Comparative retrospective study between using mesh or not in ileostomy closure as a preventive method for incisional hernia

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Background and aims
Stomal-site incisional hernia is a complication following ileostomy closure, with rates of about 40%. Because there were no previous studies undertaken to find a definite solution for it. Different preventive methods were studied to decrease the incidence of post-ileostomy closure incisional hernia. One of these methods was the usage of prophylactic mesh-reinforcement mode of absorbable poliglecaprone monofilament fiber and nonabsorbable polypropylene monofilament fiber during ileostomy closure and to study its role in prevention of stomal-site incisional hernia without increasing the incidence of wound complications.
Aim
Evaluating the importance of prophylactic mesh reinforcement during closure of ileostomy to prevent stomal-site incisional hernia.
Patients and methods
This was a retrospective study, which included 40 Egyptian patients presenting for ileostomy closure. Half of them without mesh and the other half applied mesh at ileostomy site during closure. Patients of the two groups underwent ileostomy closure between February 2018 and March 2020 and then they had been assessed in the following 2 years for the occurrence of postoperative incisional hernias.
Results
Regarding the incidence of incisional hernia, 10 (25%) out of 40 patients in the current study developed incisional hernias. In group B (without mesh reinforcement), eight (40.0%) patients developed incisional hernias, while in group A (with mesh reinforcement), two (10.0%) patients developed incisional hernias. Although there was a trend for developing incisional hernia in patients without mesh reinforcement and the study shows significant results of incisional hernia reduction with mesh reinforcement during the first 6 months after closure (P=0.035), prophylactic mesh repair significantly reduces that incidence in the total follow-up period of 2 years (P=0.028).
Conclusion
The study shows a significant decrease of incisional hernia with mesh reinforcement during the first 6 months after closure. However, in the total follow-up period of 2 years, prophylactic mesh repair significantly reduces post-ileostomy closure incidence of incisional hernia, without significantly increasing the incidence of wound infection.

Keywords:
ileostomy closure, incisional hernia, mesh repair

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Introduction

Ileostomy refers to a stoma done by pulling the ileum onto the surface of the skin. Intestinal waste is collected in an external pouching system that is adhered to the skin [1].

Ileostomy is used temporarily to protect a distal anastomosis such as in ileal pouch anal anastomosis or a low colorectal anastomosis. It is also used for fecal diversion from the distal anorectum such as perianal Crohn's disease, anorectal cancer, diverticular disease, severe perineal trauma or sepsis, and treatment of anastomotic and fecal incontinence [2].

There is no significant difference in the number of complications between early and late closure of temporary ileostomy, but there is a significant difference in the types of complications that occur where the early closure has more wound complications and not associated with increased morbidity and mortality, while the late closure has significantly small-bowel obstruction rates [3].

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The overall complication rate for ileostomy closure is ranging from 4.7 to 33.3%, and classified into early and late; early complications like wound infection, anastomotic leakage, bleeding, and death; late complications like incisional hernia and intestinal obstruction. There are other systemic complications that may occur such as cardiorespiratory problems, pneumonia, deep-vein thrombosis, and urinary-tract infection [4].

Wound infection ranges from 1.7 to 18.3% for ileostomy closure and leads to wound dehiscence and incisional hernia [5].

Incisional hernia is the most common late complication, with rates as high as 40%. As the incidence of bowel cancer increases, more temporary ileostomies are needed and the complication is likely to increase [6].

Preoperative and postoperative optimization limits the incidence of incisional hernias. The materials and technique used in abdominal wall closure are considered of the most important risk factors. That is why it is very important to optimize the surgical technique used in abdominal wall closure to prevent the patients from suffering from incisional hernias and the risks of their repair [7].

The abdominal wall has moderate strength, three-quarters of which resides in the aponeurosis and the rest in the muscles, peritoneum, and skin. Postoperative scar tissue is always weaker and reaches maximum strength about 80 days after the operation. However, if nonabsorbable meshes are used, the process of integration is efficient by the tenth day, increasing until about day 35, when it becomes stable [8].

