

## Study of Onlay versus Sublay Mesh Repair for Para-umbilical Hernia

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### ABSTRACT

**Objectives:** To compare the outcomes of Onlay versus Sublay mesh repair in para-umbilical hernia.

**Study Design:** Quasi-experimental study.

**Place and Duration of Study:** Pakistan Air Force Hospital Islamabad, Pakistan from Jul to Dec 2024.

**Methodology:** A total of 214 patients with para-umbilical hernia were divided into Group-A (Onlay mesh repair) and Group-B (Sublay mesh repair) according to the medical registration numbers of the patients without randomization. Outcomes were assessed and compared between the study groups to determine better surgical option. Data was analyzed using SPSS version 20.

**Results:** A total of 214 patients were included who were divided into two groups of 107 each. Median age of patients was 37.00 (29.00 – 50.00) years. There were 39(18.22%) male and 175(81.78%) female patients. Median BMI was 34.70 (31.80 – 37.70) kg/m<sup>2</sup>. Frequency of surgical wound infection during hospital stay in Group-A was 9(8.41%) while in Group-B, it was 2(1.87%), ( $p=0.030$ ). Frequency of seroma formation Group-A was 7(6.54%) while in Group-B, it was 16(14.95%), ( $p=0.047$ ). Frequency of persistent pain in Group-A was 20(18.69%) while in Group-B, it was 9(8.41%), ( $p=0.028$ ).

**Conclusion:** Sublay mesh repair is a better and safer option compared to Onlay mesh repair in management of para-umbilical hernia.

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

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### INTRODUCTION

Ventral hernia occurs due to defect in the abdominal wall.<sup>1</sup> Para-umbilical hernia is a type of ventral hernia which is in the vicinity of umbilicus and its repair is among most widely performed surgery globally.<sup>2,3</sup> Most patients have an uneventful surgery, however, in some cases hernia can become strangulated resulting in an increased risk of developing acute abdomen, ischemic damage to the organs and subsequently peritonitis which results in hospitalization and even death in some cases.<sup>4,5</sup>

The etiological process that leads to this type of hernia is the abnormally raised intra-abdominal pressure primarily due to obesity<sup>6</sup> as shown by studies which have revealed a significantly higher incidence of para-umbilical hernias in obese patients as compared to patients who have a normal BMI.<sup>7,8</sup> The only effective and definitive intervention for the treatment of para-umbilical hernia is either open or laparoscopic surgical resection of the herniated sac, reduction of the herniated contents and repair of the defect.<sup>9</sup>

Various methods of placement of mesh during

the surgical repair of para-umbilical hernia have been described in literature but the two most frequent methods are Onlay and Sublay mesh placement techniques. However, no concrete evidence exists to answer an important research question that which amongst these two mesh placements surgical technique can provide the best result.<sup>10</sup> This study was thus conducted with the aim to compare the outcomes of Onlay versus Sublay mesh placement technique used for the repair of para-umbilical hernia including length of surgery, hospitalization length, surgical wound infection during their stay at hospital, seroma formation, persistent pain and hernia recurrence. The results from this study will assist in finding out the best technique for placement of mesh while repairing para umbilical hernia that may be adopted as standard of care at the institutional as well as regional level.

### METHODOLOGY

This quasi-experimental study was conducted at Pakistan Air Force Hospital Islamabad, Pakistan from July 2024 to December 2024 after taking the approval from ethical review board (ERB#: FPGMI/100372/3/Org; dated: 13/06/2024).

**Inclusion Criteria:** Patients of both genders, aged more than 18 years, who presented with paraumbilical hernia having a size of 3-8cm were included in the study.

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

To calculate appropriate sample size for this study, WHO sample size calculator for two population means was used. To calculate sample size following assumptions were taken: level of significance at 5%, power at 80% and anticipated frequencies of surgical wound infection by Onlay and Sublay mesh placement technique at 16.87% and 4.82%, respectively.<sup>11</sup> Calculation gave the sample size of 214 (107 in each group).

