



2023

Section: General Surgery

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Moustafa, Magdy Mahmoud; Al-Mezaien, Osama Fathy; and Saed, Nasser Khaled Kareem (2023) "Efficacy of Prophylactic sub lay non-absorbable mesh positioning following midline laparotomy in a clean abdominal operations," *Al-Azhar International Medical Journal*: Vol. 4: Iss. 10, Article 2.

DOI: <https://doi.org/10.58675/2682-339X.1968>

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ORIGINAL ARTICLE

Efficacy of Prophylactic Sub Lay Nonabsorbable Mesh Positioning Following Midline Laparotomy in a Clean Abdominal Operations

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Abstract

Background: An incisional hernia is a common issue that arises after a midline laparotomy. The prevalence rate may be as high as 70% in some high-risk groups.

Aim and objectives: The research was conducted to determine how effective preventive sub lay mesh repair is for reducing the occurrence of midline incisional hernia following laparotomy in clean abdominal procedures.

Subjects and methods: General surgery wards of Al-Azhar University Medical Centers were used for this prospective randomised control trial. Thirty patients receiving midline laparotomy in clean fields participated in this research. One group (the Mesh group) underwent sub lay closure supported by nonabsorbable mesh, whereas the other group (the Control group) received main closure.

Results: In terms of VAS, there is no discernible difference among the 2 groups. The VAS also decreases significantly between 3 and 6 months post-op, in both groups.

We conclude that preventive sub lay mesh-augmented abdominal wall closure following laparotomy in hygienic wounds is not dangerous and beneficial in lowering the incidence of incisional hernia, however, this result was not statistically significant. It's possible that the consistency in care provided by having every patient treated by the same surgeon makes the current research more reliable.

Conclusion: Nevertheless, the present study's findings that prophylactic sub lay mesh-augmented abdominal wall closure following laparotomy in clean wounds is secure and beneficial in lowering the incidence of incisional hernia may not be statistically significant due to the small sample size.

Keywords: Eversion, Incisional hernia, Prevention, Prophylactic mesh, Prophylaxis, Prosthesis

1. Introduction

The midline incision provides quick access to the abdominal viscera while avoiding the critical structures that do not cross the midline. The Linea Alba is a vulnerable area because it is poorly vascularized and heals slowly. For abdominal organs like the tummy, intestines, gallbladder, liver, and colon, a midline incision is the way to go.¹

In the absence of a definitive diagnosis, an exploratory laparotomy may be performed through a long midline incision that avoids the umbilicus. After

the peritoneum has been opened and the cause of the patient's symptoms has been determined, the incision may be extended higher or lower.²

Incisional hernias and the abdominal wall closure method used to repair them are still a serious public health problem, resulting in substantial costs and medical complications.³

A life-threatening risk of abdominal surgery is an incisional hernia. There is a risk of incisional hernia of up to 70% following primary elective midline laparotomy.⁴

Incisional hernias can be caused by a number of factors, both medical and otherwise, including

Accepted 28 May 2023.

Available online 12 October 2023

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<https://doi.org/10.58675/2682-339X.1968>

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trauma to the incision site, improper surgical technique, and the presence of infection.⁵

To prevent an incisional hernia and restore abdominal wall integrity, surgeons have utilised a variety of suture closure (material and technique) and mesh reinforcement (position and form) strategies. The Rates of Return Nevertheless, these results are still subpar (12–54%), and patients who have returned are at risk for a never-ending cycle of morbidity because to the increasing technical challenges and risk of recurrence and morbidity associated with early subsequent repair.⁶

The incision and subsequent suture ought to extend at least four times longer than the incision itself; the European Hernia Society (EHS) recommends this ‘small-bites’ approach. Prophylactic mesh reinforcement during elective midline laparotomy in high-risk patients has little evidence supporting its utility.⁷

Mesh placement is another area that has received little research. Depending on whether it is placed in an on-lay, sub lay, or under-lay plane, the incidence of complications during abdominal wall closure varies. Patients’ needs are not adequately addressed in the current study on prophylactic mesh placement (PMP). With PMP, incisional hernias after surgery can be avoided altogether.⁸

2. Patients and methods

Prospective randomised control trial best describes the study design. The study lasted from January 25, 2023, to July 16, 2022, and it took place at the hospitals affiliated with Al-Azhar University. Patients who are having a midline laparotomy in sterile conditions.

