

Interposition of the hernia sac as a protective layer in repair of giant incisional hernia with polypropylene mesh

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Abstract

Background and purpose Repair of giant incisional hernia is still associated with high postoperative morbidity and recurrence rates. We evaluated the effectiveness of placing the hernia sac between the viscera and the polypropylene mesh in the repair.

Methods The subjects of this study were patients with an incisional hernia at least 15 cm in diameter, diagnosed between June 2004 and October 2010 and treated with on-lay polypropylene mesh at least 25 cm in length. We operated using a simplified method of placing the hernia sac between the viscera and the mesh, and fixing the mesh with interrupted trans-fascial U sutures. We evaluated the patient demographics and postoperative complications retrospectively.

Results A total of 25 patients (mean age 57.1 ± 10 years) were included. The mean length of hospital stay was 1.8 ± 1.2 days. Seroma developed in four patients (16 %), but only two with cystic seroma required excision of the cyst wall with preservation of the mesh. Twenty-two patients (88 %) were followed up for a mean period of 42.6 ± 23 months. There was no incidence of chronic pain, hospitalization for intestinal obstruction, or enterocutaneous fistulization. There was only one recurrence (4.55 %).

Conclusion The hernia sac can be interposed in all patients undergoing giant incisional hernia repair if direct

contact between the polypropylene mesh and intestine is unavoidable.

Keywords Hernia · Abdominal · Herniorrhaphy · Surgical mesh

Introduction

The development of incisional hernias after abdominal surgery is a major cause of morbidity, with high recurrence rates. Although incisional hernias can be repaired effectively with several types of synthetic mesh, repair and especially closure of giant and complex incisional hernias with massive depletion of fascial and muscular tissues is difficult [1–4]. The use of polypropylene (PP) mesh is reported to be associated with long-term complications such as severe adhesions and enterocutaneous fistula, which occur more commonly if the mesh is applied intraperitoneally with direct contact of the serosal surface of the intestine [4–8]. Composite meshes containing expanded polytetrafluoroethylene (ePTFE) have been used recently, especially in laparoscopic repair of incisional hernias. Despite the low adhesive potential of these meshes, their major drawbacks lie in their high cost, inferior handling characteristics, and poor incorporation into the tissues [8–11].

Creating tension-free repair and avoiding direct contact with intraabdominal viscera have been accepted as the most important technical points during repair of giant incisional hernias with PP meshes [8, 12]. We describe a simple modified technique of using the hernia sac as a protective layer in repair of giant incisional hernias with PP meshes, and evaluate its effectiveness in reducing morbidity and long-term complications including recurrence and enterocutaneous fistulization.

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Materials and methods

We reviewed the medical records of patients who underwent incisional hernia repair with PP mesh between June 2004 and October 2010 at The Religious Foundation of Turkey, Istanbul 29 May Hospital, after obtaining Institutional Review Board approval.

Patients and hernias

During the study period, 77 patients (mean age 58.3 ± 10.7 years) underwent incisional hernia repair with PP mesh. The subjects of this study were 25 of these 77 patients, who had hernias >15 cm in their maximum diameter and massive depletion of muscular and fascial tissues, treated with on-lay PP mesh at least 25 cm in length after tension-free fascial and hernia sac closure. The maximum diameter of the fascial defect was 18.7 ± 3.3 cm. The criteria for exclusion from the study were a lack of complete data, emergency admission, and untreated malignant disease.

We recorded patient demographics, including gender, age, American Society of Anesthesiology (ASA) score, indications for initial laparotomy and localization of the hernia. All of the patients had undergone previous laparotomy. Six (24 %) of the patients had recurrent incisional hernia, one of whom had undergone five previous midline repairs, making a collective total of ten unsuccessful attempts at closure. In other words, all but one patient had been operated on once. The previous operations were for cancer in four patients and for benign abdominal disorders in 21. The incisional hernias were located in the midline in 17 patients, the Pfannenstiell area in 3, the paramedical area in 3, the transverse abdominal area in 1, and the subcostal area in 1. We evaluated the following: length of hospital stay; development of early complications within in the first postoperative month, including seroma, hematoma, and wound infection; and late complications beyond the first month, including cystic seroma, chronic pain, recurrence, enterocutaneous fistulization, and any readmission for intestinal obstruction.