The advantages of mesh-reinforced ileostomy closure represent a simple strategy to reduce the incidence of incisional hernia with rates as high as 40% representing the most common late complication in ileostomy closure. Although not all patients with an incisional hernia require intervention, yet, medical comorbidities and intra-abdominal adhesions render hernia repair, when needed. Therefore, it is important for hernia-prevention strategies like having a prophylactic mesh application in ileostomy closure [9].

The disadvantages of mesh usage in ileostomy closure lie in that the closure site is associated with bacterial contamination because the intestine is open and there is a higher risk of wound infection, especially the onlay mesh applied above the anterior rectus sheath, which might lead to seroma formation and wound infection, that is why a suction drain in that area should be placed, but the intraperitoneal or preperitoneal mesh insertion has low incidence of wound complications, but it involves intestinal complications such as intestinal adherence and consequent fistulization that is considered a very dangerous complication [10].

Therefore, there is an important need to study and compare between the benefits and risks of having a prophylactic mesh insertion during ileostomy closure.

Aim

The aim of the study was to compare between the usage of mesh or not in prevention of stomal-site incisional hernia.

Patients and methods

Type of study: retrospective randomized study. This research was performed at the Department of General Surgery, Ain Shams University Hospitals. Ethical Committee approval and written, informed consent were obtained from all participants.

Study setting: this study was conducted on patients presenting for ileostomy closure in Ain Shams University Hospital (ASUH) and Benha University Hospital.

Study sample: this study was conducted on 40 patients presenting for ileostomy closure. Half of them do not apply and the other half applied mesh at ileostomy site during closure. The group of patients who have undergone the mesh reinforcement was named group A and the group of control patients was named group B.

Study duration: patients of the two groups underwent ileostomy closure between February 2018 and March 2020 and then they had been followed up for 2 years for the assessment of postoperative incisional hernias.

Study populations: patients attending at Ain Shams University Hospital (ASUH) with the following criteria:

Inclusion criteria: patients who have undergone abdominal surgeries who are having temporary ileostomies of any type and will need surgery for ileostomy closure.

Exclusion criteria:

(1) Patients with temporary colostomy of any type.
(2) Patients for whom laparotomy was required for closure of their ileostomies.

(3) Patients with comorbidities like diabetes mellitus, chronic liver, and chronic kidney disease.
(4) Immunocompromised patients.
(5) Pediatric-age group.

Type of patients

This was a retrospective randomized study that included 40 patients of ileostomy-closure procedure of age ranging 28–62-years old and from both sexes attending to the hospital. The patients were randomly divided into two groups, each included 20 patients, the first group underwent ileostomy closure with mesh reinforcement, the second group underwent ileostomy closure without mesh reinforcement.

All the patients in the present study were subjected to the following:

Preoperative data

Data collection from the patients including

(1) Age.
(2) Previous surgery undergone and when it was done and the indication for performing an ileostomy in it.
(3) Time between the ileostomy formation and closure to be within 4–8 weeks.
(4) Presence of any comorbidities like diabetes nullities, obesity, hypertension, chronic renal disease, and malignant patient receiving chemotherapy or radiotherapy might be risk factors raising the incidence of stoma-site closure herniation.
(5) History of any other previous operations.
(6) General and abdominal clinical examination.
(7) Laboratory investigations, including complete blood count, serum albumin level, and coagulation profile.
(8) Radiological investigations: distal loopogram with gastrografin enema, pelviabdominal computed tomography with contrast.