In this study, non-probability consecutive sampling technique was used to select the study sample. A written informed consent proforma was signed by all the patients before including them in this study. Baseline demographic information of all the patients including age, gender, body mass index (BMI) and American Society of Anesthesiology (ASA) status was documented. All the patients went through standard pre-operative assessment for anesthesia fitness as per institutional protocol. All the procedures were done by surgeon who had a minimum three years of experience in surgery. The hernia sac was dissected and its content reduced in all the patients as per the standard technique.

After this depending upon the medical registration (MR) number patients were assigned to either group. Patients with MR number ending at an even number were placed in Group-A in which a non-absorbable mesh made of polypropylene (Prolene TM) was placed over the rectus sheath after repairing the hernia defect and was sutured with anterior rectus sheath using Prolene 2/0 sutures - the Onlay technique of mesh placement. Patients with MR number ending at an odd number were placed in Group-B in which a non-absorbable mesh made of polypropylene (Prolene TM) was placed and anchored in the space created posterior to the rectus muscle - the Sublay mesh placement technique. A CONSORT flow diagram of patient selection allocation and follow up is given below in figure which demonstrates the whole process.

Abdominal closure was performed as per the routine institutional surgical practices after mesh placement. Analgesia (injection Ketorolac 30mg IV 12 hourly) and antibiotics (injection Ciprofloxacin 200mg IV 12 hourly) were given to all patients during the period of admission in the ward after surgery. Patients were told at the time of discharged to avoid lifting heavy objects and not to strain.

Outcome measures that were documented and assessed in the patients of both groups were length of surgery, hospitalization length and surgical wound infection during their stay at hospital. At first follow up scheduled at two weeks after surgery, patients 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). At second follow up scheduled at three months after surgery, patients were assessed for hernia recurrence.

Statistical analysis of the collected data was performed by the Statistical Package for Social Sciences (SPSS) software version 20. To check whether the quantitative data was distributed normally or not, Shapiro-Wilk test was used which showed that age, BMI, length of surgery and hospitalization was not distributed normally and was therefore presented as median interquartile range (IQR). For representing quantitative data frequency and percentage were utilized. To compare length of surgery and hospitalization length between groups, Mann Whitney was used. To compare frequency of surgical wound infection, seroma, persistent pain and recurrence, Chi-square test was used. A difference

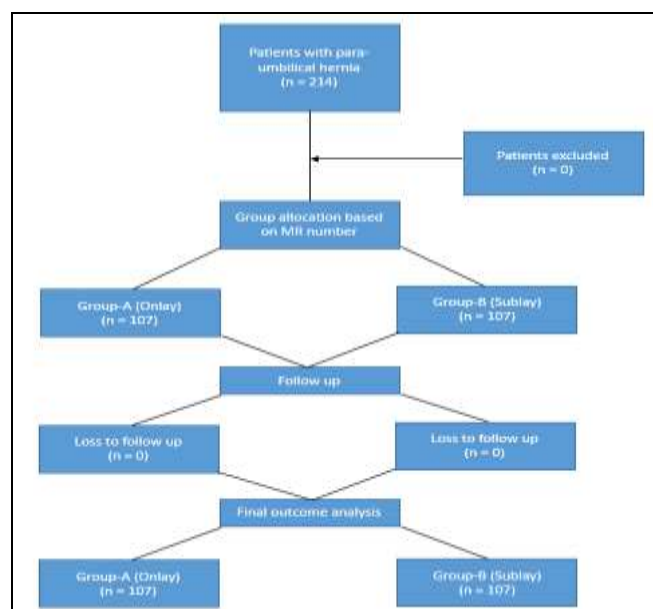


Figure: CONSORT patient flow diagram (n=214)

between groups generating a  $p$ -value of  $\leq 0.05$  was considered statistically significant.

