



Perioperative outcomes of laparoscopic total extraperitoneal inguinal hernia repair

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Background: Laparoscopic total extraperitoneal (TEP) inguinal hernia repair has become increasingly common over the past decade due to reported reduced postoperative pain, shorter convalescence and lower incidence of long-term surgical related morbidity such as chronic pain and numbness. However, the technique has not yet become standard of care in many institutions. The hesitation to adopt this approach may be related to the relatively long learning curve and limited high quality outcome data available. The purpose of this study was to evaluate perioperative morbidity and short-term outcomes of laparoscopic TEP repair.

Methods: We performed a retrospective review of a consecutive series of patients who underwent laparoscopic TEP inguinal hernia repair over a 10-year period. Data collected included patient demographics, operative parameters and postoperative complications.

Results: A total of 403 patients underwent laparoscopic TEP repair for the management of unilateral or bilateral inguinal hernia. The median age was 51 and 97% were males. The median BMI was 26 and 96% were ASA grade 1 or 2. Ninety-seven percent of repairs were primary, 15% were bilateral and 65% were indirect. The mean operative duration was 50 minutes over the entire study period, however this decreased significantly with time to a mean of 37 minutes in the final year. Postoperative complications occurred in 10.6%, 86% were Clavien-Dindo grade 1 and there were no significant visceral or vascular injuries. The most common complications were seroma formation (4.2%), urinary retention (3.7%) and rectus sheath haematoma (1.4%). Almost all patients were discharged within 24 hours.

Conclusions: Laparoscopic TEP repair is a safe and well tolerated surgical treatment of inguinal hernia, associated with a low incidence of perioperative complications.

Keywords: Laparoscopic; inguinal hernia; total extraperitoneal (TEP)

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Introduction

Inguinal hernia repair represents one of the most commonly performed procedures in general surgery with approximately 800,000 inguinal hernias repaired annually in the United States (1). The past few decades have seen a paradigm shift in operative technique, evolving from the

traditional open suture based Shouldice or Bassini repair, to the standard open tension free Lichtenstein mesh repair and more recently to laparoscopic pre-peritoneal mesh repair. The laparoscopic techniques used include a transabdominal preperitoneal (TAPP) or total extraperitoneal (TEP) approach, the latter preferred due to a lower risk of intra-

abdominal injury (2,3).

Regardless of the approach used, the advantages of minimally invasive surgery, namely reduced post-operative pain and shorter post-operative convalescence, make laparoscopic repair an attractive alternative to the traditional open approach (4-6). Furthermore, several studies have since demonstrated reduced long-term surgical related morbidity such as chronic pain and numbness (7). Despite these promising findings, it has not yet become standard of care in many institutions, presumably due to a combination of factors including complexity of the technique, relatively long learning curve and limited high quality outcome data.

A particular area of concern since its introduction in the 1990s, has been the risk of significant perioperative complications. Although rare, early meta-analyses have suggested an increased risk of serious intra-operative visceral and vascular injury with laparoscopic repair compared with open (8,9). In addition, reported rates of early surgical related morbidity such as seroma or haematoma development are limited and variable (8,9). The purpose of this retrospective study therefore, was to evaluate perioperative morbidity of laparoscopic TEP inguinal hernia repair and to assess the short term outcomes of a consecutive series of patients over a ten-year period in a single institution.

Methods

We performed a retrospective review of a consecutive series of patients who underwent laparoscopic TEP inguinal hernia repair over a 10-year period (July 2007 to July 2017). This was a single centre study and all procedures were performed by one of four consultant surgeons or by a specialist registrar under the supervision of the consultant. The primary aim of this study was to assess perioperative outcomes.

