



A Comparative Study of Onlay and Sublay Mesh Repair in The Management of Incisional Herniae

Dr Sunil M¹ Dr Prakash Dave²

***Corresponding Author:**

Dr Sunil M

Chethimattathil (H) Thookkupalam K P Colony, Idukki District thookkupalam

Type of Publication: Original Research Paper

Conflicts of Interest: Nil

Abstract

Background:

Incisional hernia (IH) is the only hernia considered to be truly iatrogenic. It is defined as the diffuse protrusion of the peritoneum, and abdominal cavity contents through a weak / poor scar of an operation or an accidental wound. Incisional hernia is a significant complications after laparotomy and can result in bowel strangulation, enterocutaneous fistula and affects quality of life. These hernias enlarge over time and make the repair difficult. Hence elective repair is indicated to avoid these complications.

Aim and objectives:

- 1.To assess the outcome of surgery in patients undergoing onlay mesh placement
- 2.To assess the outcome of surgery in patients undergoing sublay mesh placement
- 3.To compare these outcomes in terms of surgical site infection, seroma formation, hematoma formation, difficulty in fascial closure, recurrence and pain in patients undergoing onlay and sublay mesh placement

Methodology:

30 patients presenting with incisional hernia admitted to Department of General Surgery R.L. Jalappa Hospital, Tamaka, Kolar, in between the study period of December 2018 to June 2020 were preoperatively. Examined clinically and evaluated by USG to confirm the diagnosis. 15 patients in each group underwent Rives Stopa Technique (sublay) and onlay polypropylene mesh placement after obtaining proper informed consent and satisfying the inclusion & exclusion criteria.

Result:

We observed seroma formation and infection in 6.66 %, 6.66%, patients respectively on onlay mesh placement group and in 3.33% ,3.33% patients respectively in sublay mesh placement group. No recurrence was noted in any of the group during the follow up period of three months. Based on these results we observed superior and better results in sublay(Rives Stopa Technique) mesh placement in incisional hernia repair(surgery).

Conclusion:

Seroma formation, SSI and recurrence is foundd to be more commonly associated with onlay mesh placement compared to sublay(Rives Stopa Technique) mesh placement . No recurrence and haematoma were encountered in any of the group in the current study during the follow up period. Finally, to conclude “sublay mesh placement is superior to onlay mesh placement”

Keywords: Incisional Hernia (IH), Mesh placement, Onlay, sublay (Rives Stopa Technique), Seroma, Recurrence

INTRODUCTION

Incisional hernia (IH) has been a complication following abdominal surgery for more than a hundred years. IH is the one of the true iatrogenic hernia. Ian Aird defines IH as a diffuse protrusion of peritoneum and abdominal cavity contents through a weak scar of

an operation, or an accidental wound. IH occurs in 5-12 % of patients subjected to abdominal surgeries ^(1,2). Many factors are associated with IH like age of the patient, gender, obesity, chronic cough, diabetes mellitus, urinary obstructions, any occupations which

increases intra-abdominal pressure, type of suture material used and SSI¹.

IH usually starts as a result of failure of lines of closure of the anterior abdominal wall following laparotomy (open abdominal surgery) or laproscopic surgeries. If left untreated they gradually attain huge size and cause discomfort/difficulty to the patients or may lead to complications like strangulation, incarceration, obstruction, perforation or may cause skin changes or skin necrosis, all of which greatly increase the risk to patients life and morbidity.

With the advancement in anaesthesia techniques, preoperative antibiotics, sterilization, asepsis and better understanding of abdominal wall anatomy, the approach towards the hernia treatment dawned. Currently by the use of the above-mentioned concepts, IH is repaired with least morbidity and recurrence. Every surgeon has got his own methods and techniques and may modify them accordingly.

Laparoscopic IH hernia repair has revolutionized the treatment of IH repair by reducing the morbidity and hospital stay to the patient. This study has been undertaken to compare and analyze the results of two methods of surgical management of IH that is open retro muscular mesh mesh placement (sublay) and open onlay mesh placement.

METHODOLOGY:

Source of data: All patients with incisional hernias admitted to Department of General Surgery R.L. Jalappa Hospital, Tamaka, Kolar, in during the study period from Dec 2018 to June 2020.

INCLUSION CRITERIA:

All the patients above 18 years with anterior abdominal wall Incisional hernia

EXCLUSION CRITERIA:

1. Patients with obstructed and strangulated hernia
2. Patients with divarication of recti
3. Recurrent incisional hernia

METHOD OF COLLECTION OF DATA

The study includes patients with incisional hernias satisfying inclusion criteria who were admitted to the surgical wards of RLJH and RC.

