Laparoscopic Inguinal Hernia Repair by Intraperitoneal Onlay Mesh (IPOM) Technique in Specific Cases as an Alternative Method

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Purpose: Despite advancements in surgery, laparoscopic totally extraperitoneal (TEP) repair for inguinal hernia in patients with previous lower abdominal surgeries has been a burden to surgeons. This study was conducted in order to assess the feasibility of laparoscopic intraperitoneal onlay mesh (IPOM) hernia repair as an alternative method for these cases.

Methods: From May 2006 to November 2010, 48 IPOM repairs were performed in 43 patients. All medical records were reviewed retrospectively.

Results: Mean age of patients was 61 years old and male to female ratio was 37:6. Five were direct and 43 were indirect hernias. There were 15 recurrent inguinal hernias after either open or laparoscopic hernia repair, and five of 15 were re-

current cases more than two times. Mean operative time was 44.5 minutes, and mean postoperative hospital stay was 1.41 days. There were two cases of postoperative swelling at the groin area and two patients complained of pain that required oral pain-killers during out-patient follow-ups. Recurrence developed in one case.

Conclusion: Even though laparoscopic IPOM repair is not a preferred method for inguinal hernia, it can be applied as an alternative method in specific cases involving difficulties in approaching the usual plane of repair.

Key words: Inguinal hernia, Hernia repair, Laparoscopic intraperitoneal onlay mesh repair

INTRODUCTION

Inguinal hernia repair is one of the most frequently performed operations in the field of general surgery. Following the advance in laparoscopic surgical technique and equipment, laparoscopic surgery using synthetic mesh has introduced as one of the method for inguinal hernia repair. In the 1990s, common methods for such repairs could be classified under three broad categories: extraperitoneal (TEP) repair, transabdominal preperitoneal (TAPP) repair and the intraperitoneal onlay mesh (IPOM) repair.¹ Nowadays, among them, TAPP and TEP have become the most common procedures to repair inguinal hernias.² Although IPOM repair is technically the simplest and fastest methods for inguinal hernia repair, but there is a relatively high frequency of postoperative complications and early recurrences. The TEP and TAPP repair have great advantages in laparoscopic inguinal hernia repair due to escape from exposing synthetic mesh to intraperitoneal contents, but they require considerable surgical skills. In addition, laparoscopic TEP or

TAPP procedure take very heavy burden to surgeons in cases of patients who have undergone previous abdominal procedures, especially surgeries approached via extraperitoneal space or lower midline area of abdomen. This study was undertaken to assess the outcomes of laparoscopic intraperitoneal onlay mesh (IPOM) hernia repair in these cases as an alternative method.

MATERIALS AND METHODS

Patients who underwent elective IPOM inguinal hernia repair by single staff surgeon in the tertiary medical institute between May 2006 and November 2010 were reviewed retrospectively. We tried TEP hernia repair first and then TAPP repair in cases of recurrent hernias after extraperitoneal repair or patients who have history of lower abdominal surgery. We performed IPOM inguinal hernia repair if TEP and TAPP repairs failed.

The inclusion criteria were all patients who have been diagnosed inguinal hernia, including recurrent hernia with history of previous lower abdomen and pelvic surgery. The exclusion criteria were incarcerated or strangulated hernia. All patients gave their informed consent prior to surgery and understood that this procedure is not a standard method and has the possibility of complications such as bowel adhesion and obstruction.

The patients' demographics, perioperative course and out-patient follow-up records were reviewed. The following data

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collected prospectively was reviewed: age, gender, type of hernia, duration of operation, intraoperative complications, post-operative complications and recurrence. Variables are presented as mean and standard deviation.

1) Laparoscopic IPOM repair

The procedure was performed with the patient under general anesthesia. Antibiotic prophylaxis was administered with first generation cephalosporin. The patient was laid supine in Trendelenburg position. An 11 mm trocar (Endopath XCEL™, Ethicon Endo-surgery, Inc., Somerville, NJ, USA) was inserted into the peritoneal cavity at supraumbilical area by open Hasson technique, through which 45-degree laparoscope was introduced. After the abdominal cavity was explored, we confirmed hernia defects and examined contralateral inguinal area. Two additional 5 mm working trocars were inserted at umbilical level and lower abdomen of contralesional side respectively, under direct vision. The contents of the sac, if present, were carefully reduced into the peritoneal cavity with nontraumatic graspers. Any redundant floppy umbilical ligament was incised or stapled to the anterior abdominal wall to prevent it from disturbing the view. The sac was left in situ without ligation or incision at the internal ring. A 15×12 cm sized dual facing surgical mesh (PROCEED™ Mesh, Ethicon Endo-surgery, Inc., Somerville, NJ) with long non-absorbable stitch on the corner of the mesh for transfascial fixation was rolled and passed through the 11 mm trocar into the peritoneal cavity, and then the mesh was

