

Comparative study of prophylactic mesh repair versus primary suture repair to decrease incidence of incisional hernia after Midline elective open laparotomy

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Abstract

Introduction- Incisional hernia repair have high recurrence rates. Patients suffering from IH experience deterioration in quality of life and long-term dysfunction. Prevention of incisional hernias is essential for addressing the considerable associated morbidity and cost. The present study was conducted to compare the incidence of incisional hernia in patients with prophylactic mesh placement and those undergoing primary suture repair after 15 months of follow up and to assess postoperative complications among them. **Material and methods-** The present comparative follow up study was conducted at the department of Surgery of a medical college hospital. A total of 34 patients above 18 years of age undergoing elective midline laparotomy had mesh placement and another 34 patients were randomly selected who had primary closure of the abdominal wound. Socio-demographic profile of patients, their medical history, details of surgery and postoperative complications at 1, 6, 12 and 15 months were noted. **Results-** The incidence of incisional hernia for 15 months follow-up was 26.5 cases per 100 surgeries with primary closure while incidence was found to be 5.8 in those with prophylactic mesh. At 15 months, 11.8% of those with primary closure had pain, 5.9% had enterocolic fistula and 26.5% had incisional hernia. 11.8% of those with mesh placement had pain, 2.9% had enterocolic fistula and 5.9% had incisional hernia. The post-operative complications were not significant statistically for both study groups. **Conclusion-** Relative risk of incisional hernia in those with primary closure as compared to mesh placement was found to be 4.5 (95% CI- 1.1-19.3).

Keywords: mesh repair, laparotomy

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Introduction

Incisional hernia (IH) is a protrusion of intra-abdominal contents through a surgically related defect in the anterior abdominal wall. Incisional hernia after midline laparotomy is a common, challenging problem for all surgeons. Its incidence ranges widely from 11 to 20 per cent in general surgical population and these hernias are twice as common in women as in men. The variation in reported incidence is due to difference in populations studied, length of follow up, and method of hernia diagnosis.

The incidence of IH can increase up to 40 per cent in high-risk groups, such as patients with an abdominal aortic aneurysm (AAA) or morbid obesity [1]. Patients with a BMI of more than or equal to 27 kg/m² have more than 30% chance of developing IH after midline laparotomy[2]. These groups of patients are believed to have a higher intra-abdominal pressure, which can cause higher tension on abdominal wall sutures. However, this pressure might not be the only contributing factor: obesity is also associated with wound-healing complications due to decreased vascularity of adipose tissue, leading to local hypoxia. In hypoxic wounds, the synthesis of mature collagen is impaired, resulting in weaker tissue and a deficiency in the overall healing process.

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In wound healing, other known risk factors play an important role eg malignant disease, parastomal hernia, wound infection and smoking [3]. In the past decades, abdominal surgery has moved from midline laparotomies to laparoscopic or other minimally invasive techniques. This shift however, has resulted in a higher risk population of patients that still undergo midline laparotomies.

Despite advances in IH repair, recurrence rate associated with incisional hernia repair remains high, and those who experience recurrence are susceptible to a vicious cycle of morbidity, because each subsequent repair presents greater technical challenges and an increased risk for recurrence and morbidity [4-6]. Failure to effectively close the abdominal wall after open operations leaves the patient at risk for developing IH, an extremely unfavourable health state. Patients suffering from IH experience deterioration in quality of life, including disability, pain, and long-term dysfunction and dissatisfaction [7-10]. Thus, prevention of incisional hernias is essential for addressing the considerable associated morbidity and cost. To date, few studies have focused on prophylactically preventing the incidence of IH. This proactive viewpoint is paramount for developing strategies to prevent costly iatrogenic complications after abdominal operations. Prophylactic mesh placement (PMP) may be the solution to this hernia epidemic. Focus is mainly on prophylactic prevention of this iatrogenic complication after abdominal operation by using prophylactic mesh placement (PMP) whether onlay or sublay. However there is some controversy about optimal mesh position, shape and mesh fixation in the prophylactic setting. The present study was conducted to evaluate the efficacy of sublay mesh

placement in reducing the incidence of incisional hernia in high risk patients undergoing elective and midline laparotomy.

Aims & objectives

The present study was conducted

- to compare the incidence of incisional hernia in patients with prophylactic mesh placement and those undergoing primary suture repair after 15 months of follow up and
- to assess postoperative complications among these patients.

Material & methods

Study design

The present study was comparative follow up in nature.

Study place

The present study was conducted at the department of Surgery, Darbhanga Medical College Hospital, Darbhanga. It is a tertiary level institution in North Bihar catering to patients from North Bihar and Tarai areas of Nepal.

