically significant. Data were stratified based on age, gender, BMI, and socioeconomic status to account for potential effect modifiers. Following stratification, the Chi-square test was reapplied, maintaining the significance threshold of p-value ≤ 0.05.

RESULTS

A total of 140 patients were included, with 70 patients in each group. The baseline demographic characteristics were comparable between both groups. Gender distribution, age categories, mean age, BMI categories, mean BMI, and socioeconomic status showed no statistically significant differences (**Table 1**).

Table 1. Baseline characteristics between groups

Variable	Category	Group A Onlay n=70	Group B Sublay n=70	Test statistic	p-value
Gender	Male	37 (52.9%)	38 (54.3%)	$\chi^2 = 0.029$	0.865
	Female	33 (47.1%)	32 (45.7%)		
Age groups	18-30 years	19 (27.1%)	18 (25.7%)	$\chi^2 = 0.132$	0.936
	31-45 years	29 (41.4%)	28 (40.0%)		
	46-70 years	22 (31.4%)	24 (34.3%)		
Age (years)	Mean ± SD	38.91 ± 11.04	39.34 ± 11.32	t = -0.228	0.820
BMI category	Normal	30 (42.9%)	26 (37.1%)	$\chi^2 = 0.675$	0.714
	Overweight	35 (50.0%)	37 (52.9%)		

	Obese	5 (7.1%)	7 (10.0%)		
BMI	Mean ± SD	26.5 ± 2.33	26.9 ± 2.42	t = -0.996	0.321
Socio-economic status	Low	21 (30.0%)	20 (28.6%)	$\chi^2 = 0.127$	0.938
	Middle	39 (55.0%)	41 (58.6%)		
	High	10 (14.3%)	9 (12.9%)		

Postoperative outcomes showed that seroma formation was significantly higher in Group A, where 20.0% of patients developed seroma compared to 5.7% in Group B (p = 0.012). Wound infection was also more frequent in Group A, occurring in 14.3% of patients compared to 2.9% in Group B (p = 0.016) (**Table 2**).

Table 2. Outcomes between groups

Outcome	Category	Group A Onlay n=70	Group B Sublay n=70	Test statistic	p-value
Seroma formation	Yes	14 (20.0%)	4 (5.7%)	$\chi^2 = 6.375$	0.012
	No	56 (80.0%)	66 (94.3%)		
Wound infection	Yes	10 (14.3%)	2 (2.9%)	$\chi^2 = 5.833$	0.016
	No	60 (85.7%)	68 (97.1%)		

Stratified analysis indicated that seroma formation was significantly associated with male gender, patients aged 46 to 70 years, and those with normal BMI, with higher incidence in Group A (**Table 3**).

Table 3. Stratification of seroma formation

Variable	Category	Group A Yes/No	Group B Yes/No	Test statistic	p-value
Gender	Male	7 / 30	1 / 37	$\chi^2 = 5.219$	0.022
	Female	7 / 26	3 / 29	$\chi^2 = 1.749$	0.186
Age groups	18-30 years	4 / 15	2 / 16	$\chi^2 = 0.672$	0.412
	31-45 years	6 / 23	2 / 26	$\chi^2 = 2.167$	0.141
	46-70 years	4 / 18	0 / 24	$\chi^2 = 4.779$	0.029

BMI	Normal	8 / 22	0 / 26	$\chi^2 = 8.089$	0.004
	Overweight	6 / 29	2 / 35	$\chi^2 = 2.509$	0.113
	Obese	0 / 5	2 / 5	$\chi^2 = 1.714$	0.190
Socio-economic status	Low	5 / 16	1 / 19	$\chi^2 = 2.901$	0.089
	Middle	7 / 32	2 / 39	$\chi^2 = 3.420$	0.064
	High	2 / 8	1 / 8	$\chi^2 = 0.281$	0.596

Wound infection was significantly higher among males, patients aged 46 to 70 years, and those in the middle socioeconomic group in Group A (**Table 4**).