Procedure

The operative procedure was standardised. Under general anaesthesia, access was gained via a transverse incision lateral to the umbilicus on the same side as the hernia following infiltration of local anaesthesia. Prophylactic antibiotics according to hospital guidelines were administered prior to incision. The anterior rectus sheath was incised transversely; the rectus muscle retracted laterally and the extraperitoneal space developed using balloon dissection. This was followed by insertion of a 10 mm port

and insufflation to 12 mmHg. The patient was positioned in the Trendelenburg position. A 5 mm port was inserted in the midline under direct vision, as close as possible to the umbilical port. A second 5 mm port was inserted 2 cm from the anterior superior iliac spine on either the ipsilateral or contralateral side to the hernia depending on surgeon preference. The preperitoneal space was dissected, the hernia sac separated from the vessels and cord and a mesh such as the 10.8 cm × 16 cm Bard 3DMax was secured with absorbable tacks. The peritoneum was stripped back behind the mesh and the space was deflated under direct vision.

All patients were discharged the following morning if well and scheduled for review in the outpatient clinic 6 weeks post-operatively.

Data collection and analysis

Data collected included patient demographics such as age, gender, comorbidities, ASA grade, smoking history and occupation, and perioperative details including intra-operative diagnosis, operative time, duration of stay and peri- and post-operative complications. Hernias that were converted to open were excluded from the final study group. Basic descriptive statistics were calculated.

Results

Between July 2007 and July 2017, 403 patients underwent laparoscopic TEP repair for the management of unilateral or bilateral inguinal hernias. In this study, 97% were males and the median age of the study cohort was 51. The majority of patients were ASA grade 1 or 2, 19.5% were smokers and 23% had a high risk profession. BMI ranged between 19 and 37, the median was 26 (*Table 1*).

Of the 403 patients operated on, 85% had unilateral inguinal hernias and 15% had bilateral. There were 260 indirect (64.5%), 108 direct (27%), 2 femoral (0.5%) and 33 (8%) pantaloon hernias. Only 11 patients underwent repair of a recurrent hernia (*Table 1*). The mean operative time over 10 years was 50 minutes. This decreased significantly with time, decreasing from a mean of 57 minutes in the first year of the study period to a mean of 37 minutes in the final year (*Table 2*).

There were no major intraoperative vascular or visceral complications. Anaesthetic related complications occurred in five patients and included laryngospasm upon extubation (2), anaphylaxis due to an anaesthetic agent (1), pneumothorax following intubation requiring intraoperative chest drain

Table 1 Demographics and operative parameters

Characters	Value
Age, median [range] (years)	51 [17–90]
Male, n [%]	391 [97]
ASA grade, n [%]	
1	257 [64]
2	130 [32]
3	16 [4]
4	0
BMI, median [range] (kg/m ²)	26 [18–39]
Smoker, n [%]	98 [24]
High risk profession, n [%]	93 [23]
Primary, n [%]	392 [97]
Unilateral: bilateral	343:60
Indirect: direct	260:108
Pantaloon	33
Femoral	2

Table 2 Duration of operation and length of stay

Time period	Duration of operation (min)				
	Mean	Min	Max	Median	SD
Overall	50	15	190	45	9.7
2007–2008	57	30	180	60	34.5
2016–2017	37	20	77	30	15.7
Length of stay (days)	1.07	0	6	1	–

insertion and an intraoperative cardiac arrhythmia managed pharmacologically.

Postoperative complications occurred in 10.6% of patients and were graded according to the Clavien-Dindo classification as shown in *Table 3*. No patient required re-operative intervention. There were 17 (4.2%) clinically significant seromas which were managed conservatively and had resolved by the 6-week clinical review. Urinary retention occurred in 15 patients (3.7%), all of whom successfully passed a trial without catheter on either day 1 post-operatively or 2 weeks later while on tamsulosin. Six patients (1.5%) developed rectus sheath haematomas and were all managed conservatively. One patient who developed a haematoma required a blood transfusion.