Study period

The present study was conducted between March 2018 to December 2020. Patients were enrolled up to September 2019 to ensure follow up period of 15 months.

Study subjects

Patients above 18 years of age scheduled for elective laparotomy were included in the study. After ample information has been given, patients were asked for informed consent.

Inclusion criteria

Patients above 18 years of age undergoing elective midline laparotomy and signed informed consent.

Exclusion criteria

Life expectancy less than 24 months, pregnant women, immune suppression therapy within 2 weeks before surgery and bovine allergy

Sampling

Patients were divided into two groups - Primary suture repair or prophylactic sublay mesh placement. All the patients who were selected for mesh placement during the study period were included in the study. Equal number of patients with primary closure were also selected for comparison by group matching.

During the study period, 34 patients had mesh placement. Another 34 patients were randomly selected who had primary closure of the

abdominal wound. Thus, a total of 68 adults who underwent midline elective open laparotomy were included.

Surgical procedure

Group A. Primary closure of the midline- The midline fascia was closed in both groups with a running slowly absorbable suture (Vicryl 1no.) readily available in hospital. The ratio of suture length to wound length of 4:1 was as recommended (but not measured). Subcutaneous tissue and skin were closed in a fashion preferred by the surgeon.

Group B. Sublay mesh supported closure- It consisted of creating a posterior plane (fascia and peritoneum) which was closed with running slowly absorbable suture (vicryl 1 no.) and (4:1 ratio recommended). A polypropylene light weight mesh was cut to fit the dissected space and placed on the posterior plane with an overlap of 3 cm at each side. In rare cases when the incision would be greater than 3 cm, it was recommended to use another mesh and tie it to the original mesh, in order to obtain 3 cm overlap. The mesh was then fixed with prolene 1 no. to the ventral part of linea alba and posterior rectus sheath. The Prolene Mesh was used as it was shown to have an optimal fixation and to provide good tensile strength.

Data collection

Pre-operative data included socio-demographic profile of patients, their medical history, smoking status, family history of hernia, general examination and findings of systemic examination. Details of surgery included type of procedure, length of incision, operation time, antibiotic prophylaxis, suture material etc. The patients were followed –up by outpatient clinic visit at 1, 6, 12 and 15 months to note postoperative complications like SSI, Incisional hernia, wound hematoma, seroma and others.

Data entry and analysis

Data was entered in MS Excel 2010 and analysed using SPSS v 20.0. Categorical variables were summarized as frequency and percentage and numerical variables as Mean and SD. Appropriate tests of significance were done. p-value<0.05 was considered to be statistically significant.

Ethical considerations

Approval of Institutional Ethics Committee was taken. Informed consent was taken from all the patients. Those refusing consent during any part of the study were excluded. Data was kept confidential.

Results

The present study included a total of 68 patients, 34 having PMO placement and another 34 with repair by primary closure. 57.4% of them were females. Most common age group involved was <45 years (27.9%).

Table-1 showing risk factors of incisional hernia in the two groups

Risk factors	Values	GroupA (Primary closure)	GroupB (Mesh)	Significance
Anaemia	Yes	12 (35.3%)	11 (32.4%)	$\chi^2= 0.07$ p= 0.79
	No	22 (64.7%)	23 (67.6%)	
High BMI (>27)	Yes	15 (44.1%)	13(38.2%)	$\chi^2= 0.24$ p= 0.62
	No	19 (55.9%)	21(61.7%)	
Family history of hernia	Yes	10 (29.4%)	9 (26.5%)	$\chi^2= 0.07$ p= 0.79
	No	24 (70.6%)	25 (73.5%)	
Previous laparotomy	Yes	8 (23.5%)	3 (8.8%)	$\chi^2= 2.71$ p= 0.10
	No	26 (76.5%)	31 (91.2%)	
Smoking	Yes	9(26.4%)	11 (32.4%)	$\chi^2= 0.28$ p= 0.59
	No	25(73.5%)	23 (67.6%)	
Pulmonary disease (COPD/ Asthma)	Yes	7 (20.6%)	6 (17.6%)	$\chi^2= 0.09$ p= 0.76
	No	27 (79.4%)	28 (82.4%)	
Diabetes mellitus	Yes	7 (20.6%)	9(26.5%)	$\chi^2= 0.32$ p= 0.57
	No	27 (79.4%)	25(73.5%)	
Undernourished (BMI<18)	Yes	2 (5.9%)	1 (2.9%)	$\chi^2= 0.35$ p= 0.56
	No	32 (94.1%)	33 (97.1%)	
Type of operation	Upper GI	6 (17.6%)	6 (17.6%)	$\chi^2= 2.76$
	Lower GI	9 (26.5%)	8 (23.5%)	

