

Safety of Onlay versus Sublay Mesh Hernioplasty in the Management of Umbilical and Paraumbilical Hernias: A Quasi-Experimental Study

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ABSTRACT

Objectives: To compare the outcomes of onlay versus sublay mesh hernioplasty for treatment of ventral hernia.

Study Design: Quasi-experimental study.

Place and Duration of Study: Department of General Surgery, PAF Hospital Mushaf, Sargodha Pakistan, from May 2023 to Aug 2024.

Methodology: One hundred fourteen patients with ventral (umbilical/para-umbilical) hernia were divided into Onlay group (A) and Sublay group (B). Outcomes were assessed and compared between the study groups. Data were analyzed using SPSS version 20.

Results: A total of 114 patients, divided into two groups of 57, were included. The mean age of patients was 37.20 ± 5.74 years. There were 21 (18.42%) male and 93 (81.58%) female patients. Mean duration of operation in group A and B was 90.90 ± 5.96 and 116.63 ± 3.72 minutes, respectively ($p < 0.001$). Mean hospitalization length was significantly shorter in the Sublay group ($p < 0.001$). No statistically significant difference was observed between groups in terms of frequency of surgical wound infection ($p = 0.142$), seroma formation ($p = 0.106$), persistent pain ($p = 0.509$) and hernia recurrence ($p = 0.113$).

Conclusion: Both techniques of mesh placement are effective, but the Sublay technique provides much better outcomes in terms of shorter stay at the hospital.

Keywords: Outcomes, Recurrence, Seroma, Surgical Wound Infection, Ventral Hernia.

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INTRODUCTION

Ventral hernia is an abnormal bulging of the intra-peritoneal structures into a sac formed by the weakening or a defect in the abdominal wall.¹ It encompasses umbilical and para-umbilical hernias located in the vicinity of the umbilicus, and their repair is one of the most widely performed surgical procedures across the globe.^{2,3} In most cases, patients undergo uneventful treatment, yet certain hernias get strangulated, leading to prolonged hospitalization and even death if not treated appropriately and promptly secondary to the development of peritonitis and acute abdomen.^{4,5}

The etiopathological process that drives the development of ventral hernias, as well as complicates their treatment course, is abnormally increased intra-abdominal pressure, the most common cause of which is excessive body mass index or obesity.⁶ This evident cause has been demonstrated in studies showing a much higher frequency of paraumbilical hernia in

obese patients as compared to those whose BMI falls within the healthy range.^{7,8} When it comes to treatment of umbilical and paraumbilical hernia, the only effective and definitive intervention is either open or laparoscopic surgical resection of the herniated sac, reduction of the herniated contents, and repair of the defect.⁹

There are different techniques for surgical repair of paraumbilical and umbilical hernias that have been described in the literature, among which two commonly used techniques are onlay and sublay. However, when it comes to the choice of surgical technique that can yield the best possible outcomes, it is not yet established.¹⁰ The present study was thus conducted to compare the outcomes of onlay versus sublay mesh repair of the umbilical and paraumbilical hernia. Results from this study will help establish the best surgical technique that can be adopted as standard of care in the treatment of these types of abdominal hernia.

METHODOLOGY

This quasi-experimental study was conducted at the Surgery Department, PAF Hospital Mushaf,

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Sargodha Pakistan, from May 2023 to Aug 2024 after taking approval from the ethical review board (ERB#: MSF(H)/308/3/2/Trg). To calculate the appropriate sample size for the study, the WHO sample size calculator for two population means was used, and the following formula was applied:

$$n = \frac{2\sigma^2(z_{1-\alpha/2} + z_{1-\beta})^2}{(\mu_1 - \mu_2)^2}$$

To calculate sample size, the following assumptions were taken: level of significance at 1%, power at 95%, anticipated mean hospitalization length after Onlay technique at 30.00±10.7 hours, and anticipated mean hospitalization length after Sublay technique at 24.00±0.00 hours.¹¹ Calculation gave the sample size of 114.

Inclusion Criteria: Patients of both genders, aged more than 18 years, who presented with ventral (umbilical/paraumbilical) hernia diagnosed by a combination of clinical examination and ultrasonography, having a size of 3-8 cm were included in the study.

Exclusion Criteria: Patients with incisional hernia, recurrent hernia, strangulated hernia, irreducible hernia, obstructed hernia, co-morbid conditions like diabetes, hypertension, pulmonary tuberculosis, lung fibrosis, chronic obstructive pulmonary disease, poorly controlled asthma and/or ischemic heart disease, hernia size >8cm or <3cm, and ASA status III or more were excluded from the study.

Selection of the study sample was done using a non-probability consecutive sampling technique. A written informed consent proforma was signed by all the patients before being made part of this study. Baseline demographic information of all the patients, including age, gender, body mass index (BMI), and ASA status, was documented. All the patients underwent standard pre-operative assessment for anesthesia fitness as per institutional protocol through routine blood investigations, hepatitis screening, electrocardiography (ECG), and chest X-ray (CXR). All the procedures were performed by a surgeon who has a minimum of three years of experience in this surgery. Dissection of the hernia sac and reduction of its contents was performed as per standard technique in all the patients.

