

Original Research Article

Association of body mass index and operative duration with seroma formation following incisional hernia repair by composite mesh and polypropylene mesh

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ABSTRACT

Background: Seroma is a frequent complication after incisional hernia repair, with limited data on the impact of patient and procedural factors. This study aimed to assess the association of BMI and operative duration with seroma formation using composite and polypropylene mesh. The aim of the study was to evaluate the relationship between body mass index (BMI) and operative duration with the occurrence of seroma formation following incisional hernia repair using composite mesh and polypropylene mesh.

Methods: This longitudinal study, conducted at the Department of Surgery, Dhaka Medical College Hospital from October 2022 to September 2023, included 72 adult patients undergoing open incisional hernia repair with either polypropylene or composite mesh. Seroma formation was the primary outcome, with BMI, operative time and defect size as confounders. Follow-up was on days 7, 14 and 28 and data were analyzed using SPSS v26.0, with statistical significance set at $p < 0.05$.

Results: There was no significant link between BMI and seroma formation ($p = 0.783$). Group A had a higher incidence and volume of seroma at all postoperative time points, though not significantly different from Group B. Operative time was significantly shorter in Group B (85.1 ± 19.8 minutes) compared to Group A (96.4 ± 24.4 minutes; $p = 0.035$), but operative time showed no significant impact on seroma formation ($p = 0.961$).

Conclusions: This study concludes that BMI and operative time do not significantly influence postoperative seroma formation following incisional hernia repair with either composite or polypropylene mesh.

Keywords: BMI, Incisional hernia, Mesh repair, Operative duration, Seroma

INTRODUCTION

Incisional hernia is a common postoperative complication after abdominal surgery, affecting approximately 4–10% of patients.^{1,2} Around 14.5% of incisional hernias develop within the first year following surgery, particularly after open bariatric procedures and abdominal aortic aneurysm repairs.³⁻⁶ These hernias are associated with increased

hospital readmissions, elevated healthcare costs, diminished quality of life and prolonged socioeconomic burden.⁷⁻⁹

Owing to their high prevalence and the significant challenges they pose for both patients and healthcare systems; incisional hernias remain a critical focus in abdominal wall surgery. Mesh reinforcement is widely

regarded as the gold standard for hernia repair, as it significantly reduces recurrence rates across various types of abdominal hernias, including inguinal, parastomal and incisional hernias.⁹⁻¹² However, despite its advantages, mesh repair is frequently linked with complications such as seroma formation. This risk is particularly notable in extensive abdominal procedures, where seromas can compromise wound healing, predispose to infection and necessitate further interventions.¹³ These complications have driven ongoing innovations in mesh technology and refinements in surgical technique to enhance patient outcomes.

Multiple studies have identified obesity as a key risk factor for adverse outcomes following ventral hernia repair (VHR), including higher recurrence rates, longer hospital stays and increased healthcare costs.¹⁴⁻¹⁶ Accordingly, Body Mass Index (BMI) has become an important factor in preoperative risk assessment and surgical planning. In addition, the complexity of incisional hernia repair demands substantial surgical expertise, with both operative time and technique being closely tied to postoperative recovery.

Despite numerous advancements, the interplay between modifiable patient factors such as BMI and intraoperative variables like surgical duration in relation to complications such as seroma formation remains inadequately explored, particularly in local settings. A better understanding of these associations could inform risk stratification, guide surgical strategies and ultimately improve outcomes.

The purpose of the study was to assess the association between body mass index (BMI) and operative duration with the occurrence of seroma formation following incisional hernia repair using composite mesh and polypropylene mesh.

Objective

The aim of the study was to evaluate the relationship between body mass index (BMI) and operative duration with the occurrence of seroma formation following incisional hernia repair using composite mesh and polypropylene mesh.

METHODS

This longitudinal analytical study was conducted at the Department of Surgery, Dhaka Medical College Hospital, from October 2022 to September 2023.

