Repair of large incisional hernias with onlay mesh

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Background
Any surgical incision can lead to the occurrence of incisional hernia (IH) even laparoscopic trocar incision. IHs typically develop within the first 5 years of surgery; however, their development may be delayed. In large hernias, the amount of viscera which progressively stretches and holds the hernia sac can form a 'second abdomen' making the repair of hernia difficult.

Aim
IH after abdominal surgery is an important problem. We aimed to evaluate the short-term recurrence rate as well as surgical complications in patients operated with onlay mesh repair technique for large and giant IHs.

Patient and methods
In our study, we had 40 patients who were complaining of large IH with a defect size of 10 cm or more. All of these patients were operated using the onlay mesh technique in which polypropylene mesh was used.

Results
A total of 40 cases of IH were repaired with placement of onlay mesh; two (5%) cases developed recurrence. The incidence of seroma in our study was 22.5%, making it the most common complication following the repair of IH. Seroma formation was followed by surgical site infection (15%) as the second most common complication.

Conclusion
Repair of large and giant IH using prosthetic nonabsorbable mesh has a reasonably good outcome with acceptable rates of recurrence. The technique of mesh placement is still at the surgeon's discretion. However, onlay mesh repair has shown promising results in our study. Seroma is the most common complication following the repair of large and giant IHs.

Keywords:
large incisional hernia, onlay mesh repair

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Introduction

Incisional hernia (IH) is defined by the European Hernia Society as 'any abdominal wall gap with or without a bulge in the area of postoperative scar perceptible or palpable by clinical examination or imaging' [1]. Any surgical incision can lead to the occurrence of IN even the incision of laparoscopic trocar.

IHs typically develops within first 5 years of surgery; however, their development may be delayed. A number of factors contribute to the evolution of a small IH into a large one over a period of time [2,3]. According to the size of defect, European Hernia Society classifies IHs as:
(1) Small: <5 cm in width or length.
(2) Medium: 5–10 cm in width or length.
(3) Large: >10 cm in width or length [4].

There is no actual definition for giant IH but probably suggests those with a defect of 15 cm or more [5].

Large hernias are accompanied by a marked reduction of muscle–aponeurotic tissue of the abdominal wall, muscle atrophy of the abdomen with a large loss of their anatomical and physiological features that determine severe visceral and respiratory impairment [6]. The low intra-abdominal pressure changes the function of the diaphragm promoting its lower and progressive lethargy. As a result, patients may have respiratory problems due to the synergism that changed the abdominal wall, the incoordination between the chest wall, diaphragm, and abdominal muscles.

The tendency of incisional hernia (HIA) is to progressively increase the traction of the lateral rectus muscles, caused by the antagonist action of the lateral muscles of the abdomen, with the consequent enlargement of the hernia fibrotic ring, small resistance offered by the hernia sac, and the herniated contents of their own weight [7]. In large hernias, the amount

of viscera which progressively stretches and holds the hernia sac is such that it can form a 'second abdomen' [8].

By time, the viscera adopts to locate extra-abdominal as the mesentery extends and becomes thickened by difficulty of venous and lymphatic return. In addition, loss of balance between visceral and parietal tonus leads to chronic bowel dilation [6,9]. The growth of loops and its mesentery and retraction of the abdominal cavity cause the intestines to lose their 'right to housing' hindering the reintroduction into the cavity – in particular when trying to reconstruct the normal anatomy of the abdomen by approximation of the rectus muscles in the midline – conditions to produce exaggerated increase of intra-abdominal pressure with serious systemic consequences, particularly respiratory [10].

The progressive expansion of the hernia sac causes the skin covering the hernia to be thin, scarce, and highly vascularized subcutaneous, and, therefore, with frequent areas of necrosis, trophic ulcers, and possible intestinal fistulae.

For open hernia repair, there are numerous options for mesh placement. Onlay repair places the mesh on the anterior fascia, which typically involves dissection of flaps and primary closure of the fascia below the mesh. Inlay repair places the mesh in the hernia defect and secures the mesh circumferentially to the edges of the fascia. Sublay repair refers to retrorectus or preperitoneal mesh placement. It is also commonly referred to as a Rives-Stoppa or retromuscular repair. Finally, underlay repair is when the mesh is placed in the intraperitoneal position and secured to the anterior abdominal wall.

