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### Comparative Review of Outcomes: On-lay versus sub-lay Mesh Repair in Ventral Abdominal Hernias

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#### Abstract

**Objective:** The following study has been conducted to define the post-operative outcomes of patients undergoing mesh hernioplasty with both on-lay and sub-lay techniques in ventral abdominal hernias.

**Study Design:** Randomized control Trial.

**Study Setting:** Department of Surgery, Khyber Teaching Hospital Peshawar.

**Duration of Study:** 1<sup>st</sup> August 2022 till 30<sup>th</sup> August 2023.

**Subject and Methods:** Patients were divided into two groups, A and B, using stratified randomization. Group A patients had on-lay repair done compared with group B where sub-lay technique was employed during mesh hernioplasty. Post-operative outcome assessment included surgical site infection (SSI) on the 7<sup>th</sup> day follow up in OPD.

Data was collected by filling proformas, put into Microsoft excel sheet and transferred to SPSS version 23 for analysis.

**Results:** Patients were followed in the OPD on 7<sup>th</sup> post op day and it was observed that a total of 12 of patients had evidence of surgical site infection for both group A and B combined (10%) out of which 8 (6.67%) were in the on-lay group and 4 (3.33%) were in the sub-lay group. Post stratification chi-square test findings given in the description below.

**Conclusion:** Despite having a relatively higher number of SSIs in the on-lay group, the results depict no significant difference between the two techniques to provide convincing evidence as to which procedure is better.

**Keywords:** On-lay Repair, Sub-lay Repair, Mesh Hernioplasty

#### 1. Introduction

A hernia is an abnormal protrusion of tissue or an organ, specifically the bowel, through a weakness in the abdomen in the wall of its containing cavity<sup>[1]</sup>. Hernias often develop in the abdomen between the chest and the hips but they can also occur in the upper thigh and groin areas<sup>[2]</sup>. Most of the time patients are asymptomatic and the only complaint is the feeling of a lump or a swelling in the abdominal wall with a dragging sensation. The lump, if reducible, disappears with rest and re-appears with physical exertion such as during exercise and coughing<sup>[3]</sup>.

Ventral hernia is a broad term that mostly includes para umbilical hernias and epigastric hernias. They are the most common elective surgical conditions being frequently operated in the surgical wards worldwide<sup>[4]</sup>. The two surgical approaches to the management of a hernia are open surgery and minimally invasive surgery, both employing the placement of a non-absorbable synthetic mesh to strengthen/cover the hernial defect by means of a fibrous reaction in the tissues and reduce the chance of hernia recurrence<sup>[5]</sup>. The mode of mesh placement is largely dependent upon the surgeon's preference; however, the three most common open surgical techniques are on-lay (on top of the defect) sub-lay (below the defect in the retro-muscular space and in-lay (in between the defect)<sup>[6]</sup>.

The incidence of post-operative complications comparing on-lay versus sub-lay mesh hernioplasty is still a matter of constant debate and research in terms of deciding the optimal method of mesh placement [7]. The on-lay approach is favored by most surgeons because its relatively easy and straightforward while the sub-lay technique is more complex and time consuming since it requires extensive and fine dissection in the retro-muscular plane [8]. However, the main advantage of the sub-lay approach is low rate of hernia recurrence [9]. This aim of this study is to compare the outcome of on-lay and sub-lay mesh repair in ventral abdominal hernias in terms of surgical site infections.

## 2. Methodology

This randomized controlled trial was conducted in Khyber teaching hospital Peshawar from 1<sup>st</sup> August 2022 till 30<sup>th</sup> August 2023. The sample size chosen for this study was 120 patients (60 patients in group A and 60 patients in group B divided through stratification method) by applying 95% confidence interval, and 80% power of the test. Non-probability consecutive sampling technique was used.

