

Laparoscopic mesh repair of incisional hernia: an alternative to the conventional open repair?

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Abstract

Background Tension-free incisional hernia repair using alloplastic material increasingly replaces conventional repair techniques. This change resulted in a decreased recurrence rate (50% vs. 10%, respectively). Recently, laparoscopic approaches for the intraperitoneal tension-free mesh application have been introduced. The decreased trauma at the incision site and the reduction in wound infections appear to be the main advantages. The aim of the present study was to evaluate the early and long-term complications as well as patients' contentment.

Methods Laparoscopic hernia repair with intraperitoneal polytetrafluoroethylene (PTFE) mesh implantation was performed on 62 patients at the Klinikum Grosshadern between 2000 and 2005 (29 males, 33 females age 60.7). Intra- and postoperative complications were registered prospectively and retrospectively analyzed. In addition, 57 patients were evaluated for recurrence, postoperative pain and patient contentment (median follow-up 409 days).

Results A low complication rate was observed in our patient collective. One trocar bleeding occurred. Three

patients presented with wound hematoma. The recurrence rate was 8% (2/25). Sixty-two percent of the patients were free of complaints postoperatively. Eighty-five percent would once again choose the laparoscopic approach for incisional hernia repair.

Conclusion The laparoscopic technique was associated with a low recurrence rate, a small rate of wound infections and high patient comfort. Thus, the laparoscopic approach for mesh implantation appears to be a safe and effective method for the treatment of incisional hernias. The efficiency for laparoscopic intraperitoneal mesh implantation, however, should be further evaluated within a prospectively randomized multicenter trial.

Keywords Incisional hernia · Laparoscopy · PTFE mesh

Introduction

Incisional hernia is one of the most common long-term complications after abdominal surgery. In prospective studies the incidence has been reported to range from 11 to 29 % after a laparotomy [1–5]. These defects following surgery result in the performance of about 90,000 ventral hernia repairs in the United States annually [4]. Thus, ventral hernia repair is one of the most common general surgery procedures. Although various techniques have been described for their repair, results are often disappointing. After primary suture, recurrence rates are as high as 54% [5, 6]. Therefore, in the last decade primary repair has been replaced by tension-free approaches using prosthetic mesh in onlay or sublay technique [7, 8]. The use of prosthetic mesh is

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associated with lower recurrence rates of 10–34% [7, 9, 10] compared to primary repair, but it is associated with an increased risk of wound complications, i.e. infection, seromas, mesh extrusion, fistula and adhesions [7, 10–13].

With the expansion of laparoscopic surgery in the 1990s, a new laparoscopic technique of incisional hernia repair was developed and first described by LeBlanc and Booth [14]. With the use of laparoscopic methods, large incisions, excessive fascial preparation and drain placement can be avoided, which is postulated to reduce postoperative wound infections and subsequent mesh removal [15–17]. Recent reports of laparoscopic repair of ventral incisional hernia repair suggest that this technique is associated with minimal postoperative morbidity, shorter hospital stay and an earlier return to normal activity [12, 16, 18, 19]. Most of those studies, however, were performed in specialized centers.

Thus, it was the purpose of the present study to review the results of a single academic hospital over five years with laparoscopic repair of ventral incisional hernias with respect to early, i.e. wound infection, and long-term complications, i.e. recurrence rate. In particular, patients' contentment was evaluated using analog scales.

Materials and methods

Patients

Between January 2000 and June 2005, 62 laparoscopic ventral incisional hernia repairs (29 males, 33 females, median age 60.7) were performed at the Klinikum Grosshadern, University of Munich.

Patient records were reviewed for preoperative, intraoperative and postoperative data. Pertinent information for analysis including patient age, gender, operating times (measured from skin incision to application of dressing), intra- and postoperative complications (such as bleeding, wound infection, seroma and recurrence rate), and length of hospital stay were collected. Moreover, 57 patients were found for follow-up and were examined clinically and via ultrasound. In addition, subjective parameters on patient complaint were gathered using analog scales. Five patients were lost to follow-up.

Laparoscopic technique

All operations were carried out under general anesthesia. Patients were treated with a single-shot dose of

antibiotic therapy perioperatively (in general a third-generation cephalosporin). Patients are usually placed in the supine position, unless the location of the hernia dictated an alternative position on the operation table. A Foley catheter and oral gastric tube are placed to decompress the bladder and stomach.