manipulated to lie flat against the posterior inguinal floor. We tried to make as many transfascial fixation as possible, because in case of obese patient with abundant preperitoneal fat, fixation with tackers had more chances to fail. If the anatomical structures such as pubic bone, vessels, nerves were concerned, we made only one transfascial suture on the infero-medial corner of the mesh. An instrument (suture passer™, 2.8 mm, KARL STORZ GmbH & Co., KG, Tuttlingen, Germany) was passed through abdominal wall, grasped each thread of transfascial stitches, pulled it out and then tied them at subcutaneous layer (Fig. 1). Several metal tacking devices (Protac, Tyco Healthcare, Norwalk, CT) were used to secure the mesh to the Cooper ligament and to anterior abdominal wall, avoiding tacking below iliopubic tract, where lies the so-called triangle of doom and triangle of pain (Fig. 2). Several stitches were done on inferior border of the mesh including infero-medial corner of the mesh with peritoneum to fix the lower edge of the mesh (Fig. 3). Tacks were positioned on the rest of borders of the mesh avoiding deep epigastric vessels.

RESULTS

1) Patient demographics and hernia characteristics

Between May 2006 and November 2010, a total of 48 laparoscopic IPOM inguinal hernia repairs in 43 patients were performed. There were 36 patients with unilateral hernias (22 rights and 14 left) and 6 patients with bilateral hernias. There were 37 male patients and 6 female patients with a mean age

Fig. 1. Transfascial fixation of mesh. The mesh is inserted into peritoneal cavity after suturing at infero-lateral corner of the mesh with non-absorbable suture material. After threads of suture material are withdrawn by suture passer (black arrow) (suture passer™, 2.8 mm, KARL STORZ GmbH & Co., KG, Tuttlingen, Germany) through the abdominal wall, they are tied within subcutaneous layer.

Fig. 2. Additive fixation of mesh by metal tackers after transfascial fixation. Additive fixation of mesh is performed by metal tackers (Protac, Tyco Healthcare, Norwalk, CT; white arrow) along with iliopubic tract (upper border of mesh) after transfascial fixation at infero-lateral corner of the mesh (black arrow).

Fig. 3. Intraabdominal view after completion of mesh fixation. There is a trans fascial fixation at infero-lateral corner of the mesh (black arrow). There are two sutures between mesh and peritoneum by absorbable suture material (white arrows). There are multiple metal tackers (Protac, Tyco Healthcare, Norwalk, CT; black arrow heads) at upper border of the mesh along with iliopubic tract.

of 61 years. They had various previous operative histories (16 patients of prostatectomy, 3 patients of bladder surgery, and 5 patients of abdominal surgery such as ureteronephrectomy, bowel resection, and hysterectomy) and 15 patients had recurrent inguinal hernia. One patient had been misdiagnosed as spigelian hernia preoperatively, so intraperitoneal approach was performed but it came out direct inguinal hernia. Patients' demographics, site of the hernias, and the types of the previous surgeries are shown in Table 1. The number of male patients was much higher and more right hernias were observed.

2) Perioperative data

The perioperative data are summarized in Table 2. The mean operative time of unilateral hernia is 41 minutes and bilateral hernia is 56 minutes. Conversion to open repair was not required in any case. There were two intraoperative complications, bladder and small bowel injury. The bladder injury was occurred in patients with recurrent inguinal hernia. We tried TEP repair first, but converted to TAPP repair because of preperitoneal space adhesion. During peritoneal dissection, defect on bladder wall was noticed, and repaired immediately without need for conversion. The small bowel injury was occurred in patients with history of previous open bladder resection. During insertion of trocar by open Hasson technique, serosal injury of small bowel was occurred owing to postoperative adhesion. We extended incision and repaired injured small bowel imme-

