Surg Endosc (2001) 15: 1419–1422
DOI: 10.1007/s004640080077

Surgical Endoscopy
Ultrasound and
Interventional Techniques

Obesity and laparoscopic repair of ventral hernias

G. Birgisson,[1] A. E. Park,[1] M. J. Mastrangelo, Jr,[1] D. B. Witzke,[2] U. B Chu[1]

[1] Department of Surgery, University of Kentucky Chandler Medical Center, Lexington, KY, USA
[2] Department of Pathology, University of Kentucky Chandler Medical Center, Lexington, KY, USA

Received: 15 June 2000/Accepted in final form: 20 March 2001/Online publication: 5 October 2001

Abstract
Background: Laparoscopic ventral hernia repair (LVHR) is gaining acceptance and compares favorably with open repair. Patients who are morbidly obese (MO) traditionally have been considered poor surgical candidates for ventral hernia repair because of their associated comorbidities and risk of postoperative wound infection and hernia recurrence. In this study we evaluated our experience with LVHR in patients who are obese and those who are morbidly obese.
Methods: All 64 patients undergoing LVHR at the University of Kentucky between September 1997 and October 2000, representing 66 hernias, were entered prospectively into a database. Data before, during, and after surgery were collected as well as follow-up data. Patients were divided into three groups on the basis of body mass index (BMI): normal to overweight (BMI $\leq$ 29); obese (BMI 30–39), and MO (BMI $\geq$ 40).
Results: There were 16 patients in the MO group, most of them women. The mean BMI was 43.9 (range, 40–60), and the mean age was 45.6 years (range, 25–68 years). The location of defects was similar among the groups, as were the number of prior repairs. The operative time and length of stay for the MO group tended to be longer than for the other two groups. Five minor complications occurred in the MO group. During a follow-up period ranging from 1 to 35 months, there were no recurrences.
Conclusion: Laparoscopic repair of ventral hernias in patients who are morbidly obese is both safe and feasible, and can be performed with minimal morbidity. At this writing, there have been no recurrences, but long-term follow-up evaluation is required.

Key words: Ventral hernia — Incisional hernia — Laparoscopy — Obesity

Incisional hernia is a common problem for abdominal surgeons, occurring in up to 20% of the patients who undergo major abdominal surgery [9]. The risk of recurrence after initial repair may more than 50% after primary repair and up to 29% if prosthetic mesh is used [1]. Since it was first described in 1993, the laparoscopic approach to incisional and ventral hernias has been used increasingly with good results. The advantages of laparoscopic over open incisional hernia repair include less postoperative pain, more rapid recovery, shorter hospital stay, and fewer wound complications [13].

Common in the United States, obesity is associated with increased risk of other medical problems. Approximately 63% of men and 55% of women age 25 years or older are overweight or obese [10]. Morbid obesity, defined as a body mass index (BMI) exceeding 40, is a major risk factor in the development of incisional hernia, with 20% to 28% of obese patients who undergo abdominal surgery developing an incisional hernia within 12 to 28 months of the initial procedure [5, 12]. Obesity also is a risk factor for perioperative anesthetic and wound complications as well as postoperative cardiovascular, pulmonary, and thromboembolic complications [4].

The purpose of this study was to evaluate our experience with laparoscopic ventral hernia repair (LVHR) in the obese and morbidly obese (BMI exceeding 30), and to compare their outcomes to those of patients with a lower BMI.

Materials and methods

Patients undergoing laparoscopic incisional or ventral hernia repair at the University of Kentucky Medical Center, Lexington, between September 1997 and October 2000 were included in this study. Data on patients was collected prospectively using a computer database to record, among other information, age, gender, BMI, American Society of Anesthesiologists (ASA) status, hernia defect size and location, operating time, previous operations and length of hospital stay. Patients were seen in follow-up assessments at 1, 6, and 12 months, and then annually for evaluation of hernia recurrence and complications. Body mass index, used to classify obesity, is calculated as BMI = weight (kg) / height^2 (m). Patients were divided into three groups according to BMI based on the World Health Organization classification system: normal to overweight (BMI $\leq$ 29), obese (BMI 30–39), and morbidly obese (MO)(BMI $\geq$ 40) [11].