A complete detailed history, as per standard proforma was obtained and documented. All patients underwent clinical examination with relevant investigations after obtaining an informed consent. Patients were divided into two groups using even-odd method to include similar types of cases in both groups. The subjects in “even group” underwent onlay repair where those in “odd group” underwent sublay repair. Intraoperatively the difficulty in fascial closure, time taken to complete the procedure were noted.

Patients were followed up throughout the course of their hospital stay for complications like post-operative pain, seroma formation, hematoma formation and surgical site infection and reviewed over a period 1, 2 and 3 months for recurrence.

STATISTICAL METHODS:

Difficulty in fascial closure, time taken to complete the procedure, Pain (VAS), surgical site infections were considered as primary outcome variables. Procedure (Onlay vs Sublay) was considered as primary explanatory variable. age, gender were other explanatory variables. All Quantitative variables were checked for normal distribution within each category of explanatory variable by using visual inspection of histograms and normality Q-Q plots. Shapiro- Wilk test was also conducted to assess normal distribution. Shapiro Wilk test p value of >0.05 was considered as normal distribution. For normally distributed Quantitative parameters the mean values were compared between study groups using independent sample t-test (2 groups). For non-normally distributed Quantitative parameters, Medians and Interquartile range (IQR) were compared between study groups using Mann Whitney u test (2 groups). Categorical outcomes were compared between study groups using Chi square test /Fisher's Exact test. P value < 0.05 was considered statistically significant.

SAMPLE SIZE: 30

Sample size of standard deviation based on difference in duration of surgery in onlay and sublay mesh repair. Reported a variance estimate of 16.4 min to detect a difference of 30% deduction in duration of surgery with 95% confidence interval; with 80% power. The estimated sample size in each group is 12 (follow up study). Expecting a drop out ratio of 20% during follow up, the final sample size per group will be $12 + 2.4 = 15$ (aprox).

Formulae

$$n = \frac{2s_p^2 [z_{1-\alpha/2} + z_{1-\beta}]^2}{u_d^2}$$

$$s_p^2 = \frac{s_1^2 + s_2^2}{2}$$

Where

s_1^2 : standard deviation in the first group

s_2^2 : standard deviation of second group

u_d^2 : mean difference between the samples

α : significance level

$1 - \beta$: Power

RESULT

A total of thirty (Fifteen subjects were included in each group) subjects for final analysis

Table 1: Descriptive analysis of procedure in the study population (N=30)

Procedures	Frequency	Percentages
ONLAY	15	50.00%
SUBLAY	15	50.00%

Among the study population, 15(50%) participants underwent Onlay Procedure and 15(50%) underwent Sublay Procedure. (Table 1 & Figure 1)

Graph 1: Bar chart of procedures in the study population (N=30)

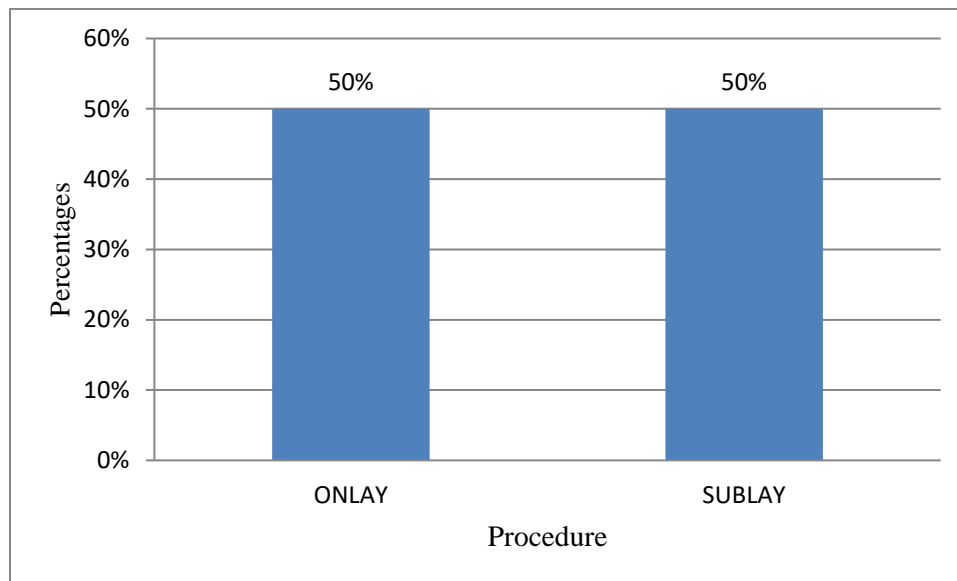


Table 2: Comparison of means of age across procedures (N=30)