Operative techniques

One of the authors of this study (M.H.) performed all the operations. At the time of induction of general anesthesia, a first generation cephalosporin was administered intravenously as prophylaxis. First, the thin skin scar around the hernia was excised and then, using an electrocautery needle, the subcutaneous tissue was dissected until it was 5–7 cm away from the fascial margins. After opening the hernia sac, the peritoneal cavity was explored and complete adhesiolysis was performed. If there were multiple defects,

they were transformed into one large defect. The hernia sac was incised into two leaves and a series of 0/0 polypropylene U sutures were placed around the hernia orifice by penetrating all fascial (trans-fascial) layers. These sutures were placed about 2 cm apart at the end of the dissected fascial margins, without knotting at this stage. After placing the U sutures, the omentum was interposed between the viscera and the posterior layer of the abdominal wall, if available. After removing the protruding portion of the sac, it was carefully closed on the midline by a continuous 2/0 absorbable suture in a tension-free manner (Fig. 1).

Using an on-lay technique, the PP mesh was placed over the hernia sac and the fascia extending at least 5 cm beyond the borders of the defect. The size of the mesh, to be placed in a tension-free manner, was calculated according to the diameter of the defect after closure of the midline using leaves of the hernia sac, including at least a 6 cm overlap in all directions. It was fixed to the fascia with the previous series of 0/0 polypropylene U sutures, without tension or wrinkling so as not to cause ischemia of the tissues (Figs. 2, 3). Interrupted 2/0 polypropylene sutures were placed between the U sutures over the fascia, if necessary. No suture was placed in the hernia sac while fixing the mesh. After hemostasis, two closed suction drains were placed on top of the repaired fascia on each side. The subcutaneous fascia was approximated, and the skin was closed with 3/0 non-absorbable sutures. The drains were kept in place until the daily output was below 10 ml.

All patients were given thromboembolic prophylaxis with low molecular weight heparin and pulmonary training during hospitalization. The patients were encouraged to mobilize with abdominal bandages in the early postoperative period and were discharged when they had recovered

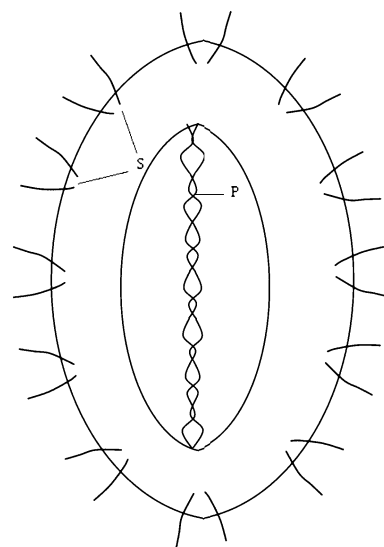


Fig. 1 Placement of trans-fascial U sutures (S) around the hernia defect after midline closure of the peritoneum and hernia sac (P)

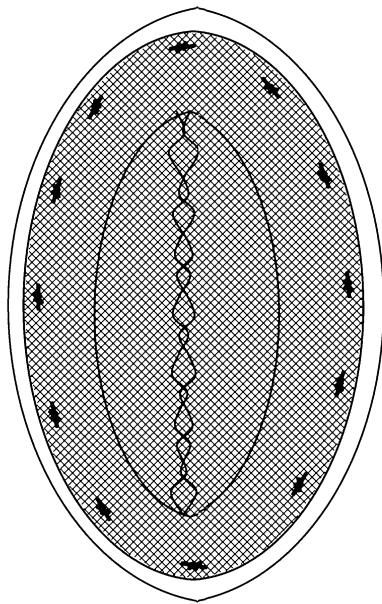


Fig. 2 Upper view of repair of the incisional hernia

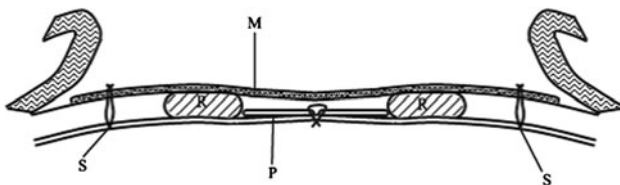


Fig. 3 Schematic drawing of the repair. Mesh (*M*) was placed anteriorly over the bilateral rectus abdominis muscles (*R*), and hernia defect, which is covered by peritoneum and hernia sac (*P*)

