SURGICAL ENDOSCOPY

and Other Interventional Techniques

Minimally invasive incisional herniorrhaphy

A review of 208 cases

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Abstract

Background: Minimally invasive incisional herniorrhaphy has become an accepted approach for incisional hernia. However, the ideal technique for this procedure is not known. The authors present their technique and personal experience with minimally invasive incisional herniorrhaphy.

Methods: A retrospective review investigated 208 consecutive patients who underwent minimally invasive incisional hernia repair under the supervision of a single surgeon between 1995 and 2002.

Results: An intraperitoneal mesh repair was performed in all cases. There were no conversions. The mean operative time was 2.1 h (range, 0.8–4.5 h). The mean length of hospital stay was 2.5 days (range, 0–13 days). There were six complications, including two bowel perforations, and zero mortality. There were three recurrences during the follow-up period, which ranged from 6 to 72 months (median, 24 months).

Conclusions: Minimally invasive incisional herniorrhaphy yielded an acceptable morbidity and recurrence rate during the follow-up period. The outcome compares favorably with that for open incisional hernia repair. Although long-term follow-up evaluation is desirable, the data support the contention that the minimally invasive approach is an appropriate option for incisional hernia.

Key words: Laparoscopic incisional herniorrhaphy — Incisional or ventral hernia — Minimally invasive surgery

The incidence of primary incisional hernia after laparotomy ranges from 10% to 20% in reports describing thousands of incisions [14, 27]. Incisional hernia repair without prosthesis can result in a 30% to 50% rate of recurrence [1, 18, 22]. The use of mesh in the repair of incisional hernia can reduce this recurrence rate to 0% to 10% [19, 26]. Mesh repair of noninguinal abdominal hernia has been superior to suture repair in randomized trials [2, 18]. Overall, there has been a move to repair most incisional hernias with prosthetic mesh [19].

The minimally invasive approach to incisional herniorrhaphy was first described in the mid-1990s [17, 24]. This technique typically involves the intraperitoneal (subfascial) placement of prosthetic mesh to repair the defect. The recurrence rate after short and intermediate follow-up evaluation has been 0% to 9%, with recent studies reporting rates lower than 5% [5, 8, 10, 13, 16, 21, 25]. Current controversies concerning the technical aspects of minimally invasive incisional hernia repair include what type of mesh to use, how large the mesh should be in relation to the defect, where the mesh should be placed in relation to the abdominal wall layers, and how the mesh should be secured. For the most part, these and other issues regarding minimally invasive incisional herniorrhaphy have not been resolved. In this report we present our technique of laparoscopic incisional herniorrhaphy and provide a 7-year review of our experience with this procedure.

Materials and methods

A review investigated all patients who underwent minimally invasive incisional hernia repair under the direct supervision of the senior author (C.T.F.) in an academic setting from 1995 to 2002. Hernia defect size, operative time, length of hospital stay, complication occurrence, conversion, readmission, infection, and recurrence were recorded. Follow-up evaluation consisted of clinic appointments with physical examination by a surgeon on the primary team. Our postoperative clinic routine consisted of visits at 1 week, 1 month, and 6 months, then yearly thereafter. Other follow-up data (e.g., phone calls, referring

physician visits) were not used in determining the recurrence rate. No patient in this series, however, reported from the outside as having a possible recurrence was not subsequently examined by the primary surgical team. That is, we followed up on any leads that a patient might be having a problem.

The technique of minimally invasive incisional herniorrhaphy did not change appreciably during the study period. Cefazolin (1–2 g intravenously) was given with induction of anesthesia, and a urinary catheter was placed. The peritoneal cavity was entered with an optical bladeless trocar (Endopath Bladeless Trocar; Ethicon-EndoSurgery, Cincinnati, OH, USA) as far as possible from the hernia defect to avoid potential adhesions. Additional trocars were placed under direct vision. The number of trocars ultimately needed depended on the difficulty of the subsequent adhesiolysis. Intraabdominal contents were removed from the hernia defect with blunt and sharp dissection. Electrocautery and ultrasonic energy were used carefully in the vicinity of the intestines. The hernia sac was excised if doing so was relatively easy. Otherwise, it was left in place. After completion of the adhesiolysis, the length and width (greatest distance) of the defect was measured with the open jaws of a laparoscopic Babcock grasper (5 cm span). The hernia defect area was defined as the product of the length and width.