Parameter	Procedure (Mean± SD)		P value
	Onlay (N=15)	Sublay (N=15)	
Age	54.8 ± 14.73	45.87 ± 11.92	0.079

There was no statistically significant difference in Mean Age between Procedures (P value 0.079). (Table 2)

Table 3: gender wise distribution across procedures (N=30)

Gender	Procedure		Chi square	P value
	Onlay (N=15)	Sublay (N=15)		
Male	3 (20%)	7 (46.67%)	2.400	0.121
Female	12 (80%)	8 (53.33%)		

There was no statistically significant difference in gender distribution of patients across procedures (P value 0.121). (Table 3 & Figure 2)

Graph 2: Stacked bar chart of comparison of gender across procedures (N=30)

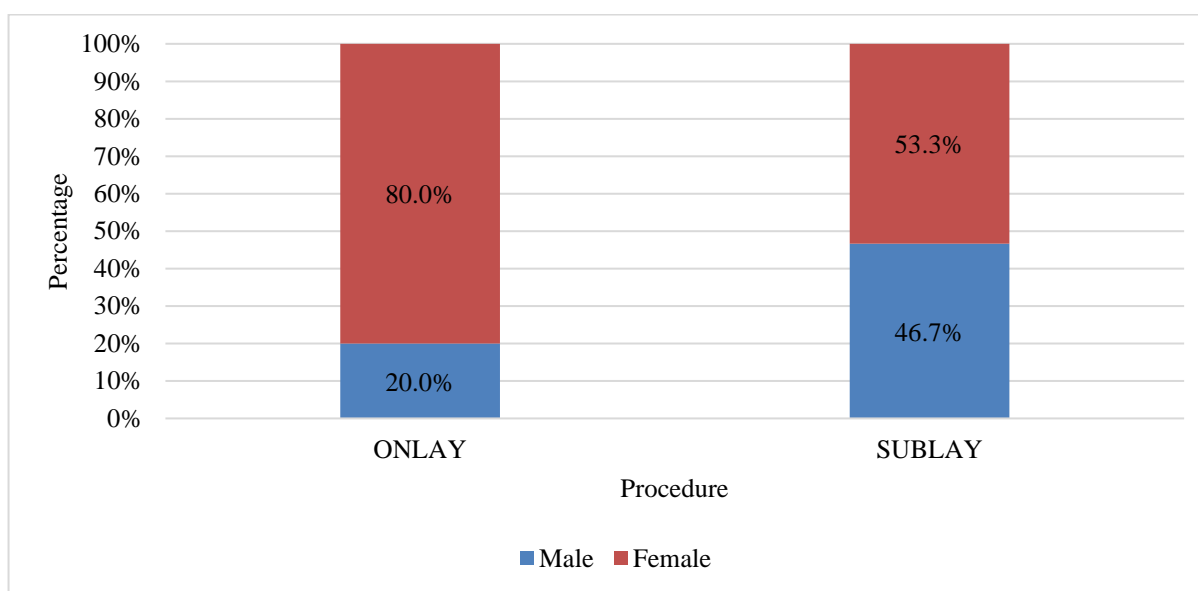


Table 4: Comparison of difficulty in fascial closure across procedures (N=30)

Difficulty in Fascial Closure	Procedure		Fisher exact P value
	Onlay (N=15)	Sublay (N=15)	
Yes	1 (6.67%)	5 (33.33%)	0.169
No	14 (93.33%)	10 (66.67%)	

There was no statistically significant difference in difficulty in fascial closure across Procedures (P value 0.169). (Table 4 & Figure 3)

Graph 3: Stacked bar chart of comparison of difficulty in fascial closure between procedure (N=30)