their autonomy. Abdominal bandages were kept in place for 3 months postoperatively. The patients were reviewed at 1 and 6 months, and followed up at least once a year thereafter. To assess if they had complained of pain and bulging and for confirmed recurrence, we checked the medical records or telephoned them in January 2012. Any concerns were then re-evaluated by physical examination.

Seroma and hematoma were defined as an accumulation of fluid or blood, respectively, in the operative field after the drains were removed, for which percutaneous drainage or aspiration was required. Cystic seroma was defined as a fluid collection in the subcutaneous tissue, demarcated by the cyst wall after 3 months postoperatively. Wound infection was defined as redness over the wound and purulent drainage from the incision. Recurrence was defined as any abdominal wall gap associated with a bulge not covered by mesh in the area of a postoperative scar, which was diagnosed by physical examination after complaint by the patient. Chronic pain was defined as pain which was described by the patient as discomfort preventing daily activities alone.

All data were collected in a spreadsheet (Microsoft Excel; Microsoft, San Jose, CA, USA). Results are expressed as mean values \pm standard deviation (SD).

Results

The study group included 5 men and 20 women, with a mean age of 57.1 ± 10 years and a mean ASA score of 1.5 ± 0.5 . There were no major postoperative cardiovascular and pulmonary complications in the group, none of the patients required intra- or postoperative transfusion, and there was no mortality. The mean length of hospital stay was 1.8 ± 1.2 days. The postoperative complications are shown in Table 1. Seroma developed in the early postoperative period in four patients. Although all were treated with a single aspiration, two patients had cystic seroma, which required excision of the cyst wall with preservation of the mesh (Fig. 4). Closed suction drains were placed in the operative area.

Of the 25 patients, 22 (88 %) were followed up for a mean of 42.6 ± 23 months (range 16–92 months). There were two deaths associated with cardiovascular problems. There was no hospitalization for intestinal obstruction, enterocutaneous fistulization, or chronic pain within the follow-up period. The patients who had had the cystic seromas were also free of complaints including bulging and pain. The patient who had been operated on for recurrent incisional hernia five times before suffered another recurrence.

Discussion

Repair of an incisional hernia longer than 15 cm presents important technical challenges with regard to closure of its edges in a tension-free manner, the type and placing of the

Table 1 Postoperative complications

Complication	Number of patients, <i>n</i> (%)
Early (<i>N</i> = 25)	
Seroma	4 (16)
Hematoma	0
Wound infection	0
Late (<i>N</i> = 22)	
Prolonged pain lasting more than 6 months	0
Intestinal obstruction	0
Enterocutaneous fistulization	0
Cystic seroma	2 (9)
Recurrence	1 (4.55)



Fig. 4 Computed axial scan showing cystic seroma formation (*white arrow*) in the anterior abdominal wall after repair of the incisional hernia. Mesh (*M*) was placed over the bilateral rectus abdominis muscles (*R*) and granulation tissue between the mesh and peritoneum (*P*)

prosthetic material to be used, and postoperative complications such as recurrence and enterocutaneous fistulization. Many criteria have been proposed to define “giant” or “complex” incisional hernia [1, 2, 10, 11, 13–15]; however, for this study, we accepted “the diameter of the hernia measuring at least 15 cm and the diameter of the mesh measuring at least 25 cm”.

As yet, no technique or approach has become the gold standard for repair of an incisional hernia [2, 9, 16]. In recent years, laparoscopic repair, even of large incisional hernias, has been performed at many centers, with similar morbidity to open repair [11, 17, 18]. However, long-term follow-up is needed to elucidate whether laparoscopic repair of incisional hernias is efficacious [18]. Ultimately, the choice of technique is generally determined by the surgeon’s preference, surgical tradition, or even by the hospital’s economic situation [2].

