

Laparoscopic totally extraperitoneal inguinal hernia repair: lessons learned from 3,100 hernia repairs over 15 years

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Abstract

Background Two revolutions in inguinal hernia repair surgery have occurred during the last two decades. The first was the introduction of tension-free hernia repair by Liechtenstein in 1989 and the second was the application of laparoscopic surgery to the treatment of inguinal hernia in the early 1990s. The purposes of this study were to assess the safety and effectiveness of laparoscopic totally extraperitoneal (TEP) repair and to discuss the technical changes that we faced on the basis of our accumulative experience. **Methods** Patients who underwent an elective inguinal hernia repair at the Department of Abdominal Surgery at the Institute of Laparoscopic Surgery (ILS), Bordeaux, between June 1990 and May 2005 were enrolled retrospectively in this study. Patient demographic data, operative and postoperative course, and outpatient follow-up were studied.

Results A total of 3,100 hernia repairs were included in the study. The majority of the hernias were repaired by TEP technique; the repair was done by transabdominal preperitoneal (TAPP) repair in only 3%. Eleven percent of the hernias were recurrences after conventional repair.

Mean operative time was 17 min in unilateral hernia and 24 min in bilateral hernia. There were 36 hernias (1.2%) that required conversion: 12 hernias were converted to open anterior Liechtenstein and 24 to laparoscopic TAPP technique. The incidence of intraoperative complications was low. Most of the patients were discharged at the second day of the surgery. The overall postoperative morbidity rate was 2.2%. The incidence of recurrence rate was 0.35%. The recurrence rate for the first 200 repairs was 2.5%, but it decreased to 0.47% for the subsequent 1,254 hernia repairs

Conclusion According to our experience, in the hands of experienced laparoscopic surgeons, laparoscopic hernia repair seems to be the favored approach for most types of inguinal hernias. TEP is preferred over TAPP as the peritoneum is not violated and there are fewer intra-abdominal complications.

Keywords Inguinal hernia · Totally extra peritoneal repair · Laparoscopic repair · 3-D mesh

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Hernia repair is the most frequently performed operation in general surgery. Since Bassini's report of inguinal hernia cure in 1887 [1], numerous other techniques have been described. During the first half of the 20th century, repairs were based on bringing together and suturing the edges of the defect. These techniques resulted in high recurrence rates and postoperative morbidity due to the tension on the suture lines.

Two revolutions in inguinal hernia repair surgery have occurred during the last two decades. The first was the introduction of tension-free hernia repair by Lichtenstein in 1989, which significantly reduced recurrence rates [2].

Open anterior tension-free mesh repairs became the most common repairs throughout the world. The second revolution was the application of laparoscopic surgery to the treatment of inguinal hernia in the early 1990s, which led to decrease in postoperative pain and faster recovery along with low recurrence rates. Two laparoscopic techniques have become the most common procedures to repair these hernias: the transabdominal preperitoneal repair (TAPP) and the totally extraperitoneal (TEP) repair. To the best of our knowledge, we (J.L.D.) were the first to perform laparoscopic TEP repair, in June 1990 [3].

Since then, our approach for inguinal hernia repair is laparoscopic TEP; only in complicated hernias (sliding or incarcerated inguinal hernias) do we use the TAPP technique.

The purposes of this study were to assess the safety and effectiveness of this procedure as demonstrated by perioperative outcomes and incidence of complications and recurrences, and to discuss the technical changes that we faced on the basis of our accumulative experience since the introduction of this method. These improvements contributed to reducing complications and recurrences rates.

Patients and methods

Patients who underwent an elective inguinal hernia repair, in the Department of Abdominal Surgery at the Institute of Laparoscopic Surgery (ILS), Bordeaux, between June 1990 and May 2005 were retrospectively enrolled to the study. The inclusion criteria were all patients diagnosed with inguinal hernia, including with recurrence, scrotal hernia, and with previous lower abdomen and pelvic surgery. Patients with urgent incarcerated hernia were excluded from the study.

Patient demographic data, operative and postoperative course, and outpatient follow-up were studied. The following data were collected retrospectively: age, sex, American Society of Anesthesiologists (ASA) physical status score, duration of surgery, intraoperative complications, postoperative complications, hospital stay, recurrence and distant events. Variables are presented as mean and standard deviation. Statistical analysis including the χ^2 test and Student's *t* test was carried out where appropriate. A *p* value of less than 0.05 was considered statistically significant.