A total of 72 adult patients admitted with incisional hernia and undergoing hernioplasty were included in the study, selected based on specific inclusion and exclusion criteria. Patients were randomly allocated into two groups: Group A (36 patients) received open mesh repair with lightweight polypropylene mesh, while Group B (36

patients) underwent open mesh repair with composite mesh.

Inclusion criteria

Diagnosed cases of uncomplicated incisional hernia. Recurrent incisional hernia. Abdominal wall defect ≤ 10 cm

Exclusion criteria

Obstructed or strangulated incisional hernia. Concomitant intra-abdominal pathology. Loss of abdominal domain in recurrent cases. Drain tube collection > 30 mL on postoperative day 5. The primary dependent variable was seroma formation, while the independent variable was meshing type (polypropylene vs composite).

Confounding variables included body mass index (BMI), operative time and defect size. Incisional hernia was defined as the protrusion of abdominal contents through a postoperative abdominal wall defect. Seroma was defined as a localized collection of sterile serous fluid greater than 20 ml, confirmed by ultrasonography after removal of the drain on postoperative day.

Composite mesh consisted of absorbable polyglactin and non-absorbable polypropylene fibers (Vypro-II), while polypropylene mesh referred to a lightweight monofilament mesh with large pores (Prolene Soft Mesh). After obtaining informed written consent, eligible patients were enrolled and randomly allocated to receive either composite or polypropylene mesh.

All patients underwent open onlay mesh repair under general or spinal anesthesia. Following hernia site dissection and preparation, the mesh was sutured to the anterior rectus sheath and a 14Fr suction drain was placed in the subcutaneous space and removed on postoperative day 5 if drainage was less than 30 ml.

The procedures were conducted by different surgeons and operative time was recorded. Postoperative follow-up was carried out on days 7, 14 and 28 to assess seroma formation via ultrasonography, performed by different sonologists. Ethical approval was obtained from the Ethical Review Committee of Dhaka Medical College and written informed consent was obtained from all participants.

Confidentiality was maintained and participants had the right to withdraw at any stage. No conflict of interest was declared.

Data analysis was performed using SPSS version 26, with descriptive statistics reported as mean \pm standard deviation for continuous variables and frequencies with percentages for categorical variables. Independent samples t-test and chi-square test were used to determine statistical significance, with a p value < 0.05 considered significant.

RESULTS

Table 1 shows the association between BMI categories and postoperative seroma formation. Among patients who developed seroma, 33.3% (3 out of 9) had a normal BMI and 66.7% (6 out of 9) were overweight. In comparison, 38.1% (24 out of 63) of patients without seroma were of normal weight and 61.9% (39 out of 63) were overweight. The difference in BMI distribution between the two groups was not statistically significant ($p=0.783$).

Table 2 summarizes the frequency and ultrasonographic volume of postoperative seroma in Group A and Group B at three time points. Although the differences were not statistically significant, Group A consistently showed a higher incidence of seroma than Group B.

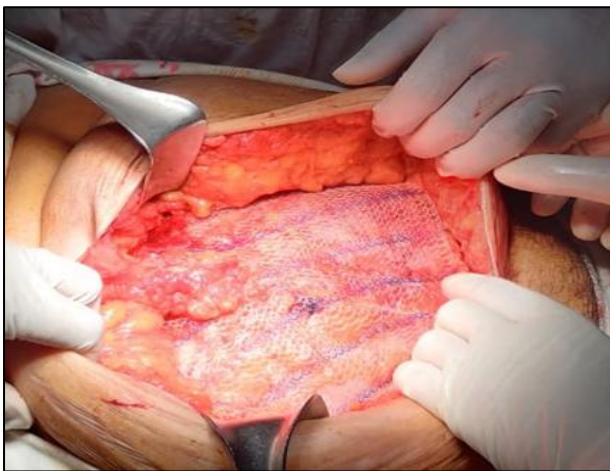


Figure 1: Polypropylene mesh repair technique.