PP mesh is the most commonly used mesh for hernia repairs [13, 19]. Its advantages include its easy use, elasticity, strength, low rate of rejection, well-formed resistant tissue, and lower cost than ePTFE [8, 13]. It can even be used in clean-contaminated and contaminated wounds [13, 20]. It has been shown that composite mesh containing ePTFE as a tissue-impervious layer is potentially useful for preventing adhesion [2, 6]. However, the use of such meshes may be associated with seroma and hematoma formation and lower tissue resistance, leading to recurrence [2]. To repair the incisional hernias in our patients, we used PP mesh via an open approach, because of its cost-effectiveness in addition to the above features. There are several different techniques for open repair of incisional hernia according to the site where the surgeon decides to place the mesh; namely, on-lay, sub-lay (preperitoneal/retromuscular), and intraperitoneal anatomical positions [2, 4, 5, 13].

Although on-lay positioning has proven to be quick and efficient, it has been associated with a high incidence of postoperative surgical complications such as wound infection, seroma formation, and recurrence [5, 7, 14–16, 21]. The on-lay positioning was chosen for this study because of the ease of performing it quickly without a large dissection area. The sub-lay or retromuscular approach, known as “Rives–Stoppa repair”, has had the advantage of minimal adhesion formation, but it requires longer operation time and has a higher incidence of local complications, including seroma and hematoma formation because of the large retrorectus muscle dissection, prolonged drainage, and chronic pain [2, 14, 22, 23]. Although the technique involved in this repair is similar to that of ours, we avoided retrorectal dissection and eliminated the intraperitoneal application of composite meshes used in Rives–Stoppa repair because of their expense [24]. Moreover, intraperitoneal mesh has been associated with dense adhesions and enterocutaneous fistulization. It was also shown that re-laparotomy after previous incisional hernia repair with intraperitoneally placed PP meshes was associated with more intraoperative and postoperative complications than repair via the preperitoneal approach [5]. Although the technical details related to the presence or absence of interposed tissues during previous incisional hernia repair were not mentioned, there were more adhesions requiring adhesiolysis, necessitating small-bowel resections and wound infections in the intraperitoneal PP group during re-laparotomy [5].

Although a few studies suggest that the intraperitoneal placement of PP mesh does not carry a risk of fistula [23, 25], it is generally accepted that intraperitoneal placement with direct contact of the intestine may cause enterocutaneous fistulization and severe intraabdominal adhesions making future surgery difficult [2, 5, 6, 8]. In one study that concluded intraperitoneal PP mesh was a safe method to avoid the development of enterocutaneous fistulization, interposition of the omentum or the peritoneum was performed in 49 % of the patients and not performed in 42 %, while there was inconclusive evidence about interposition in the remaining 10 % [25]. Therefore, it could not be concluded that the intraperitoneal application of PP mesh is safe to avoid enterocutaneous fistulization. On the other hand, interposition, either by the omentum or the peritoneum including the hernia sac, was thought to be an important step for preventing adhesion. From a technical viewpoint, the absence of omental interposition, the presence of a fascial gap, and the pre- and intraperitoneal placement of mesh are regarded as the accepted risk factors for enterocutaneous fistulization associated with prosthetic mesh abdominal wall reconstruction [6]. The interposition of omentum between the mesh and underlying intestine has been proposed as a protective measure while placing PP

mesh intraperitoneally [2, 5, 8, 14, 25, 26]. However, this measure is not suitable for every patient in case of a lack of satisfactory omental tissue [1].

With the advent of laparoscopic incisional hernia repair, the intraperitoneal application of mesh is becoming standard [18]. However, these meshes are usually composite ones containing ePTFE and associated with higher costs. We believe that proper intraperitoneal placement of PP meshes with good interposition techniques produces satisfactory results without incurring high costs. We attribute the lack of enterocutaneous fistulization after placement of PP meshes in our series to using the hernia sac as a protective layer for preventing severe adhesions between the mesh and the intestine, in accordance with other studies on using the hernia sac for this purpose [1, 13, 19, 26–29].