Surgical technique

The patient is placed, under general anesthesia, in the supine position. The surgeon and the camera holding surgeon are on the opposite side of the hernia. Veress needle is first inserted in the midline just above the pubis to penetrate the linea alba with slight resistance and enters the

suprapubic space of Retzius. The space is insufflated with CO₂ to a pressure of 15 mmHg, while free flow of CO₂ at the rate of 1 l/min indicates correct position of the needle. After 1.5 l of CO₂ enters the space, the insufflation pressure is lowered to a maximum of 12 mmHg. A 1-cm transverse or vertical subumbilical incision is made; a 10-mm trocar is inserted in the subcutaneous plane in a horizontal direction, then slowly lifted up and introduced at an angle of 60° towards the sacrum. The linea alba should be pierced at the level of arcuate line, a point roughly level with the anterior superior iliac spine. The trocar pierces the linea alba to enter the newly created preperitoneal space. The laparoscope is then introduced and the space is expanded by blunt dissection with a 0° telescope. Gentle side-to-side movements of the telescope are used to dissect the areolar tissue. The inferior epigastric vessels are clearly visualized laterally on the posterior surface of the rectus muscle and during their free course within the preperitoneal space. The retropubic space of Retzius and the space of Bogros are easily expanded by the telescopic approach. At this stage a 5-mm working trocar is introduced in the midline, midway between the camera port and symphysis pubis. Thereafter, the preperitoneal space is widened by alternate sharp and blunt dissection under telescopic guidance. A second working trocar is placed in the midclavicular line on the side of the hernia to dissect the sac in cases of indirect hernias. The hernia sac is gradually dissected and freed from the internal inguinal ring. Dissection continues by gentle traction on the cord elements in order to identify and free the peritoneal sac from the spermatic cord, vas deferens, and spermatic vessels. A direct hernia is easily reduced by simple traction. The sac in femoral hernias is reduced by gentle traction with fenestrated forceps. The peritoneum is pushed back as far as possible into the abdominal cavity. The anterior part of the psoas muscle, as well as the crossing of the iliac vein by the vas deferens must be fully exposed. The 14 × 10 cm anatomical (Microval, ETHICON, France) mesh is rolled and introduced through the 10-mm trocar to reinforce the myopectineal orifice (Fig. 1). The inferior and lateral edge

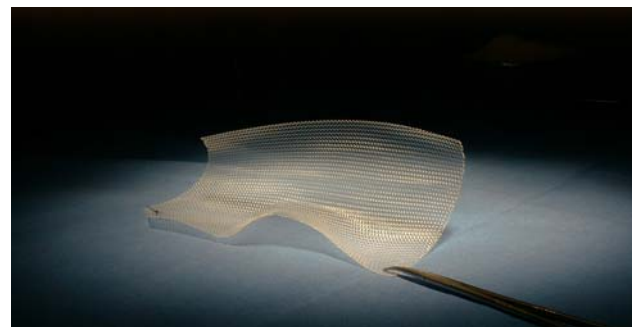


Fig. 1 Left-sided 3-D mesh (Microval, Malmont, France)

of the mesh is placed on the anterior surface of the psoas muscle and the inferior and medial edge is placed under Cooper's ligament. The inferior edge of the mesh covers the iliac vessels and the spermatic cord and the superior edge follows the contour of the abdominal wall during release of the pneumoperitoneum. Desufflation must be performed with care, under permanent visual control of the correct position of the mesh [4].

Results

Patient demographics and hernia characteristic

Between June 1990 and May 2005, 2,356 patients underwent laparoscopic hernia repair in our institute. Patient demographics and hernia characteristics are shown in Table 1. A total of 3,100 hernias were included in this study. Of these, 1,612 hernias were unilateral and the remainder were bilateral. Most of the patients were males with a mean (\pm SD) age of 61 ± 15 years. Indirect hernias were the most common, followed by direct and then femoral hernias. Right-sided hernias were more common than left-sided hernias. The majority of the hernias were repaired by TEP technique; in only 3% of them was the repair done by initial or converted TAPP. Eleven percent of the hernias were recurrences after conventional repair.