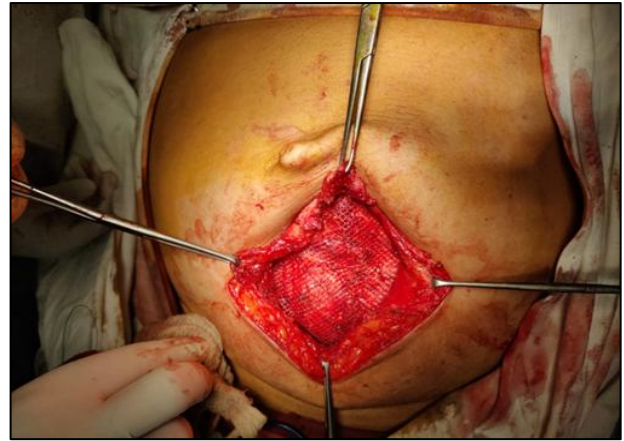


Figure 2: Vypro II composite mesh repair technique.

On the 7th postoperative day, 13.9% of Group A patients developed seroma versus 11.1% in Group B ($p=0.722$). On day 14, the incidence was 11.1% in Group A and 2.8% in Group B ($p=0.164$). By day 28, 8.3% of Group A patients still had seroma, while no cases were reported in Group B ($p=0.077$). Mean seroma volumes were also higher in Group A on all assessment days.

Table 3 reveals a statistically significant difference in operative time between the two groups. The mean operative time in Group B was significantly shorter (85.1 ± 19.8 minutes) than in Group A (96.4 ± 24.4 minutes), with a p value of 0.035.

Table 4 shows no statistically significant difference in operative time between patients who developed seroma (91.1 ± 23.95 minutes) and those who did not (90.7 ± 22.84 minutes) ($p=0.961$).

Table 1: Association between seroma formation and body mass index (BMI) (n=72).

BMI (kg/m ²)	Seroma present (n=9)	Seroma absent (n=63)	P value
	No. (%)	No. (%)	
Normal weight	3 (33.3)	24 (38.1)	0.783
Overweight	6 (66.7)	39 (61.9)	

Table 2: Frequency and volume of postoperative seroma in group A and group B.

Postoperative seroma	Group A (n=36)	Group B (n=36)	P value
	No. (%)	No. (%)	
At 7th POD	5 (13.9%)	4 (11.1%)	0.722
At 14th POD	4 (11.1%)	1 (2.8%)	0.164
At 28th POD	3 (8.3%)	0 (0.0%)	0.077
Volume (ml) (by USG)	Mean±SD	Mean±SD	
Postoperative 7th POD	14.1±6.17	11.1±6.21	
Postoperative 14th POD	7.39±6.64	4.78±4.37	
Postoperative 28th POD	4.17±6.28	1.88±1.75	

Table 3: Comparison of operative time between group A and group B (n=72).

Variable	Group A (n=36)	Group B (n=36)	P value
	Mean±SD	Mean±SD	
Operative time (min)	96.4±24.4	85.1±19.8	0.035

Table 4: Association between operative time and seroma formation (n=72).

Variable	Seroma present (n=9)	Seroma absent (n=63)	P value
	Mean±SD	Mean±SD	
Operative time (min)	91.1±23.95	90.7±22.84	0.961

DISCUSSION

Incisional hernia (IH) repair commonly involves mesh reinforcement to reduce recurrence; however, postoperative complications such as seroma formation continue to present significant clinical challenges. Contributing factors to seroma development include the type of mesh used, patient-related factors such as body mass index (BMI) and intraoperative variables like the duration of surgery. This study investigated the association between BMI, operative time and seroma formation following IH repair using two mesh types composite mesh and polypropylene mesh. A total of 72 patients undergoing IH repair at the Department of Surgery, Dhaka Medical College Hospital, were evenly divided into two groups: Group A (composite mesh) and Group B (polypropylene mesh).