	Hepatobiliary	8 (23.5%)	10 (29.4%)	p= 0.60
	Gynaecological	11 (32.4%)	8 (23.5%)	
	Others	0	2 (5.9%)	
Length of incision	Upper midline	17 (50.0%)	15 (44.1%)	$\chi^2= 0.32$ p= 0.85
	Lower midline	9 (26.5%)	11 (32.4%)	
	Extensive midline	8 (23.5%)	8 (23.5%)	

Table-1 shows that the difference between patients undergoing primary closure and those having mesh placement with regard to various risk factors were not significant statistically ($p>0.05$).

Table 2: showing risk of incisional hernia in patients with primary closure vs patients with mesh

Closure method	Incidence of incisional hernia (new cases per 100 surgeries in 15 months)	Relative risk	95% CI of relative risk
Primary closure	26.4	4.5	1.1 -19.3
Mesh	5.8		

The incidence of incisional hernia for 15 months follow-up was 26.5 cases per 100 surgeries with primary closure while incidence was found to be 5.8 in those with prophylactic mesh. Relative risk of incisional hernia in those with primary closure as compared to mesh placement was found to be 4.5 (95% CI- 1.1-19.3).

Table 3: showing post-operative complications at 15 months

Complications	Group A (Primary closure)	Group B (Mesh)	Significance
Pain	4 (11.8%)	4 (11.8%)	$\chi^2= 0.00, p= 1.0$
Haematoma	0 (0%)	0 (0%)	-
Seroma	0 (0%)	0 (0%)	-
Surgical site infection	0 (0%)	0 (0%)	-
Entero-Colic Fistula	2 (5.9%)	1 (2.9%)	$\chi^2= 0.35, p= 0.56$
Incisional hernia	9 (26.5%)	2 (5.9%)	$\chi^2= 5.31, p= 0.02$
Reoperation	0 (0%)	0 (0%)	-

Table-3 shows post-operative complications at 15 months. 11.8% of those with primary closure had pain, none had haematoma, seroma, surgical site infection or had undergone reoperation, 5.9% had enterocolic fistula and 26.5% had incisional hernia. 11.8% of those with mesh placement had pain, none had haematoma, seroma, surgical site infection or had undergone reoperation. 2.9% had enterocolic fistula and 5.9% had incisional hernia. The difference between two study groups was not significant statistically ($p>0.05$) except for occurrence of incisional hernia ($p<0.05$).

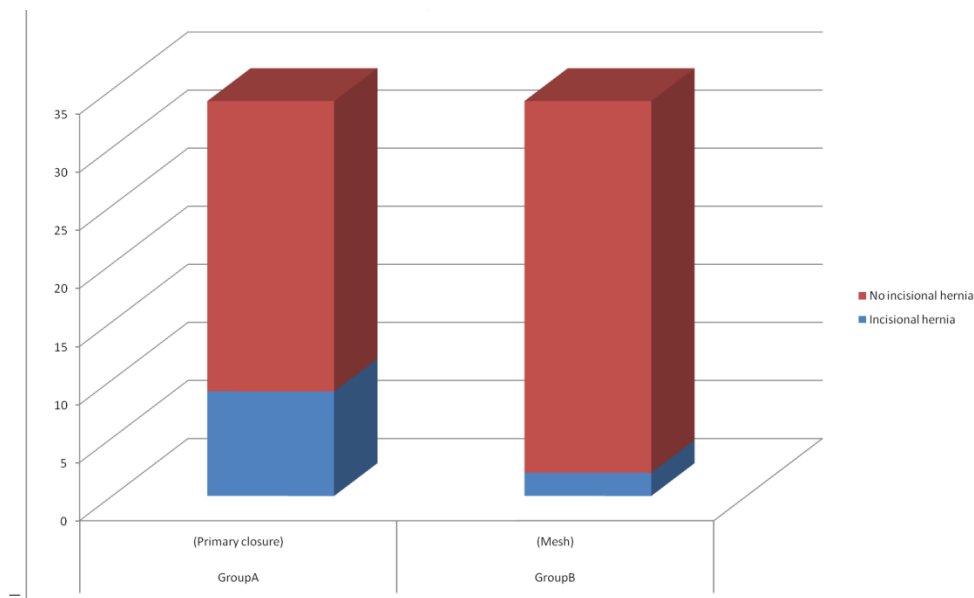


Fig 1: Occurrence of incisional hernia

Discussion

In the present study, it was observed that the percentage of patients was equally distributed across all the age groups and the percentage of females was greater in both the study groups (58.8% in primary closure group vs 55.9% in mesh group). Nigam A et al (2020) conducted a study to explore factors related to incisional hernia and observed that the mean age of study subjects was 47.27±13.16 years. Maximum 46% of study subjects were between 41-60 years age group and 64% of the study subjects were female[1].