The surgical technique bas been described in detail previously [14].

Correspondence to: A. E. Park

Table 1. Patient characteristics

	Normal to overweight BMI < 30 (n = 18)	Obese BMI = 30–39 (n = 30)	Morbidly obese BMI ≥ 40 (n = 16)
Mean BMI n (range)	25.6 (18–29)	33.1 (30–39)	43.9 (40–60)
Age (years) n (range)	55.2 (32–82)	52.8 (30–79)	45.6 (25–68)
Gender (M/F)	10/8	16/14	3/13
ASA score n (range)	2.1 (1–3)	2.1 (1–3)	2.3 (1–3)
Prior repair n (%)	3 (17)[a]	17 (57)	7 (44)
Hernia location			
Central/midline	15	21	11
Right or left upper quadrant	1	6	3
Right or left lower quadrant	2	5	2

[a] $p < 0.05$ vs obese group
BMI, body mass index; ASA, American Society of Anesthesiologists

Preoperatively, prophylactic antibiotics are administered, and pneumatic intermittent compression stockings are applied intra- and postoperatively until the patient is ambulating well. Pneumoperitoneum is created by placing a Veress needle into the left or right subcostal space, depending on the location of the hernia. A direct viewing 10- to 12-mm trocar is placed laterally and, a 5- or 10-mm 30° laparoscope is used to inspect the abdomen. Two 5-mm ports are placed under direct vision laterally in the upper and lower quadrants of the abdomen. Reduction of hernia contents and adhesiolysis then are performed, and the margins of the defect are delineated. No attempt is made to dissect the hernia sac. The prosthetic patch (expanded polytetrafluoroethylene) then is tailored to overlap the defect by at least 3 cm in all directions, wrapped around a grasper, and introduced through the 10-mm trocar. The mesh, once intra-abdominal, is unfurled, oriented, and secured in place with nonabsorbable sutures placed through the abdominal wall and buried subcutaneously. The sutures are placed 4 or 5 cm apart, and titanium tacks are placed at 1-cm intervals around the circumference of the patch.

Data are given as mean and range. Comparisons among the groups were made using a three-group one-way analysis of variance (ANOVA) and the Student-Newman-Keuls test. A p value less than 0.05 was considered significant.

Results

During the study period, 64 patients underwent LVHR. A total of 66 hernias were repaired because two patients had two distinct hernia defects in separate anatomic locations. The demographic data of the patients are listed in Table 1.

Of the 64 patients, 16 (25%) were MO, having a mean BMI of 43.9. The mean BMIs in the normal to overweight (NO) and the obese groups were 25.6 and 33.1, respectively. Overall, 46 (72%) of the patients were obese or MO, with BMI exceeding 30. Patients who were MO tended to be younger, with a mean age of 45.6 years, and 13 of them were women. There was no difference among the groups in ASA score and location of defects. Seven in the MO group had a history of hernia repair (44%), as compared with 17 (57%) in the obese and three (17%) in the NO groups. One patient in the MO group underwent concomitant liver biopsy, and cholecystectomy was performed in one patient who was obese.

The operative and perioperative results are presented in Table 2. The hernia defect in the MO group averaged 156 cm^2, as compared with 118.4 cm^2 in the obese group and 83.1 cm^2 in the NO group. Despite the trend toward larger hernias in the MO group, the difference in defect size among the groups was not statistically significant. The average operative time was similar in the MO and obese groups (161.5 and 131.6 min, respectively), but in the NO group it was 99 min ($p < 0.05$). Postoperative length of stay averaged 2.1 days in the MO group, with nine patients (82%) discharged home within 48 h. In the obese group, the mean length of stay was 1.6 days, and in the NO group it was 1.6 days, with 85% and 78% of the patients discharged to home within 48 h, respectively.

