

Endoscopic total extraperitoneal repair of primary and recurrent inguinal hernias

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Received: 3 December 1997/Accepted: 7 May 1998

Abstract

Background: In most reports different techniques have been described for combinations of primary and recurrent hernias. The aim of this study was to investigate and compare the results of endoscopic total extraperitoneal repair (TEP) of primary and recurrent inguinal hernias.

Methods: From January 1993 to July 1995, 221 patients with an unilateral inguinal hernia (186 primary and 35 recurrent) underwent TEP repair. Follow-up, including physical examination, was performed at regular 3-month intervals.

Results: The mean operation time was 37.6 min. Minor perioperative complications occurred in 23 cases. Conversion was required for 16 patients (7.2%). Postoperative complications were reported for 11.7% of the patients. Hospital stay was short. Mean follow-up was 40.4 months. The recurrence rate was 3.2% for primary hernias and 20% for recurrent hernias.

Conclusions: This study confirms the preliminary success of TEP for primary inguinal hernia repair, as previously reported. The high recurrence rate after endoscopic repair of recurrent hernias needs to be studied further.

Key words: Primary inguinal hernia — Recurrent inguinal hernia — Total extraperitoneal procedure — Tension-free mesh repair — Learning curve

Physicians who treat primary inguinal hernias are often confronted with a disappointing number of recurrences. Specialized centers have reported excellent results after conventional repair. However, they are not easily equalled by others [10, 8, 18]. The repair of recurrent inguinal hernias is

even more difficult due to the obscured anatomy and poor tissue quality [6, 14]. Once a hernia has recurred after conventional herniorrhaphy, the result of every successive conventional repair will be worse, with an ultimate recurrence rate of 23–33% [14, 21, 27].

Some promising reports on endoscopic hernia repair have been published [4, 5, 16, 18, 26]; however follow-up in these studies has been short. When compared to the trans-abdominal preperitoneal procedure (TAPP), the total extraperitoneal (TEP) procedure seems to have a lower potential for intraperitoneal complications; TEP repair is therefore the procedure of choice in most situations [3, 5, 9, 19, 22].

To investigate the technical feasibility, complication rate, and morbidity of this procedure, we performed a retrospective analysis. Specifically, we determined the recurrence rate for the TEP procedure for primary and recurrent inguinal hernias. In our opinion, primary and recurrent inguinal hernias have different characteristics; therefore to obtain a clear idea of the results of endoscopic hernia repair for these specific groups, primary and recurrent hernias were analyzed separately.

Materials and methods

Patients who underwent TEP repair for a unilateral primary or recurrent inguinal hernia at the Reinier de Graaf Hospital in Delft, The Netherlands, were included in this study. A total of 186 patients had a primary inguinal hernia, while 35 had a recurrent hernia. In all cases of recurrent hernia, the hernia occurred after prior conventional repair without the use of prosthetic material. All patients were declared fit for general anesthesia, and none had an infection of the abdominal wall. The operations were performed by two staff surgeons who were experienced in endoscopic surgery. A standardized procedure for TEP hernia repair was followed in all cases. The essentials of this technique, which was described previously by Liem and van Vroonhoven [13], are general anesthesia, total extraperitoneal dissection, and positioning of a 10 × 15 cm polypropylene mesh prosthesis. The prosthesis is anchored to the abdominal wall by intraabdominal pressure alone; in other words, staples or stitches are not used for fixation of the mesh. Patients are allowed to leave the hospital as soon as they feel up to it, as long as no postoperative complications needing clinical care had occurred.

Patients were seen postoperatively at regular 3-month intervals in the 1st year and then annually by staff surgeons. All data on each group (i.e.,

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Table 1. Characteristics of 221 patients who underwent endoscopic total extraperitoneal repair of an inguinal hernia

	Primary hernia	Recurrent hernia
No. of patients	186	35
Male:female	174:12	35:0
Age (yr)	median: 54; range: 20–90	median: 66; range: 25–89

primary and recurrent hernias) were registered separately. Initial data and data recorded during regular follow-up were collected from patient dossiers.

Localization of the primary hernia was classified according to Nyhus [17]. In cases of recurrent hernia, the location found during the operation was recorded. Operation time was defined as the time from the first incision to the last suture. Perioperative complications (diffuse hemorrhage or bleeding from an epigastric vessel, injury to the vas deferens, technical defects of instruments, peritoneal defects), postoperative complications (hematoma of the abdominal wall, seroma, paresthesia, wound infection, urine retention), and conversion of the total extraperitoneal procedure to a transabdominal laparoscopic or a conventional procedure were all noted. Length of hospital stay (i.e., number of days in the hospital after surgery) and morbidity (i.e., number of days needed for recovery before returning to work or full daily activities) were assessed.

