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Sublay versus Onlay Mesh Repair in Incisional Hernia: A Comparative Analysis.

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ABSTRACT

Background: Incisional hernia is a common complication following abdominal surgery, and mesh reinforcement has become the standard of care. This study aimed to compare the clinical outcomes of sublay versus onlay mesh repair in patients with incisional hernia.

Methods: This prospective randomized controlled clinical trial was conducted at the General Surgery Department, Faculty of Medicine, ….. Hospitals. A total of 60 patients diagnosed with incisional hernia and scheduled for elective surgical repair were recruited from general surgery outpatient clinics and the emergency department. Patients were randomly assigned into two equal groups: Group A (Onlay Group, n=30) underwent onlay mesh repair, and Group B (Sublay Group, n=30) underwent sublay (retrorectus) mesh repair. Baseline demographic, clinical, laboratory, and radiological characteristics were recorded. Operative parameters, postoperative pain scores (Visual Analogue Scale), hospital stay, return to normal activity, postoperative complications (seroma, hematoma, surgical site infection), and hernia recurrence at 12 months were compared between the two groups.

Results: Operative time was significantly shorter in the onlay group (88.93 ± 7.93 minutes) compared to the sublay group (99.67 ± 7.74 minutes) ($p < 0.001$). Postoperative pain scores were significantly lower in the sublay group at day 1 (4.70 ± 0.76 vs. 6.10 ± 0.79), 1 week (2.39 ± 0.75 vs. 3.99 ± 0.82), 1 month (0.85 ± 0.74 vs. 2.41 ± 0.88), 3 months (0.30 ± 0.49 vs. 1.41 ± 0.86), 6 months (0.16 ± 0.36 vs. 1.02 ± 0.82), and 12 months (0.14 ± 0.48 vs. 0.82 ± 0.86) ($p < 0.001$ for all). Hospital stay was significantly shorter in the sublay group (3.47 ± 1.11 days vs. 4.40 ± 0.93 days, $p < 0.001$), and return to normal activity was significantly earlier (21.53 ± 3.41 days vs. 26.07 ± 4.73 days, $p < 0.001$). No significant difference was found in drain removal day ($p = 0.257$). Postoperative complications including seroma (10.0% vs. 23.3%, $p = 0.299$), hematoma (3.3% vs. 6.7%, $p = 1.000$), and surgical site infection (6.7% vs. 16.7%, $p = 0.424$) were directionally lower in the sublay group but did not reach statistical significance. Hernia recurrence at 12 months was 3.3% in the sublay group versus 10.0% in the onlay group ($p = 0.612$). All patients completed the 12-month follow-up.

Conclusion: Sublay (retrorectus) mesh repair offers significant clinical advantages over onlay mesh repair for incisional hernia, including superior postoperative pain control, shorter hospital stay, and earlier return to normal activity. Postoperative complications and recurrence showed consistent trends favoring sublay repair. These findings support sublay mesh repair as the preferred technique for elective incisional hernia repair in appropriately selected patients..

Keywords: Incisional hernia, mesh repair, sublay, retrorectus, onlay, postoperative pain, randomized controlled trial.

INTRODUCTION

Incisional hernia is a serious complication after laparotomy; its incidence ranges between 10% and 20%. This widespread condition can result in bowel strangulation, pain, and enterocutaneous fistula, and it impacts the quality of life. The effects of mending treatments vary greatly. High recurrence rates have been documented for suture approaches, however mesh deployment can minimize recurrence [1].

In mesh repair, one of the most essential difficulties is the positioning of the mesh. Some procedures are claimed to be associated with particularly high rates of some problems, including as recurrence, wound infection, and fistula. In the literature, various studies compare mesh and suture repair approaches, open and laparoscopic repair techniques, and mesh type as well as the plane in which the mesh should be inserted. Currently, there is no unanimity regarding the abdominal plane in which the mesh should be inserted [2].

Mesh reinforcement has become the standard of care due to considerably lower recurrence rates compared with suture repair. However, the plane of mesh placement remains contentious. Onlay repair, in which mesh is put over the anterior rectus sheath, is technically uncomplicated and widely used. Yet, it is connected with problems such as seroma, surgical site infection (SSI), and longer hospital stay [3].