Table 2. Perioperative data

	BMI < 30 n (range)	BMI = 30–39 n (range)	BMI ≥ 10 n (range)
Defect size (cm^2)	83.1 (4–299)	118.4 (9–400)	156.0 (24–416)
Operative time (min)	99.0 (45–210)[a]	131.1 (65–254)	161.5 (65–400)
Length of stay (days)	1.6 (0.4–6)	1.6 (0.4–5)	2.1 (0.5–6)

[a] $p < 0.05$
BMI, body mass index

None of the patients in the MO group required conversion to an open procedure. Two patients had minor postoperative complications (Table 3). In one patient a cellulitis developed, which responded to outpatient antibiotic therapy.

In two patients, an enterotomy occurred in the process of adhesiolysis. In the first case (NO patient), no spillage of enteric contents occurred, and the enterotomy was closed laparoscopically. Adhesiolysis then was completed, as was placement of the mesh for the hernia repair. An antibacterial impregnated mesh was used, and perioperative antibiotics were administered. The patient recovered uneventfully.

In the second patient (obese group), there was a small amount of spillage with the enterotomy. The enterotomy again was repaired laparoscopically. Adhesiolysis was completed, but the hernia repair was abandoned, and the mesh was not inserted. Instead, the patient was placed on a 5-day course of antibiotics and then observed for 3 days. She was discharged from the hospital with a view to completing the repair a few weeks later once there was no evidence of infection.

Paralytic ileus developed in two patients postoperatively. Follow-up assessment for the MO group ranged from 1 to 35 months (mean, 8.5 months), as compared with 1 to 36 months (mean, 10.1 months) for the whole group. At this writing, there has been only one recurrence in the obese group.

Discussion

Obesity, considered a risk factor in the development of incisional hernias [16], has been associated with a higher rate of hernia recurrence after open incisional hernia repair [1] and a significantly higher perioperative complication rate [18]. Multiple factors contribute to this tendency, including delayed wound healing, impaired pulmonary function, and high intraabdominal pressure. In this study, we found that patients who are MO can successfully undergo laparoscopic repair of ventral hernias with minimal perioperative morbidity.

Obesity has long been regarded as a relative contrain-

Table 3. Complications

	BMI < 30	BMI = 30–39	BMI ≥ 40
Complications (%)	4/18 (22)	3/30 (10)	5/16 (31)
Minor (*n*)	Hematoma (2) Cellulitis (1)	Seroma (1) Cardiac (1)	Cellulitis (1) Ileus (2) Seroma (2)
Major (*n*)	Enterotomy (1)	Enterotomy (1)	

BMI, body mass index

dication to laparoscopic surgery because of expected intraoperative complications such as suboptimal visualization, subcutaneous emphysema, and trocar injuries requiring conversions to open surgery [7]. Outcomes of surgeries in obese patients have been variable, depending on factors such as urgency and type of operation. Careful review of the literature has not found that obesity, even morbid obesity, increase operative mortality. However, perioperative morbidity is moderately increased, especially in urgent and emergent surgery [4]. More recently, laparoscopy has emerged as the most likely technique of choice in many surgical situations involving individuals who are obese. Both laparoscopic cholecystectomy [8] and laparoscopic appendectomy [6] have proved to be the preferred operation in individuals who are obese by allowing better visualization and averting large incisions, thus decreasing the risk commonly encountered of wound infections or dehiscence in the surgical patient who is obese. The body habitus of these patients imposes many technical challenges for the laparoscopic surgeon, but advanced technology, a wealth of new equipment, and improved instrument design have made laparoscopic procedures technically more feasible and safe in the patient who is obese. The operative ergonomics, however, remain far from ideal in this patient population. The thickness of the abdominal wall requires the use of increased force on instruments, thereby decreasing the sensitivity experienced by the surgeon (tactile feedback), which can result in an inappropriate force applied to tissues and possible damage to intraabdominal organs [17].