### Data Collection:

The study began after taking proper approval from the hospital ethical and research committee. Participants who met the inclusion criteria were enrolled after taking complete informed consent. There admission was facilitated through OPD and they were referred to ward for further pre-operative assessment. They were made aware of the aim and purpose of the study and reassured that it was being carried out solely for research and analysis.

The patients were categorized in two groups through stratified randomization. Group A (on-lay technique) and Group B (sub-lay technique). All patients were subjected to spinal anesthesia and the pre-operative antiseptic and draping methods were kept the same for both groups. Only patients with para umbilical and epigastric hernias were included in the study and those with incarcerated and strangulation were excluded. The procedures were performed by consultants registered with the college of physicians and surgeons (CPSP). Injection 500 gm Amikacin was used as per -operative antibiotic. As per protocol, on-lay mesh was placed on top of the defect to cover it while sub-lay mesh was anchored in the preperitoneal plane through fine dissection. A standard Ethicon proline mesh (size 15\*15) was utilized. The mesh was fixed using Ethicon polypropylene 2/0 round body suture. Hemostasis was secured and wound was closed over a suction drain. The time taken throughout the surgical procedures was recorded and all the patients were given 2 gm injection sulzone (cefoperazone and sulbactam) twice daily for 2 days in the post operative period. Factors such as mean operative time and pain was recorded for the purpose of data collection. In the OPD follow up after 7 days surgical site infection (SSI), if present, was documented. Patients were properly counselled regarding avoidance of physical activity and daily wound dressing and discharged with tablet Ciproxin 500mg twice daily for 5 days.

### Data Analysis:

Data was analyzed by using a statistical software SPSS version 23.0. Continuous variables i.e., age and mean operative time were calculated as Means  $\pm$  Standard deviation. Categorical variables i.e., gender, technique of

mesh fixation, and surgical site infections were analyzed as proportions. Outcomes were stratified with age, gender and technique of mesh fixation in both groups and students T test was applied to control the confounders and assumptions. P value of  $\leq 0.05$  was considered significant. All the results were presented in the form of description and tables.

## 3. Results

The mean age of the patients was 36.63 years  $\pm$  12.1 and the mean BMI was 29.6  $\pm$  3.6. The Mean duration of surgery was 56.12  $\pm$  5.2 mins. In terms of the type of hernia, equal number of patients had paraumbilical and epigastric hernias (60 each). Male patients were 45 in number (37.5) while 75 subjects were females (62.5%). Patients were followed in the OPD on 7<sup>th</sup> post op day and it was observed that a total of 12 of patients had evidence of surgical site infection for both group A and B combined (10%) out of which 8 (6.67%) were in the on-lay group and 4 (3.33%) were in the sub-lay group. Surgical site infection was compared with the type of procedure, duration of the procedure, age of the patients and the gender.

Post stratification chi-square test revealed the following results: SSI with gender (p-value 0.346), SSI with age (p-value 0.424), SSI with type of procedure (p-value 0.951) and SSI with duration of procedure (p-value 0.891). The data has been depicted in the table below.

**Table 1:** Demographics and statistical correlation

Variable	Mean	Frequency	Percentages	Standard deviation	P-value
Age	36.6	*	*	12.1	0.424
Gender	*	Male:45 Female:75	37.5% 62.5%	*	
Group	*	A:60 B:60	50% 50%	*	0.951
Duration of procedure	56.12	*	*	5.2	0.891
SSI (on-lay)	*	8	6.67%	*	0.346
SSI (sub-lay)	*	4	3.33%	*	0.346
BMI	29.6	*	*	3.6	*

\*Detailed statistical analysis present in SPSS output sheet.