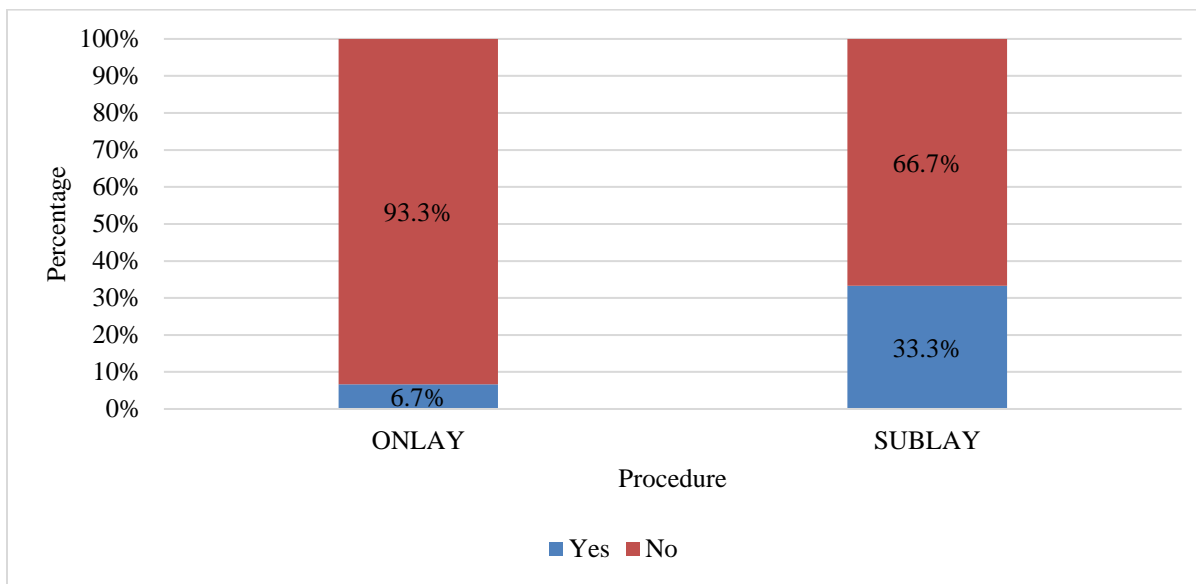


Table 5: Comparison of Pain (VAS) between procedure (N=30)

Parameter	Procedure Median (IQR)		Mann Whitney U test (P value)
	Onlay (N=15)	Sublay (N=15)	
Pain (VAS)	4 (4,5)	5 (4,5.5)	0.103

There was no statistically significant difference in Pain (VAS) across procedures (P value 0.103). (Table 5 & Figure 4)

Graph 4: Line chart of comparison of difficulty in facial closure across procedures (N=30)

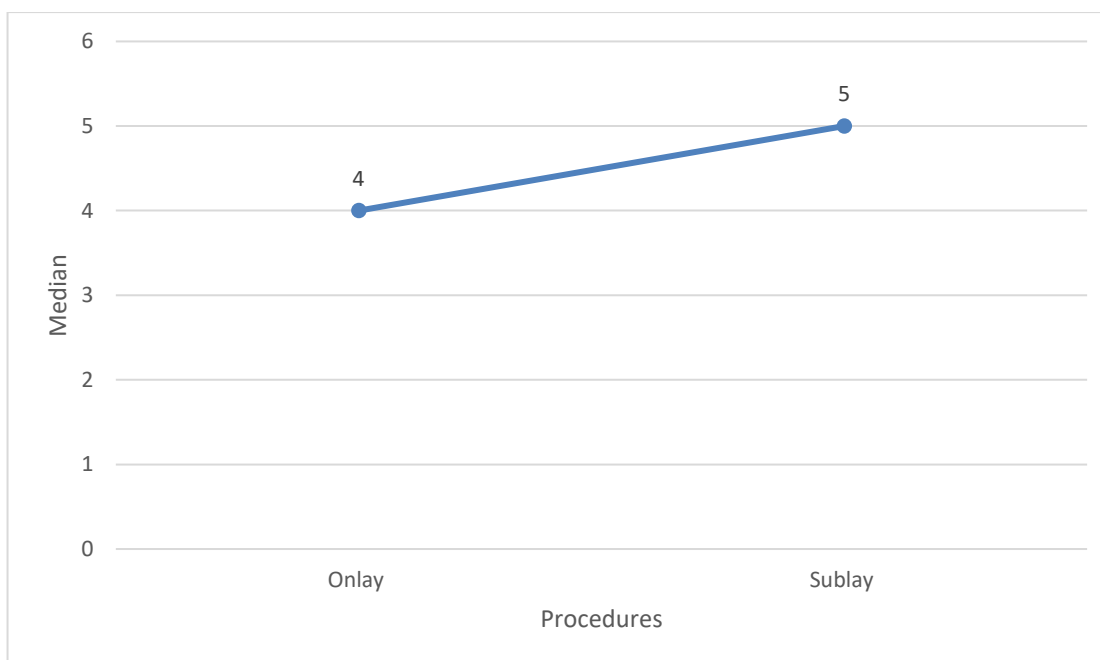


Table 6: Comparison of SSI across procedures (N=30)