Access to the abdomen was obtained with as much distance as possible from the hernia in order to achieve the best working space (Fig. 1). For safe access in these patients with a high incidence of adhesions we used the open technique. Nonetheless, prior to surgery an ultrasound examination was performed in an attempt to detect patients with severe adhesions. After insufflation of the pneumo-peritoneum, the laparoscope is introduced via 10 mm trocar, the whole abdominal cavity is explored and the other trocars (usually one 5 mm trocar and one 10 mm trocar) are placed under direct vision according to the location of the hernia and adhesions. Adhesiolysis was performed to relieve the anterior abdominal wall, allowing sufficient area for mesh placement and fixation (Fig. 2a). The hernia sac contents are completely mobilized. The hernia sac is left in situ. The fascial defect is not closed directly. Using trans-illumination the hernia defect is marked on the skin (Fig. 2b). After measuring the defect, the size and shape of the mesh is determined, allowing for an overlap of at least 5 cm circumferentially. The prosthetic material used to cover the defect was polytetrafluoroethylene (PTFE) (Gore-Tex Dual Mesh, Gore & Associates, Flagstaff, AZ, USA) in all patients. Non-absorbable PTFE sutures (Gore & Associates, Flagstaff, AZ, USA) are placed at the corners of the mesh and at a distance of 5 cm around the edges. The mesh is then inserted through the 10 mm trocar. Following this step, the mesh is positioned intra-corporally, covering the hernia defect and sutures are retrieved transfascial

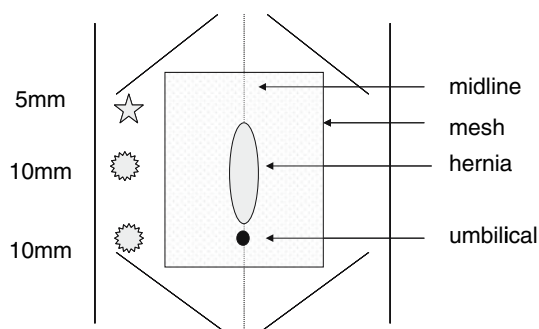
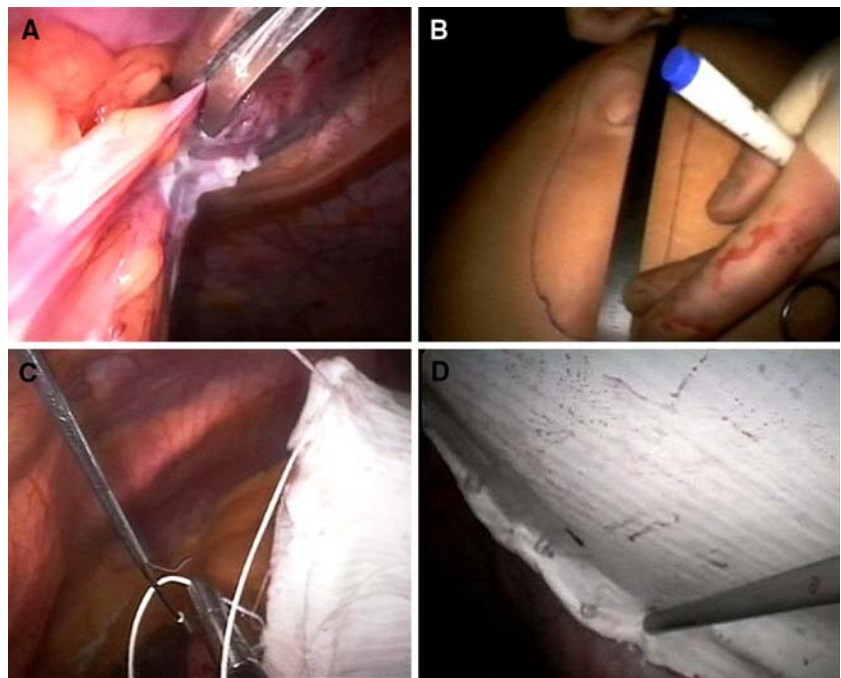


Fig. 1 Schematic presentation of the mesh and trocar placement in relation to the hernia. The lower 10 mm trocar may be replaced by a 5 mm trocar, depending on the diameter of the taker instruments. Note that the position of the trocars may vary and is determined by the size, position, and shape of the hernia

Fig. 2 Intraoperative images of the surgical procedure. **a** Dissection of abdominal wall adhesions. **b** Identification and determination of the size and shape of the hernia in the trans-illumination technique. **c** Transfascial fixation of the corner stitches (PTFE suture) placed on the mesh via endoclose needle. **d** Terminal fixation of the mesh with spiral tacks, distance 1 cm to each other



using an endoclose needle (Ethicon, Hamburg, Germany) (Fig. 2c). The mesh is fixed with tacks placed around the whole circumference at a distance of 1 cm (Fig. 2d). Moreover, tacks are placed around the fascial defect (double crown technique). After complete mesh fixation and removal of the pneumo-peritoneum, the fascia of the 10-mm trocars is closed. Drains are not used routinely.