Operative technique

(1) All patients received prophylactic intravenous antibiotics (Maxipime 1 g and flagyl 500 mg).
(2) Upon general or spinal anesthetic induction.
(3) Sterilization was done.
(4) Circumferential skin incision was done surrounding the ileostomy site and dissection was done from all abdominal wall layers till separation of the loops from the edge of the peritoneum and the ileostomy defect in the intestinal wall was sutured.
(5) Following reestablishment of intestinal continuity and return of bowel back into the intraperitoneal cavity.
(6) Closure of the rectus sheath with continuous 0-polypropylene sutures.
(7) The tissue plane just superficial to the aponeurosis surrounding the fascial closure was dissected with monopolar diathermy to allow onlay placement of a polypropylene mesh-size cover about 5 cm all around the defect. (Ultrapro, Ethicon; Johnson & Johnson, New York, NY, USA). The Ultrapro mesh is manufactured from equal parts of absorbable poligleaprone-25 monofilament fiber. The mesh is a macroporous partially absorbable mesh that offers strength with reduced foreign body mass formation and reduces the risk of complications as compared with microporous mesh.
(8) Circumferential 2.0-polypropylene sutures were used to fix the mesh to the underlying fascia.
(9) Suction drain was placed in the subcutaneous tissue.
(10) The subcutaneous tissue and skin were closed with sutures.

In patients who did not undergo mesh reinforcement, the anterior rectus sheath was closed in a similar fashion using the same suture and the subcutaneous tissue and skin will be closed with sutures.

Postoperative course and follow-up

(1) Patients were nil per os for 3 days postoperatively.
(2) Received intravenous fluids, antibiotics (Maxipime 1 g and flagyl 500 mg), analgesics, and a pack of FFP twice per day.
(3) Oral diet started on postoperative day 4.
(4) Discharge of the patients was after normal vital signs without fever, normal passage of flatus and stool, normal feeding without vomiting, and clean incision wound.
(5) The suction drain was not removed upon discharge of the patients.
(6) Postoperative follow-up was done once per week during the postoperative month during which the drain is removed in the first or second visit.
(7) The follow-up visits become once per month to observe the occurrence of wound dehiscence or infection, which was detected either if the patient was feverish and generally ill or by local inspection and palpation if the signs of inflammation and infection, such as erythema, hotness, tenderness, and pus discharge, were present, or by laboratory investigations, including high white-blood-cell count (>10 000 cells/mm^3).
(8) The occurrence of ileostomy closure-site herniation was detected by clinical examination of the wound or radiologically through pelviabdominal ultrasound.
(9) Postoperative follow-up visits for a period of 24 months from the date of ileostomy closure.

Statistical analysis

Data were collected, revised, coded, and entered to the Statistical Package for Social Science (SPSS). Statistical analysis was done using IBM SPSS statistics for windows, Version 23.0 (IBM Corp., Armonk, NY, USA). Quantitative data were represented as mean, SD, and ranges. Data were analyzed using independent *t* test to compare means of two groups. Qualitative data were presented as number and percentage and compared using χ^2 test. Graphs were produced by using Excel. *P* value is considered significant if it is less than 0.05.

Results

During the follow-up period of 6 months, in group A, no patients presented by a postoperative incisional hernia, while in group B, four patients presented by postoperative incisional hernia representing 20.0% of the total patients who underwent closure without mesh reinforcement. That is shown in Table 1.

Therefore, as regards postoperative incisional hernia, there is a significant difference between the two groups in the postoperative follow-up period of the first 6 months.

However, in the subsequent follow-up visits of the remaining 24 months, group A showed two cases of incisional hernia (one patient between 6 and 12 months and the other between 12 and 18 months). Also, group B showed an additional one case at the period between 6 and 12 months and another two cases in the period between 12 and 18 months and another one case in the period between 18 and 24 months, which were all confirmed radiologically. In the total follow-up period, only two cases in group A (10.0%) versus eight cases in group B (40.0%) with a statistically significant difference between groups with *P* value of 0.028. That is shown in Table 2.

In group A, six patients had a postoperative wound infection representing 30.0% and 14 patients did not show infection representing 70.0%. That is shown in Table 3. Two cases of the four patients were treated surgically by mesh removal and that cases subjected later to postoperative incisional hernia, otherwise, the remaining four cases were treated by wound care and medical treatment. One case of them got a postoperative incisional hernia.