This study explored the association between body mass index (BMI) and the occurrence of seroma following surgery. Among patients who developed seroma, 33.3% (3 out of 9) were of normal weight, while 38.1% (24 out of 63) of those without seroma also fell into the normal weight range. Additionally, 66.7% (6 out of 9) of patients with seroma were overweight, compared to 61.9% (39 out of 63) among those without seroma. This difference in BMI distribution was not statistically significant ($p=0.783$). In contrast, Klink et al, reported a 36% incidence of seroma in patients with a BMI>25 kg/m² ($p=0.0038$), indicating a stronger association in their study than observed here.¹⁷

A significant variation in operative time was observed between the two mesh groups. Patients in Group B (polypropylene mesh) had a shorter mean operative time (85.1±19.8 minutes) compared to those in Group A (composite mesh), whose mean operative time was 96.4±24.4 minutes ($p=0.035$). Despite this significance, the relatively small sample size (n=72) may constrain the broader applicability of these results. In comparison, Kumar et al, reported mean operative times of 71.36±8.30 minutes for the polypropylene mesh group and 69.6±8.10 minutes for the composite mesh group, with no statistically significant difference ($p=0.20$).¹⁸ It is important to consider that factors such as surgeon experience, hernia size and location and mesh fixation techniques can influence operative time and potentially explain the variation in results.

The study also examined the correlation between operative duration and the incidence of seroma formation. The present study found no statistically significant difference in operative time between patients with seroma

(91.1±23.95 minutes) and those without (90.7±22.84 minutes) ($p=0.961$). Conversely, Zhou et al, found a significant association between longer operative times and higher rates of postoperative seroma formation.¹⁹ Their study, involving a larger cohort of 354 elderly patients, differs in both sample size and demographic characteristics, which may account for the discrepancy in findings. Nevertheless, both studies contribute valuable insights into the potential influence of operative duration on seroma formation, highlighting the role of patient-specific and procedural factors.

In terms of postoperative seroma incidence over time, this study found no statistically significant difference between the two groups at any postoperative time point. On the 7th postoperative day (POD), 13.9% of patients in Group A and 11.1% in Group B developed seroma ($p=0.722$). By the 14th POD, seroma incidence decreased to 11.1% in Group A and 2.8% in Group B ($p=0.164$). On the 28th POD, seroma persisted in 8.3% of Group A patients, while no cases were reported in Group B ($p=0.077$).

Although these differences were not statistically significant, Group A consistently showed a higher percentage of seroma cases at each time point. These findings are consistent with those of Khan et al, who reported comparable seroma rates of 3.6% and 3.5% in their two study groups ($p=0.993$).²⁰ Overall, while the present study did not identify statistically significant associations between mesh type, BMI or operative time and seroma formation, it highlights trends that warrant further investigation. Future research with larger sample sizes, more diverse patient populations and extended follow-up durations is necessary to validate these findings and better understand the multifactorial nature of seroma formation following incisional hernia repair.

This study had some limitations like the surgeries were performed by different surgeons, which could introduce variability in the outcomes. The seroma volume measurements were performed by different sonologists, potentially leading to variability in the results.

CONCLUSION

The present study found no significant association between body mass index (BMI) and postoperative seroma formation following incisional hernia repair with either composite mesh or polypropylene mesh. Additionally, while operative time differed significantly between the two groups, it did not influence seroma development. Therefore, both mesh types can be used

