Laparoscopic incisional and ventral hernia repair in a district general hospital

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ABSTRACT

INTRODUCTION The laparoscopic approach to repairing ventral and incisional hernias has gained increasing popularity worldwide. We reviewed the experience of laparoscopic ventral hernia repair at a district general hospital in the UK with particular reference to patients with massive defects (diameter ≥ 15 cm) and the morbidly obese.

METHODS A total of 144 patients underwent laparoscopic ventral (incisional or umbilical/paraumbilical) hernia repair between April 2007 and September 2012.

RESULTS The prevalence of conversion to open surgery was 2.8%. The prevalence of postoperative complications was 3.5%. Median postoperative follow-up was 30.2 months. A total of 5.6% cases suffered late complications and 2.8% developed recurrence. Thirty-four patients underwent repair of defects ≥ 10 cm in diameter with a prevalence of recurrence of 5.6%. Sixteen patients underwent repair of 'massive' incisional hernia (diameter ≥ 15 cm) with a prevalence of recurrence of 12.5%. Sixteen patients with a body mass index (BMI) ≥ 40 kg/m² (range, 40–61kg/m²) underwent laparoscopic repair with a prevalence of recurrence of 6.3% ($p > 0.05$ vs BMI < 40 kg/m²).

CONCLUSIONS Laparoscopic ventral hernia repair can be carried out safely with a low prevalence of recurrence. It may have advantages in morbidly obese patients in whom open repair would represent a significant undertaking. Laparoscopic ventral hernia repair may be used in cases of large and massive hernias, in which the risk of recurrence increases but is comparable with open repair and associated with low morbidity.

KEYWORDS

Laparoscopic ventral hernia – Recurrence – Defect size – Complications

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First reported by Le Blanc *et al* in 1993,¹ the laparoscopic approach to repairing ventral and incisional hernias has gained increasing popularity. Purported advantages include reduced levels of postoperative pain, fewer wound complications and surgical-site infections, and shorter stay in hospital,² though these advantages are not universally supported by the literature.^{3–5} Laparoscopic repair may be associated with a lower prevalence of complications than open repair. However, there is evidence that the complications that do occur tend to be more severe.⁵ Several series have been reported, but few long-term follow-up and analyses of recurrences have been documented.

Exactly which patients are suitable for laparoscopic repair is contentious, with criteria differing between centres. In general, open suture repair is adequate for a defect of diameter < 2 cm. Multiple defects, however, may shift the benefit towards the laparoscopic approach. The maximum defect size treatable by laparoscopic surgery remains undefined. Several investigators have recommended using only the laparoscopic approach for defects < 10 cm in diameter due to the

high prevalence of recurrence.⁶ In addition, the mesh may sink into the defect, leaving a residual 'bulge'.⁷

It is clear, therefore, that a strong evidence base supporting laparoscopic surgery is lacking. As such, it is essential that results are audited regularly to ensure satisfactory results are achieved. We reviewed our experience with laparoscopic ventral hernia repair at a single district general hospital in the UK. In particular, we focused on groups of patients previously considered to be poorly suited for laparoscopic repair: those with massive hernias (defect diameter ≥ 15 cm) and the morbidly obese.

Methods

All patients undergoing laparoscopic ventral (incisional or umbilical/paraumbilical) hernia repair at Northampton General Hospital were identified from a database acquired prospectively. All patients underwent surgery consecutively (or by trainee surgeons supervised) by a single consultant surgeon from April 2007 until September 2012. Patient demographics,

including age, sex, and the body mass index (BMI) were collected, as well as intraoperative details and follow-up.