Surgical site infections	Procedure		Fisher exact P value
	Onlay (N=15)	Sublay (N=15)	
Yes	2 (13.33%)	1 (6.67%)	1.00
No	13 (86.67%)	14 (93.33%)	

There was no statistically significant difference in Surgical site infections between Procedures (P value 1.00). (Table 6 & Figure 5)

Graph 5: Stacked bar chart of Surgical site infections across procedures (N=30)

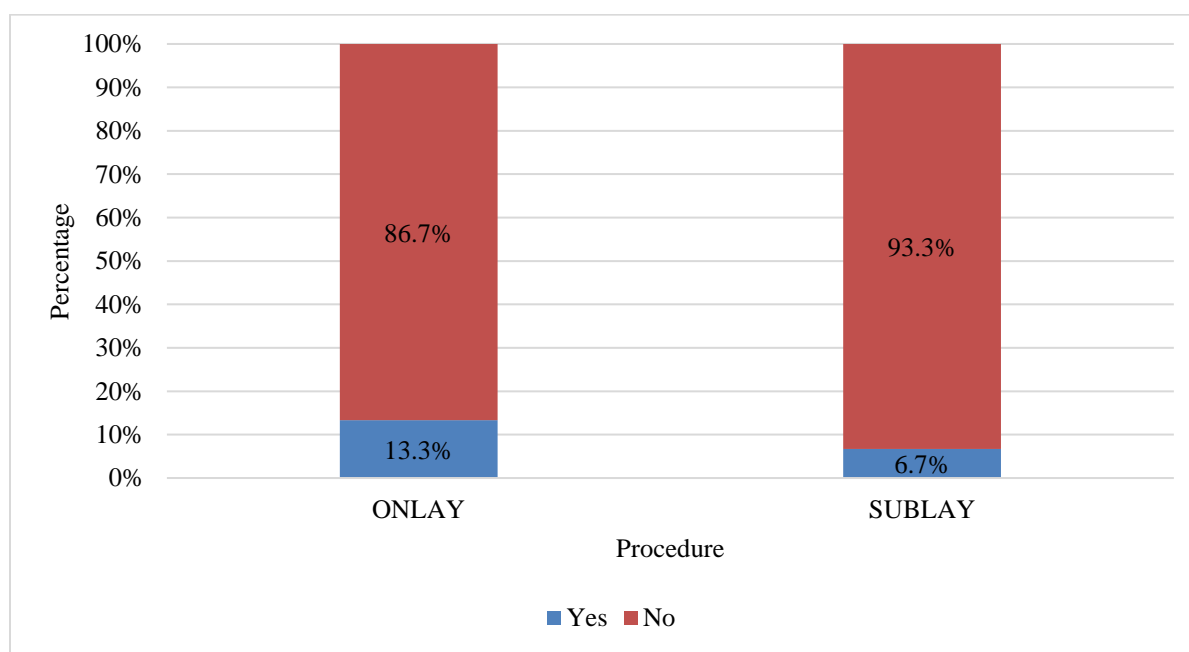


Table 7: Comparison of seroma across procedures (N=30)

Seroma	Procedure		Fisher exact P value
	Onlay (N=15)	Sublay (N=15)	
Yes	2 (13.33%)	1 (6.67%)	1.000
No	13 (86.67%)	14 (93.33%)	

There was no statistically significant difference in Seroma between procedures (P value 1.00). (Table 7 & Figure 6)

Graph 6: Stacked bar chart of Seroma across procedures (N=30)