Data collection was completed with data from the routine follow-up, including physical examination. For the present study, all patients received a questionnaire and were asked to report to the outpatient department. Patients who did not respond to our mailing were approached by telephone. Patients who were lost to follow-up had moved outside the Netherlands or died. All other patients responded to our mailing or telephone request. At this final check-up, recurrence of the hernia was evaluated by a thorough physical examination.

Results

Primary inguinal hernia

From January 1993 to July 1995, 186 patients (174 male and 12 female) were operated upon. Their age at surgery ranged from 20 to 90 years (Table 1). Predisposing factors for hernia occurrence (heavy weight bearing, chronic obstipation, urinary obstruction, chronic cough) were present in 38 of 186 patients. Hernia localization was classified according to Nyhus [17] (Table 2). The mean operating time was 37 min.

Perioperative and postoperative complications are shown in Table 3. Perioperative complications, which were minor, occurred in 16 patients (8.6%). Only once did injury of the epigastric vessels lead to preperitoneal bleeding. The vessels were clipped and the hematoma was evacuated. Peritoneal tears occurred during dissection in 11 cases (5.9%); in four cases, a peritoneal dissection balloon (PDB) had been used. Conversion to another procedure was necessary in 12 cases (6.4%). Conversion due to CO₂ leakage into the abdominal cavity, leading to reduction of the preperitoneal space and therefore to difficult dissection, occurred in eight patients. In three patients, conversion was necessary for technical reasons and once due to bleeding that hampered visibility. Nine times the switch to a transabdominal procedure (TAPP) was successful; three times a conventional anterior approach was used, and twice prosthetic material was needed.

Postoperative complications included a hematoma of the abdominal wall in five patients (2.7%), paresthesia of the

Table 2. Classification according to Nyhus of 221 patients with an inguinal hernia

Nyhus classification	Primary hernia	Nyhus classification	Recurrent hernia
NII (indirect)	88	NIV (indirect)	10
NIIA (direct)	30	NIV (direct)	13
NIIB (combined)	54	NIV (combined)	6
NIIC (femoral)	5	Unclassified	6

Table 3. Complications among 221 patients who underwent endoscopic total extraperitoneal repair of an inguinal hernia

	Primary hernias		Recurrent hernias		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Perioperative complications						
peritoneal tears	11	5.9	11	31	22	9.9
bleeding	10	5.3	2	5.7	12	5.4
Postoperative complications						
hematoma	5	2.7	5	14	10	4.5
paresthesia	4	2.2	2	5.7	8	3.6
seroma	3	1.6	0		3	1.4
urine retention	4	2.2	0		4	1.8
hydrocele	1	0.5	0		1	0.5

n, number of patients with this complication; %, number expressed as percentage of all the patients with a primary or recurrent hernia and the total number of patients

inguino-femoral region in four patients (2.2%), and seroma in three patients (1.6%). Except for two hematomas that required fine-needle aspiration, these complications disappeared spontaneously. Urine retention, which was seen in four cases (2.2%), was treated by temporary catheterization of the bladder. In one patient, a hydrocele developed due to a retained hernial sac; it was corrected surgically 1 year after primary repair (Table 3).

Mean hospital stay was 1.2 days. Patients returned to work or full daily activities after a mean period of 4.7 days (Table 4). Mean follow-up was 40 months. Six patients were lost to follow-up; two had moved outside the country and four had died. Their data at the last follow-up have been included in this study.

Six patients suffered a recurrence. Two of these patients had done a lot of heavy weight bearing before the operation but not afterward. Of these six recurrences, four developed within the 1st year of surgery, the other two in the 2nd year. These recurrences were among the first 30 cases of the surgeons. In three of these cases, a large postoperative hematoma or seroma occurred after the primary repair. Three cases of recurrence were repaired surgically. In all three cases, a direct recurrence was diagnosed during the operation. The mesh had shifted laterally, allowing the new direct hernia to develop. Repair was performed by an endoscopic transabdominal procedure (TAPP), and there has been no recurrence to date. Patients with a recurrent hernia that was not repaired had no complaints related to this hernia and were therefore not interested in an intervention.

Recurrent inguinal hernia

Between January 1993 and July 1995, 35 patients with a recurrent unilateral inguinal hernia after prior conventional

Table 4. Hospital stay, return to work, and follow-up time for 221 patients with endoscopic TEP repair of an inguinal hernia

	Primary hernia	Recurrent hernia
Hospital stay (days)	median: 1; range: 1–5	median: 1; range: 1–3
Return to work (days)	median: 3; range: 1–30	median: 3; range: 1–14
Follow-up (mo)	median: 42; range: 22–55	median: 43; range: 27–55

herniorrhaphy were treated by the TEP technique. All patients were male; their ages ranged from 25 to 89 years (Table 1). Predisposing factors for hernia occurrence (heavy weight bearing, chronic constipation, urinary obstruction, chronic cough) were present in 14 of 35 patients. A total of 25 patients had undergone one previous repair, eight patients had two previous repairs, one patient had three previous repairs, and one patient had four previous repairs. The localization of the recurrent hernia (NIV) was described according to findings during the operation (Table 2). The mean operation time was 41 min.