Surgical procedure

The surgical strategy was adapted for each patient, but the general surgical principles were identical. All procedures were undertaken under general anaesthesia and patients received thromboprophylaxis (low-molecular-weight heparin and anti-thromboembolic stockings) unless contraindicated. Prophylactic antibiotics were not administered routinely. Urethral catheterisation and insertion of a nasogastric tube were used selectively. In most cases, pneumoperitoneum was established using a 5mm optical port (Visiport™ (Covidien, Dublin, Eire); Kii Fios™ (Applied Medical, Rancho Santa Margarita, CA, USA)) in the left upper quadrant at Palmer's point using a 5mm 30° laparoscope. This approach was used particularly for midline hernias. A standard sub-umbilical blunt entry was used in cases of hernias away from the midline (eg at previous stoma sites). If possible, the hernia was repaired using three trocars only (usually two 5mm ports and one 10mm port). Port positioning was dependent upon hernia site, but for midline hernias were usually inserted low down on the patient's left flank. Additional ports were inserted if necessary, and occasionally directly into the hernial sac if required for dissection (Figures 1a and b).

Adhesions to the anterior abdominal wall were divided and the hernia reduced. The hernial sac was not excised. The defect size was measured extracorporeally using four hypodermic needles inserted under laparoscopic vision at the edge of the defect (with the distances between needles equating to defect size) and was done under low-pressure pneumoperitoneum to avoid over-estimating defect size. Additional smaller defects and areas of attenuation were detected using trans-illumination of the abdominal wall. If possible, defects were closed primarily (particularly those of diameter >5cm) using a non-absorbable 0' suture (Ethilon® or Prolene®; Somerville, NJ, USA) and an Endo Close™ needle (Covidien) or laparoscopic closure device (Dyna Medical, Ontario, Canada) under low-pressure pneumoperitoneum to prevent mesh eventration. Small defects were not closed primarily routinely. An adequate area of abdominal wall was cleared for mesh placement. For upper-abdominal hernias, this method often involved taking down the falciform ligament. Similarly, for lower-abdominal hernias, the bladder was often taken down to allow mesh placement in the Cave of Retzius. An intraperitoneal onlay composite mesh was used to repair all hernias. An appropriate size was chosen and tailored to overlap the defect in all directions by ≥5cm and oriented using at least two transfascial orientation sutures. Sutures were placed in the midline if possible. The mesh was secured to the posterior fascia in a 'double-crown' fashion at ≤1cm intervals using a laparoscopic tacking device. Multiple defects adjacent to each other were covered with a single mesh. If distant from each other, separate meshes were used for coverage. Ports were removed under direct vision and the pneumoperitoneum emptied, assisted by an artificial Valsalva manoeuvre in the latter part of the study. Drains were not used.

Figure 1 Laparoscopic repair of a massive incisional hernia

Patients were followed up routinely in outpatient clinics. Recurrence was assessed by clinical examination with computed tomography employed to confirm hernia recurrence. Subgroup analyses were carried out using the Fisher exact test. $p < 0.05$ was considered significant.

Results

During the study period, 144 patients underwent laparoscopic ventral hernia repair. The demographic features of these patients are displayed in Table 1. A total of 76.4% ($n=110$) subjects underwent repair of incisional hernias and 23.6% ($n=34$) underwent repair of primary ventral hernias. Of the patients undergoing incisional hernia repair, 30% ($n=36$) had undergone open repair previously. The median diameter of the largest defect was 5cm, and 36% of patients had more than one defect. DynaMesh®-IPOM (DynaMesh, Aachen, Germany) was used in 86% of cases. No mesh was used in a patient who had to undergo conversion for an iatrogenic colotomy owing to the risk of mesh infection.

Table 1 Patient demographics and operative characteristics				
Characteristic	Median	Range	N	%
Number of patients			144	
Age (years)	55	17–86		
Male:female			77:67	
BMI (kg/m ²)	33	21–61		
ASA grade	2	1–4		
Diameter of largest defect (cm)	5	2–37		
Number of defects				
1			92	64
2			28	19
≥3			24	17
Mesh				
DynaMesh®-IPOM			124	86
Physiomesh®			13	9
Other			6	4
None			1	0.7
Size of mesh (cm ²)	240	110–1193		
BMI = body mass index; ASA = American Society of Anaesthesiologists				