Table 1 Patient demographics and hernia characteristics

Variable	No. (%)
Number of patients	2,356
Number of hernias	3,100
Age (years), mean \pm SD	61 ± 15
Sex	
Male	2,049 (87%)
Female	307 (13%)
Site of hernias	
Right inguinal	880 (37%)
Left inguinal	732 (31%)
Bilateral inguinal	744 (32%)
Types of hernias	
Direct hernia	978 (32%)
Indirect hernia	1,593 (51%)
Femoral hernia	190 (6%)
Recurrent hernia	339 (11%)
Surgery	
TEP	3,008 (97%)
TAPP	92 (3%)

Perioperative data

Perioperative data are summarized in Table 2. Preoperative risk was evaluated in the patients according to the American Society of Anesthesiologists (ASA) physical status score. Mean surgery time was 17 min in unilateral hernia and 24 min in bilateral hernia. There were 36 hernias (1.5%) that required conversion; 12 hernias were converted to open anterior Lichtenstein and 24 to laparoscopic TAPP technique. Most of these conversions occurred early in our experience for complicated hernias. The incidence of intraoperative complications is reported in Table 3. Inferior epigastric vessel injury occurred in 11 patients and was managed by clipping. One patient had partial thickness burn of the ileum during TEP converted to TAPP. This

Table 2 Summary of perioperative data

Variable	
ASA [†]	1.5 ± 0.5
Surgery time (min)	
Unilateral	17 ± 6
Bilateral	24 ± 4
Intraoperative complications (<i>n</i>)	61 (1.9%)
Conversion	36 (1.2%)
Open	12 (0.04%)
TAPP	24 (0.08%)
Ambulation (days)	1.2
Hospital stay (days)	1.5 ± 0.4
Complications (<i>n</i>)	69 (2.9%)

[†] American Society of Anesthesiologists physical status score

Table 3 Intra- and postoperative complications

Intraoperative complications	
Bowel injury	1 (0.04%)
Inf. epigastric vessel injury	11 (0.47%)
Spermatic cord injury	1 (0.04%)
Extensive subcutaneous emphysema	48 (2%)
Total	61 (2.5%)
Postoperative complications	
Hematoma or seroma	50 (2.1%)
Neuralgia	5 (0.21%)
Mesh infection	1 (0.04%)
Port site hernia	3 (0.1%)
Urinary retention	6 (0.2%)
Total	69 (2.9%)
Recurrence	
Early	3 (0.1%)
Late	8 (0.3%)
Total	11 (0.46%)

injury was recognized and treated immediately by intracorporeal suturing. The patient recovered completely. An 82-year-old patient had spermatic cord injury in very complicated scrotal hernia without repair of the injury. Forty-eight patients had subcutaneous emphysema early in our experience.

Most of the patients were discharged at the second day of the surgery.

Morbidity

The overall postoperative morbidity rate was 2.9%. Incidence of various morbidities is reported in Table 3. Postoperative hematoma or seroma were the most common postoperative complications. All were managed by conservative treatment. Five patients suffered pain and burning sensation in the upper lateral thigh and the inguinal area. Three of these required removal of tackers causing nerve entrapment at the lateral aspect close to the ileopubic tract. This occurred in our early experience when we used to fix the mesh by tackers or sutures. At the start of our experience, we inserted the mesh through the 12-mm trocar, which caused three cases of port-site hernias requiring operative repair. Six patients had urinary retention and required catheterization in the postoperative period. One patient suffered intractable mesh infection, which was resolved by removal of the mesh at the ninth postoperative day.

The recurrence rate was 0.46%. The recurrence rate for the first 200 repairs was 2.5%, but it decreased to 0.47% for the subsequent 1,254 hernia repairs.

Discussion

Inguinal hernia is the most common hernia, accounting for 90% of all spontaneous hernias. Inguinal hernia repair is the most frequently performed operation in general surgery; more than 700,000 groin hernia repairs are performed in the USA annually [5, 6].

In recent years, minimally invasive surgery has gained worldwide acceptance, not only for abdominal surgical procedures but also for thoracic, soft tissue, and other surgical fields.