Table 3 Postoperative morbidity

Variables	Number (%)
Postoperative surgical complication	43 (10.6)
Reoperation	0
Seroma	17 (4.2)
Rectus sheath haematoma	6 (1.4)
Urinary retention	15 (3.7)
Superficial wound infection	5 (1.2)
Deep/Mesh infection	0 (0)
Clavien-Dindo grade	
Grade 1	37 (86.0)
Grade 2	6 (14.0)
Grade 3	0
Grade 4	0
Grade 5	0

There were 5 (1.2%) superficial wound infections treated with antibiotics. The 30-day re-admission rate was zero. The mean length of hospital stay was 1 day.

Discussion

The past two decades have seen an evolutionary change in the surgical management of unilateral primary inguinal hernia. The unambiguous advantages of minimally invasive surgery have underpinned the development of TEP and TAPP repair, transforming a procedure historically associated with considerable postoperative pain and convalescence.

In addition, reduction in long-term surgical related morbidity, specifically chronic pain, makes laparoscopic repair an attractive alternative to the conventional open approach (7). Interestingly however, the frequency of laparoscopic repair remains variable (10). In fact, according to the Swedish hernia register, 20% of all registered hernia repairs were performed laparoscopically in the 1990s. This figure had dropped to 9% by 2006 (10,11). Hesitation to adopt this technique may stem from a lack of clarity on long-term efficacy and recurrence. Furthermore, the technical complexity and concern regarding potential risk of serious intra-operative complications may also deter many surgeons from abandoning a method of repair that is not only familiar but also proven to be safe and reliable.

The focus of this study was solely to assess perioperative outcomes of laparoscopic TEP repair. A recent meta-analysis of eighteen trials including almost 4,500 patients reported a significantly increased risk of perioperative complications with laparoscopic repair. On subgroup analysis however, the increased risk was noted only in patients undergoing TAPP. There was no significant difference in risk when TEP was compared with open repair (7). It is likely that technical skill and proficiency achieved over time has led to an overall improvement in perioperative outcomes, particularly outcomes related to operative technique such as seroma and haematoma formation. With regards to significant intra-operative complications, although uncommon, previous reports have suggested an increased rate with laparoscopic repair compared to the traditional open technique. In a systematic review of 34 studies involving 6,804 patients, vascular and visceral injuries occurred in 4.7 per 1,000 laparoscopic repairs compared to 1.1 per 1,000 open cases (8). Similar findings were demonstrated in an early Cochrane review of 41 randomised trials with a total of 7,161 patients (9). It must be acknowledged however that the power of these analyses was limited by a lack of high quality studies. Furthermore, as they included many of the earliest studies evaluating minimally invasive repair, the level of experience with the technique at that time was low.

In this consecutive series of 403 patients the results demonstrate that laparoscopic TEP repair is a safe and well tolerated surgical treatment of inguinal hernia, associated with a low incidence of perioperative complications. Importantly, no significant intraoperative complications occurred and no patient required re-operative intervention. The majority of surgical related complications encountered in this study were grade 1 according to the Clavien-Dindo classification (12). Seroma formation and urinary retention were most commonly observed, with rates comparable to those reported in the literature.

The most common post-operative complication in our series was a clinically significant seroma, which occurred in 4.2% of patients. Seroma following laparoscopic inguinal hernia repair has a reported incidence of 3.6–7.2% and is most commonly associated with large indirect hernias (13–16). It has been postulated that the increased risk of development with laparoscopic repair may be due to the management of the hernia sac. For large direct hernias, the guidelines of the International Endohernia Society recommend that the sac should be inverted and fixed to Cooper's ligament to reduce seroma development (14,17,18).

For indirect hernias, division of the sac appears to increase seroma development. In a study of 520 TEP repairs comparing transection of the indirect sac to complete reduction of the sac, there was a statistically significant increase in postoperative seromas in the transected sac group (8.73% *vs.* 2.45%, $P=0.002$) (19). The majority of clinically significant seromas resolve with conservative management with aspiration reserved for those that persist. In our series all seromas were small and self-limiting, none required any intervention and all had resolved by the 6-week clinical review.