Long-term follow-up

Fifty-seven of 62 patients were examined physically and via ultrasound. In five patients no examination was possible due to lost follow-up. Median follow-up period was 409 days. Although a longer follow-up period for evaluation of the recurrence rate would be desirable, 409 days appear to be clinically relevant since the majority of recurrent hernias appear within the first year following surgery. Particular attention was given to postoperative pain reported by the patients, as well as problems in daily life following laparoscopic mesh repair. Postoperative pain has been evaluated using an analogue scale from 1 to 6 in the style of the McGill pain questionnaire score published by Kremer and Atkinson [20]. The method used in the present study was adapted to the specific issues relevant after incisional hernia repair. Although this system was not validated, it was based on a previously published scoring system using an analogue scale [20]. In addition, hernia recurrence rate was determined.

Results

General data, operation time and perioperative complications

Between January 2000 and June 2005, 62 patients underwent laparoscopic ventral hernia repair. Average operative time was 126 ± 56 min. One patient (1.6%) required conversion to an open procedure due to severe adhesions. Intraoperative complications were in one case trocar bleeding, which could be stopped by laparoscopy. In one patient iatrogenic bowel injury caused a major complication with severe peritonitis, several revisions and a long-term intensive care unit stay. Finally, this patient recovered from this complication.

Average length of stay was 7.9 days (range 4–16 days). Postoperative complications occurred in six patients. During the hospital stay one patient had a minor wound infection requiring antibiotics resulting in secondary wound healing. Two patients developed obstipation symptoms. Three patients had port site haematoma that were managed conservatively.

Thus, the total wound complication rate was 1.6%.

Postoperative pain

On a scale from 1 to 6 (1 means no pain; 6 means severe pain), 49% (28/57) of the patients reported none or only little postoperative pain (1 and 2). Thirty-five percent (20/57) of the patients suffered from mild

to moderate pain and 15% (9/57) complained severe postoperative pain (5 and 6) (Table 1).

Long-term follow up

Fifty-seven patients were available for long-term follow-up with an average observation time of 409 days. Three patients (5.2%) presented a recurrent hernia within one year of surgery. All three patients had their recurrences documented on physical examination and ultrasound diagnosis and had surgical repair of their recurrent hernia.

Postoperative pain

On a scale from 1 to 6 the overall patient’s contentment was 2.3.

Thirty-six patients were very content (scale 1) (Table 2). Five patients were very dissatisfied with the procedure (scale 6). In every day life 49 of 57 patients had no or only minor problems. Eighty-five percent of the patients would choose again a laparoscopic approach for hernia repair, demonstrating the positive attitudes towards this procedure.

Discussion

In the industrial countries, i.e. US or Western Europe, it is common to perform ventral incisional hernia repair with tension-free prosthetic mesh grafts if the hernia exceeds 5 cm [21]. The first ventral incision hernia repair by laparoscopy was reported in 1993 [14]. Both positioning of the mesh (intra-abominal, onlay technique or sublay technique) and the operative entry (laparoscopic vs. open) are discussed controversially.

Several innovative approaches to the treatment of ventral hernias using prosthetic mesh have been

reported [22–24]. Nonetheless, Rives–Stoppa–Wantz (RSW) repair for large ventral hernias is considered to be the gold standard for hernia repair, and is reported to have the lowest recurrence rates. The laparoscopic ventral hernia repair is based on the method described by Stoppa. It involves posterior reinforcement of the abdominal wall with a large piece of prosthetic mesh based on Laplace’s law. The large surface area of the mesh allows substantial ingrowth of tissue for permanent mesh fixation, and the intra-abdominal pressure tends to hold the mesh in apposition to the posterior abdominal wall over a wide surface area [24, 25]. Although the laparoscopic approach affords a number of advantages, it does not require large incisions or significant abdominal wall dissection, in contrast to the sublay technique for open mesh implantation. By eliminating subcutaneous flaps and percutaneous drain placement, the laparoscopic approach reduces the incidence of wound complications, i.e. wound infections associated with open repair while maintaining a recurrence rate equivalent to the RSW repair [13]. Furthermore, there is no need to open the old incision and therefore prolonged exposure of the mesh to skin flora and potential bacteria in the former wound are avoided [19]. This is of special importance following wounds with prior infections and after recurrence of subfascial repairs [19].