The method of fixation of the mesh can be the cause of acute and chronic pain and postoperative discomfort [14, 17, 18]. Trans-fascial sutures were believed to predispose to chronic pain after laparoscopic repair of the incisional hernia, probably as a result of nerve entrapment, and extensive tension over the hernia repair is reported to be an important issue for the development of recurrences [20]. Thus, fibrous shrinkage of the mesh over time should be borne in mind while it is being placed [13, 20]. As a principle, it is advisable to leave the mesh slack to prevent future shrinkages causing tense repairs, and to avoid primary closure of a large fascial defect if it is going to cause tension over the repair. Good fixation and satisfactory overlapping of the mesh over the anterior fascial tissues help prevent future recurrences. Knotting of the trans-fascial U sutures without tension was also thought to be responsible for preventing both recurrences and chronic pain in the long follow-up period in the present study. Giant incisional hernia repair is made difficult by previously operated abdominal wall lacking proper fascial and muscular tissues [2]. Several studies report high incidences of several postoperative complications including pneumonia, upper extremity embolism and higher incidence of recurrences [3]. The lack of such complications in our study may be due to early mobilization, effective use of low molecular weight heparins, and good surgical technique.

Wound infection and graft removal are two of the most common complications of hernia repair surgery [20]. Wound infection was reported to be seen in up to 8.5 % of patients [11, 20]. We attributed the lack of wound infections in our series to the administration of prophylactic antibiotics to every patient, although we did not have a control group for comparisons. Seroma formation occurs after up to 21 % of incisional hernia repairs with mesh, making it one of the most common postoperative complications in spite of postoperative drainage [7, 21]. Measures to prevent the accumulation of chronic fluid collections include avoiding the dissection of a large skin flap, using

electrocautery carefully for hemostasis, leaving the smallest possible area of PP mesh in direct contact with subcutaneous cellular tissue, and the use of surgical drainage. Therefore, good surgical technique with closed suction drains for a longer period may help prevent seroma formation. Cystic seroma formation in the subcutaneous abdominal wall may develop in these patients, and it is possibly underreported [7, 21]. Although most seromas resolve with or without aspiration in 60–90 days postoperatively, surgical excision of the cyst wall is required for recurrent fluid collections. In the present study, there were two cystic seromas that required surgical excision. Although the cyst wall could be removed from the subcutaneous cellular tissue with relative ease, care must be taken not to damage the integrity of the mesh to prevent future recurrences [11]. We were able to remove all of the cystic tissue over the mesh completely in our patients. The need for a second operation under general anesthesia may be regarded as a disadvantage; however, the disappearance of any swelling causing discomfort over the incision can be regarded as the main purpose for excising a cystic seroma. A follow-up period of at least 3 years is mandatory to assess the recurrence rate correctly [17, 19, 20]. The mean follow-up period of 42.6 months (approximately 3 and a half years) in this study could be accepted as a reliable time period for detecting recurrences after repair of the incisional hernia.

These results may be similar to those of other techniques [3–5, 16, 22, 24]; however, low cost and greater ease in the surgical technique are its main advantages. Moreover, the lack of enterocutaneous fistulization and readmission for intestinal obstruction, and the low recurrence rate of 4.55 % after a mean follow-up period of 42.6 months may be the result of our simplified and cheaper technique in which the intestine is protected from the mesh by the hernia sac, and good fixation of the mesh over the fascia is achieved by U trans-fascial sutures without tension. It was also notable that the only recurrence was in a patient who had undergone repairs of their incisional hernia five times before.

The main limitations of this study were the lack of patient demographics such as body mass index, retrospective design, and the small number of cases studied.

In conclusion, we described the effectiveness of placing the hernia sac as a protective layer between the intestines and PP mesh, which is more cost-effective than other meshes, and fixing the mesh with interrupted trans-fascial U sutures without tension. This simplifies the repair and makes the technique more secure, preventing recurrence and enterocutaneous fistulization.

Conflict of interest M. Hasbahceci and F. Basak have no conflict of interest.

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