based on factors such as availability and affordability, with no significant impact on seroma formation.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Al Chalabi H, Larkin J, Mehigan B, McCormick P. A systematic review of laparoscopic versus open abdominal incisional hernia repair, with meta-analysis of randomized controlled trials. *Int J Surg.* 2015;1;20:65-74.
2. Dietz UA, Menzel S, Lock J, Wiegering A. The treatment of incisional hernia. *Deutsches Ärzteblatt Int.* 2018;19;115(3):31.
3. Deerenberg EB, Harlaar JJ, Steyerberg EW, Lont HE, van Doorn HC, Heisterkamp J, et al. Small bites versus large bites for closure of abdominal midline incisions (STITCH): a double-blind, multicentre, randomised controlled trial. *Lancet.* 2015;386(10000):1254-60.
4. Fink C, Baumann P, Wente MN, Knebel P, Bruckner T, Ulrich A, et al. Incisional hernia rate 3 years after midline laparotomy. *J Br Surg.* 2014;101(2):51-4.
5. Muysoms FE, Detry O, Vierendeels T, Huyghe M, Miserez M, Ruppert M, et al. Prevention of incisional hernias by prophylactic mesh-augmented reinforcement of midline laparotomies for abdominal aortic aneurysm treatment: a randomized controlled trial. *Ann Surg.* 2016;263(4):638-45.
6. Strzelczyk JM, Szymański D, Nowicki ME, Wilczyński W, Gaszynski T, Czupryniak L. Randomized clinical trial of postoperative hernia prophylaxis in open bariatric surgery. *J Br Surg.* 2006;93(11):1347-50.
7. Gillion JF, Sanders D, Miserez M, Muysoms F. The economic burden of incisional ventral hernia repair: a multicentric cost analysis. *Hernia.* 2016;20:819-30.
8. Fischer JP, Basta MN, Mirzabeigi MN, Bauder AR, Fox JP, Drebin JA, et al. A risk model and cost analysis of incisional hernia after elective, abdominal surgery based upon 12,373 cases: the case for targeted prophylactic intervention. *Ann Surg.* 2016;1;263(5):1010-7.
9. Rogmark P, Petersson U, Bringman S, Ezra E, Österberg J, Montgomery A. Quality of life and surgical outcome 1 year after open and laparoscopic incisional hernia repair: PROLOVE: a randomized controlled trial. *Ann Surg.* 2016;263(2):244-50.
10. Luijendijk RW, Hop WC, Van Den Tol MP, De Lange DC, Braaksma MM, IJzermans JN, et al. A comparison of suture repair with mesh repair for incisional hernia. *New England J Med.* 2000;343(6):392-8.
11. Verhagen T, Zwaans WA, Loos MJ, Charbon JA, Scheltinga MR, Roumen RM. Randomized clinical trial comparing self-gripping mesh with a standard polypropylene mesh for open inguinal hernia repair. *J Br Surg.* 2016;103(7):812-8.
12. Berger D, Bientzle M. Polyvinylidene fluoride: a suitable mesh material for laparoscopic incisional and parastomal hernia repair! A prospective, observational study with 344 patients. *Hernia.* 2009;13:167-72.
13. Lashari A, Mirani SH, Bozdar AG, Shar ZA, Malik AB. Effectiveness of tranexamic acid for prevention of postoperative seroma formation in patients undergoing ventral hernioplasty. *Pakistan J Med Health Sci.* 2020;14(4):1143-5.
14. Sauerland S, Korenkov M, Kleinen T, Arndt M, Paul A. Obesity is a risk factor for recurrence after incisional hernia repair. *Hernia.* 2004;8:42-6.
15. Parker SG, Mallett S, Quinn L, Wood CP, Boulton RW, Jamshaid S, et al. Identifying predictors of ventral hernia recurrence: systematic review and meta-analysis. *BJS Open.* 2021;5(2):71.
16. Novitsky YW, Orenstein SB. Effect of patient and hospital characteristics on outcomes of elective ventral hernia repair in the United States. *Hernia.* 2013;17:639-45.
17. Klink CD, Binnebösel M, Lucas AH, Schachtrupp A, Grommes J, Conze J, et al. Serum analyses for protein, albumin and IL-1-RA serve as reliable predictors for seroma formation after incisional hernia repair. *Hernia.* 2011;15:69-73.
18. Kumar N, Kapur N, More S. Comparative study of outcome following open meshplasty in incisional hernia cases using composite mesh versus polypropylene mesh. *Hellenic J Surg.* 2016;88:297-305.
19. Zhou Y, Ge Y, Liu J, Shen W, Gu H, Cheng G. Modified frailty index and albumin-fibrinogen ratio predicts postoperative seroma after laparoscopic TAPP. *Clin Interv Aging.* 2023;31:1397-403.
20. Khan N, Bangash A, Sadiq M, Hadi AU, Hamid H. Polyglactine/polypropylene mesh vs. propylene mesh: is there a need for newer prosthesis in inguinal hernia. *Saudi J Gastroenterol.* 2010;16(1):8-13.

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