Sublay repair, proposed by Rives [4], incorporates retro rectus placement of the mesh, allowing better integration with wellvascularized tissue, reduced dead space, and stronger abdominal wall reconstruction. Multiple studies and meta-analyses reveal superior outcomes with sublay mesh repair, although randomized controlled trials in different populations are still scarce [5, 6].

The study aimed to compare the outcomes of sublay (retrorectus) versus onlay mesh repair in patients presenting with incisional hernia.

Patients and Methods

This was a prospective randomized controlled clinical trial conducted at the General Surgery Department, Faculty of Medicine, Zagazig University Hospitals. The study included (n patients) diagnosed with incisional hernia and scheduled for elective surgical repair. Patients were recruited from general surgery outpatient clinics and emergency department.

Inclusion criteria

Patients eligible for inclusion in this study were adults aged ≥18 years diagnosed with primary or recurrent incisional hernia, with a defect size ranging from approximately 3 to 10 cm, who were deemed fit for elective surgical repair under general anesthesia and provided written informed consent to participate.

Exclusion criteria

Patients were excluded if they presented with complicated hernias such as strangulated or obstructed cases, had a body mass index (BMI) ≥ 40 kg/m², suffered from severe comorbid conditions classified as ASA class IV or higher, had active infection at the surgical site, were pregnant, had a history of previous mesh infection or rejection, or were considered unfit for general anesthesia.

Eligible patients were randomly assigned into two equal: **Group A (Onlay Group):** Underwent onlay mesh repair. **Group B (Sublay Group):** Underwent sublay (retrorectus) mesh repair

Preoperative Assessment: Every patient underwent a thorough preoperative evaluation, which included a thorough physical examination with an emphasis on hernia characteristics like size, reducibility, and overlying skin condition, as well as a detailed clinical evaluation with full history taking (including age, sex, occupation, risk factors, prior abdominal surgeries, duration, and symptoms of the hernia). All patients underwent laboratory tests, such as blood glucose levels, coagulation profiles, liver and kidney function tests, and complete blood counts (CBCs). Abdominal ultrasonography was used for radiological evaluation to examine the size and contents of hernia defects, and computed tomography (CT) of the abdomen was requested when large or complex hernias required it. Preoperative preparation comprised thromboprophylaxis in accordance with institutional hospital procedure, bowel preparation when necessary, and prophylactic antibiotic treatment at the time of anesthetic induction.

Operative Technique: All operations were performed under general anesthesia with standard aseptic precautions, after which patients in Group A (onlay mesh repair) underwent an incision over the previous scar followed by dissection of the subcutaneous tissue to expose the anterior rectus sheath, identification and reduction of the hernia sac contents, closure of the fascial defect using non-absorbable sutures, placement of a polypropylene mesh over the anterior fascia in an onlay position, fixation of the mesh with interrupted non-absorbable sutures, insertion of a suction drain when indicated, and finally closure of the subcutaneous tissue and skin, whereas patients in Group B (sublay mesh repair) underwent incision and exposure of the hernia sac, opening of the posterior rectus sheath, development of the retrorectus space, reduction of hernia contents with closure of the posterior sheath, placement of a polypropylene mesh in the retrorectus (sublay) plane, fixation of the mesh with interrupted sutures, closure of the anterior rectus sheath, insertion of a drain if required, and closure of the skin in layers.

Postoperative Care

Monitoring of vital signs

Analgesia using standardized protocol

Early ambulation encouraged

Antibiotics as per hospital protocol

Drain removal when output <30 ml/day

Wound care and dressing

Outcome Measures: The evaluation of hernia recurrence, which was assessed clinically and confirmed radiologically when necessary, as well as postoperative complications such seroma, hematoma, and surgical site infection (SSI), were the main results of this study. The length of hospital stay, postoperative pain as assessed by the Visual Analog Scale (VAS), operative time, and the amount of time needed to resume regular daily activities were the secondary outcomes.

Follow-Up: Following surgery, all patients were monitored at regular intervals of one week, one month, three months, six months, and twelve months. In addition to recording pain scores, patients were assessed during each follow-up visit using a clinical examination to look for recurrence and evaluate wound-related or other postoperative sequelae. When necessary, relevant imaging modalities were used to confirm any potential recurrence.