In the early part of the study a prosthetic bilayer, comprising one layer each of polypropylene and polytetrafluoroethylene (PTFE), was assembled on the backtable and then inserted into the abdomen [11]. Subsequently, a piece of dual-surface (smooth/macroporous) PTFE mesh (DualMesh Gore-Tex; W. L. Gore & Associates, Phoenix, AZ, USA) was used for the repair. The largest sheet of this mesh available was 26 × 34 cm. If a larger surface area was required for the hernia repair, two PTFE sheets were sutured together (using a permanent monofilament) on the back table before intraabdominal insertion through a trocar. Care was taken to avoid contact of the mesh with the skin. For a large piece of mesh, an 18-mm trocar was used for insertion. The orientation of the mesh inside the abdomen was facilitated with suture tagging or inking of the mesh.

The goal of the mesh fixation was a minimum fascia "underlap" of 3 cm on all sides of the hernia (i.e., the edge of the PTFE exceeded the fascial rim of the hernia defect by at least 3 cm at any given point along the rim). The mesh was anchored around the perimeter with a straight laparoscopic hernia stapler (Ethicon-EndoSurgery, Cincinnati, OH, USA). The distance between each staple was no more than 1 cm. The staples were placed with counterpressure on the abdominal wall with the free hand (i.e., using a two-handed stapling technique). Suture fixation was not used.

After completion of the hernia repair, all trocar sites larger than 5 mm were closed with suture. No drains were placed. An abdominal binder was placed in the operating room before the patient awoke. The patient was discharged when oral intake was tolerated.

Results

This review was conducted from January 1995 to December 2002. During this time, 208 procedures were performed for the same number of patients (there were no reoperations). The mean patient age was 49 ± 14 years (median, 49 years; range, 25–75 years). The mean hernia defect size, as measured in 157 subjects, was 173 ± 128 cm^2 (median, 150 cm^2; range, 3–484 cm^2). The mean operative time was 2.1 ± 1.0 h (median, 2 h; range, 0.5–8.4 h). There were no open conversions. The mean length of hospital stay was 1.4 ± 1.5 days (median, 1 day; range, 0–13 days). On the day of operation, 64 patients (31%) were discharged, and 95 patients (46%) were discharged on postoperative day 1.

A sequence of images documenting the minimally invasive repair of a large incisional hernia in a 70-year-old man is shown in Fig. 1. This patient underwent a renal transplant for polycystic kidney disease 3 years before his presentation to us. An incisional hernia
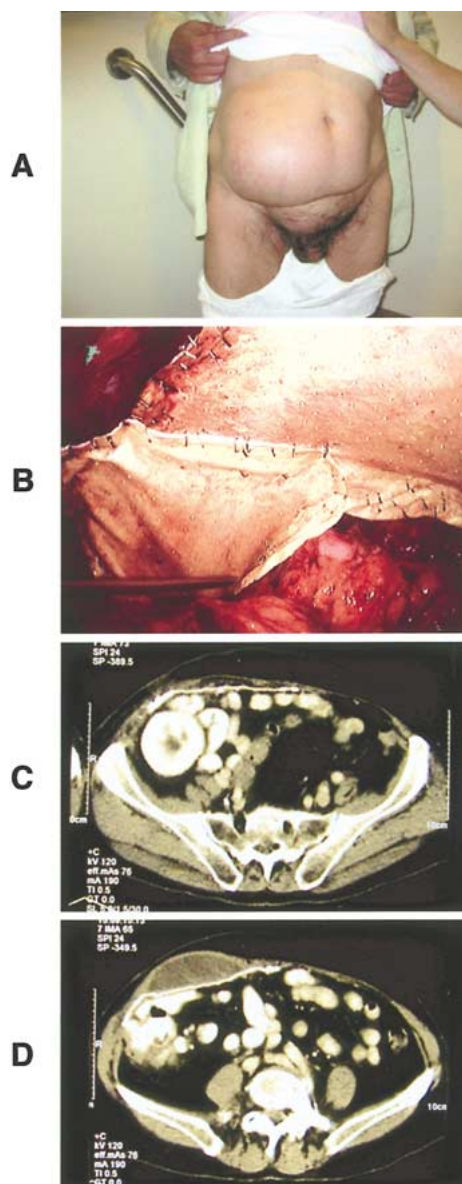
Fig. 1. Repair of a large incisional hernia. **A** Preoperative photograph. **B** Intraoperative photograph. Note two sheets of polytetrafluoroethylene stapled together. **C** Postoperative computed tomography (CT) scan at 6 months showing intact repair. The transplanted kidney is in the right pelvis. **D** A CT cut showing the seroma superior to the mesh.