Two groups were formed from the participants: Mesh group (Group 1): Group 2 (Control group): received a sub lay closure supported by nonabsorbable mesh, and -The initial closure stage has been completed successfully.

2.1. Inclusion criteria

Age: over 18 years, both sex (male and female) and Patients undergoing midline laparotomies in sterile areas at the Department of General Surgery.

2.2. Exclusion criteria

Patients who were younger than 18, were expecting a child, or were using immunosuppressants in the weeks leading up to surgery were excluded from the analysis. Contaminated and unsanitary bruises, Individuals who have undergone previous abdominal

surgery or who have hernias are not good candidates for a wound longer than 10 cm.

All patients were subjected to the following: Complete preoperative evaluation and surgical procedure (third-generation cephalosporin antibiotic prophylaxis, primary closure of midline laparotomy (control group), sub lay mesh-supported closure (mesh group), and cointerventions).

2.3. Statistical analysis

Data was collected, tabulated, and analysed using SPSS 22.0 for Windows (SPSS Inc., Chicago, IL, USA).

The Shapiro-Wilk test was performed to check the data’s normality of distribution. Frequencies and percentages were used to depict the qualitative data. χ^2 test and Fisher exact tests were employed to calculate the statistical significance of the differences found between the qualitative variables.

The middle and outer limits of the data set were displayed for parametric data sets, whereas the median and interquartile range were displayed for non-parametric data sets (Standard Deviation). We used the Independent *T* test to compare continuous variables with known distributions, and the Mann Whitney *U* test to compare categorical variables with unknown distributions.

All significance tests were done using two-tailed distributions. A *P* value < 0.05 is considered significant when comparing two groups, and a *P* value < 0.001 is reflected extremely significant.

3. Results

Table 1, Fig. 1.

Age Mean in control group was higher than mesh group. Also BMI Mean in control group was higher than mesh group Table 2.

The table presented that there is no significant difference among the 2 groups about comorbidities. Meanwhile, the most prevalent comorbid in both groups was smoking followed by HTN Table 3.

Table 1. Demographic characteristics among studied groups.

Variables	Mesh (n = 15)	Control (n = 15)	t/ χ^2	<i>P</i>
Age (years)				
Mean \pm SD	56.13 \pm 9.43	58.45 \pm 10.81	0.626	0.536
Sex				
Male	6 (40%)	7 (46.7%)	0.136	0.713
Female	9 (60%)	8 (53.3%)		
BMI (kg/m ²)				
Mean \pm SD	26.82 \pm 3.77	27.36 \pm 3.58	0.402	0.691

We found no significant difference amongst the 2 studied groups concerning age, and sex.

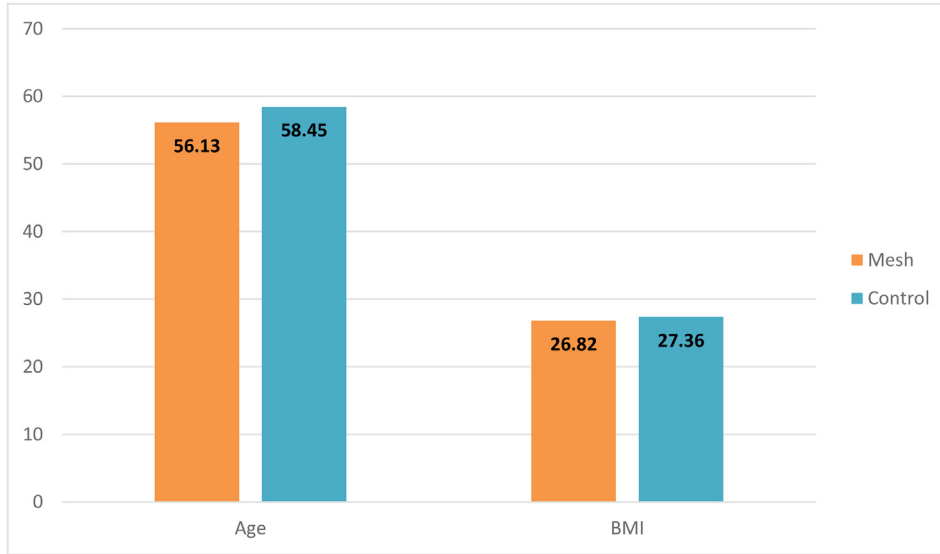


Fig. 1. Age and BMI among studied groups.