As there is lack of consensus on the definition and standard treatment for large IHs [11], dearth of data on the procedures and outcomes of giant IHs especially from developing countries, we have conducted this study to determine the outcomes of large and giant IH repaired by the onlay mesh technique at a tertiary care hospital in a developing country.

Patients and methods

Ethics committee of Assuit university hospital approved the study. The study included 40 patients with IHs with a defect size of 10 cm or more. All of these patients were operated using the onlay mesh technique in which polypropylene mesh was used. The study was carried out at the Assiut University Hospital. The hospital is a main teaching hospital for Assiut University Faculty of Medicine. Adult patients with large IHs were seen in the general surgery outpatient clinic. The general outpatients' clinic is run by a general surgery professor who is assisted by an assistant lecturer, senior residents, intern doctors, and nursing officers. The study was conducted between October 2016 and April 2018.

(1) Age: 18–70 years
(2) IHs that follow: midline, paramedian, subcostal, pfannenstiel, and lumbar incisions.

Selection

Inclusion criteria

(1) Male or female adults
(2) Age 18–70 years
(3) Patients who had uncomplicated IH
(4) Size of the defect 10 cm or more
(5) Defect either single or multiple
(6) Patients who are fit for anesthesia (American Society of Anesthesiologists score 1 and 2)
(7) Patients who provide a written informed consent
(8) Patient who came for the follow-up at the outpatient clinic.

Exclusion criteria

(1) Male and female children below 18 years of age
(2) Patients who are unfit for anesthesia (American Society of Anesthesiologists score > 2)
(3) Patients with small hernia with a defect of less than 10 cm
(4) Patients requiring any other concomitant surgical procedures
(5) Patients with recurrent IH
(6) Patients with strangulated hernias
(7) Patients with abdominal malignancies
(8) Patients with cirrhosis and end-stage liver diseases.

Site of incision of previous surgery

Incidence of development of IH postmidline incision was 70% (28 patients), supraumbilical 32.5%, and infraumbilical 37.5% (Fig. 1).

Preoperative

In addition to thorough clinical examination, laboratory tests required for the patient's clinical condition, the size of the operation and repair and/or compensation of associated disease, and the ulcers on the skin overlying the hernia were treated with appropriate care.

Other measures, mainly, were aimed to improve the respiratory conditions. Elimination of smoking allows the patient to improve the lung capacity and the cough reflex. Weight reduction was recommended.

Preoperative passage of nasogastric tube with suction was done in some cases to reduce the distension of the bowel and mechanical preparation of the colon.

Surgical technique

All surgeries were done under spinal or general anesthesia.

After the period of physiotherapy, the patient tolerating the supine position and abdominal elastic straps was considered fit for operation. The coverage of preoperative antibiotic prophylaxis was routinely performed, usually using cephalosporin (cefazolin), as well as the prevention of deep venous thrombosis of the limbs and pulmonary embolism in patients at risk (pharmacological prevention, compression stockings, and early active movement on the bed).

The skin incision was usually fusiform around the skin changes. The skin scar over the hernia sac was sometimes excised, and the sac was dissected until reaching the hernia ring ~2 cm from the aponeurotic tissue. A plane of at least 5 cm was made in all directions over the fascia. To not restrict the abdominal cavity after dissection of the hernia sac, opening and lysis of adhesions was done. After reducing the hernia contents, the edges of the hernia sac were approximated by sutures of Vicryl 2-0. Additional maneuvers were performed to increase the abdominal cavity. Among them the most common were:

(1) Rectus muscle relaxation maneuver (Gibbons technique) held sectioning both the anterior sheath of the rectus muscles
(2) Section of the external oblique muscle aponeurosis along the lateral border of rectus muscle (changed the Ramirez technique), both to the full extent of the hernia defect.

After the dissection and preparation for placement of the prosthesis, surgeon and assistants changed gloves and skin antisepsis was done again before manipulating the prosthesis. All cases were checked for good hemostasis (Fig. 2).