Among surgeons LVHR is gaining popularity because it has been proved safe and effective, with reduced hospital stay and quicker recovery time [13, 15]. The laparoscopic repair of incisional hernias follows the same surgical principles used in open repair [19]. The Stoppa-Rives technique of open incisional hernia repair places the prosthetic mesh posteriorly to the deep fascia, which when possible is then approximated over the patch. The LVHR procedure differs from this in that no attempt is made to approximate the fascia, thus ensuring a tension-free repair. In individuals who are obese, this approach has clear advantages because the high intraabdominal pressure plays an important role in the development of incisional hernia. Securing the patch by transabdominal sutures and generous overlap of the patch in the prefascial position may be crucial in the repair of these hernias. This technique generally is used in the repair of incisional hernia after gastric bypass surgery [20]. Laparoscopy also is an attractive alternative to conventional (open) repair because it also allows complete evaluation of the abdominal wall for hernias, often detecting clinically occult defects ("Swiss cheese type") in the patient who is obese.

The explosion of advanced laparoscopy also has resulted recently in enthusiasm for the emergence of laparoscopic bariatric surgery. Like incisional hernia surgery, conventional bariatric surgery has been associated with a high rate of wound complications and development of hernia. As compared with the open approach, laparoscopic vertical banded gastroplasty is associated with significant reduction in wound complication (3.3% vs 10.8%) and incisional hernia (none vs 15.8%) [2]. Other benefits likely to be enjoyed include fewer pulmonary, cardiac, and thromboembolic complications as experience with laparoscopic bariatric surgery accumulates.

In the MO group five minor complications (31%) occurred, a result consistent with other published series. Mendoza et al.[7] reported a 22% intraoperative and a 26% postoperative complication rate in a multi-institutional review of various urologic laparoscopic procedures in patients who are obese. Some studies have listed seroma as a frequent complication of this procedure, often requiring aspiration of the seroma [3]. We, however, do not consider seroma a complication unless it persists more than 6 weeks or is symptomatic. Seroma will develop in many patients, but in our experience, the condition will resolve spontaneously in the vast majority.

The patient who is MO poses some unique technical challenges to performing LVHR. Access to establish pneumoperitoneum may be difficult to obtain. We have found the Veress needle to be a safe and effective means for accomplishing this, usually by inserting the needle in the left upper quadrant, an area generally free of intraabdominal adhesions. This allows for careful assessment of the defect(s) after pneumoperitoneum has elevated the anterior abdominal wall, altering the contour so trocars can be placed in an optimal configuration. Because most of these patients have had prior surgeries, we place the first trocar under direct visualization to minimize the risk of bowel or other intraabdominal injury. Careful consideration of port placement is of paramount importance and can make the difference between a smooth procedure and a protracted and sometimes frustrating experience. Trocars should be placed perpendicularly to the abdominal wall to minimize the distance traversed in the subcutaneous tissues, because greater distance will increase the force used on the laparoscopic instrument and decrease tactile feedback. Also, if trocars are placed close to the anterior superior iliac spine (ASIS), the excess adipose tissue over the ASIS will often interfere with instrument or trocar freedom of movement. Sometimes placement of an extra port on the contralateral side will aid in the final "tacking" of the mesh. In this group of patients large pieces of prosthetic mesh often are required to effect the repair, and orientation of the mesh can be greatly facilitated by placing additional sutures on the prosthesis before introducing it into the abdomen. In performing adhesiolysis and securing the titanium tacks, it is helpful to use counterpressure on the hernia sac or the abdominal wall, and to lower the intraabdominal pressure to 8 to 12 mmHg because this allows for easier manipulation of the abdominal wall.

Conclusion

Incisional hernia is a common problem in patients who are obese, and the laparoscopic approach to the repair of these

hernias may offer advantages over the open approach in terms of diagnosis of multiple defects, fewer wound complications, and reduced overall perioperative morbidity. The recurrence rate in our study is acceptably low, but longer follow-up assessment is needed to assess the durability of the repair in this group of patients.