In the present study, the surgeries performed in the two groups included upper GI (17.6% in each), lower GI (26.5% vs 23.5%), hepatobiliary (23.5% vs 29.4%), gynaecological (32.4% vs 23.5%) and others (nil vs 5.9%). Incision used in the two groups respectively was upper midline in 50% vs 44.1%, lower midline in 26.5% vs 32.4% and extensive midline in 23.5% each. Basta et al (2019) determined the incidence of incisional hernia according to speciality. Colorectal (7.7%), vascular (5.2%), bariatric (4.8%), and transplant (4.5%) specialties demonstrated the highest incidence of surgically

repaired hernia [3]. Abdelhameed et al (2019) conducted the study concerning the type of incision. Large number of patients were subjected to upper midline incision (31 patients 47.69%), while the lower midline incision and the extended midline was (19 patients 29.23%) and (15 patients 23.07%) respectively [2].

Post operative complications

Follow-up at 15 months showed that 11.8% of those with primary closure had pain, none had haematoma, seroma, surgical site infection or had undergone reoperation, 5.9% had enterocolic fistula and 26.5% had incisional hernia. 11.8% of those with mesh placement had pain, none had haematoma, seroma, surgical site infection or had undergone reoperation. 2.9% had enterocolic fistula and 5.9% had incisional hernia. The difference between two study groups was not significant statistically ($p>0.05$) except for occurrence of incisional hernia ($p<0.05$). Abdelhameed et al (2019) found chronic wound pain, as a late complication, which was more in prophylactic mesh placement (PMP) group (14.28%) while it occurred in (3.33%) in group with primary simple closure (PSC). In this study, the incidence of seroma increased in PMP group (17.14%) compared to (13.33%) in PSC group. SSI occurred in 2 patients (6.66%) in non-mesh group while it occurred in 2 patients (5.71%) in the mesh group, this is comparable to several studies that describe the range of SSI was from 0-10% in the mesh group compared to 0-6% in non-mesh group [2].

Glauser et al (2019) studied that there was no significant difference in postoperative morbidity and mortality in short term. However, six meshes were removed during the 6-week follow-up period due to burst abdomen ($n = 2$), mesh infection leading to the formation of a sinus tract ($n = 2$), bowel perforation not related to the implanted mesh ($n = 1$) and retroperitoneal infection ($n = 1$) [5]. Kohler et al (2018) studied that the incidence of SSI was not statistically different between the control (18 of 69 [26.1%]) and mesh (11 of 61 [18.0%]). However, patients who developed SSI experienced delayed wound healing. The median healing time in the mesh group was 2 months, 5 of 12 patients had a chronic wound, defined as a healing time of more than 3 months [4].

Incidence of incisional hernia

The incidence of incisional hernia was 26.5 cases per 100 surgeries with primary closure in 15 months while incidence was found to be 5.8 in those with mesh. Relative risk of incisional hernia in those with primary closure as compared to mesh placement was found to be 4.5 (95% CI 1.1-19.3). Anaemia, High BMI (>27), Previous laparotomy and closure method of abdominal wound were significantly associated ($p<0.05$) with occurrence of incisional hernia while family history of hernia, smoking, pulmonary disease (COPD/ Asthma), diabetes mellitus, undernourishment (BMI <18), type of operation and length of incision were not significantly associated ($p>0.05$).

Glauser et al (2019) after a 2-year follow-up period in the PRIMA study reported a rate of incisional hernia of 30% after primary fascial closure and a rate of 18% and 13% after mesh reinforcement in sublay and onlay positions, respectively [5]. Kohler et al (2018) studied that the incidence of incisional hernia 3 years after surgery was significantly higher in the control group vs the mesh group (15 of 81 [18.5%] vs 5 of 69 [7.2%]). Findings reveal that prophylactic intraperitoneal mesh implantation significantly reduces the incidence of incisional hernia 3 years after laparotomy compared with standard abdominal closure in a high-risk population. According to study, 9 patients had to undergo prophylactic mesh implantation to prevent 1 incisional hernia [4]. Jairam et al (2017) found that 92 (19%) of 480 patients developed incisional hernia during the 2 years of follow-up, 33 (31%) of 107 in the primary suture group, 25 (13%) of 188 in the onlay mesh reinforcement group, and 34 (18%) of 185 in the sublay mesh reinforcement group. Among the subgroup of 330 patients with a BMI of 27 kg/m² or higher, incisional hernia occurred in 54 (16%), 16 who were allocated closure by primary suture, 15 assigned onlay mesh reinforcement, and 23 allocated sublay mesh reinforcement [6].