Ethical Considerations: Approval obtained from ….. Ethics Committee. Written informed consent obtained from all participants. Confidentiality of patient data ensured

Statistical Analysis

The SPSS software (Statistical Package for Social Science) version 27.0 was used to computerize and statistically analyze the gathered data (IBM, 2020). Frequencies and relative percentages were used to display qualitative data. To determine the difference between qualitative variables, the Chi-square test was employed. When one or more of the examined cells were less than five, Fisher's exact test was utilized to determine the difference between qualitative variables in various groups. Mean ± SD (standard deviation) was used to express quantitative data. The difference between quantitative variables in two groups of normally distributed data was determined using the independent T test. In data that was not regularly distributed, the Mann Whitney (MW) test was employed to determine the difference between quantitative variables in two groups.

Results:

Table 1. Baseline demographic and clinical characteristics of the studied groups (Onlay vs Sublay)

Variable	Onlay (n=30)	Sublay (n=30)	P-value
Age (years)	48.43 ± 9.36 (33–66)	48.00 ± 9.51 (33–68)	0.859
BMI (kg/m²)	31.14 ± 2.77 (27.2–36.5)	30.91 ± 3.40 (23.3–37.2)	0.778
Duration (months)	14.23 ± 5.44 (5–23)	12.70 ± 5.57 (4–32)	0.285
Defect size (cm)	5.49 ± 1.43 (3.3–9.0)	5.50 ± 1.34 (3.2–8.0)	0.993
Sex: Female	23 (76.7%)	16 (53.3%)	0.104
Male	7 (23.3%)	14 (46.7%)	

BMI: Body Mass Index, SD: Standard Deviation, n: Number of patients.

There was no statistically significant difference between the Onlay and Sublay groups regarding baseline demographic and clinical characteristics, including age, BMI, duration of disease, defect size, and sex distribution ($p > 0.05$ for all). This indicates that both groups were comparable at baseline, ensuring that any observed postoperative differences can be attributed to the surgical technique rather than preoperative disparities (Table 1).

Table 2. Distribution of occupation among the studied groups (Onlay vs Sublay)

Category	Onlay (n=30)	Sublay (n=30)	P-value
Cleaner	1 (3.3%)	2 (6.7%)	0.783
Driver	4 (13.3%)	2 (6.7%)	
Farmer	3 (10.0%)	1 (3.3%)	
Housewife	2 (6.7%)	1 (3.3%)	

Manual worker	3 (10.0%)	1 (3.3%)	
Nurse	3 (10.0%)	4 (13.3%)	
Office worker	3 (10.0%)	4 (13.3%)	
Retired	1 (3.3%)	3 (10.0%)	
Shopkeeper	4 (13.3%)	2 (6.7%)	
Tailor	4 (13.3%)	5 (16.7%)	
Teacher	1 (3.3%)	1 (3.3%)	
Technician	1 (3.3%)	4 (13.3%)	

There was no statistically significant difference between the Onlay and Sublay groups regarding occupational distribution (p = 0.783). The distribution of different occupations was comparable between both groups, indicating that socioeconomic or occupational factors are unlikely to confound the study outcomes (Table 2).

Table 3. Comparison of ASA classification and associated risk factors between the studied groups (Onlay vs Sublay)

	Onlay (n=30)	**Sublay (n=30)**	**P-value**
ASA class			**0.866**
I	5 (16.7%)	4 (13.3%)	
II	15 (50.0%)	17 (56.7%)	
III	10 (33.3%)	9 (30.0%)	
Associated risk factors			
COPD	4 (13.3%)	3 (10.0%)	1.000
Diabetes	10 (33.3%)	5 (16.7%)	0.233
Hypertension	8 (26.7%)	7 (23.3%)	1.000
Multiparity	6 (20.0%)	6 (20.0%)	1.000
Previous wound infection	2 (6.7%)	2 (6.7%)	1.000
Obesity	16 (53.3%)	18 (60.0%)	0.794
Smoking	6 (20.0%)	9 (30.0%)	0.552

ASA: American Society of Anesthesiologists, COPD: Chronic Obstructive Pulmonary Disease, n: Number of patients.

There was no statistically significant difference between the Onlay and Sublay groups regarding ASA classification (P=0.866). In addition, the distribution of associated risk factors, including COPD, diabetes, hypertension, multiparity, previous wound infection, obesity, and smoking, showed no statistically significant differences between both groups (P>0.05 for all) (Table 3).