Four patients (2.8%) required conversion to open repair. These cases were due to: an iatrogenic colotomy; devascularised ileostomy in a patient undergoing a concomitant laparoscopic parastomal hernia repair; suspected gastric injury (though this was disproven on conversion); extensive adhesions and failure to make progress. One other patient suffered an iatrogenic enterotomy but this was repaired with a laparoscopic suture. Two patients required intraoperative intervention to stop haemorrhage from the inferior epigastric artery. Five patients (3.5%) suffered early postoperative complications – three patients developed sac haematomas (though none required intervention) and one patient was treated for a port-site infection. The other patient developed signs of peritonitis, underwent a negative laparoscopy, and eventually required mesh removal. After further testing, it was found that the patient had suffered an allergic reaction to the mesh.

Postoperative follow-up was 1.7–66 months (median, 30.2 months; mean ± SD, 20.0 ± 16 months). Eight patients (5.6%) suffered late complications. Two patients re-presented with port-site hernias. Four patients required re-laparoscopy owing to chronic pain. Three had mesh adhesions divided; one had four ProTack™ (Covidien) removed owing to trigger-point pain in the abdominal wall; one patient re-presented as an emergency with small-bowel obstruction due to adhesions (though these were not due to the mesh). Four patients (2.8%) developed recurrent incisional hernias during follow-up. One of these patients re-presented as an emergency with

Table 2 Impact of defect size on hernia recurrence			
	<10cm	10–15cm	≥15cm
Number	110	18	16
Recurrence	1/110 (0.9%)	1/18 (5.6%)*	2/16 (12.5%)*
*p<0.05 vs <10cm group			

small-bowel obstruction. This patient had required two overlapping meshes to fix a large incisional hernia. At laparotomy, the meshes had ‘detached’ at the point of overlap with a loop of small bowel herniating through. One patient developed a new incisional hernia at a site distant from the previous procedure one year after repair that was also repaired laparoscopically, but the original repair was intact.

Impact of defect size

During the study period, 34 patients with a dominant defect ≥10cm in diameter (defined as ‘large’) underwent repair. All of these hernias were incisional rather than primary ventral. Of these, 16 were defined as ‘massive’ incisional hernias (diameter ≥15cm). The median maximum diameter of defects in the ‘massive’ incisional hernia group was 19.5 (range, 15–37)cm, with eight patients having defect diameters ≥20cm repaired. One patient required conversion to an open procedure owing to extensive adhesions. Multiple meshes were required in three patients. There was no postoperative death and no major postoperative complications. During follow-up, recurrent hernias had developed in two patients (12.5%).

Impact of the BMI

Sixteen patients in this series were classified as ‘morbidly obese’ (BMI >40 (range, 40–61)kg/m²). Two cases (12.5%) in this group had to undergo conversion to an open procedure compared with two cases in patients with a BMI <40kg/m² (1.5%; p<0.05). There was no significant difference in the prevalence of complications. Long-term, there was one recurrence in a patient who originally had a repair of a 4cm x 4cm defect at 7 months, compared with three recurrences in those with a BMI <40kg/m² (6.3% vs 2.3%; p>0.05).

Discussion

Buoyed by promising early results and rapidly developing technology, there has been a considerable increase in the number of laparoscopic ventral hernia repairs. Meta-analyses of randomised controlled trials (RCTs) have demonstrated that laparoscopic ventral hernia repairs maintain the advantages of minimally invasive surgery: reduced prevalence of complications, shorter stay in hospital, and faster return to work.⁸