developed through his oblique left lower quadrant transplant incision, with partial loss of domain (Fig. 1A). A minimally invasive hernia repair was performed. The large defect was spanned with two sheets of PTFE stapled together (Fig. 1B). An abdominal computed tomography (CT) scan obtained at his 6-month postoperative visit (his most recent evaluation) showed his repair to be intact (Fig. 1C), but there was a seroma superior to the mesh (Fig. 1D). Because this seroma was decreasing in size, it was determined that it should be observed. This patient's tolerance of physical activity improved markedly after his hernia repair.

Perioperative complications that prolonged hospital stay or resulted in readmission occurred in six patients (2.9%) and consisted of postoperative ileus ($n = 3$), bowel perforation ($n = 2$), and abdominal wall hematoma ($n = 1$). Two of the patients with ileus were readmitted, and all improved with conservative care. One patient had a large abdominal wall hematoma extending into the scrotum. This was presumed to be a trocar injury of an epigastric vessel. This patient's hematocrit decreased 6 points, but he was discharged home on postoperative day 4 after observation only, and experienced no sequelae.

The first perforation occurred in a 50-year-old man who had a midline incisional hernia that had been repaired previously with open intraperitoneal placement of polypropylene mesh. There were dense adhesions between the mesh and the intestines, which were lysed during his laparoscopic herniorrhaphy. No injury was identified at this operation. The patient was discharged on postoperative day 2, but was readmitted 5 days later with a fever. A CT scan on the readmission day showed intraabdominal fluid. Given the clinical scenario, the patient underwent a laparotomy on the readmission day. A jejunal enterotomy was found and repaired. The PTFE was removed, and the fascia was closed with the aid of polyglactin 910 mesh (Vicryl; Johnson & Johnson, New Brunswick, NJ). As expected, the patient experienced a recurrent hernia, which was repaired laparoscopically 2 years later (the second repair was not included in this series). One year after this last hernia repair, the patient was doing well with no recurrence.

The second perforation occurred in a 72-year-old man with a massive ventral hernia, who underwent a combined minimally invasive hiatal and ventral herniorrhaphy. The latter was classified as a total abdominal wall reconstruction. The patient's postoperative course was slow. He did not have fever or an elevated white blood cell count, but he did have persistent tachycardia. A CT scan on postoperative day 4 showed intraabdominal fluid with mesenteric striations. He underwent a laparotomy on the same day. A jejunal enterotomy was found and repaired. The PTFE was removed, and the fascia was closed with the aid of polyglactin 910 mesh. The patient was well at his 6-month appointment, but subsequently was lost to follow-up evaluation.

The follow-up period ranged from 6 months to 6 years. There was no 30-day mortality. Three (1.4%) patients were readmitted (2 with ileus and 1 with a perforation). No wound or mesh infections were noted except those for the two patients with perforation described earlier. There were three (1.4%) recurrences. One recurrence was experienced at 3 months by a morbidly obese woman who required two pieces of PTFE for reconstruction of a 484-cm^2 defect. She elected not to undergo a reoperation. The second recurrence was noted at 6 months in a construction worker, who elected to undergo a laparoscopic reoperation. The apparent cause of his recurrence was an inadequate underlap of the fascia by the PTFE. The third recurrence, noted at a 12-month visit, had no identifiable cause, and the patient did not want a reoperation.