## RESULTS

In this study, 214 patients were included. Median age of patients was 37.00 (29.00 - 50.00) years. There were 39(18.22%) male and 175(81.78%) female patients. Median BMI was 34.70 (31.80 -37.70) kg/m<sup>2</sup>. In terms of ASA status, 183(85.51%) patients had ASA status I and 31(14.49%) patients had ASA status II. Comparison of baseline characteristics between study groups is given below in Table-I.

**Table-I: Comparison of Baseline Characteristics among Study Groups (n=214)**

| Characteristic(s) | Study groups                         |                                      | p-value |
|-------------------|--------------------------------------|--------------------------------------|---------|
|                   | Group-A (n=107)                      | Group-B (n=107)                      |         |
| Median age        | 39.00(29.00-50.00) years             | 34.00(30.00-50.00) years             | 0.016   |
| Gender            |                                      |                                      |         |
| Male              | 24(22.43%)                           | 15(14.02%)                           | 0.111   |
| Female            | 83(77.57%)                           | 92(85.98%)                           |         |
| Median BMI        | 34.60(31.80-37.70) kg/m <sup>2</sup> | 34.70(32.20-37.70) kg/m <sup>2</sup> | 0.243   |
| ASA Status        |                                      |                                      |         |
| I                 | 95(88.79%)                           | 88(88.24%)                           | 0.174   |
| II                | 12(11.21%)                           | 19(17.76%)                           |         |

BMI = Body mass index; ASA = American association of anesthesiology; kg = kilograms, m<sup>2</sup> = meters squared

Frequency of surgical wound infection during hospital stay in Group-A (n=107) was 9(8.41%) while in Group-B (n=107), it was 2(1.87%), ( $p=0.030$ ). Comparison of intra-operative and immediate post-operative outcomes between groups is given below in Table-II.

**Table-II: Comparison of Operative and Immediate Post-Operative Outcomes Between Study Groups (n=214)**

| Outcome(s)                    | Study groups                |                               | p-value |
|-------------------------------|-----------------------------|-------------------------------|---------|
|                               | Group-A (n = 107)           | Group-B (n = 107)             |         |
| Median length of surgery      | 89.00(81.00-102.00) minutes | 117.00(109.00-122.00) minutes | <0.001  |
| Median hospitalization length | 6.00(4.00-7.00) days        | 4.00(3.00-6.00) days          | <0.001  |
| Surgical wound infection      | 9 (8.41%)                   | 2(1.87%)                      | 0.030   |

At two weeks follow-up visit, frequency of seroma formation Group-A (n=107) was 7(6.54%) while in Group-B (n=107), it was 16(14.95%), ( $p=0.047$ ). Frequency of persistent pain in Group-A (n=107) was 20(18.69%) while in Group-B (n=107), it was 9(8.41%), ( $p=0.028$ ). Comparison of these early post-operative outcomes at 2 weeks follow up visit is given below in Table-III.

At three months follow up visit, frequency of hernia recurrence in Group-A (n=107) was 3(2.80%) while in Group-B (n=107), it was 1(0.93%), ( $p=0.313$ ). Comparison of frequency of hernia recurrence at 3

months follow up between study groups is given below in Table-IV.

**Table-III: Comparison of Early Post-Operative Outcomes at 2 Weeks Follow Up Visit Between Study Groups (n=214)**

| Characteristic(s) | Study groups      |                 | p-value |
|-------------------|-------------------|-----------------|---------|
|                   | Group-A (n = 107) | Group-B (n=107) |         |
| Seroma            | 7(6.54%)          | 16(14.95%)      | 0.047   |
| Persistent pain   | 20(18.69%)        | 9(8.41%)        | 0.028   |

**Table-IV: Comparison of Frequency of Hernia Recurrence At 3 Months Follow Up Between Study Groups (n=214)**

| Characteristic | Study groups    |                 | p-value |
|----------------|-----------------|-----------------|---------|
|                | Group-A (n=107) | Group-B (n=107) |         |
| Recurrence     |                 |                 |         |
| Yes            | 3(2.80%)        | 1(0.93%)        | 0.313   |
| No             | 104(97.20%)     | 106(0.93%)      |         |