After this, depending upon the medical registration (MR) number, patients were assigned either “sublay” or “onlay” technique of mesh placement. Fifty-seven patients with MR numbers

ending in an even number were placed in the “Onlay technique” group (A), in which non-absorbable mesh made of polypropylene (Prolene TM) was placed over the rectus sheath, after repair of the hernia defect, and was sutured with anterior rectus sheath using Prolene 2/0 sutures. Fifty-seven patients with MR numbers ending in an odd number were placed in the “Sublay technique” group (B), in which non-absorbable mesh made of polypropylene (Prolene TM) was placed and anchored in the space created posterior to the rectus muscle.

After mesh placement, abdominal closure was performed as per standard technique. Following the surgery whilst admission in the ward, all patients were administered with analgesia (injection paracetamol 1g IV eight hourly) and antibiotics (injection ciprofloxacin 0.2g IV twelve hourly). At discharge, patients were advised not to perform heavy lifting work and avoid straining. Outcome measures that were documented and assessed in the patients of both groups were duration of operation (in minutes), hospitalization length (in days), and occurrence of surgical wound infection. After 14 days of discharge from the hospital, patients were called for follow-up when they were assessed for seroma formation (defined as presence of fluid collection under the site of incision detected by ultrasound) and persistent pain (defined as pain visual analogue scale score >1). The second follow-up visit was set at nine months after surgery, when patients were assessed for recurrence of their repaired hernia.

Data were analyzed using Statistical Package for Social Sciences (SPSS) software version 20. Mean±SD was used to represent quantitative variables. Frequency and percentage were used to represent qualitative variables. To compare quantitative variables between groups, Independent Samples t-test was used. To compare qualitative variables between groups, the chi-square test was used. A *p*-value of ≤0.05 was considered statistically significant.

RESULTS

In this study, 114 patients with ventral (umbilical/para-umbilical) hernia were included in the study. The mean age of patients was 37.20±5.74 years. There were 21(18.42%) male and 93(81.58%) female patients. Mean body mass index (BMI) was 34.66±1.63 kg/m². In terms of ASA status, 96(84.21%) patients had ASA status I and 18(15.79%) patients had ASA status II. Comparison of baseline characteristics between study groups is given below in Table-I.

Table-I: Comparison of Baseline Characteristics Between Study Groups (n=114)

Characteristic	Study groups		p-value
	Onlay group-A (n=57)	Sublay group-B (n=57)	
Mean age	37.96±5.91 years	36.43±5.50 years	0.157
Gender			
Male	13(22.81%)	8(14.04%)	0.227
Female	44(77.19%)	49(85.96%)	
Mean BMI	34.46±1.69 kg/m ²	34.86±1.55 kg/m ²	0.194
ASA Status			
I	49(85.96%)	47(82.46%)	0.607
II	8(14.04%)	10(17.54%)	

*ASA - American Society of Anesthesiologists

Mean duration of operation in the Onlay group-A was 90.47±5.66 minutes, while in the Sublay group-B, it was 116.89±3.64 minutes ($p<0.001$). Mean hospitalization length in group A was 5.80±1.05 days, while in group B, it was 3.94±0.87 days ($p<0.001$). Frequency of surgical wound infection during hospital stay in group A (n=57) was 6(10.52%), while in group B (n=57), it was 2(3.51%) ($p=0.142$). These operative and immediate post-operative outcomes are given below in Table-II.

Table-II: Comparison Of Operative And Immediate Post-Operative Outcomes Between Study Groups (n=114)

Outcome	Study groups		p-value
	Onlay group-A (n=57)	Sublay group-B (n=57)	
Mean duration of operation	90.47±5.66 minutes	116.89±3.64 minutes	<0.001
Mean hospitalization length	5.80±1.05 days	3.94±0.87 days	<0.001
Surgical wound infection			
Yes	6(10.53%)	2(3.51%)	0.142
No	51(89.47%)	55(96.49%)	

At the 14-day follow-up visit, the frequency of seroma formation in group A (n=57) was 5(8.77%), while in group B (n=57), it was 11(19.30%) ($p=0.106$). Frequency of persistent pain in group A (n=57) was 15(26.32%), while in group B (n=57), it was 12(21.05%) ($p=0.509$). Comparison of these early post-operative outcomes at 14 days follow-up visit is given below in Table-III.

Table-III: Comparison Of Early Post-Operative Outcomes At 14 Days Follow-Up Visit Between Study Groups (n=114)

Characteristic	Study groups		p-value
	Onlay group-A (n=57)	Sublay group-B (n=57)	
Seroma			
Yes	5(8.77%)	11(19.30%)	0.106
No	52(91.23%)	46(80.70%)	
Persistent pain			
Yes	15(26.32%)	12(21.05%)	0.509
No	42(73.68%)	45(78.95%)	

At nine months follow up visit, the frequency of hernia recurrence in the Onlay group (A) was 8(14.04%), while in the Sublay group (B), it was 3(5.26%) ($p=0.113$). Comparison of frequency of hernia recurrence at 9 months follow-up between study groups is given below in Table-IV.