While in group B, only four patients had postoperative wound infection representing 20%, and 16 patients did not show infection representing 80%. That is shown in Table 3. All of those cases were treated by wound care and medical treatment. Two cases of them got a postoperative incisional hernia.

Table 1 Comparison between group A and group B regarding demographic data

	Group A (*N*=20) [*n* (%)]	Group B (*N*=20) [*n* (%)]	Test value	*P* value	Significance
Sex					
Male	16 (80.0)	13 (65.0)	1.129*	0.287	NS
Female	4 (20.0)	7 (35.0)			
Age (years)					
Range	28.0–59.0	31.0–62.0	0.681•	0.500	NS
Mean±SD	49.22 ± 10.31	51.37 ± 9.65			

*χ^2 test. •Student *t* test. *P* value more than 0.05: nonsignificant (NS); *P* value less than 0.05: significant.

Table 2 Comparison between group A and group B regarding ileostomy-closure site incisional hernia in every 6 months during the 24-month follow-up period

Ileostomy-closure site incisional hernia	Group A (*N*=20) [*n* (%)]	Group B (*N*=20) [*n* (%)]	Test value	*P* value	Significance
0–6 months					
No	20 (100.0)	16 (80.0)	4.444	0.035	S
Yes	0	4 (20.0)			
6–12 months					
No	19 (95.0)	15 (75.0)	3.137	0.076	NS
Yes	1 (5.0)	5 (25.0)			
12–18 months					
No	18 (90.0)	13 (65.0)	3.584	0.058	NS
Yes	2 (10.0)	7 (35.0)			
18–24 months					
No	18 (90.0)	12 (60.0)	4.800	0.028	S
Yes	2 (10.0)	8 (40.0)			

χ^2 test. *P* value more than 0.05: nonsignificant (NS); *P* value less than 0.05: significant (S).

Table 3 Comparison between group A and group B regarding wound infection at the closure site

Infection at the closure site	Group A (*N*=20) [*n* (%)]	Group B (*N*=20) [*n* (%)]	Test value	*P* value	Significance
No	14 (70.0)	16 (80.0)	0.533	0.465	NS
Yes	6 (30.0)	4 (20.0)			

χ^2 test. *P* value more than 0.05: nonsignificant (NS); *P* value less than 0.05: significant (S).

Therefore, despite the wound infection being an important risk factor for occurrence of incisional hernia, no significant difference between mesh usages or not in increasing the incidence of wound infection.

Discussion

The present study was designed trying to find a solution for post-ileostomy closure incisional hernia. Up till now, there are no sufficient published studies about this issue. The main concern was postoperative wound infection [11].

Regarding the incidence of incisional hernia, 10 (25%) out of 40 patients in the current study developed incisional hernias. In group B (without mesh reinforcement), eight (40%) patients developed incisional hernias (which was close to the mentioned rates of incisional hernias at ileostomy-closure site) [12], while in group A (with mesh reinforcement), two (10%) patients developed incisional hernias. Although there was a trend for developing incisional hernia in patients without mesh reinforcement and the study shows significant results of incisional hernia reduction with mesh reinforcement during the first 6 months after closure, prophylactic mesh repair significantly reduces the incidence in the total follow-up period of 2 years (*P*=0.028).

In the study done by Liu *et al.* [13], 47 patients had onlay mesh reinforcement with the same type of mesh as in the current study and only three patients had incisional hernias (6.3% compared with 13.3% in our study). Contrary to our study, they have concluded that this technique has significantly reduced the incidence of incisional hernias at ileostomy-closure site (*P*=0.001).

This was despite the fact that both studies were similar regarding the main indication of the ileostomy-creative surgery and mean postoperative follow-up time.

This difference is most probably explained by lower wound-infection rate in their study (4.3% in the mesh-reinforcement group and 2.8% in the control group), this might be due to noncomplete skin closure compared with complete closure in our study.