## 4. Discussion

There has been a lot of debate in the last two decades regarding the choice of mesh placement techniques and up-till now five methods have been defined in literature: On-lay, sub-lay, in-lay, IPOM (intra-peritoneal on-lay mesh) and the recently introduced minimally invasive total extraperitoneal repair (TEP) and transabdominal preperitoneal repair (TAPP). What varies between these approaches is the type of mesh being used and the plane in which the mesh is placed. On-lay mesh repair is technically easier to perform as it involves dissection down to the anterior abdominal defect, on top of which the mesh is secured [10]. Mesh placement in the preperitoneal, retro muscular sub-lay position with overlapping the hernia defect in all directions was introduced in the late 1980s [11].

On-lay mesh repair involves creating a space in the fats and subcutaneous fascia above the anterior rectus sheath. This technique involves cauterization of blood vessels and raising subdermal tissue planes hence creating a potential space which leads to collection and formation of seroma [12]. During sub-lay repair, after meticulous dissection, a space is also created between the rectus muscle and the posterior rectus sheath. Since the space is less, the amount of seroma formation is controlled and the lymphatics help to drain the

collection effectively. These findings are supported by multiple studies: Aoda FS *et al*<sup>[13]</sup> and Haytham MA<sup>[14]</sup> have chosen the sub-layer technique to be superior as far as seroma formation is concerned.

Reports from previous trials have mentioned two drawbacks for the sub-layer group with convincing evidence: A relatively longer duration of surgery<sup>[15-16]</sup> inadvertently related to more anesthesia and period of intubation along with chances of hematoma formation<sup>[17]</sup>. A systemic review has reported 11 cases of hematomas in the sub-layer group owing to the rich vascular network in the preperitoneal plane however the difference was not significant<sup>[18]</sup>.

Lastly, as far as surgical site infection is concerned, our study illustrated a total of 12 patients who had evidence of surgical site infection (SSI) for both group A and B combined (10%) out of which 8 (6.67%) were in the on-layer group and 4 (3.33%) were in the sub-layer group. In accordance with our findings, SSI is regarded as the most common complication of on-layer mesh maneuver, with a reported incidence of 6-12%<sup>[19]</sup>. Similarly, one RCT at Jinnah Medical and Dental College Karachi reported wound infections hitting 14(28%) patients in on-layer group compared to 6(12%) in sub-layer group (p=0.04). However, there are several RCTs supporting the fact that there are no statistically significant changes in wound infection rates between the two techniques: Rashid *et al*<sup>[20]</sup>, Gulen Cicek Okuyan *et al*<sup>[21]</sup> and Jat MA *et al*<sup>[22]</sup>.

## 5. Conclusion

The objective of the current study was to compare mesh repair with on-layer and sub-layer technique in ventral abdominal hernias with respect to surgical site infection as a post-operative complication. According to the obtained results, we cannot conclude for sure which method is the standard technique of mesh hernioplasty, however infection rates were slightly higher with the on-layer technique. Despite being the procedure of choice as far as surgeons' preference is concerned, we may see an increasing trend towards the sub-layer technique in the near future. Further multicentric trials are needed to support this conclusion.

## 6. Funding

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## 7. Conflict of Interest

The authors hold no conflict of interest.