Table-IV: Comparison of frequency of hernia recurrence at 9 months follow-up between study groups (n=114)

Characteristic	Study groups		p-value
	Onlay group-A (n=57)	Sublay group-B (n=57)	
Recurrence			
Yes	8(14.04%)	3(5.26%)	0.113
No	49(85.96%)	54(94.74%)	

DISCUSSION

The findings of the present study clearly highlighted female predominance of ventral hernia, which has been reported in multiple studies. Umbilical and para-umbilical hernias are amongst the two most common types of ventral hernia that are encountered in the surgical outdoor department.¹² The present study focused on the surgical outcomes of these two types of ventral hernia when operated on either through "Onlay" or the "Sublay" mesh placement techniques. This predominance can be attributed not only to the natural difference in male and female muscular physiology of the abdomen but also to the increased risk of females having laxity in the integrity of their abdominal wall secondary to the pregnancies and cesarean sections they often undergo.¹³ In the present study, analysis of mean body mass index suggests that most patients who had ventral hernia had BMI ranging in the obese range. This can be attributed to a strong association of obesity and development of the ventral hernia.¹⁴

When it comes to comparison of "Onlay" and "Sublay" techniques, it was observed that the mean duration of operation was significantly shorter among patients who underwent "Onlay mesh hernioplasty" ($p<0.001$). This was similar to the finding of Heteta *et al.*, reporting "Onlay technique" to be associated with a much shorter duration of operation span as compared to "Sublay technique".¹⁵ In terms of mean hospitalization length, patients who underwent "Sublay mesh hernioplasty" stayed for a significantly shorter duration at the hospital ($p<0.001$). This shorter hospitalization length associated with "Sublay mesh hernioplasty" has been reported in multiple past studies.^{11,19} Contrarily, Ahmad *et al.*, reported significantly shorter hospitalization length in patients

who had “Onlay mesh hernioplasty,” which was opposite to the findings of the present study.¹⁶

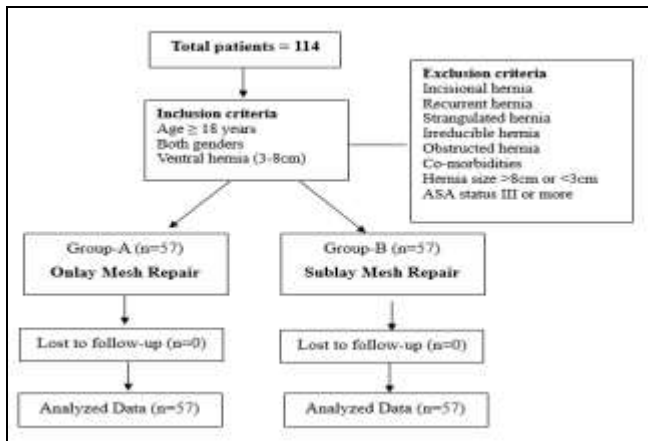


Figure: CONSORT Patient flow diagram

In terms of frequency of surgical wound infection ($p=0.142$), seroma formation (0.106), and persistent pain (0.509), no statistically significant difference was observed between the two techniques of mesh hernioplasty. This was similar to multiple previous studies.^{17,18} However, numerically, a higher number of patients developed surgical wound infection and persistent pain who had “Onlay mesh hernioplasty,” while the seroma formation rate was higher with “Sublay mesh hernioplasty,” as reported by Shi *et al.*¹⁹ This higher number of patients developing surgical wound infection after “Onlay mesh hernioplasty” has also been reported in study by Veilleux *et al.*²⁰ Shakeel *et al.*, found a higher frequency of surgical wound infection after “Sublay mesh hernioplasty”.²¹ Similarly, a higher frequency of seroma formation was observed without statistical significance with “Sublay mesh hernioplasty”, as reported in the present study, while, in contrast to the present study, Prakash *et al.*, have reported a higher frequency of seroma formation with “Onlay mesh hernioplasty”.²² In terms of recurrence of hernia, although the frequency was higher with “Onlay technique”, the difference was statistically insignificant ($p=0.113$). Similar findings have been observed in the literature showing lower recurrence rates with “Sublay technique”, while other studies reported in favor of “Onlay technique” in terms of a lower recurrence rate of hernia.

LIMITATION OF STUDY

Based on the results of the present study, it is evident that in most aspects, “Sublay mesh hernioplasty” is better than the “Onlay mesh hernioplasty”. However, whether it could be adopted as the standard of care is still a question to

be answered. Limited sample size was the main limitation of the present study, for which it is strongly recommended to conduct long-term follow-up studies with a much larger sample size in this regard.

CONCLUSION

Both techniques of mesh placement are effective, but the “Sublay technique” provides much better outcomes in terms of shorter stay at the hospital.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MZKN & SAA: Data acquisition, data analysis, critical review, approval of the final version to be published.

NT & MNBT: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

SRM & YW: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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