Recently published analyses of the American College of Surgeons database comparing 21,463 open and 5,303

laparoscopic ventral/incisional hernia repairs demonstrated significant reductions in the prevalence of superficial and deep surgical-site infections, wound disruption, and duration of hospital stay in the laparoscopic group.² Despite these findings, there is evidence that if complications occur, they are potentially more severe. A RCT by Kaafarani *et al.* comparing laparoscopic with open repair reported that 23% of complications from laparoscopic repair required surgical intervention (with 5% deemed to be life-threatening) compared with 7% undergoing open repair (of which none were life threatening).⁹ Clearly, there are concerns regarding bowel injury and adhesions with laparoscopic methods and with intraperitoneal placement of foreign material. However, patients with incisional hernias are highly likely to have adhesions whatever the form of repair, and enterotomies also occur regularly during open surgery. It is the recognition of bowel injury that is important, and we recommend early conversion for inspection if there are any concerns. This series provides further evidence of the general safety of placement of intraperitoneal meshes, with only 2% of mesh deployment contributing to clinically relevant adhesion-related problems and no fistulae due to the presence of meshes. The data in the current series demonstrate that laparoscopic repair can be carried out with a low prevalence of complications. Laparoscopic repair compares favourably with recent series, which have reported a prevalence of complications of $\leq 31\%$. In addition, the overall prevalence of recurrence of 2.8% was low compared with that reported in the literature (1–20%).^{5,10–14} The duration of follow-up of our study was relatively short (median, 30.2 months), but most recurrences reported in the literature occur within one year of surgery, and our follow-up period is at least comparable with that of other studies. Similarly, the prevalence of recurrence reported here is equal or superior to most series of open repairs reported. This finding suggests that, given the right expertise, laparoscopic repair of ventral hernias can be carried out safely and effectively.

Several areas of contention surround laparoscopic ventral hernia repair. Patient selection, mesh technology, fixation, use of transfascial sutures, defect closure, and optimum mesh overlap have yet to be defined. This series reports ‘all-comers’ undergoing laparoscopic repair of ventral hernias, but it is clear that it is a heterogeneous condition and that the laparoscopic approach may be more suitable for particular groups. Patients with high BMI, comorbidities that make open repair a high risk, and those with multiple small defects are likely to be particularly suited to laparoscopic repair. Defect size remains a contentious issue in laparoscopic hernia repair, with some centres recommending open repair above a certain cut-off point,^{6,14} and other centres imposing no limit. Some studies have reported no relationship between defect size and recurrence of hernia,^{15,16} whereas others have reported an increased risk of recurrence with increasing defect size.^{6,17} Patients may be dissatisfied with cosmetic outcome due to mesh eventration.⁷ It has, therefore, been suggested that hernias >10cm in diameter are not suitable for laparoscopic repair.^{6,14} The present study suggests an increased

risk of recurrence with increasing defect size: 5.6% for a defect size of 10–15cm and 12.5% for a defect size of ≥ 15 cm. These results, however, are comparable with those in the literature for open repair. Similarly, for defects >15cm in diameter, the alternative is component separation. A prevalence of recurrence after component separation of 0–53% has been reported, and this method is associated with a significant risk of complications (particularly wound complications).^{18–21} In addition, many patients with large defects have considerable comorbidities, in whom component separation would represent a significant undertaking that carries a high risk of complications.

CONCLUSIONS

Laparoscopic ventral hernia repair can be undertaken safely with a low prevalence of recurrence. It can be done safely in morbidly obese patients, in whom open repair would represent a significant undertaking. The risk of recurrence is higher in patients undergoing repair of large and massive hernias, but the risk is comparable with open repair and associated with low morbidity, which justifies its use.