## DISCUSSION

Para-umbilical hernia is one of the most common types of ventral hernia encountered in the surgical outdoor department.<sup>12</sup> Present study focused on determining the better mesh placement technique between Onlay and Sublay while surgically repairing hernia of the para-umbilical region. Upon analysis of the gender distribution of the hernia, it was observed that most patients of hernia who were operated upon were females. Consistent with our findings, Oma et al. reported majority of patients with hernia of the abdominal wall were of female gender constituting 59% of the study population.<sup>13</sup> Similarly, in another study conducted by Ullah *et al.*, it was found that amongst all the cases of paraumbilical hernia, women constituted 62% of the patients exhibiting a clear female predominance over men.<sup>14</sup> This predominance can be attributed to the natural differences in male and female abdominal muscular physiology combined with higher risks of abdominal wall laxity in women after pregnancies and cesarean sections.<sup>15,16</sup> Upon analysis of body mass index of the hernia patients that were included in present study, it was observed that most patients who had para-umbilical hernia had BMI ranging in obese range. This can be attributed to a strong association of obesity and development of the para-umbilical hernia secondary to persistently raised abdominal pressure that puts strain on the abdominal musculature contributing to its progressive weakening.<sup>17,18</sup>

When it comes to comparison of the two mesh placement techniques, it was observed that Onlay technique significantly shortened the length of surgery ( $p<0.001$ ). Similar to this, Heteta *et al.*, reported much

shorter surgery length when mesh was placed by using Onlay technique ( $p<0.001$ ).<sup>19</sup> On the other hand, hospitalization length was significantly shortened by using Sublay mesh placement technique ( $p<0.001$ ). This shorter hospitalization length may be associated with lower frequency of complications associated with this technique that may prolong the need to remain admitted at hospital. Similar to the finding of present study, Heteta *et al.*, also reported shortened hospitalization length with Sublay technique<sup>19</sup> Contrarily, Ahmad *et al.*, reported significantly shorter hospitalization length with the Onlay method of mesh placement rather than the Sublay method.<sup>20</sup>

Regarding safety analysis in terms of frequency of complications, Sublay mesh placement was found to be much safer compared to Onlay technique since the frequencies of various complications were significantly less with the former technique including surgical wound infection ( $p=0.030$ ) and persistent pain ( $p=0.028$ ). Similar to this trend, Zia *et al.*,<sup>11</sup> reported higher infection rates ( $p=0.042$ ) and pain ( $p=0.0001$ ) with Onlay method while Shakeel *et al.*,<sup>21</sup> and Ismail *et al.*,<sup>22</sup> found higher frequency of surgical wound infection in Sublay rather than Onlay mesh placement. In terms of seroma formation, significantly higher frequency was observed in Sublay group ( $p=0.047$ ). Similar to this, Prakash *et al.*,<sup>23</sup> found higher seroma frequency in Onlay group. Opposite to present study in this regard, however, higher frequency of seroma formation in Onlay group was reported by Heteta *et al.*,<sup>19</sup> In terms of recurrence of hernia, the overall frequency was not only very low but the difference between the two techniques was statistically insignificant ( $p=0.313$ ) which may be attributed much shorter follow up period.

Based on the results of present study, it is evident that in majority of aspects, Sublay rather than Onlay technique of placing mesh while performing para-umbilical hernioplasty is better and safer option and it is strongly recommended to be adopted as a preferred methodology of mesh placement while repairing para-umbilical hernia.

#### LIMITATION OF STUDY

Short follow up period was the only limitation of present study.

#### CONCLUSION

For management of para-umbilical hernia Sublay mesh placement is a better and safer technique compared to Onlay mesh placement as it is associated with lesser complication rate and shorter hospitalization length.

**Conflict of Interest:** None.

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#### Authors' Contribution

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

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

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

RA & SS: 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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