While in the study of Bhangu *et al.* [14], no cases developed incisional hernias at ileostomy-closure site after biological mesh insertion intraperitoneally. This might be due to the usage of a different type of mesh inserted in a different anatomical site, the small number of patients in the study (only seven patients), and short follow-up time of only 1 month.

In another well-established study, Maggiori *et al.* [15] studied the effect of using a retromuscular (preperitoneal) bioprosthetic collagen porcine mesh at ileostomy-closure site exclusively for rectal cancer patients who have undergone total mesorectal excision. They compared 30 patients' mesh group with 64 patients with direct closure as a control group. Their technique significantly reduced the incisional hernia incidence as 3% in the mesh group developed incisional hernias compared with 24% in the control group (*P*=0.016).

This might be due to performing the study on a larger sample of patients and usage of a bioprosthetic mesh with postoperative wound infection of only 5.3% instead of a synthetic one as in our study.

Van Barneveld *et al.* [16] in their study used a different technique that was intraperitoneal mesh insertion during stoma-creation surgery around the peritoneal defect of the stoma (a mesh consisted of a monofilament polyester structure with a one-sided layer of absorbable collagen for adhesion prevention) followed by reversal after a median time interval of 6 months through a technique similar to our study. They concluded that such a technique was safe (regarding bowel-contact complications) and effective in reducing the incidence of incisional hernias (despite not performing any statistical analyses).

In their study, no cases developed incisional hernias, this might be due to the fact that previously inserted mesh has been already incorporated within the abdominal wall, giving it an extra strength. These results might also be due to that no cases in their study developed wound infection. But such study was performed on only 10 rectal cancer patients.

Birolini *et al.* [17] in their study have undergone onlay prosthetic mesh repair (polypropylene mesh) in cases that developed incisional hernias after stoma-closure procedures. Neither of the patients developed recurrence of incisional hernia. This might be explained by that such wounds have become less contaminated

as hernias developed and were operated on years after the primary surgeries. This was confirmed by that only one (5%) of the 20 patients developed wound infection.

Morris-Stiff and Hughes [18] in their study tried intraperitoneal usage of nonabsorbable mesh (polypropylene) in repair of parastomal hernias in seven cases, five with terminal ileostomies and two with terminal colostomies. They reported failure of their technique as two (29%) cases developed recurrence of the hernias in addition to more serious complications such as bowel perforation and obstruction. This failure was most probably due to the risk of inserting an intra-abdominal prosthetic material, especially when related to colostomies rather than ileostomies.

Guzman-Valdivia [19] studied the incidence of incisional hernia after stoma closure. They gave different results regarding the indication of stoma formation, where diversion for other pathological conditions (mainly diverticulitis) was the main indication (79%) followed by malignancy (17%) and trauma (4%).

These data were supposed to result in a lower incidence of incisional hernias (as malignancy compared with any other indication is itself a risk factor for herniation), but they resulted in a similar incidence (31.4%). This might be due to that this study was performed on both ileostomies and colostomies with the majority of cases with colostomies (93%) and all incisional hernias occurred in cases with colostomies, as colostomies produce more well-formed stool with more incidence of wound infection and other complications after the surgery [19].

All the surgeries in our study were performed by different levels of surgeons with different levels of experience (senior residents, assistant lecturer, lecturer, and associated professor). In other studies, the level of experience was not reported in some papers or consultant surgeons performed the closure surgeries. Different levels of experience might lead to different results [15].

Conclusion

Prophylactic mesh reinforcement during ileostomy-closure procedure significantly reduces the incidence of incisional hernia in the first postoperative 6 months. Although it significantly decreases the incidence of incisional hernia in the total follow-up period of the postoperative 24 months.

Furthermore, prophylactic mesh insertion during ileostomy-closure procedure does not significantly increase the incidence of the closure-site wound infection and dehiscence.

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Conflicts of interest

No conflict of interest.

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