References

1. Anthony T, Bergen PC, Kim LT, Henderson M, Fahey T, Rege RV, Turnage RH (2000) Factors affecting recurrence following incisional herniorrhaphy. World J Surg 24: 95–100
2. Azagra JS, Goergen M, Ansay J, De Simone P, Vanhaverbeek M, Devuyst L, Squelaert J (1999) Laparoscopic gastric reduction surgery: preliminary results of a randomized, prospective trial of laparoscopic vs open vertical banded gastroplasty. Surg Endosc 13: 555–558
3. DeMaria EJ, Moss JM, Sugerman HJ (2000) Laparoscopic intraperitoneal polytetrafluoroethylene (PTFE) prosthetic patch repair of ventral hernia: prospective comparison to open prefascial polypropylene mesh repair. Surg Endosc Ultrasound Intervent Techniques 14: 326–329
4. Flancbaum L, Choban PS (1998) Surgical implications of obesity. Annu Rev Med 49: 215–234
5. Israelsson LA, Jonsson T (1997) Overweight and healing of midline incisions: the importance of suture technique. Eur J Surg 163: 175–180
6. Memon MA (1997) Laparoscopic appendicectomy: current status. Ann R Coll Surg Engl 79: 393–402
7. Mendoza D, Newman RC, Albala D, Cohen MS, Tewari A, Lingeman J, Wong M, Kavoussi L, Adams J, Moore R, Winfield H, Glascock JM, Das S, Munch L, Grasso M, Dickinson M, Clayman R, Nakada S, McDougall EM, Wolf IS, Hulbert J, Leveillee RJ, Houshair A, Carson C (1996) Laparoscopic complications in markedly obese urologic patients (a multi-institutional review). Urology 48: 562–567
8. Miles RH, Carballo RE, Prinz RA, McMahon M, Pulawski G, Olen RN, Dahlinghaus DL (1992) Laparoscopy: the preferred method of cholecystectomy in the morbidly obese. Surgery 112: 818–822
9. Mudge M, Hughes LE (1985) Incisional hernia: a 10-year prospective study of incidence and attitudes. Br J Surg 72: 70–71
10. Must A, Spadano J, Coakley EH, Field AE, Colditz G, Dietz WH (1999) The disease burden associated with overweight and obesity. JAMA 282: 1523–1529
11. NHLBI Obesity Task Force Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults: the evidence report. Obes Res 6 (Suppl 2): 51s–209s
12. Pans A, Elen P, Dewe W, Desaive C (1998) Long-term results of polyglactin mesh for the prevention of incisional hernias in obese patients. World J Surg 22: 479–482
13. Park A, Birch DW, Lovrics P (1998) Laparoscopic and open incisional hernia repair: a comparison study. Surgery 124: 816–821
14. Park A, Gagner M, Pomp A (1996) Laparoscopic repair of large incisional hernias. Surg Laparosc Endosc 6: 123–128
15. Ramshaw BJ, Esartia P, Schwab J, Mason EM, Wilson RA, Duncan TD, Miller J, Lucas GW, Promes J (1999) Comparison of laparoscopic and open ventral herniorrhaphy. Am Surg 65: 827–831
16. Rath AM, Chevrel JP (2000) The healing of laparotomies: a bibliographic study. Hernia 4: 41–48
17. Robinson SP, Hirtle M, Imbrie JZ, Moore MM (1998) The mechanics underlying laparoscopic intraabdominal surgery for obese patients. J Laparoendosc Adv Surg Tech A 8: 11–18
18. Shenkman Z, Shir Y, Brodsky JB (1993) Perioperative management of the obese patient. Br J Anaesth 70: 349–359
19. Stoppa RE (1989) The treatment of complicated groin and incisional hernias. World J Surg 13: 545–554
20. Sugerman HJ, Kellum Jr JM, Reines HD, DeMaria EJ, Newsome HH, Lowry JW (1996) Greater risk of incisional hernia with morbidly obese than steroid-dependent patients and low recurrence with prefascial polypropylene mesh. Am J Surg 171: 80–84