Concerning hernia repair, in the beginning of the 1990s, laparoscopic hernia repair was controversial since various studies reported an early recurrence rate as high as 25% [6, 7]. However, after a decade of experience in laparoscopic hernia surgery, this method gained worldwide acceptance and became, in many centers, the first choice for inguinal hernia repair. In their prospective randomized controlled study, Bringman and co-workers compared three tension-free methods of hernioplasty and concluded that

laparoscopic hernioplasty was superior to tension-free open herniorrhaphy with mesh-plug and patch or Lichtenstien's operation in terms of postoperative pain and rehabilitation [8]. Laparoscopic hernia repair has several advantages over conventional open methods as shown by prospective randomized trials comparing the two approaches. The major advantages include postoperative pain reduction, short recovery period, earlier return to work, better cosmetic results, and cost effectiveness [9, 10]. In addition, the laparoscopic approach allows viewing of the entire myopectineal orifice and repair of any unexpected hernias, and thereby reduces the chance of recurrence [11, 12].

Several laparoscopic techniques have been described for the management of groin hernias [13–18]. Two laparoscopic techniques have become the most common procedures for the repair of these hernias: transabdominal pre-peritoneal repair (TAPP) and totally extraperitoneal (TEP) repair. In both methods a mesh prosthesis is implanted into the preperitoneal space dorsal to the transversalis fascia. These techniques therefore represent minimally invasive versions of open mesh implantation techniques. In TAPP the surgeon enters the peritoneal cavity and places a mesh through a peritoneal incision over possible hernia sites. TEP is superior because the peritoneal cavity is not entered and mesh is used to seal the hernia from outside the peritoneum. This approach is considered to be more difficult than TAPP but may result in fewer complications.

The TAPP approach has been advocated for complicated hernias (sliding or incarcerated inguinal hernias) and hernias with previous pelvic surgery (radical prostatectomy). This technique has been criticized for exposing intra-abdominal organs to potential complications, including small bowel injury and obstruction.

Laparoscopic TEP hernia repair has gained ground in recent years, and is preferred over TAPP as it is less invasive and is associated with fewer complications. In their comparative study, Felix et al. reported 11 major complications in the TAPP group (two recurrences, six hernias in the trocar site, and others), whereas only one recurrence was observed in the TEP group, with no intra-peritoneal complications [13]. Khoury et al. found that patients who underwent TEP received less narcotic analgesia than those who underwent TAPP and that they were discharged more frequently at the operative day [19].

Since June 1990, our approach for inguinal hernia repair has been laparoscopic TEP. Up to May 2005, a total of 3,100 hernias were repaired. The majority of the hernias were repaired by TEP technique. The short mean operative time, the minimal conversion rate, and the low incidence of intraoperative complications prove that laparoscopic TEP repair is a feasible and safe procedure. Most of the patients were discharged at the second postoperative day. The

overall postoperative morbidity rate was 2.9%. The recurrence rate was 0.35%. In last few years we have begun using this method for inguinal hernia diagnosed in patients who underwent previous pelvic surgery and radical prostatectomy [20].

Since 1996 we have used three-dimensional (3-D) anatomically contoured polypropylene mesh (Microval; Malmont, France) for the reinforcement of the inguinal region. This mesh proved to be favorable for laparoscopic handling, has good local tolerance, and minimizes complications related to the mesh. We concur with a recent report that suggested that it is not necessary to fix the mesh as long as it is large enough to cover all hernia spaces. Avoiding mesh fixation not only prevents nerve entrapment, but also saves the cost of a hernia stapler and reduces operating time [21].

Historically, cost analysis favored open hernia repair over laparoscopy (TEP or TAPP) [22, 23]. However, now, with a decade of experience in laparoscopic hernia repair, the cost of TEP repair is comparable with that of open repair [24, 25], mainly due to successful cost-reduction strategies (factors related to learning curve effects, including reduced operative time, surgical errors, unnecessary instrumentations, and materials, plus global variables including complications, postoperative pain, recurrences, and return to work).

According to our experience, in the hands of experienced laparoscopic surgeons, laparoscopic hernia repair seems to be the favored approach for most types of inguinal hernias. TEP is preferred over TAPP as the peritoneum is not violated and there are fewer intra-abdominal complications.

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