The polypropylene prosthesis (Marlex or Prolene) was used. We noted the length and width of the defect and transfer these measurements to 20 × 30 or 30 × 30 cm prosthesis, sectioned rounding their edges. The prostheses were fixed with Prolene 2-0 or 3-0 either as interrupted sutures at an interval of 3 cm or as continuous sutures in order to keep the prosthesis stretched, but not tense. In addition, several sutures between the prosthesis and the underlying hernia sac were done. After correction the wound was washed with saline solution under pressure and redone the skin disinfection. To provide better accolade of the subcutaneous tissue to the wall, separate absorbable sutures were given in the middle portion of the flap and subcutaneous aponeurosis/prosthesis. Two closed suction drains were placed. The skin was closed with continuous intradermal absorbable sutures (Monocryl 4-0) (Fig. 3).

Drains remained for an average of 7 days or more until drainage reduced to 20 or 30 ml. The patient was discharged using an elastic strap.

Postoperative follow-up was done at the outpatient clinic.

Statistical analysis

The findings were analyzed using SPSS, version 10.0 (SPPS Inc., Chicago, Illinois, USA). Values were expressed as mean ± SD. The χ^2-test was used to analyze categorical variables. Student's unpaired *t*-test was used to compare statistical significance of numerical variables. A *P* value less than 0.05 was considered as statistically significant.

Results

Age and sex distribution

A total of 40 patients with large IH (defect ≥10 cm) underwent onlay mesh repair from October 2016 to April 2018. The youngest patient was 32 years old, the oldest was 65 years old with a mean ± SD of 47.8 ± 10.12.

Female-to-male ratio was 5: 3 showing that the incidence of IH is higher in women. The highest incidence of IH among them was in the third decade of life.

BMI varies from 24 to 34 with a mean ± SD of 28.25 ± 2.68 [Table 1].

Size and number of defects

The number of patients who underwent previous emergent operation were 33 either in the emergency room or in the trauma unit in the Assiut University Hospital, whereas the number of patients who underwent elective operation were seven patients [Table 2].

Risk factors for the development of incisional hernia

Several items about risk factors were seen during the previous operation and proceeded to the occurrence of IH [Table 3].

Operative data

Operative data includes time of the operation, blood loss, hospital stay, and duration of drain [Table 4].

Postoperative complication

In this series, wound complications were noted in 45% of patients. The most common complication noticed was seroma formation. The cases of seroma in our study were noticed between the 3rd and 7th postoperative day, needed aspiration and resolved within a week with pressure dressing. No case of wound hematoma was noticed.

The next most common complication was surgical site infection (SSI). All the infections were superficial and responded well to dressings and antibiotics. There was no case with deep infection or extrusion of the mesh. The incidence of tissue necrosis at the wound edge was 7.5%.

The most important complication of IH repair is recurrence of the hernia. The recurrence rate in the study was 5% [Table 5].

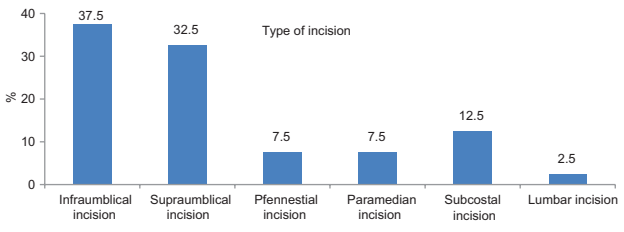
Discussion

Ventral IH develop in 10–20% of patients after abdominal surgery [12]; they are a major source of morbidity and up to 44% recurrence rate is reported within the first 5 years after repair [13–15].

Diabetes mellitus is a common risk factor in postoperative IH development seen in 21 (52.5%) patients that may be related to delayed wound healing and wound infection. Screening for diabetes and hyperglycemia among patients having giant IH repair may be warranted to prevent postoperative and long-term complications of this metabolic abnormality.

The detrimental effect of smoking on the healing of the acute fascial wound has been documented in the risk factors for the development of IH. Ten (40%) patients who developed IH were smokers. Smoking and peripheral tissue hypoxia, which may be caused by smoking, increase the risk of wound infection and dehiscence presumably through reduction of the oxidative killing mechanism of neutrophils, which constitute a critical defense against surgical pathogens.

Figure 1



Site of incision of previous surgery.