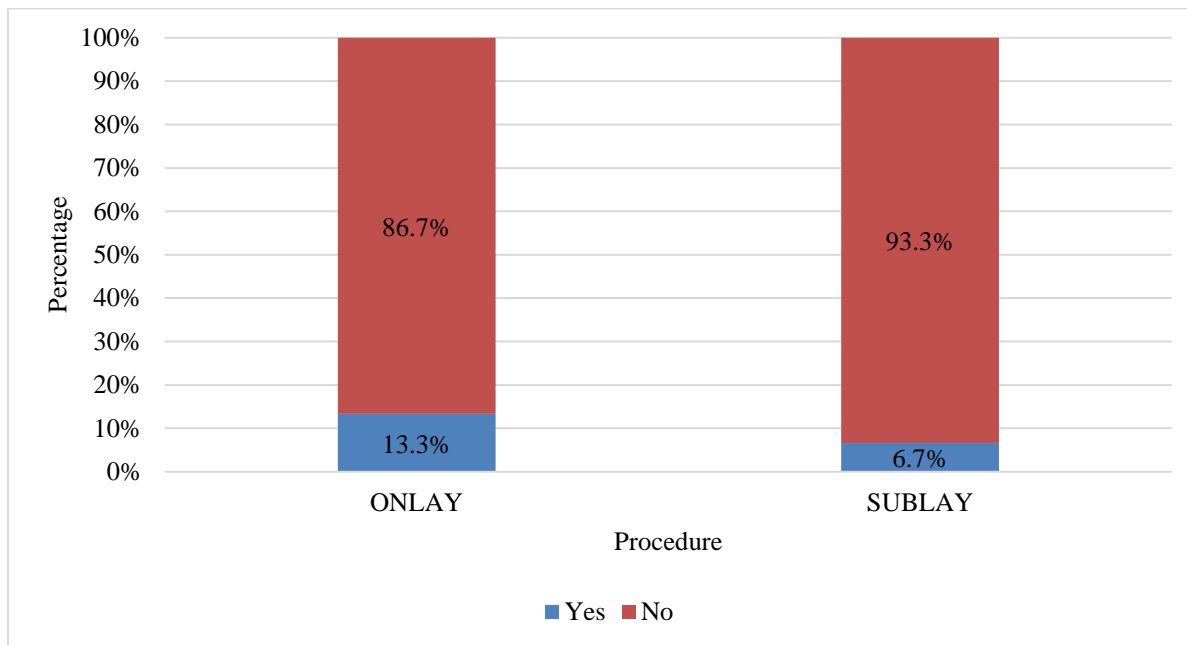


Table 8: Comparison of haematoma formation across procedures (N=30)

Haematoma	Procedure	
	Onlay (N=15)	Sublay (N=15)
No	15 (50%)	15 (50%)

Table 9: Comparison of Recurrence between procedure (N=30)

Recurrence	Procedure	
	Onlay (N=15)	Sublay (N=15)
No	15 (50%)	15 (50%)

None of the patients developed recurrence or hematoma on a follow up of three months (Table 8 and Table 9)

DISCUSSION

Incisional hernia (IH) has been a complication following abdominal surgery for more than a hundred years. Ian Aird defines IH as a “diffuse protrusion of peritoneum and abdominal cavity contents through a weak / poor scar of an operation, or an accidental wound“. IH occurs in 5-12 % of patients subjected to abdominal surgeries. Many factors are associated with IH like age of the patient, gender, obesity (BMI>30) ,

chronic cough , diabetes mellitus, urinary obstructions , any occupations which increases intra-abdominal pressure, type of suture material used and SSI(surgical site infection).

ONLAY MESH REPAIR:

Onlay mesh repair was done in preference to other procedures because of the following reasons: -

1. Onlay is technically simple and easy procedure compared to others.
2. No need to dissect in complex areas like behind the rectus, which leads to hematoma formation.
3. Complications like obstruction due to adhesion formation and fistula formation are rare compared to other procedures.

RETROMUSCULAR (sublay) MESH REPAIR

It is an excellent technique (Rives-Stoppa technique) by placing the sheet of prosthetic mesh in the plane between the posterior rectus sheath and the rectus muscles. This has distinct advantages over the intraperitoneal, inlay or onlay technique. Though it is technically challenging with the higher rate of blood loss it has the distinct advantage of reducing the rate of infection and recurrence.

Mesh repair has become the standard for the repair of all incisional hernias. Among the various techniques described in the mesh placement; onlay repair, though technically easier and associated with the negligible blood loss, is complicated by a higher rate of infection and seroma formation.

It is estimated that 2 to 10% of all abdominal operations result in an IH. Small hernias less than one inch in diameter can be successfully closed with anatomical repair. However, larger ones have a recurrence rate of up to 30-40% when a anatomical repair alone is performed. Nowadays tension free

repair using prosthetic mesh has decreased recurrence to negligible.

In this study we have compared the two different type of mesh repair ie.onlay and sublay .Controversy exists among the surgeons regarding the use of types of either mesh repair, due to difference in ease in performing the surgery, difficulty in facial closure, complications like seroma , hematoma , SSI, occurring in the post-operative period and the recurrence.

In our study attempt has been made to compare both these types of mesh repair and their outcome.