## 8. References

1. Fitzgibbons RJ, Forse RA. Clinical practice. Groin hernias in adults. *The New England Journal of Medicine*. February 2015; 372(8):756-763. Doi: 10.1056/NEJMcpl404068. PMID 25693015.
2. <https://www.healthline.com/health/hernia#What-is-a-hernia?>
3. <https://www.nhs.uk/conditions/hernia/>
4. Malik AM. Laparoscopic versus open repair of para-umbilical hernia. Is it a good alternative? *J Pak Med Assoc*. 2015; 65(8):865-868.
5. See CW, Kim T, Zhu D. Hernia mesh and hernia repair: A review. *Eng Reg*. 2020; 1:19-33.
6. Alimi Y, Merle C, Sosin M, Mahan M, Bhanot P. Mesh and plane selection: A summary of options and outcomes. *Plast Aesthet Res*. 2020; 7:5-10
7. Forbes SS, Eskicioglu C, McLeod RS, Oakrainec A. Meta-analysis of randomized controlled trials comparing open and laparoscopic ventral and incisional hernia repair with mesh. *Br J Surg*. 2009; 96:851-8.
8. Strâmbu V, Radu P, Brătucu M, Garofil D, Iorga C, Iorga R, *et al*. Rives technique, a gold standard for incisional hernias - our experience. *Jan-Feb;108(1):46-50. Chirurgia (Bucur)*, 2013.
9. Petro CC, Posielski NM, Raigani S, Criss CN, Orenstein SB, Novitsky YW. Risk factors for wound morbidity after open retromuscular (sublay) hernia repair. *Surgery*. 2015; 58(6):1658-68. Doi: 10.1016/j.surg.2015.05.003. [Epub ahead of print]
10. Lindmark M, Strigård K, Löwenmark T, Dahlstrand U, Gunnarsson U Risk factors for surgical complications in ventral hernia repair. *World J Surg*. 2018; 42:3528-3536.
11. Goda El-Santawy HM, El-Sisy AA, El-Gammal AS, El-Kased AF, Sultan HM. Evaluation of retromuscular mesh repair technique for treatment of ventral incisional hernia. *Menoufia Med J*. 2014; 27:226-229.
12. White TJ, Santos MC, Thompson JS. Factors affecting wound complications in repair of ventral hernias. *Am Surg*. 1998; 64:276-280. <https://pubmed.ncbi.nlm.nih.gov/9520825/#:~:text=Wound%2Drelated%20complications%20are%20common,%20incidence%20of%20these%20complications.>
13. Aoda FS, Ibrahim AS. Sublay versus onlay mesh repair of ventral hernia. *QMJ*. 2013; 9(16):208-213
14. Haytham MA, Hur K, Hirter A, Kim LT, *et al*. Seroma in ventral incisional herniorrhaphy: Incidence, predictors and outcome. *Am J Surg*. 2009; 198:639-644.
15. Aly Saber, Emad K. Bayumi. Onlay Versus Sublay Mesh Repair for Ventral Hernia. *Journal of Surgery. Special Issue: Abdominal Surgery: Toward the Best*. 2015; 4(1-1):1-4. Doi: 10.11648/j.js.s.2016040101.11
16. Oh T, Hollands MJ, Langcake ME, Parasyn AD. Incisional hernia repair: A Retrospective review and early experience of laparoscopic repair. *Surgery*. 2004; 74:50-56.
17. Timmermans L, de Goede B, van Dijk SM, Kleinrensink GJ, Jeekel J, Lange JF. Meta-analysis of sublay versus onlay mesh repair in incisional hernia surgery. *Am J Surg*. 2014; 207:980-988.
18. Pereira C, Gururaj S. Onlay Versus Sublay Mesh Repair for Incisional Hernias: A Systematic Review. *Cureus*. 2023; 15(1):e34156. Doi: 10.7759/cureus.34156. PMID: 36713818; PMCID: PMC9879281.
19. Leithy M, Loulah M, Greida HA, Baker FA, Hayes AM. Sublay hernioplasty versus onlay hernioplasty in incisional hernia in diabetic patients. *Menoufia Med J*. 2014; 27:353-358.
20. Ibrahim R, Abounozha S, Alshehri T. Is the surgical site infection rate higher in sublay or onlay mesh repair of incisional hernia? *Ann Med Surg (Lond)*. 2021; 62:200-202. Doi: 10.1016/j.amsu.2021.01.028. PMID: 33537129; PMCID: PMC7843358.
21. Çiçek Okuyan. Comparison of Onlay and Sublay Methods of Mesh Repair of Incisional Hernia / Doi: 10.14744/hnhj.2021.76588
22. Jat MA, Memon MR, Rind GH. SQA Shah. Comparative evaluation of "Sublay" versus "Inlay" meshplasty in incisional and ventral hernias. *Pak J Surg*. 2011; 27(1):54-58.