Table 1 Age

Age (years)		
<40	13	32.5
40-49	9	22.5
50-59	12	30.0
≥60	6	15.0
Range	32-65	
Mean±SD	47.8±10.12	

Table 2 Size and number of defects

	n (%)
Previous surgery	
Emergency	33 (82.5)
Elective	7 (17.5)
Number of defects	
Multiple	23 (57.5)
Single	17 (42.5)
Size of defect (cm)	
10-15	22 (55.0)
>15	18 (45.0)

Table 3 Risk factors for the development of incisional hernia

	n (%)
Smoking	10 (25.0)
Diabetes mellitus	21 (52.5)
Anemia	11 (27.5)
Hypoproteinemia	7 (17.5)
Corticosteroid use	5 (12.5)
Wound sepsis	22 (55.0)
Postoperative cough	10 (25.0)
Postoperative strain	7 (17.5)

Table 4 Operative data

	n (%)
Operative time (min)	
Range	60-100
Mean±SD	82.25±11.21
Blood loss (ml)	
50-100	17 (42.5)
101-150	16 (40.0)
151-200	5 (12.5)
201-250	1 (2.5)
251-300	1 (2.5)
Range	50-300
Mean±SD	138.75±49.98
Hospital stay (days)	
Range	2-7
Mean±SD	3.48±1.55
Drain (days)	
Range	4-11
Mean±SD	7.60±1.79

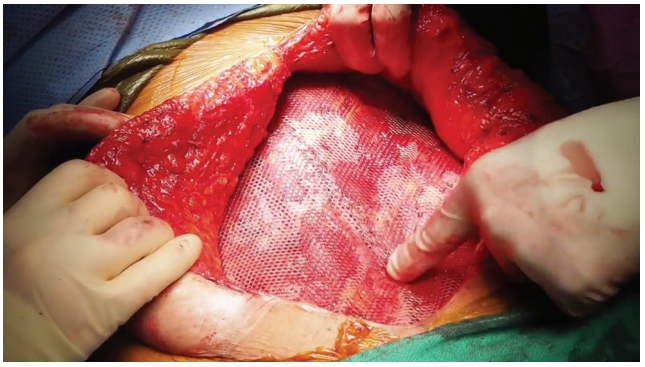
Table 5 Postoperative complications

Complications	*n* (%)
Seroma	9 (22.5)
Surgery site infections	6 (15.0)
Wound edge necrosis	3 (7.5)
Abdominal discomfort	5 (12.5)
Recurrence	2 (5.0)
Death	0 (0.0)

Figure 2

Upper midline defect about 10 cm.

Figure 3



Onlay mesh placement after repair of the defect.

In addition, decreased collagen deposition and the reduced collagen I–collagen III ratio may also be attributed to smoking. Degradation of connective tissue caused by an imbalance between proteases and their inhibitors has also been postulated [16].

Repair of large and giant IHs has undergone major changes in the last two decades and patients can now be treated with high success rates. With the use of prosthetic mesh becoming the standard of care in the management of IHs, the subsequent rate of recurrence has been lowered.

The rate of recurrence in the onlay group in our study was 5% (mean follow-up: 12 months), which is significantly lower compared with an average of 18.3 and 20% for the onlay technique of repair reported in Mohebali *et al.* [17] and Gleysteen *et al.* [18], but little bit higher in the study of Karan *et al.* [19]. The discrepancy in results can be because of patient factors and follow-up time.

Common complications following IH repair include infection, seroma, wound dehiscence, and the formation of enterocutaneous fistulae. Each of these complications conveys morbidity and the risk for additional sequelae.

There is no real agreement on the factors that predict the occurrence of postoperative complications or recurrence after mesh repair of IH. Out of the two cases of recurrence in our study, one was associated with SSI and the other had postoperative straining.

The incidence of seroma in our study was 22.5%, making it the most common complication following the repair of IH. Seroma formation was followed by SSI (15%) as the second most common complication. The type of surgery (elective vs. emergency) was significantly associated with the rate of SSI in our study. SSI was seen in four (10%) patients who underwent previous emergent operations, whereas the other two (5%) patients who developed SSI had underwent previous elective operation. As both of these factors are related to wound care, they warrant better intraoperative and immediately postoperative services.

Mesh infection is a devastating complication of IH repair which may result in sepsis, requiring mesh extraction or fistula formation; however, neither mesh infection nor enterocutaneous fistula were seen in our study.

Conclusion

Any surgical procedure can be complicated by IH that may enlarge by time as a result of multiple factors. Repair of large and giant IH using prosthetic nonabsorbable mesh has a reasonably good outcome with acceptable rates of recurrence. In our study, onlay mesh repair has shown promising results. Seroma is the most common complication following the repair of large and giant IH.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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