AGE OF PRESENTATION

Incisional hernias are more common in patients aged between 40-60 years (60 %) in our study. Youngest patient in our study was 25 years old. It was found that incisional hernias could be rare after 80 years as no patient was more than 80 years in our study.

GENDER DISTRIBUTION

Incisional hernias are more common among females.20 (66.6 %) patients were females and 10 (33.3%) patients were male (p<0.121) . In literature the ratio is 3:1. In our study it was 2:1. There is no significant difference in age distribution in males and females, as disease is more common between 40 to 60 years in both. Ellis H. et al.²³ have observed 64.6% of female preponderance in his study of 342 patients. In our study females comprised 66.6%, in a study by Godara et al³¹ 42.5% of all subjects were females.

TABLE 10: - Percentage females in different study series

Study Group	Percentage females (%)
Ellis H. et al ²³	64.6
Godara et al ³⁵	42.5
Present study	66.6

ASSOCIATED FACTORS IN INCISIONAL HERNIA

Among incisional hernias Gynaecological surgeries are the most common associated surgery. Tubectomy was the most common predisposing surgery, constituting 50% followed by LSCS (45.8%), Hysterectomy (4-2%). Godara et al series³⁵ also

mentions Gynaecological surgeries as the most common associated preceding surgery.

DIFFICULTY IN FASCIAL CLOSURE

Difficulty in fascial closure was seen in 1 (6.67%) case of onlay and 5 (33.33%) cases of sublay mesh placement ($P < 0.169$). This was studied depending upon the duration of surgery.

Mean duration of procedure in our series, in onlay mesh repair was 48.6 minutes and those who underwent sublay mesh repair was 74.6 minutes ($p < 0.169$). The difference could be accounted to more time required for dissection for creating pre peritoneal space. Securing adequate haemostasis is another

reason for delay in completing the procedure. Ease of operation was largely subjective, and depended on surgeons' experience, exposure, quality of assistance and conducive facilities. Godara *et al*³⁵, reported a mean duration of 49.35 minutes for Onlay and a mean duration of 63.15 minutes for sublay Mesh repair ($p < 0.0001$), while in John. J. Gleysteen *et al*³⁶ series the mean duration for onlay and Pre-peritoneal Mesh repair were 42 and 70.5 minutes respectively. Table 10 shows the comparison of duration of surgery in different series.

TABLE 11: - Comparison of duration of surgery in different series

Mean Duration (in minutes)	Godara <i>et al</i> ³⁵ (100)	John. J. Gleysteen <i>et al</i> ³⁶ (125)	Present study (*30)
ONLAY	49.35	42	48.6
SUBLAY	63.15	70.5	74.6

COMPLICATIONS

The most common complication observed was seroma and surgical site infection. Seroma was seen in 30 % (3 patients) patients. Of these 2 patients under went onlay repair and 1 patient sublay mesh repair ($P < 1.0$). Seroma was less in the **sublay** group. This complication was managed with seroma drainage. Onlay technique had more of seroma formation, due to the fact that onlay techniques requires significant subcutaneous dissection to place the mesh, which can lead to devitalized tissue with seroma formation or infection. The superficial location of the mesh also puts it in danger of becoming infected if there is a superficial wound infection.

Wound infection rate is about 30 % (three patients) in our patients. Of these 2 patients had onlay mesh and 1 patient had sublay mesh placement ($P < 1.0$). These patients were treated with appropriate antibiotics as per culture and sensitivity and regular dressing. No patient required removal of mesh because the infection was superficial and responded well to antibiotics.

The mean pain score assessed by VAS was 4 (4, 5) in onlay and 5 (4, 5.5) in sublay mesh placement ($P < 0.103$). Pain was more in sublay group. This is due to the fact that sublay mesh placement requires extensive dissection to create plane between the rectus muscle and posterior rectus sheath.

TABLE 12: - Comparison of overall complications of surgery in different series

Complications	Godara <i>et al</i> ³⁵	John. J. Gleysteen <i>et al</i> ³⁶	Present study
ONLAY	15%	19%	13.33%
SUBLAY	22.5%	12%	6.66%

RECURRENCE AND HAEMATOMA

No recurrence of hernia or hematoma was noticed in both sublay and onlay mesh placements during the limited observation follow up period, in the present series. John. J. Gleysteen *et al*³⁶ found a recurrence rate to be 20% in

Onlay and 4% in sublay Mesh repairs. A retrospective study in Europe done by de Vries Relingh *et al*³⁷ (2004) noticed a recurrence rate of 23% in cases that underwent onlay mesh repair, and no recurrence in patients with sublay mesh repair. According to the Shackelford primary repair is often under tension in onlay meshplasty, which can contribute to recurrence.