Post-operative urinary retention was the second most common complication in this series, occurring in 3.7% of patients. This is in keeping with that reported in the literature which ranges between 1% and 22% compared to up to 3% following open repair (20–24). It is likely that urinary retention is more frequently encountered with TEP repair as this technique involves dissection in the pre-peritoneal space near the bladder. All patients in this series successfully passed a trial without catheter at either the first attempt on day 1 postoperatively or on the second attempt 2 weeks later while on tamsulosin.

The rate of rectus sheath haematoma was 1.5% in this series. This relatively uncommon complication occurs as result of injury to small perforating vessels in the subcutaneous fat during port placement. The bleeding may not be recognised intra-operatively due to the tamponading effect of both the pneumoperitoneum and the ports themselves. The majority resolve with conservative management as was the case in our series. All 6 patients in this study were managed expectantly and none required operative or radiological intervention.

Although an uncommon occurrence, one of the greatest concerns surrounding laparoscopic inguinal hernia repair following its introduction was the potential increased risk of significant visceral or vascular injury. In terms of visceral injury, rates appear lower with TEP compared to TAPP. The opposite is true for vascular injury. The majority of vascular complications involves the inferior epigastric vessels and may occur during port insertion or dissection. Care should be taken to develop the correct plane of dissection and in certain circumstances it may be advisable to ligate the vessel to prevent injury and bleeding, particularly if the vessel is obstructing the surgeon's view.

The optimal technique for laparoscopic unilateral inguinal hernia repair remains to be determined. Although TEP is the preferred approach, it has not been adopted as standard of care and many surgeons continue to perform

TAPP repair. Theoretical advantages of TEP include reduced risk of intraabdominal injury and less adhesion formation. Proponents of TAPP however, favour this approach due to the larger working space, particularly advantageous in patients with previous abdominal surgery and large inguinoscrotal hernias (25,26).

Over the past decade there have been four systematic reviews or meta-analyses comparing TEP versus TAPP repair (7,27-29). The conclusions drawn have unfortunately been limited by the quality of the studies used. Low patient numbers and lack of experience or learning curve led to a consensus that superiority of one technique over the other could not be demonstrated and that further high quality trials were required.

One of the largest and most recent studies comparing the perioperative outcomes of TEP and TAPP in 17,587 patients undergoing primary unilateral inguinal hernia repair reported a significantly lower postoperative complication rate with TEP (1.70% *vs.* 3.97%, $P < 0.0001$) (30). Further analysis showed that this was due to a significantly higher seroma rate (0.51% *vs.* 3.06%, $P < 0.0001$) in the TAPP group, however there was no significant difference in complication related re-operation rates. On multivariate analysis, a large hernia defect and scrotal hernia were associated with increased risk of postoperative complication, particularly seroma formation, and were noted to be significantly more common in patients undergoing TAPP repair. The authors hypothesised that the difference in perioperative outcome may therefore be related to the indication rather than surgical technique and thus advocate a tailored approach. The authors of this study favour open Lichtenstein repair for large inguinoscrotal hernias.

This study has a number of limitations including its retrospective nature and lack of long-term follow up. Despite these limitations, we have demonstrated low perioperative complication rates in a large consecutive series of laparoscopic TEP inguinal hernia repair supporting this technique as a safe alternative to the conventional open approach.

Conclusions

Inguinal hernia repair continues to be one of the most commonly performed general surgical procedures. The past few decades have witnessed the development of minimally invasive techniques associated with reduced postoperative pain, shorter convalescence and lower rates of chronic pain and numbness. Laparoscopic TEP repair has been shown

to be a safe alternative to the traditional open approach and is associated with a low incidence of perioperative complications.

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Footnote

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at <http://dx.doi.org/10.21037/ales.2018.03.08>). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). Ethical approval was not sought given that data collection was anonymised and no patients were contacted.

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