Table 4. Comparison of previous abdominal surgeries and hernia characteristics between the studied groups (Onlay vs Sublay)

Previous abdominal surgery	**Onlay (n=30)**	**Sublay (n=30)**	**P-value**
Appendectomy	3 (10.0%)	4 (13.3%)	0.188
Bowel resection	4 (13.3%)	0 (0.0%)	
Exploratory laparotomy	2 (6.7%)	7 (23.3%)	

Hysterectomy	3 (10.0%)	6 (20.0%)	
LSCS	5 (16.7%)	6 (20.0%)	
Open cholecystectomy	10 (33.3%)	5 (16.7%)	
Ovarian cyst surgery	2 (6.7%)	1 (3.3%)	
Perforated ulcer repair	1 (3.3%)	1 (3.3%)	
Hernia type			
Primary	22 (73.3%)	27 (90.0%)	0.182
Recurrent	8 (26.7%)	3 (10.0%)	

LSCS: Lower Segment Cesarean Section, n: Number of patients.

There was no statistically significant difference between the Onlay and Sublay groups regarding the type of previous abdominal surgeries (p = 0.188). Additionally, hernia characteristics, including the proportion of primary and recurrent cases, were comparable between both groups (p = 0.182). This indicates that prior surgical history and hernia status were similar in both groups, minimizing their potential confounding effect on the study outcomes (Table 4).

Table 5. Comparison of presenting symptoms, reducibility, and overlying skin condition between the studied groups (Onlay vs Sublay)

	Onlay (n=30)	**Sublay (n=30)**	**P-value**
Symptoms			
Pain + dragging sensation	4 (13.3%)	2 (6.7%)	0.574
Swelling + discomfort	8 (26.7%)	7 (23.3%)	
Swelling + pain	11 (36.7%)	16 (53.3%)	
Swelling only	7 (23.3%)	5 (16.7%)	
Reducible			
No	6 (20.0%)	3 (10.0%)	0.472
Yes	24 (80.0%)	27 (90.0%)	
Overlying skin condition			
Hyperpigmented scar	6 (20.0%)	2 (6.7%)	0.124
Normal	14 (46.7%)	11 (36.7%)	
Thinned scar	10 (33.3%)	17 (56.7%)	

There was no statistically significant difference between the Onlay and Sublay groups regarding presenting symptoms (p = 0.574), reducibility (p = 0.472), or overlying skin condition (p = 0.124). The distribution of pain characteristics, swelling patterns, and skin findings was comparable between both groups, indicating similar clinical presentation at baseline (Table 5).

Table 6. Comparison of radiological findings (ultrasound and CT) between the studied groups (Onlay vs Sublay)

US hernia content	**Onlay (n=30)**	**Sublay (n=30)**	**P-value**
Omentum	16 (53.3%)	13 (43.3%)	0.740
Omentum + small bowel	5 (16.7%)	6 (20.0%)	
Small bowel loop	9 (30.0%)	11 (36.7%)	
CT requested			

No	15 (50.0%)	17 (56.7%)	0.796
Yes	15 (50.0%)	13 (43.3%)	
CT key finding			
Complex content delineation	6 (20.0%)	9 (30.0%)	0.320
Large defect with adhesions	2 (6.7%)	2 (6.7%)	
Missing	15 (50.0%)	17 (56.7%)	
Recurrent defect with bowel adherence	7 (23.3%)	2 (6.7%)	

US: Ultrasound, CT: Computed Tomography.

There was no statistically significant difference between the Onlay and Sublay groups regarding ultrasound findings of hernia content (p = 0.740), CT request rates (p = 0.796), or CT key findings (p = 0.320). The distribution of omentum, bowel involvement, and complex radiological features was comparable between both groups, indicating similar preoperative radiological characteristics (Table 6).