TABLE 13: - Comparison of recurrence rates in different studies

Recurrence Rate	John. J. Gleysteen <i>et al</i> ³⁶	de Vries Relingh <i>et al</i> ³⁷	Present study
ONLAY	20%	23%	0
SUBLAY	4%	0%	0

All the complications were comparable between both types of mesh repairs based on P value.

Sublay mesh repair is considered superior because the mesh with significant overlap placed under the muscular abdominal wall works according to Pascal's principles of hydrostatics. The intra-abdominal cavity functions as a cylinder, and therefore the pressure is distributed uniformly to all aspects of the system. Consequently, the same forces that are attempting to push the mesh through hernia defects are also holding the mesh in place against the intact abdominal wall. In this manner, the prosthetic is held firmly in place by intra-abdominal pressure. The mechanical strength of the prosthetic mesh prevents protrusion of the peritoneal cavity through the hernia because the hernia sac is indistensible against the mesh. Over time, the prosthetic mesh is incorporated into the fascia and unites the abdominal wall, now without an area of weakness.

CONCLUSION

Sublay mesh repair is a better technique with less incidence of postoperative complications like seroma formation, surgical site infection and least recurrence rate, and minimal mesh related-complication. Finally, it can be concluded that "Sublay mesh repair is superior to Onlay mesh repair" for ventral incisional hernia repair

BIBLIOGRAPHY

- Bucknall TE, Cox PJ, Ellis H. Burst abdomen and incisional hernia: A prospective study of 1129 major laparotomies. *British Medical Journal* 1982; 284:931-3
- Mudge M, Hughes LE. Incisional hernia: A 10-year prospective study of incidence and attitudes. *Br J Surg* 1985; 72: 70-1
- Devlin HB, Kingsmith HB. Abdominal wall and hernias. Chapter 10th in *A new aids companion in surgical studies*, 2nd edition. Keim GB Lunard, Edingburgh Churchill Livingstone; 1998:688-99
- Ponka JL, *Hernias of the abdominal wall*. Philadelphia, PA: WB Saunders; 1981.
- Devlin HB. *Incisional hernia, management of abdominal hernia*, 1st edition, Butterworth and Co limited, Cleveland : 1988:161-77
- Mc Arthur LL. Autoplastic suture in hernia and other diastases- Preliminary report. *JAMA* 1901; 37: 1162
- Koontz AR. Preliminary report on the use of tantalum mesh in the repair of ventral hernia. *Ann of Surg* 1948; 127: 1079
- Throckmorton TD. Tantalum gauze in the repair of hernia and complicated by tissue deficiency. *Surg* 1948; 23:32
- Judd ES. The prevention and treatment of ventral hernia. *Surg Gynecol Obstet* 1912; 14: 175
- Gibson LC. Operation for cure of large ventral hernias. *Ann Surg* 1920; 72: 214-17
- Mair GB. Preliminary report on the use of whole skin grafts as a substitute for fascial sutures in the treatment of hernia. *Br J Surg* 1945; 32: 381

12. Usher FC, Oschner J, Tuttle LLD Jr. Use of marlex mesh in the repair of incisional hernia. *Am J Surg* 1958; 24: 969
13. Jayant Sharma. Prolene meshplasty in hernia repair. *Br J Surg* 1997; oct: 289-92
14. Lichtenstein IL, Shulman AG, Amid PK. Twenty questions about hernioplasty. *Am Surg* 1991; 57: 730-3
15. Carbajo MA, Martpdel, Olmo JC, Blanco JL. Laparoscopic approach to incisional hernia . *Surg Endoscopy* 2003; 17(1): 118-22
16. Cassar K, Munro A. Surgical treatment of incisional hernia. *Br J Surg* 2002; 89(5): 534-45
17. Nayman J. Mass closure of abdominal wounds. *Med J Australia* 1976; 1: 183
18. Bartlett LC. Pressure necrosis is the primary cause of wound dehiscence. *Can J Surg* 1985; 28: 27
19. Zimmerman LM. The use of prosthetic materials in the repair of hernias. *Surg Clinics of N. America* 1968; 48: 143-53
20. Goligher JC, Irwin TT et al. A controlled trial of three methods of closure of laparotomy wounds. *Br J Surg* 1975; 62 : 823