Table 1. Patient demographics and hernia sites

Variable	Number
Number of patients	43*
Number of hernias	50
Age (years, mean $\pm$ SD)	61 $\pm$ 16
Gender	
Male	37
Female	6
Site of hernias	
Right	22
Left	14
Bilateral	7
Type of hernia	
Indirect hernia	43
Direct hernia	5
Pantaloon	1
Femoral	1
Recurrent hernia [†]	15
Laparoscopic [†]	10
Open [†]	12
Previous surgery	
Prostatectomy [§]	16
Open bladder surgery	3
Others	5

*3 patients had concomitant operation with hernia repair: removal of undescended testis, removal of foreign bodies in groin region and pelvis, resection of appendiceal mucocoele 1 patient misdiagnosed as spigelian hernia; [†]5 patients of 15 patients with recurrent inguinal hernia had more than 2 times of recurrence; [†]Indicate previous hernia operation; [§]9 patients had open radical prostatectomy, 5 patients had robotic prostatectomy and 2 patients had TUR-P (transurethral resection of prostate); ^{||}3 patients had hysterectomy, 1 patient had uretero-nephrectomy and 1 patient had bowel resection.

Table 2. Summary of perioperative data

Operation time (minutes)	
Unilateral	41 $\pm$ 22
Bilateral	56 $\pm$ 18
Intraoperative complications (n)	2
Urinary bladder injury	1
Small bowel injury	1
Conversion	0
Hospital stay (days, mean $\pm$ SD)	1.4 $\pm$ 0.9
Complications (n)	7

diately. We performed IPOM repair because there was no soiling of bowel contents.

Table 3. Intra- and postoperative complications

Intraoperative complications (n)	
Urinary bladder injury	1
Small bowel injury	1
Total	2
Postoperative complications (n)	
Pain*	2
Swelling or seroma	2
Hematoma or bleeding	0
Total	4
Recurrence (n)	1

*Pain requiring oral analgesics at out-patient clinics on postoperative day 7.

3) Morbidity

The morbidity data are summarized in Table 3. There were four early postoperative complications of mild entity: 2 seromas with swelling and 2 transient inguinal pain. As far as postoperative pain is concerned, only 2 patients required analgesics at outpatient clinic after the surgery. One patient had no more pain after a week of medication and the other one recovered completely in a month. In cases of seromas, they were resolved spontaneously without any intervention in 4 to 6 weeks. After a median follow up of 51 months (range 22~77), we have observed only one case of recurrence in the patient operated for re-recurrent hernia. The recurrence was treated by anterior approach using bilayer mesh (Prolene Hernia System™, Ethicon Endo-surgery, Inc., Somerville, NJ, USA).

DISCUSSION

Nowadays laparoscopic surgery has become the gold standard procedure in many surgical fields. Likewise, after decades of experience in laparoscopic hernia surgery, this method has gained worldwide acceptance and has become the first choice for inguinal hernia repair in many centers.² The advantages of laparoscopic hernia repair include reduced pain and hospital stay, rapid convalescence, quicker return to work, better functional and cosmetic results.^{3,4} In addition, laparoscopic approach allows viewing the entire myopectineal orifice and repairing any unexpected hernias and more specifically in case of recurrent hernia. It also allows reducing risk of spermatic cord damage, chronic pain and especially further recurrence (observed in up to 35% of the cases).⁵

In the early periods of laparoscopic hernia repairs, extraperitoneal (TEP) repair, transabdominal preperitoneal (TAPP)

repair and intraperitoneal onlay mesh (IPOM) repair had been performed generally. But recently, TEP and TAPP are being performed widely because IPOM has shown relatively high recurrence rate and complications such as small bowel obstruction and formation of fistula.⁶

Among laparoscopic techniques for the inguinal hernia repair, our preferential approach has been TEP procedure. We have repaired inguinal hernias after previous surgery of lower abdomen also via laparoscopic TEP approach. We believe this approach is safe and feasible because we have no particular complications. However, despite of a thousand and hundreds of experience, there are some difficult cases of being repaired via TEP or TAPP approach such as after prostatectomy and bladder surgery or recurrent hernia after hernia repair with bilayer mesh. So we employed the IPOM technique in cases of hernia repairs failed via TEP or TAPP repair.