Only minor perioperative complications were encountered. Peritoneal tears occurred during preperitoneal dissection in 11 patients; in six of these cases, a peritoneal dissection balloon (PDB) had been used. Preperitoneal bleeding occurred in two patients due to injury to an epigastric vessel (Table 3). The epigastric vessel was clipped, and the hematoma was evacuated successfully. In four cases, the TEP procedure could not be continued due to peritoneal tears and intraabdominal gas leakage. In all four procedures, the surgeon switched to a TAPP procedure.

Postoperative complications included a hematoma of the abdominal wall in five patients and paresthesia of the inguino-femoral region in two (Table 3). All recovered spontaneously. The mean hospital stay was 1.3 days. On the average, patients returned to work or full daily activities after 4.2 days (Table 4).

Only one patient was lost to follow-up due to death of unrelated origin. After a mean follow-up of 43 months, seven patients were found to have a recurrence. Only one of these patients had done some heavy weight bearing before operation but not thereafter. Five of these recurrences occurred within the 1st year of surgery; the other two occurred at the beginning of the 2nd year. Reintervention was done in three of these seven cases. In all three patients, the mesh had moved laterally, allowing a new direct hernia to develop. Repair of these recurrent hernias was performed with a TAPP procedure, and there has been no recurrence to date. The four patients who did not undergo repair did not have any complaints due to this hernia and were therefore not motivated to undergo intervention.

Discussion

Thanks to promising early reports indicating rapid recuperation and a low recurrence rate after short follow-up, laparoscopic repair is gaining in popularity for the treatment of inguinal hernias [4, 5, 16, 18, 26]. The use of prosthetic mesh to create a tension-free repair and the endoscopic tech-

nique itself are major factors in these excellent results. Some conventional techniques have shown promising results in specialized centers, but they could not be equaled in other series. The results of conventional techniques for recurrent hernia repair are even more disappointing. Until now, studies of endoscopic hernia repair have generally described the results of different techniques within a single group of patients [4, 6, 7]. Other reports on endoscopic inguinal hernia repair have described the results of repairs in a variable group of hernias—i.e., one that combined primary, recurrent, and bilateral hernias [4–7, 18, 24, 26].

In our opinion, the findings in these reports cannot be applied to the repair of any one specific group of inguinal hernias using a single laparoscopic technique. In most series, follow-up was short. Furthermore, physical examination was not mentioned, although, physical examination is crucial in the follow-up of hernia repair. Many recurrences tend to be asymptomatic and therefore cannot be diagnosed adequately from questionnaires or telephone interviews [8, 12].

Since the early days of endoscopic hernia surgery, a variety of techniques have been used. The complications of the intraperitoneal onlay mesh technique (IPOM) and the transabdominal preperitoneal procedure (TAPP) appeared to be the consequence of (a) adhesion of the bowel to the intraabdominally positioned mesh, (b) exposure of parts of the mesh after inadequate closure of the peritoneum, or (c) injury of the intraabdominal organs [5, 19, 25]. Because these risks are lower with the total extraperitoneal procedure (TEP), it is therefore our technique of choice in most situations [3, 5, 9, 19, 22, 26]. In our study of TEP repair for unilateral primary hernias and recurrent hernias after conventional repair, the occurrence of perioperative and postoperative complications was low and comparable to other reports on endoscopic hernia repair [4–7, 18, 22, 24]. The operation time for the two groups is comparable; it is not longer than for conventional repair. Conversion to another procedure involved the TAPP procedure in the majority of cases, thereby maintaining the advantages of laparoscopic surgery. In cases where it was not possible to continue endoscopically, there were problems with anesthesia (muscle relaxation) or other technical problems.

This study confirmed the previously reported positive results of a short hospital stay and rapid recuperation for both primary and recurrent hernia repair. In cases where the patient remained at home longer after hernia repair, he or she was usually persuaded by others to do so; the fear of overdoing things is still present among both patients and general practitioners [13, 20].