Table 2. Comorbidities distribution amongst the 2 considered groups.

Variables	Mesh (n = 15)	Control (n = 15)	χ^2	P
Smoking	8 (53.3%)	6 (40%)	0.536	0.464
DM	5 (33.3%)	4 (26.7%)	0.159	0.690
HTN	6 (40%)	4 (26.7%)	0.600	0.439
Cardiac diseases	1 (6.7%)	2 (13.3%)	0.371	0.543
COPD	2 (13.3%)	2 (13.3%)	–	1

This table demonstrates a significant difference between the studied groups in terms of the extended operative time for closure in the mesh group Table 4.

This table shows that Incidence of hernia was lesser between mesh group matched to control at 3 and 6 months postoperative but without statistically significant difference Table 5, Fig. 2.

This table demonstrate that there is no significant difference amongst the 2 studied groups regarding VAS. Moreover, there is a significant decrease in VAS from three-months to six-months postoperatively in groups Table 6, Fig. 3.

This fig showed that Seroma and Blood transfusion in mesh group had the highest percent.

Table 3. Operative and clinical data between the two studied groups.

Variables	Mesh (n = 15)	Control (n = 15)	t/ χ^2	P
Operative time (closure) (min)				
Mean \pm SD	20.53 \pm 4.73	13.75 \pm 6.11	3.4	0.002
Length of laparotomy (cm)				
Mean \pm SD	18.39 \pm 4.62	19.65 \pm 3.55	0.838	0.409
Stoma	1 (6.7%)	0	1.03	0.311
Hospital stay (day)				
Mean \pm SD	7.89 \pm 2.13	8.15 \pm 2.27	0.323	0.749

Table 4. Incidence of hernia among the two studied groups.

Variables	Mesh (n = 15) N (%)	Control (n = 15) N (%)	χ^2	P
3 months	0 (–)	1 (6.7%)	1.03	0.311
6 months	1 (6.7%)	2 (13.3%)	0.371	0.543

4. Discussion

During general abdominal surgery, incisional hernias (IH) are very common complications, happening in roughly 5%–20% of cases and up to 30% in high-risk populations.⁹ When a hernia is not treated, it can lead to pain, skin deterioration, and even intestine strangulation. In 2007 and 2011, there were approximately 470,000 IH repairs in the United States¹⁰

Key findings from this study included:

There were no statistically significant differences in age, sex, BMI, or comorbidities across the groups tested, allowing researchers to rule out the influence of these potential confounders. While HTN was the most common comorbidity in both groups, smoking was by far the most common comorbidity.

Prophylactic sub lay mesh was found to considerably increase operating time, as the mesh fixation

Table 5. Postoperative VAS between the two studied groups.

VAS	Mesh (n = 15)	Control (n = 15)	t	P
3-months Postoperative				
Mean \pm SD	1.26 \pm 0.381	1.03 \pm 0.365	1.84	0.077
6-months Postoperative				
Mean \pm SD	0.654 \pm 0.217	0.801 \pm 0.328	0.463	0.647
Pt test	<0.001	0.003		