Conclusions

In our series of patients who underwent laparoscopic incisional hernia repair, the overall complication and recurrence rates were less than 2%. No conversions or infections were noted. Five patients (2.4%) had an adverse outcome from the procedure (3 recurrences and 2 enterotomies). It might be reasonable to classify the two patients who had perforations as also experiencing a recurrence because one of these patients did undergo a subsequent herniorrhaphy and the other was at high risk for reherniation because his incision had to be supported with an absorbable mesh (he was lost to follow-up evaluation). In this case, the recurrence rate would be 2.4%, which still is well within the range of recently reported rates [5, 10, 13].

The risk of enterotomy is of concern with this procedure. Dissection of the bowel should be meticulous with a liberal use of sharp technique, especially during the lysis of adhesions between the anterior abdominal wall, hernia sac, and bowel. A low threshold must be kept for continued observation or reoperation for patients in whom an enterotomy is suspected. We have not felt obliged to perform a minimally invasive reoperation in this urgent setting. Although laparoscopy may be feasible, we still would use an open approach to manage the complication of enterotomy.

One abdominal wall hematoma occurred in this series. Two methods that we believe decrease the risk for this complication are the use an optical trocar to gain intraabdominal entry and transillumination of the abdominal wall before insertion of all subsequent trocars. These maneuvers potentially allow the operator to visualize abdominal wall vessels before the trocar passes through them. Seroma is a common occurrence after this procedure [8, 13], especially for patients who have undergone extensive repair (Fig. 1). Because the seromas that occurred in this series of patients did not result in morbidity, we have not classified this occurrence as a complication.

Some surgeons use transabdominal suture fixation of the mesh during laparoscopic incisional hernia repair. This may prevent mesh slippage and thus hernia recurrence. Although our three recurrences may have been prevented if suture fixation had been used, suture fixation has potential disadvantages including increased pain or suture sinus. We believe that our rate of recurrence has not been high enough to justify the use of fixation sutures. Our use of the straight hernia stapler (as opposed to a screw-tacking device) appears to result in adequate mesh fixation.

There has been a theoretical concern about placing prosthetic mesh directly in contact with the hollow viscera, as described in this and other reports of minimally invasive incisional herniorrhaphy. The real risk of placing polypropylene mesh on the intestines has been described [3, 9, 28], but it seems that PTFE does not carry the same risk. We have not been able to find a published description of bowel fistula or similar complication that occurred in the presence of PTFE without any other identifiable risk factor, such as a local inflammatory process. If this type of complication has

indeed happened, then it needs to be reported. To date, the collective world experience with intraperitoneal placement of PTFE for elective incisional hernia repair suggests that this procedure does not pose a significant risk to the patient.

One complication that is notably absent from this series is wound infection. Recent rates of this complication after open hernia repair are in the range of 2% to 4% [2, 18]. Other recent reports of minimally invasive incisional herniorrhaphy have described wound infection rates (involving the mesh) of 0% to 0.7% [8, 13]. We cannot definitely say that the minimally invasive approach yields a lower infection rate than the open approach for incisional hernia repair, but a soft comparison of historical data suggests that this may be so.

The issue of wound infection leads into the question of whether minimally invasive incisional herniorrhaphy is better than the open approach. This is a difficult issue to resolve considering the variations in technique, surgeon skill, local attitudes, and so on. To date, there have been some comparative studies of laparoscopic and open incisional hernia repair [6, 7, 12, 15, 20, 23] and one randomized trial [4]. Generally, the results of these reports indicate that the laparoscopic approach results in less perioperative morbidity and a shorter hospital stay, and may produce a lower recurrence rate than the open approach. It is too early to pass a judgment favoring either minimally invasive or open incisional herniorrhaphy.

Our technique of minimally incisional hernia repair was performed with low complication and recurrence rates. On the basis of our experience and the published experience of others, we can recommend minimally invasive repair as a worthwhile treatment method for the patient with incisional hernia.

Note added in proof

The Seroma shown in Fig. 1D resolved completely without intervention by the 12 month follow-up visit.

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