Conclusion

Despite the continuous research and advances to optimize abdominal fascia closure, the greater opportunity to decrease IH rates lies in

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preventing hernia with mesh implantation at the time of primary abdominal surgery. In this study, we found that PMP reduces the incidence of incisional hernia significantly as compared to PSC technique. After 15 months of follow up, the incidence of incisional hernia in primary closure group and PMP group were 26.5% and 5.8% respectively and the post-operative complications were not significant statistically for both study groups. High BMI (>27) and previous history of abdominal surgery were found to be associated with increase in occurrence of incisional hernia. Further study and follow up is required for significant conclusion.

References

- Jairam AP, López-Cano M, Garcia-Alamino JM, Pereira JA, Timmermans L, Jeekel J, Lange J, Muysoms F. Prevention of incisional hernia after midline laparotomy with prophylactic mesh reinforcement: a meta-analysis and trial sequential analysis. *BJS Open*. 2020 Jun;4(3):357-368.
- Borab ZM, Shakir S, Lanni MA, Tecce MG. Hernia Does prophylactic mesh placement in elective , midline laparotomy reduce the incidence of incisional hernia ? A systematic review and meta-analysis. *Surgery [Internet]*. 2017;161(4):1149–63.
- Hb D. No Title. Chapter 10th A new aids companion *Surg Stud* 2nd Ed. 1998;688–99.
- Atkins M, Zemke R, Burt C, Submission HCF. Book Reviews. *Occup Ther Heal Care*. 1988;5(2):203–9.
- Kingsnorth A. The Management of Incisional Hernia. *Ann R Coll Surg Engl [Internet]*. 2006;88(3):252–60.
- Gaston EA. Living Aponeurotic Sutures to Repair Inguinal Hernias. *Arch Surg [Internet]*. 1962 Sep 1;85(3):418.
- Koontz AR. Preliminary report on the use of tantalum mesh in the repair of ventral hernias. *Ann Surg* 1948 ;127(5): 1079–85.
- Throckmorton TD. Tantalum gauze in the repair of hernias complicated by tissue deficiency; a preliminary report. *Surgery*. 1948 Jan;23(1):32-46
- ES Judd. The prevention and treatment of ventral hernia. *Surg Gynecol Obs*. 1912;14:175.
- Gibson CL. Operation for cure of large ventral hernia. *Ann Surg [Internet]*. 1920;72(2):214–7.
- Barabde M, Lavankar V, Deshmukh T. Prevalence and Risk Factors of Incisional Hernia: an Observational Study. *Int J Clin Biomed Res*. 2018;4(1):32.
- Abdelhameed HF, Abdelmageed SA. Does pre-emptive onlay mesh reinforcement of midline laparotomies reduce incidence of incisional hernia in high-risk patients? *Int Surg J*. 2019;6(7):2300.
- Basta MN, Kozak GM, Broach RB, Messa CA, Rhemtulla I, Dematteo RP, et al. Can We Predict Incisional Hernia?: Development of a Surgery-specific Decision-Support Interface. *Ann Surg*. 2019;270(3):544–53.
- Kohler A, Lavanchy JL, Lenoir U, Kurmann A, Candinas D, Beldi G. Effectiveness of Prophylactic Intraperitoneal Mesh Implantation for Prevention of Incisional Hernia in Patients Undergoing Open Abdominal Surgery: A Randomized Clinical Trial. *JAMA Surg*. 2019;154(2):150–8.
- Glauser Philippe M, Philippe B, Benjamin S, Käser Samuel A, Andres H, Rosenberg R, et al. Prophylactic Intraperitoneal Onlay Mesh Following Midline Laparotomy—Long-Term Results of a Randomized Controlled Trial. *World J Surg*. 2019; 1669–75.
- Jairam AP, Timmermans L, Eker HH, Pierik REGJM, van Klaveren D, Steyerberg EW, et al. Prevention of incisional hernia with prophylactic onlay and sublay mesh reinforcement versus primary suture only in midline laparotomies (PRIMA): 2-year follow-up of a multicentre, double-blind, randomised controlled trial. *Lancet*. 2017;390(10094):567–76.