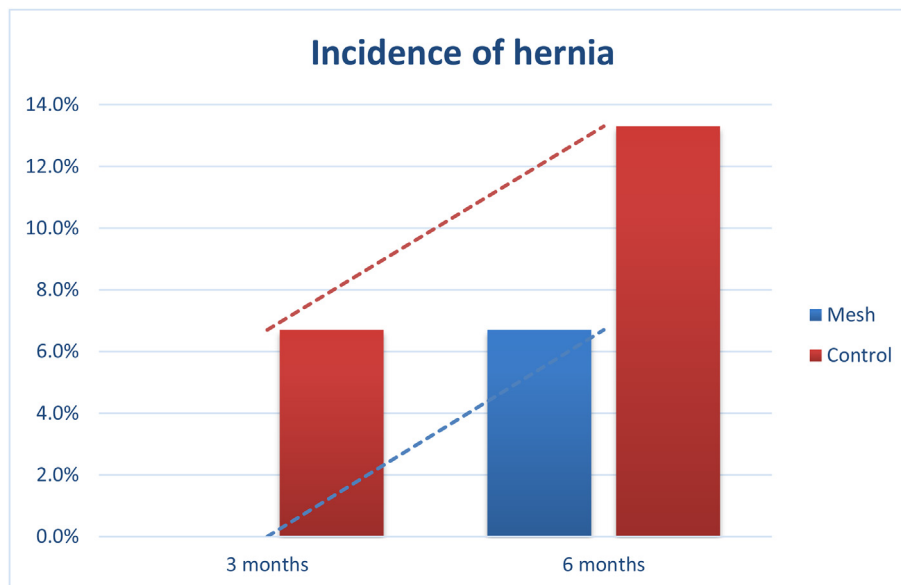


Fig. 2. Incidence of hernia among studied groups.

process required more time in the prophylactic sublay mesh group than in the suture only group.

The current study relied on the findings of a previous randomised controlled trial conducted by *Pizza et al.*,¹¹ which enrolled 100 patients in the mesh group and 100 cases in the control group to assess the risk of incisional hernia following urgent midline laparotomy for clean-contaminated surgery. In terms of age, gender, body mass index, and prevalence of comorbidities, there were no significant differences among the two groups; in both, smoking was the most common comorbidity, followed by diabetes. In line with our findings, the investigation found that the mesh group had significantly longer operational times.

In line with the results of the present investigation in a randomised trial, *Muysoms et al.*¹² enrolled 56 cases in the mesh group and 58 in the simple suture (control) group; Baseline characteristics were comparable across the two groups, including age, sex, body mass index, and comorbidities, the most prevalent of which were smoking and coronary

artery disease. It took longer to complete the operation and more time to seal the abdominal cavity in the mesh group, the study revealed.

This study reported that no statistically significant difference amongst the mesh group and the control group when it came to the duration of laparotomy and hospital stay.

Similar findings were found by *Pizza et al.*,¹¹ showing that the mesh group experienced non-significantly shorter laparotomy and hospital stay times.

Also, the present study is in line with previous research by *Muysoms et al.*,¹² which found that patients assigned to the mesh group had a shorter hospital stay.

*Timmermans et al.*¹³ found that there was also no statistically significant difference in the length of time cases spent in the hospital between the groups.

From their meta-analysis, *Ahmed et al.*¹⁴ also concluded that there was no statistically significant difference in hospital stay among the mesh and control groups.

No significant variations in stoma size or shape were detected across the research groups.

Importantly, *Pizza et al.*¹¹ observed no statistically significant variations in stoma across the groups they evaluated, lending credence to the consequences of the current investigation.

There were no statistically significant variations in stoma among the groups in the current investigation and the study by *Muysoms et al.*¹²

At 3 and 6 months after surgery, there was no statistically significant difference in the incidence of

Table 6. Postoperative complications among the two studied groups.

Variables	Mesh (n = 15) N (%)	Control (n = 15) N (%)	χ^2	P
Superficial infection	1 (6.7%)	1 (6.7%)	—	1
Deep infection	0 (—)	1 (6.7%)	1.03	0.311
Hematoma	1 (6.7%)	0 (—)	1.03	0.311
Seroma	2 (13.3%)	1 (6.7%)	0.371	0.543
Blood transfusion	2 (13.3%)	1 (6.7%)	0.371	0.543

This table shows that there is no significant difference amongst the groups as regards postoperative complications.