Table 7. Comparison of baseline laboratory quantitative variables between the studied groups (Onlay vs Sublay)

Variable	Onlay (n=30)	Sublay (n=30)	P-value
Hb (g/dL)	12.73 ± 1.14 (10.8–15.5)	13.05 ± 1.12 (10.7–15.1)	0.279
WBC (×10³/µL)	7.61 ± 0.90 (5.3–9.1)	7.82 ± 1.02 (5.4–9.5)	0.401
Platelets (×10³/µL)	273.37 ± 51.72 (155–375)	257.20 ± 38.04 (160–329)	0.174
ALT (U/L)	23.63 ± 6.79 (11–38)	26.13 ± 7.43 (16–44)	0.179
AST (U/L)	24.73 ± 7.13 (14–47)	26.90 ± 6.55 (14–41)	0.225
Creatinine (mg/dL)	0.83 ± 0.19 (0.5–1.2)	0.82 ± 0.15 (0.5–1.1)	0.879
Urea (mg/dL)	29.17 ± 7.96 (16–47)	28.93 ± 6.40 (17–42)	0.901
INR	1.07 ± 0.08 (0.9–1.2)	1.09 ± 0.07 Range: 0.9–1.2	0.340
Random glucose (mg/dL)	106.70 ± 20.64 (78–176)	98.07 ± 13.69 (79–129)	0.062

Hb: Hemoglobin, WBC: White Blood Cells, ALT: Alanine Aminotransferase, AST: Aspartate Aminotransferase, INR: International Normalized Ratio, n: Number of patients.

There was no statistically significant difference between the Onlay and Sublay groups regarding baseline laboratory parameters, including hemoglobin, white blood cell count, platelet count, liver enzymes (ALT and AST), renal function tests (creatinine and urea), INR, and random blood glucose levels (p > 0.05 for all). This indicates that both groups were comparable in terms of baseline laboratory profile (Table 7).

Table 8. Comparison of operative parameters and postoperative pain outcomes between the studied groups (Onlay vs Sublay)

Variable	Onlay (n=30)	Sublay (n=30)	P-value
Operative time (min)	88.93 ± 7.93 (74–102)	99.67 ± 7.74 (86–115)	**<0.001**
Drain removal day*	3.76 ± 1.67 (2–6	4.32 ± 1.53 (2–6)	0.257
VAS day 1	6.10 ± 0.79 (4.6–7.5)	4.70 ± 0.76 (3.2–6.8)	**<0.001**
Hospital stay (days)	4.40 ± 0.93 (3–6	3.47 ± 1.11 (2–7)	**<0.001**
Return to normal activity (days)	26.07 ± 4.73 (17–37)	21.53 ± 3.41 (17–30)	**<0.001**
Pain at 1 week (VAS)	3.99 ± 0.82 (2.0–5.5)	2.39 ± 0.75 (1.1–4.2)	**<0.001**
Pain at 1 month (VAS)	2.41 ± 0.88 (0.6–4.0)	0.85 ± 0.74 (0.0–2.8)	**<0.001**
Pain at 3 months (VAS)	1.41 ± 0.86 (0.0–3.3	0.30 ± 0.49 (0.0–1.6)	**<0.001**
Pain at 6 months (VAS)	1.02 ± 0.82 (0.0–3.0)	0.16 ± 0.36 (0.0–1.5)	**<0.001**
Pain at 12 months (VAS)	0.82 ± 0.86 (0.0–2.7)	0.14 ± 0.48 (0.0–2.5)	**<0.001**

VAS: Visual Analogue Scale

There was a statistically significant difference between the Onlay and Sublay groups regarding operative time ($p < 0.001$), with shorter operative duration in the Sublay group. No statistically significant difference was observed in drain removal time ($p = 0.257$). The Sublay group demonstrated significantly better postoperative outcomes, including lower pain scores at day 1, 1 week, 1 month, 3 months, 6 months, and 12 months ($p < 0.001$ for all), along with shorter hospital stay and earlier return to normal activity ($p < 0.001$). These findings indicate a clear advantage of the Sublay technique in terms of both early and long-term postoperative recovery (Table 8).

Table 9. Comparison of postoperative complications and recurrence between the studied groups (Onlay vs Sublay)

Drain inserted	Onlay (n=30)	Sublay (n=30)	P-value
No	5 (16.7%)	11 (36.7%)	0.144
Yes	25 (83.3%)	19 (63.3%)	
Seroma			
No	23 (76.7%)	27 (90.0%)	0.299
Yes	7 (23.3%)	3 (10.0%)	
Hematoma			
No	28 (93.3%)	29 (96.7%)	1.000
Yes	2 (6.7%)	1 (3.3%)	
SSI			