Despite these apparent advantages of laparoscopic hernia repair the standard treatment of ventral hernia repair remains conventional mesh repair. Several meta-analyses have compared laparoscopic mesh repair with conventional treatment for incisional hernia repair, showing a significant advantage for the minimal-invasive approach [26–28]. Most of those studies, however, were performed in specialized centers. In the present study 62 patients were evaluated for postoperative complications and long-term results. Although sample size is limited this study provides information on the safety and feasibility of the laparoscopic approach for the treatment of incisional hernias in the setting of a university hospital not specializing in this procedure. This appears to be important information as opposed to series reported from specialized centers since those results may better reflect a clinical relevant situation. In addition, patients’ subjective emotions, i.e. postoperative pain, problems to manage daily life or general contentment were not considered in these studies.

Table 1 Postoperative pain using analog scale

	Scale					
	1	2	3	4	5	6
Pain	None	Little	Mild	Moderate	Strong	Severe
Patients	10	18	10	10	4	5

Table 2 Contentment and every day problems using analogical scale

	Scale					
	1 (very good)	2 (good)	3 (alright)	4 (not good)	5 (bad)	6 (very bad)
Contentment	36	6	7	3	0	5
All day problems	35	7	7	3	1	4

The conversion rate of 16% in our series is comparable to the literature, where conversion rates in the range 0 to 7% are reported [27, 29, 30].

Most comparative studies have reported a lower overall postoperative complication rate with the laparoscopic, compared to the open technique (20% vs. 31%, respectively) [29]. The laparoscopic approach results in lower wound complication rates, including haematoma, infections and wound dehiscence. Similar to those results, wound infection rates were 1.6% in the present study compared to 14% following open mesh repair in a historic control (Table 3). Wound complications after laparoscopic hernia repair often occur in small trocar incisions and therefore they tend to be less severe, easier to treat and require mesh removal less frequently than in open repair [5, 16]. In our series we had one trocar site infection which had to be treated with antibiotics. In one patient iatrogenic small-bowel injury occurred, resulting in peritonitis that required mesh removal.

The average hospitalization in our series was 7.9 ± 2.6 days, which was similar to an open approach for mesh implantation (Table 3). This long hospitalization period appears to be due to relative high rate of comorbidities of patients at a university hospital. Nonetheless, it is the aim to reduce hospitalization time for laparoscopically operated patients. In contrast to our results, Carbajo et al. [16] report a significantly reduced hospitalization time for patients treated with laparoscopic hernia repair. In addition, Holzman et al. [12] performed a cost analysis and found that, despite longer operative times in laparoscopic ventral hernia repairs, early hospital discharge resulted in significant overall cost savings compared to open hernia repairs. The most frequent major complication is iatrogenic bowel injury and peritonitis, occurring in 0.8% of the cases [8, 28]. In our study, one case with iatrogenic bowel injury was observed. In general, complications following laparoscopic hernia repair appear to be rare and are observed more frequently in the early phase of the learning curve [27, 28].

Table 3 Comparison of complication rate between different surgical procedures

	Method		
	Laparoscopic	Open surgery with mesh graft	Mayo
Patients	62 (2000–2005)	29 (2000)	16 (2000)
Recurrence rate	5.2%	10%	25%
Wound complications	1.6%	14%	25%
Hospital stay (days)	7.9	7.3	6.8

Our recurrence rate of 5.2% (3/57) is consistent with previously reported rates of 1 to 11% [6, 18, 26–29]. The largest study populations consist of 407 and 850 patients from multicenter trials with less than two years follow-up, both published by the same institution [18, 27]. In those studies, a recurrence rate of 3.4% and a complication rate of 13% were noted [18]. LeBlanc et al. and Ben Haim et al. reported recurrence rates of 9.3 and 2%, respectively. The higher recurrence rate in the study of LeBlanc et al. [28] was referred to technical problems, i.e. mesh fixation technique and small mesh grafts [1, 10]. Other authors did not find any significant difference between recurrence rates after laparoscopic or open repair [11, 31, 32]. Our findings suggest that the laparoscopic approach as opposed to the open repair results in a reduction of the recurrence rate of 10%, compared to 5.2%.

Eighty-five percent of the patients answered the question of whether they would chose again a laparoscopic technique for hernia repair positively. In long-term follow-up one patient complained of persisting pain without any morphological correlation in various imaging techniques. Vermeulen et al. [33] described a patient with similar pain due to transfacial mesh fixation sutures.

Our data suggest that laparoscopic approach to ventral incisional hernia repair represents a safe and feasible alternative to conventional hernia repair techniques, although prospective multicenter trials are required for further evaluation. In the present study, postoperative wound complications and recurrence rates were acceptable. Patient contentment was high in our study with little postoperative pain and fast return to normal activity was noted. Based on those findings a multicenter clinical trial has been initiated for comparison of the laparoscopic and open hernia repair including information on life quality and pain as well as documentation of wound complications and recurrence rates.

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