The low recurrence rate of 3.2% for the primary hernia group is also in accordance with previous reports. Four of the six recurrences occurred in patients who were treated during the early phase of our experience with the TEP procedure; i.e., these cases were among the first 30 patients of each surgeon. The learning curve may play a role here [13]. Four of these recurrences developed within the 1st year of surgery. This result is in accordance with the suggestion that recurrences after endoscopic repair are mainly due to technical errors and therefore occur early [2, 20]. However, we consider our mean follow-up of 40.4 months only the start of a decent surveillance. Further study is needed to confirm the present promising results.

In contrast, the recurrence rate of 20% (seven of 35 repairs) for recurrent inguinal hernia repair is rather disappointing. Comparable studies have not yet been published, which makes it difficult to draw any firm conclusions. The cause of this high recurrence rate is uncertain. Patient-related factors leading to higher recurrence rates do not seem to be salient, although more patients with, for instance, heavy weight bearing were seen in the recurrence group. Knowing the specific causes of recurrence after endoscopic repair of a primary inguinal hernia might help to explain the failure of endoscopic repair of recurrent hernias [2, 20, 25]. Although it is possible that the initial hernia was not repaired adequately, recurrences are mainly due to insufficient mesh size, inadequate mesh positioning, and mesh migration [20].

Although the learning curve [11, 13] for this procedure might have some effect, both surgeons had passed this initial period, and both had achieved positive results with low recurrence rates for primary inguinal hernia repair using the same technique. For all three patients who underwent re-intervention, a direct recurrence after the initial endoscopic repair was diagnosed during the subsequent operation. The mesh had moved laterally, thus allowing a new direct hernia to develop. Mesh migration may have been facilitated by postoperative hematoma or seroma formation; however, only minor postoperative hematomas and seromas were seen in these patients, which in our opinion makes this a less likely possibility.

The problem could lie in the fact that the mesh is not fixed. If a hernia consists of a large abdominal wall defect or tissue of poor quality—which is often the case in recurrent inguinal hernias—not fixating the mesh might result in inadequate covering of the inguinal floor sooner than would be the case with a primary inguinal hernia [1, 19, 25]. However, in the course of stapling a mesh, a number of different problems can be encountered. Far fewer surgeons are familiar with the inguinal anatomy as seen in the posterior or preperitoneal approach than in the anterior approach. This knowledge is important, because as this approach poses a risks to specific nerves and vessels. Inserting staples from the symphysis pubis to the anterior superior iliac spine jeopardizes all lumbar plexus nerves (genital branch of the genitofemoral nerve, ilioinguinal nerve, lateral femorocutaneous nerve, femoral branch of the genitofemoral nerve) [18, 23, 25].

A thorough understanding of the anatomy of these nerves would obviate stapling in the areas of danger and thus reduce the incidence of this complication. Because of the inconstancy and unpredictability of the course of nerves deep to the iliopubic tract and the iliopsoas fascia, this area must be avoided when placing staples or sutures lateral to the internal ring [18, 25]. Knowledge of the inguinal anatomy is also essential to prevent damage to the vessels of the inguinal area. Medially, the iliopubic and aberrant obturator vessels can be lacerated in the area of the femoral ring and the pectineal ligament. Also, the external iliac artery and the vein located in the so-called Triangle of Doom (the area between the epigastric vessels and the vas deferens) are in danger [15].

When there is a preference for stapling over the use of a larger-size mesh, stapling to Cooper's ligament or a margin of several centimeters of the abdominal wall more cra-

nially is a relatively safe alternative. Nevertheless, complications such as osteitis of the pubic bone may occur, and the obturator branch of the epigastric artery, which runs in craniocaudal direction over the inner side of the superior pubic arch, can easily be severed when stapling inferiorly [15]. Furthermore, it is advisable to use tackers instead of staples, so as to reduce the chance of entrapment of nerves.

Overall, we still prefer enlarging the mesh size over taking the known risks associated with mesh stapling.

Conclusions

In our hospital, the results of endoscopic TEP repair of primary or recurrent inguinal hernias confirm the rapid recuperation cited by earlier investigators. Our series of patients with unilateral primary inguinal hernias confirms the feasibility, low complication rate, and low recurrence rate reported for this specific technique. Most recurrences are seen early, both in time elapsed postoperatively and relative to the surgeons' experience. This early recurrence implies that technical errors are the underlying cause of the problem. If this is true, better results can be expected in the future.

A disappointing recurrence rate was found for TEP repair of recurrent inguinal hernias after conventional herniorrhaphy. Having considered a number of possible causes for this result, we have concluded that it was due to the poor tissue quality of the recurrent hernia, which resulted in larger defects and general failure of the abdominal wall. A mesh size that suffices for primary inguinal hernia repair is probably not adequate for repair of a recurrent hernia. Since our preference is to avoid fixation of the mesh, a larger mesh prosthesis for TEP repair of recurrent inguinal hernias must be investigated in the future.

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