No	25 (83.3%)	28 (93.3%)	0.424
Yes	5 (16.7%)	2 (6.7%)	
Recurrence at 12 months			
No	27 (90.0%)	29 (96.7%)	0.612
Yes	3 (10.0%)	1 (3.3%)	
Follow-up completed at 12 months			
Yes	30 (100.0%)	30 (100.0%)	1.000

SSI: Surgical Site Infection

There was no statistically significant difference between the Onlay and Sublay groups regarding postoperative complications, including drain insertion ($p = 0.144$), seroma ($p = 0.299$), hematoma ($p = 1.000$), and surgical site infection (SSI) ($p = 0.424$). Additionally, recurrence rates at 12 months were comparable between both groups ($p = 0.612$). All patients in both groups completed the 12-month follow-up. These findings indicate that both techniques have similar safety profiles and recurrence outcomes despite the observed differences in postoperative recovery (Table 9).

DISCUSSION

In order to compare the results of sublay (retrorectus) with onlay mesh repair in patients presenting with incisional hernia, a prospective randomized controlled clinical trial was carried out at the General Surgery Department, Faculty of Medicine, Hospitals. A total of sixty patients were divided into two equal groups at random to have either sublay (retrorectus) mesh repair (Group B, n = 30) or onlay mesh repair (Group A, n = 30).

The current investigation showed that there were no statistically significant variations in age, body mass index (BMI), length of illness, hernia defect size, or sex distribution ($p > 0.05$ for all), indicating that the two study groups were well matched at baseline. The distribution of occupations was also similar between groups ($p = 0.783$).

The two groups' ASA classifications differed statistically significantly ($p = 0.042$), with the sublay group having a greater percentage of ASA class II patients. Other than that, the distribution of related risk factors and comorbidities was similar among groups ($p = 0.797$). Additionally, the characteristics of the hernia (primary versus recurrent), presenting symptoms, reducibility, overlaying skin condition, radiographic abnormalities, and prior history of abdominal surgery were all statistically identical. Baseline laboratory data, including hemoglobin, white blood cell count, platelet count, liver enzymes, renal function tests, INR, and random blood glucose, likewise showed no significant differences ($p > 0.05$ for all).

In this investigation, the onlay group's mean operating time was substantially lower (88.93 ± 7.93 minutes) than the sublay group's (99.67 ± 7.74 minutes) ($p < 0.001$).

This finding is consistent with **Ullah et al. [7]** They used uniform mesh diameters and fixation techniques to compare the rates of wound infection, seroma development, and recurrence between the two methods. The onlay group had a considerably lower operating time (72.3 ± 12.1 minutes) than the sublay group (78.6 ± 14.3 minutes) in their prospective randomized controlled study, which included 96 patients with ventral abdominal wall hernias ($p = 0.032$).

Similarly, **Hassan et al. [8]**, sought to assess the frequency of recurrence, surgical site infection, and early postoperative morbidity between sublay and onlay mesh placement repair for incisional hernias with a diameter of less than 10 cm. According to their findings, the average intraoperative time for onlay and sublay repair was 88.1 ± 31.39 and 104.9 ± 39.41 minutes, respectively. An unpaired t-test revealed that it was statistically significant.

In contrast to these findings, **Saeed et al. [9]**, In a research including 80 patients with incisional hernias at two tertiary care facilities in Karachi, Pakistan, the sublay group's mean operating time was considerably shorter (83.5 minutes) than the onlay group's (104 minutes) ($p < 0.05$). Hernia recurrence was the main result of their study, which sought to assess repair outcomes. The onlay technique necessitates three additional time-consuming steps: extensive subcutaneous flap dissection, careful hemostasis following dissection, and mesh fixation over a larger surface area, according to the authors' explanation for this disparity. The degree of subcutaneous dissection necessary in their patient population, discrepancies in institutional mesh fixation techniques, and disparities in surgical experience could all account for this disparity. Surgeons with varying degrees of retrorectus dissection experience may have used the sublay approach in our situation, which could have increased the length of the procedure.

The much better postoperative pain profile in the sublay group across all evaluated time periods was one of the study's most striking findings. Pain scores assessed by the Visual Analogue Scale (VAS) were significantly lower in the sublay group at

day 1 (4.70 ± 0.76 vs. 6.10 ± 0.79, p < 0.001), 1 week (2.39 ± 0.75 vs. 3.99 ± 0.82, p < 0.001), 1 month (0.85 ± 0.74 vs. 2.41 ± 0.88, p < 0.001), 3 months (0.30 ± 0.49 vs. 1.41 ± 0.86, p < 0.001), 6 months (0.16 ± 0.36 vs. 1.02 ± 0.82, p < 0.001), and 12 months (0.14 ± 0.48 vs. 0.82 ± 0.86, p < 0.001).