Table 4. Stratification of wound infection

Variable	Category	Group A Yes/No	Group B Yes/No	Test statistic	p-value
Gender	Male	9 / 28	1 / 37	$\chi^2 = 7.634$	0.006
	Female	1 / 32	1 / 31	$\chi^2 = 0.000$	0.982
Age groups	18-30 years	4 / 15	1 / 17	$\chi^2 = 1.899$	0.168
	31-45 years	1 / 28	1 / 27	$\chi^2 = 0.001$	0.980
	46-70 years	5 / 17	0 / 24	$\chi^2 = 6.120$	0.013
BMI	Normal	5 / 25	1 / 25	$\chi^2 = 2.393$	0.122
	Overweight	4 / 31	1 / 36	$\chi^2 = 2.119$	0.145
	Obese	1 / 4	0 / 7	$\chi^2 = 1.527$	0.217
Socio-economic status	Low	1 / 20	0 / 20	$\chi^2 = 0.976$	0.323
	Middle	8 / 31	1 / 40	$\chi^2 = 6.539$	0.011
	High	1 / 9	1 / 8	$\chi^2 = 0.006$	0.937

DISCUSSION

The present study compares the postoperative outcomes of two surgical techniques, Onlay and Sublay mesh repair, for ventral hernias in a cohort of 140 patients. The key findings highlight

significant differences in seroma formation and wound infection rates between the two groups, corroborated by recent literature.

The demographic characteristics presented in **Table 1** indicate comparable baseline variables between Group A (Onlay) and Group B (Sublay). This is consistent with similar studies which assert that baseline demographics such as age, gender, and BMI should ideally be matched in comparative studies to ensure that any differences in outcomes can be attributed to the surgical technique used rather than patient characteristics [12, 13, 14.]

Table 2 demonstrates that the rate of seroma formation was significantly higher in Onlay repair group, with 20.0% of patients experiencing this complication compared to only 5.7% in Sublay repair group ($p = 0.012$). This result is in line with current studies that have shown higher levels of seroma occurrence in Onlay repair methods than in Sublay method. An example is a localstudy which found that seroma rates were significantly greater in patients that received Onlay mesh repair than in patients that received Sublay [15]. SimilarPakistani investigations of confirm the fact that the incidence of seroma formation is reduced by a large margin in case of Sublay repair, which highlights its relative safety and efficacy [16, 17].

The stratified analysis showed in our study that seroma formation had significant relations with male gender, 46 to 70 years age group, and normal BMI among patients of onlay repair. These results are consistent with the findings of another study which reported that older age and male gender contribute to a higher incidence of postoperative complications following hernia repairs [18]. It is worth noting that the occurrence of seromas can also be influenced by technical aspects of the surgical procedure, postoperative care, and patient demographics [19, 20.]

Similarly, the incidence of wound infection was significantly elevated in Group A, where 14.3% of patients were affected, as opposed to 2.9% in sublay repair group ($p = 0.016$) (**Table 2**). This result concurs with other recent analyses, such as those conducted by Ibrahim et al. and Claessen et al., indicating a lower risk of wound infections associated with Sublay mesh repair techniques [14, 21]. The lower wound infection rates in the Sublay group can potentially be attributed to reduced exposure of the mesh to the wound environment and lower tension in closure [22, 23.]

Analysis of stratified data associated wound infections with male gender, age groups of 46 to 70 years, and middle socioeconomic status for patients in of onlay repair (**Table 4**). This stratification supports existing literature highlighting that factor such as gender and socioeconomic status significantly impact the likelihood of developing postoperative infections following hernia repairs [24, 25].

In summary, the findings from this study echo the growing body of literature that suggests Sublay mesh repair is more favorable than Onlay repair in terms of postoperative outcomes, specifically concerning seroma formation and wound infections. The results from recent studiesemphasize that surgical techniques should be tailored to minimize complications and improve patient recovery [21, 26]. In a broader perspective, the findings indicate that it is important to select the method of surgery not only on the basis of technical convenience but also on the careful and thoughtful analysis of the effect it has on patient outcomes.

In general, the findings of this paper, together with the recent academic literature, justify the use of Sublay mesh repair as a better choice in the context of ventral hernias than Onlay mesh repair. The multifactorial nature of the factors that affect the complication rates should be further explored in future studies in order to improve the surgical techniques and the patient care protocols.

The study was done in one surgical unit and this might not be representative of all surgical units. The follow-up was limited to 30 days and thus no evaluation of long-term complications like recurrence was done. Also, some possible confounders, such as differences in surgeon technique, were not considered.

CONCLUSION

Sublay mesh repair was associated with lower rates of wound infection and seroma formation compared to onlay mesh repair, making it a safer and more effective option for ventral hernia repair.

LIST OF ABBREVIATIONS

None

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CONFLICT OF INTEREST

None.

ETHICAL APPROVAL

The study was conducted after approval from the institutional ERC committee Ref/UOL/31-148 dated 27-04-2025.

AUTHORS' CONTRIBUTION

All authors contributed equally as per ICMJE.

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