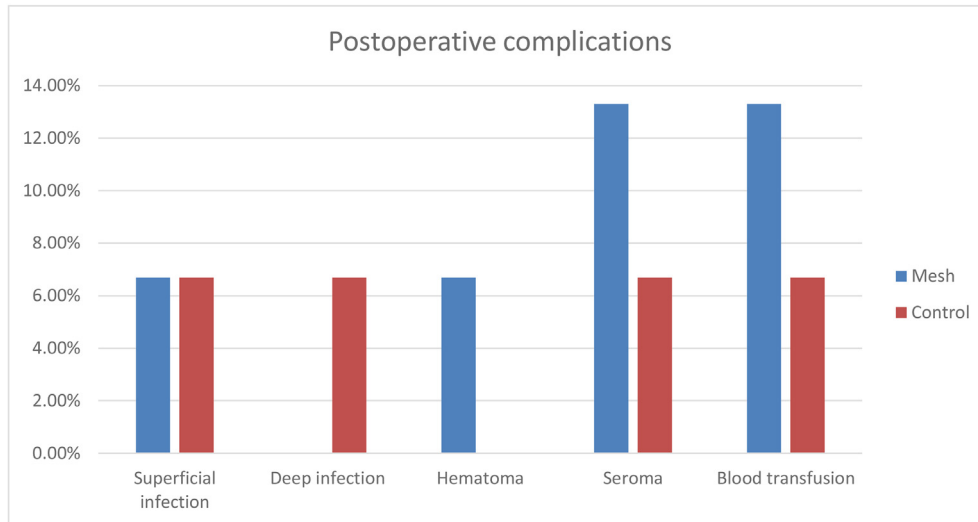


Fig. 3. Postoperative complications among studied groups.

hernias among the mesh group and the control group.

Dewulf *et al.*¹⁵ enrolled 33 cases in the no-mesh group (33/58, 56.9%) and 34 cases in the mesh group (34/56, 60.7%) in a prospective, multicenter, open-label, randomised design study, contradicting the current study's findings. As many as ten patients in each treatment group passed away between the 24- and 60-month follow-up periods. Incisional hernias (IHs) developed in 32.9% of patients in the no-mesh group after 24 months and 49.2% after 60 months. There were no inflammatory hematomas in the mesh group. Reoperation for an IH occurred in 21.7% (5/23) of the no-mesh group within 5 years. Differences in sample size, inclusion criteria, and operative details could account for the discrepancy.

In contrast to our findings, Pizza *et al.*¹¹ found that incisional hernias were more common in the control group than in the mesh group 24 months after surgery ($P = 0.002$). It's possible that this is because of the disparity in sample size and eligibility requirements. The study further validated the protective effect of mesh in a multivariate analysis (OR 0.11, 0.03 to 0.37; $P < 0.001$), whereas male sex (OR 8.52, 0.03 to 0.48; $P = 0.003$), diabetes mellitus (OR 13.04, 3.53 to 48.18; $P < 0.001$), and smoking (OR 33.97, 8.12 to 142.12; $P < 0.001$) were risk factors.

It was determined that there was no statistically significant difference in VAS at 3 and 6 months postoperatively between the two groups. Three to six months after surgery, the VAS reduces markedly in both groups.

Consistent with our findings, Pizza *et al.*¹¹ found that patients in both groups experienced modest postoperative discomfort 3 months after surgery (VAS score 1.0 in the control group against 1.2 in the

mesh group; $P = 0.105$) and 6 months after surgery (VAS score 0.8 versus 1.0; $P = 0.154$). At 24 months, no patient had experienced any postoperative pain, which had diminished by 12 months (0.12 versus 0.14; $P = 0.311$).

In addition, Muysoms *et al.*¹² found no statistically significant distinction among the groups in terms of the prevalence of persistent abdominal wall discomfort.

As stated by the outcomes of the current study, there were no statistically significant differences in the rates of postoperative complications among the groups.

Consistent with our findings, Pizza *et al.*¹¹ reported that no statistically significant difference in the rates of postoperative superficial infection, deep infection, hematoma, or blood transfusion among the groups compared. We found that subclinical wound seroma was recorded in one patient in the control group and seven cases in the mesh group, a statistically significant difference ($P = 0.030$).

4.1. Conclusion

We concluded that prophylactic sub lay mesh-augmented abdominal wall closure following laparotomy in clean wounds is safe and beneficial in lowering the incidence of incisional hernia may not be statistically significant due to the small sample size. It's possible that the consistency in care provided by having every patient treated by the same surgeon makes the current research more reliable.

The current study's limitations are its small sample size, single-center design, and short follow-up duration.

Consistent confirmation of our findings and the identification of risk factors for adverse events will

require larger, more carefully controlled comparative studies.

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Authorship

All authors have a substantial contribution to the article.

Conflicts of interest

The authors declared that there were no conflicts of interest.

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