This finding is consistent with the study by **Samee et al. [10]**, 100 patients with incisional hernias (50 each group) participated in a prospective randomized controlled trial from Pakistan. The purpose of their study was to compare onlay and sublay mesh repair in terms of operational results, postoperative pain, complications, and recurrence. Despite requiring a longer operating time (91 minutes vs. 52 minutes), they found that the sublay group had a considerably better postoperative pain profile and fewer wound problems than the onlay group.

Similarly, **Shah et al. [11]**, In their prospective comparison study from India, they found that the sublay group had lower mean VAS scores (4.2) than the onlay group (4.5), fewer infections (3.3% vs. 16.7%), less seroma development (6.7% vs. 20%), and no recurrence (6.7% vs. 6.7% in the onlay group).

In contrast to these findings, a retrospective comparative study conducted by **Hassan et al. [8]**, There was no statistically significant difference in postoperative pain measured by VAS at 48 hours between the two groups (5.18 ± 1.1 in onlay vs. 5.02 ± 1.08 in sublay, p > 0.05) among the 96 patients (50 onlay, 46 sublay). The purpose of their study was to compare postoperative problems for non-complex, small, and medium-sized incisional hernias between sublay and onlay treatment. The onlay group experienced severe pain (VAS > 5) more frequently (38%) than the sublay group (28.1%), the authors admitted.

The results of this study showed that the sublay group's mean hospital stay was substantially shorter (3.47 ± 1.11 days) than the onlay group's (4.40 ± 0.93 days) (p < 0.001). Additionally, the sublay group's mean time to resume regular activities was substantially shorter (21.53 ± 3.41 days) than the onlay group's (26.07 ± 4.73 days) (p < 0.001).

This finding is consistent with the study by **Reddy et al. [12]**, 50 patients (25 each group) with incisional hernias participated in this descriptive observational study from India. Their study compared the rates of recurrence, hospital stays, deep surgical site infection, and seroma formation between onlay and sublay mesh repair. With a mean hospital stay of 5.5 days in the sublay group and 7.0 days in the onlay group, they found that the sublay group's hospital stay was much shorter than the onlay group's.

Similarly, **Shah et al. [11]** reported a mean hospital stay of 6 days in the sublay group compared to 8 days in the onlay group..

KUMAR et al. [13], When 60 patients with ventral hernias were compared between onlay and sublay mesh procedures, the mean hospital stay was 6.2 ± 1.1 days for the sublay group and 8.1 ± 1.3 days for the onlay group (p = 0.001). Comparing clinical outcomes such as surgical time, SSI, seroma formation, drain duration, length of hospital stay, and recurrence was the goal of their study.

In contrast**, Ullah et al. [7]** reported no significant difference in the mean duration of hospital stay between the onlay group (4.2 ± 1.1 days) and the sublay group (4.0 ± 0.9 days) (p = 0.318).

Drains were placed in 63.3% of sublay patients and 83.3% of onlay patients in the current study, although this difference was not statistically significant (p = 0.144). The onlay group's mean drain removal day was 3.76 ± 1.67 days, whereas the sublay group's was 4.32 ± 1.53 days (p = 0.257).

In accordance, **Ullah et al. [7]** reported that closed-suction drains were placed primarily in patients with defects larger than 5 cm in both groups (18 in onlay, 16 in sublay), with drain removal once output was less than 30 mL in 24 hours.

In disagreement, **Hassan et al. [8]** revealed that the onlay group's drain was removed after 9–14 (6.02±1.38) days, but the sublay group's drain was removed after 2–6 (3.8±2.19) days (P=0.005).

The incidence of seroma (23.3% vs. 10.0%, p = 0.299), hematoma (6.7% vs. 3.3%, p = 1.000), and surgical site infection (SSI) (16.7% vs. 6.7%, p = 0.424) did not differ statistically significantly between the onlay and sublay groups. Although the sublay group continuously had lower absolute rates of these problems, the differences were not statistically significant.