The mean operative time was longer than our data of TEP inguinal hernia repair.⁷ It is probably because we performed IPOM repair if TEP or TAPP failed.

We could not find any fatal intraoperative complications. We have observed only 4 cases of minor postoperative morbidity (2 seromas, 2 inguinal pains) and a case of recurrence. TAPP and TEP, due to the wide dissection of preperitoneal space, are rather more complicated procedure requiring a long learning curve with a higher risk of morbidity.⁸⁻¹⁰ In addition, the IPOM has same advantage to other laparoscopic techniques in terms of postoperative pain and faster recovery. Furthermore, IPOM repairs also allow exploration of the contralateral side that may show a non-symptomatic hernia in 11.2~32.3% of the cases.¹¹ The second hernia may be repaired simultaneously without affecting postoperative pain and course.¹¹

The most important point in the evaluation of the efficacy of hernia repair is certainly recurrence.¹² After a median follow up of 51 months, we have experienced one recurrence out of 50 hernias. The recurrence occurred in an obese patient with large direct re-recurrent hernia after TEP repair in 3 month. After another 2 month after IPOM repair, the recurrence occurred again, and then we performed bilayer mesh repair via open anterior approach. The reason of recurrence was migration of mesh. The first migration was due to relatively smaller sized mesh than hernia defect. We used commercialized mesh but it was too small to cover the patient's hernia defect and entire myopectineal orifice. The second migration of the mesh was due to weak fixation of the mesh. We think tacks on upper border of the mesh might have failed to fix the mesh because the patient was so obese that tackers couldn't reach to muscular structure but preperitoneal adipose tissue layer.

The features of mesh are another fundamental point. There have been reports about several properties of theoretically ideal mesh: It should be strong enough to withstand physiologic stresses over a long period of time, conform to the abdominal wall, promote strong host tissue ingrowth, which mimics normal tissue healing, resist the formation of bowel adhesions and erosions into visceral structures, not induce allergic or adverse foreign body reactions, resist infection, and be non-carcinogenic.¹³⁻¹⁵ No single product possesses all the properties of the ideal mesh. And the characteristics of the mesh are more important in intraperitoneal hernia repair. Sometimes mesh-related complications such as bowel obstruction and even fistula formation have been reported.¹⁶ We used dual facing surgical mesh. This mesh has different characteristics on both sides: the parietal surface is rough with micro-pores in order to stimulate a strong fibroblastic tissue reaction and the visceral surface is coated with anti-adhesive material in order to minimize tissue reaction, thus avoiding intestinal adhesions. For period of our all follow up, there has been neither bowel obstruction nor fistula formation due to bowel adhesion to mesh.

The size of the mesh is another crucial point. It should not be less than 10×15 cm so that entire myopectineal orifice (possible inguino-crural hernia sites) can be largely covered.¹² This is utmost important in order to prevent recurrence.¹⁷

The appropriate fixation of the mesh is also important point. The staples should ensure tight fixation to the underlying naïve abdominal wall musculature and this is better achieved by using tacks. But in cases of obese patients, the thickness of fat tissue can interfere with appropriate fixation of the staples to the underlying fascia. The recurrence rate for transfascial suture plus tacks was lower than the use of tacks alone.¹⁸

The IPOM repair is also acceptable in terms of operative times, easiness.^{1,12} However, compared to open surgery, laparoscopic repair is expensive and needs general anesthesia,¹² and so does the IPOM repair. Even more, IPOM repair has big concerns about relatively high recurrence rate and complication rate other than other laparoscopic hernia repair.^{19,20}

It is very important not to depend on fascial structures and to avoid use of scarred tissue to repair recurrent inguinal hernia.²¹ It is believed that to avoid approaching previously damaged plane is crucial for better results. If recurrent inguinal hernia has occurred after hernia repair with bilayer mesh, or after anterior approaching procedure in a patient who has had previous lower abdominal surgery, another alternative method could be helpful.

There are limitations of this study. Since our study have been performed retrospectively to relatively small number of pa-

tients, large-numbered prospective study must be required for valuable results.

CONCLUSION

Though laparoscopic IPOM repair for inguinal hernia is not a standard method, it can be performed for specific cases of recurrent hernias which have difficulties in approaching usual plane of repair as an alternative option with proficient skills and care.

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