References

1. LeBlance KA, Booth WV. Laparoscopic repair of incisional abdominal hernias using expanded polytetrafluoroethylene: preliminary findings. *Surg Laparosc Endosc* 1993; **3**: 39–41.
2. Kaoutzanis C, Leichtle SW, Mouawad NJ, Welch KB, Lampman RM, Cleary RK. Postoperative surgical site infections after ventral/incisional hernia repair: a comparison of open and laparoscopic outcomes. *Surg Endosc* 2013; **27**: 2,221–2,230.
3. Forbes SS, Eskicioglu C, McLeod RS, Okrainec A. Meta-analysis of randomized controlled trials comparing open and laparoscopic ventral and incisional hernia repair with mesh. *Br J Surg* 2009; **96**: 851–858.
4. Asencio F, Aguilo F, Peiro S *et al.* Open randomized clinical trial of laparoscopic versus open incisional hernia repair. *Surg Endosc* 2009; **23**: 1,441–1,448.
5. Itani KM, Hur K, Kim LT *et al.* Comparison of laparoscopic and open repair with mesh for the treatment of ventral incisional hernia: a randomized trial. *Arch Surg* 2010; **145**: 322–328.
6. Moreno-Egea A, Carrillo-Alcaraz A, Aguayo-Albasini JL. Is the outcome of laparoscopic incisional hernia repair affected by defect size? A prospective study. *Am J Surg* 2012; **203**: 87–94.
7. Liang MK, Clapp M, Li LT, Berger RL, Hicks SC, Awad S. Patient satisfaction, chronic pain and functional status following laparoscopic ventral hernia repair. *World J Surg* 2013; **37**: 530–537.
8. Salvilla SA, Thusi S, Panesar SS. Analysing the benefits of laparoscopic hernia repair compared to open repair: a meta-analysis of observational studies. *J Minim Access Surg* 2012; **8**: 111–117.
9. Kaafarani HM, Hur K, Campasano M, Reda DJ, Itani KM. Classification and valuation of postoperative complications in a randomized trial of open versus laparoscopic ventral herniorrhaphy. *Hernia* 2010; **14**: 231–235.
10. Rosen M, Broady F, Ponsky J *et al.* Recurrence after laparoscopic ventral hernia repair. *Surg Endosc* 2003; **17**: 123–128.
11. Sanchez LJ, Bencini L, Moretti R. Recurrences after laparoscopic ventral hernia repair: results and critical review. *Hernia* 2004; **8**: 134–143.
12. Earle D, Seymour N, Fellingner E. Laparoscopic versus open incisional hernia repair: a single-institution analysis of hospital resource utilization for 884 consecutive cases. *Surg Endosc* 2006; **20**: 71–75.
13. Pierce RA, Spitler JA, Frisella MM, Matthews BD, Brunt LM. Pooled data analysis of laparoscopic vs. open ventral hernia repair. 14 years of patient data accrual. *Surg Endosc* 2007; **21**: 378–386.
14. Bageacu S, Blanc P, Breton C *et al.* Laparoscopic repair of incisional hernia: a retrospective study of 159 patients. *Surg Endosc* 2002; **16**: 345–348.

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15. Bencini L, Sanchez LJ, Bernini M *et al.* Predictors of recurrence after laparoscopic ventral hernia repair. *Surg Laparos Endosc Percutan Tech* 2009; **19**: 128–132.
 16. Ferrari G, Bertoglio C, Magistro C *et al.* Laparoscopic repair for recurrent incisional hernias: a single institute experience of 10 years. *Hernia* 2013; **17**: 573–580.
 17. Heniford BT, Park A, Ramshaw BJ, Voeller G. Laparoscopic repair of ventral hernias: nine years' experience with 850 consecutive hernias. *Ann Surg* 2003; **238**: 391–400.
 18. Eriksson A, Rosenberg J, Bisgaard. Surgical treatment for giant incisional hernia: a qualitative systematic review. *Hernia* 2014; **18**: 31–38.
 19. De Vries Reilingh TS, van Goor H *et al.* Repair of giant midline abdominal wall hernias: 'components separation technique' versus prosthetic repair: interim analysis of a randomized controlled trial. *World J Surg* 2007; **31**: 756–763.
 20. Pantelis D, Jafari A, Vilz TO *et al.* Abdominal wall components separation method for closure of complicated abdominal hernias. *Chirurg* 2012; **83**: 555–560.
 21. Ko JH, Wang EC, Salvay DM, Paul BC, Dumanian GA. Abdominal wall reconstruction: lessons learned from 200 'component separation' procedures. *Arch Surg* 2009; **144**: 1,047–1,055.