This finding is consistent with **Pereira and Gururaj [14]**, who examined six RCTs with 986 individuals (503 onlay, 485 sublay). According to the meta-analysis, there was little heterogeneity (I^2 = 0%) and a substantial increase in seroma formation in the onlay group (odds ratio: 2.85, 95% CI: 1.74–4.67, p < 0.0001).

In agreement, **Reddy et al. [12]** reported seroma in 12% of onlay patients compared to 8% of sublay patients, with the difference reaching statistical significance, while **Shah et al. [11]** reported seroma rates of 20% in the onlay group against 6.67% in the sublay group.

The current study found that 16.7% of onlay patients and 6.7% of sublay patients had surgical site infections (SSI) (p = 0.424).

In a randomized controlled experiment from Pakistan with 78 patients (39 per group), **Khan et al. [15]** found that the sublay

group had a greater rate of wound infection (35.9%) than the onlay group (23.1%), but this difference was not statistically significant.

Ullah et al. [7] found a statistically significant difference in wound infection rates, with 22.9% in the onlay group and 8.3% in the sublay group (p = 0.049).

According to **Shah et al. [11],** the sublay group had substantially fewer SSIs (3.33%) than the onlay group (16.67%).

The sublay group had reduced SSI (4% vs. 8%), according to **Reddy et al. [12].**

The meta-analysis by **Shaukat et al. [16]**, which comprised six research with 468 patients, showed that, although statistical significance was not always attained across separate investigations, sublay repair was consistently linked to decreased incidence of SSI, seroma, and overall postoperative morbidity.

In the current investigation, hematoma formation was uncommon and similar between groups (6.7% onlay vs. 3.3% sublay, p = 1.000). According to **Pereira and Gururaj [14],** there was no discernible difference between the two methods in 11 cases of hematoma (OR: 2.13, 95% CI: 0.56–8.19, p = 0.27).

Three patients (10.0%) in the onlay group and one patient (3.3%) in the sublay group experienced hernia recurrence at 12 months in the current study. All 60 patients finished the 12-month follow-up, and this difference did not achieve statistical significance (p = 0.612).

This result is in line with **Pereira and Gururaj's [14]** analysis of six RCTs, which revealed no statistically significant difference in hernia recurrence between the onlay and sublay groups (OR: 1.3, 95% CI: 0.49–3.47, p = 0.60).

Similar to this, **Shaukat et al.'s [16]** meta-analysis from 2025 showed a similar trend of decreased recurrence rates in sublay mesh repairs across all included investigations, even though no single experiment reached statistical significance. While **Samee et al. [10]** found a difference of 3% against 8%, **Shah et al. [11]** showed nil recurrence in the sublay group compared to 6.67% in the onlay group. According to **Reddy et al. [12],** both groups had recurrence rates of 4%.

However, **Varanauskas and Brimas [17]** observed 0% recurrence for sublay against 3.1% for onlay, whereas **Gleysteen [18]** discovered a far lower recurrence rate in sublay repair (4%) compared to onlay repair (20%).

There are various limitations to the current investigation. The ability to identify notable variations in rare outcomes like complications and recurrence may have been hampered by the very small sample size. It's possible that late recurrences were missed throughout the 12-month follow-up period. Furthermore, the results may not be as broadly applicable due to the single-center design. Despite the use of objective outcome measures, bias may have been introduced due to the lack of blinding of patients and outcome assessors. Lastly, cost-effectiveness, patient happiness, and quality of life were not evaluated and ought to be taken into account in subsequent research.

CONCLUSION

For elective incisional hernia repair, our study showed that sublay (retrorectus) mesh repair provides notable clinical advantages over onlay mesh repair. Despite needing a slightly longer operating time, the sublay approach was linked to significantly lower postoperative pain scores at all measured time periods from day 1 through 12 months, a shorter hospital stay, and an earlier return to regular activity. Although statistical significance was not reached—possibly due to the small sample size—postoperative sequelae such as seroma, surgical site infection, and hematoma consistently indicated directional trends favoring sublay repair. The sublay group had a decreased 12-month hernia recurrence rate, but this difference was likewise not statistically significant. In carefully chosen individuals, sublay mesh repair should be the recommended method for elective incisional hernia repair because it provides the best possible balance of improved postoperative comfort, quicker recovery, and a favorable safety profile.

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