INTRODUCTION

Inguinal hernia repair is one of the most frequently performed operations in general surgery. Several techniques have been introduced to treat inguinal hernias over the past 100 years. A laparoscopic procedure first described in 1990 is now widely used. Laparoscopic surgery has several advantages over conventional open methods. The advantages include less postoperative pain, faster recovery and early return to work, and cosmetic benefit. In addition, the laparoscopic approach provides a clear view around the inguinal region, allowing detection of type and site of unexpected hernia.

Among various laparoscopic techniques, laparoscopic totally extraperitoneal (TEP) hernia repair is accepted to be superior to and less invasive than other methods and has become the...
first choice of treatment for inguinal hernias in many centers. When performed in a recurrent case after open hernia repair, it allows adhesions resulting from the previous procedure to be avoided. However, this procedure is known to be relatively difficult in cases with a history of radical prostatectomy or previous lower abdominal surgery. When performed in a recurrent case after open hernia repair, it allows adhesions resulting from the previous procedure to be avoided. However, this procedure is known to be relatively difficult in cases with a history of radical prostatectomy or previous lower abdominal surgery. This is because there may be severe tissue adhesion after previous operations, which increases the risk of organ injury and bleeding during dissection. Several studies have reported the results of laparoscopic TEP hernia repair in selective patients with a previous history of various lower abdominal surgery. Although most studies have reported favorable results, no clear conclusion has yet been reached, and the suitability is still a matter of debate. We have published our early experience of laparoscopic TEP repair in these patients in 2011 that the procedure is quite challengeable under operation by skilled surgeon, although longer operation time should be overcome.

Our purpose in this study was to assess the safety and feasibility of laparoscopic TEP hernia repair in patients with a previous history of radical prostatectomy or lower abdominal surgery based on our experience.

**MATERIALS AND METHODS**

**Patients**

Between July 2007 and July 2014, a total of 35 patients were enrolled in this study at Kyung Hee University Hospital. Patients who had a previous history of radical prostatectomy or lower abdominal surgery and underwent laparoscopic TEP hernia repair for inguinal hernia were reviewed retrospectively. Previous lower abdominal surgeries were gastrointestinal surgery, vascular surgery, gynecologic surgery, and urologic surgery.

**Operation procedure**

Laparoscopic procedure with three trocars was performed by a single experienced surgeon. The patient was placed in a supine position under general anesthesia. About 1.5 cm longitudinal incision was made and dissection was done to find the preperitoneal field between the rectus abdominis muscle and posterior sheath of the muscle. A balloon dissector (Autosuture, Norwalk, USA) was inserted through the area and inflated with air. Inflation was done by balloon pump included in the trocar set. Space making was much slowly and carefully done than conventional cases to avoid peritoneal tear or bleeding. After securing the proper space, the balloon dissector was deflated and a 12-mm balloon trocar (peritoneal distension balloon, Autosuture, Norwalk, USA) was inserted into the space. The space was inflated with CO2 and a laparoscopic videoscope was inserted. Next, a 5-mm trocar was placed above the pubic symphysis, while the last 5-mm trocar was placed between the two trocars on the midline. Dissection was done gently to expose the space of Retzius and space of Bogros so as to identify the type of hernia. Once the hernia sac was detached, the sac returned itself into the abdominal cavity because of the inflated CO2 pressure. The sac was detached successfully in all cases. Peritoneal tear was repaired if it disturbed laparoscopic view or procedure. Most procedures were similar to conventional laparoscopic TEP hernia repair except for dissecting severe adhesion. During operation, electrocautery was frequently used when dissecting tissues resistant to blunt dissection. Blunt dissection could be more dangerous than cauterization in severely adhered condition. An anatomical mesh (Parietex®, Sofradim, Formans, France) was inserted through the 12-mm trocar and placed to cover the operation field evenly. CO2 was gradually deflated to check the position and fixation of the mesh. Trocars were removed after full deflation. Skin closure and dressing were done to finish the operation. The patient remained in the hospital on the operation day and was generally discharged the next day. Follow-up was planned at 5~7 days after the surgery and once a year thereafter.

**RESULTS**

**Demographic characteristics**

Thirty three out of the 35 patients (94%) were men. Average age was 68 years (38~88). Twenty two patients (63%) had a history of radical prostatectomy by either an open or robotic method and 6 (17%) had a history of urinary bladder or/and ureter surgery. Others were 5 (14%) laparoscopic operations for colorectal cancers, 1 (3%) femoro-femoral arterial bypass

| Type of surgery                  | Number | Operation time (min) |
|----------------------------------|--------|----------------------|
| Radical prostatectomy            | 22 (63%) | 124                  |
| Cystectomy                       | 5 (14%) | 80                   |
| Urachal fistula repair           | 1 (3%)  | 12                   |
| Laparoscopic AR/LAR              | 5 (14%) | 84                   |
| Femoro-femoral arterial bypass   | 1 (3%)  | 60                   |
| Laparoscopic hysterectomy        | 1 (3%)  | 105                  |
| **Total**                        | 35     | **111**              |

AR = anterior resection; LAR = low anterior resection.
surgery, and 1 (3%) laparoscopic hysterectomy (Table 1).

Operative outcomes

Laparoscopic TEP hernia repair was successfully done on 30 out of 35 cases (86%), but five cases (14%) had to be converted to transabdominal preperitoneal (TAPP) hernia repair (n=3) or open methods (n=2). In conversion cases, 4 cases (3 TAPP procedure and 1 open method) had previous radical prostatectomy and 1 (open method) had previous radical cystectomy. Twenty five cases (71%) were right inguinal hernias, including 1 recurrent case after previous hernia repair in other hospital. Six cases (17%) were left hernias, and 4 cases (11%) had an inguinal hernia on both sides. Hernia repair with onlay mesh and plug method was used as the open method. Mean operation time was 111 minutes (50~220). Operation time for patient with previous radical prostatectomy was longer than average. Blood loss was less than 50 cc in all cases. Seroma and surgical site infection were reported in one case respectively and recovered with conservative management. Average hospital stay was 1.2 days (0~3) after surgery. Voiding difficulties requiring catheterizations were observed in 13 cases (37%), 5 cases were resolved on the operation day and the others on the following day. There was no recurrence of urinary retention. Median follow up period was 5 years (1~15) (Table 2).

We divided patients into four groups according to operation period using a 2–year interval. Although the number of cases in each group differed, the average operation time tended to decrease over time (Table 3).

Table 2. Patients and surgical characteristics

|                      | Number |
|----------------------|--------|
| Total number of patients | 35     |
| Sex (M:F)            | 33:2   |
| Age (years)          | 68 (38~88) |
| Type of hernia       |        |
| Right inguinal hernia| 25 (71%) |
| Left inguinal hernia | 6 (17%)  |
| Bilateral inguinal hernias | 4 (11%) |
| Procedure            |        |
| TEP repair           | 30 (86%) |
| Conversion to TAPP repair | 3 (8%)  |
| Conversion to open repair | 2 (6%) |
| Mean operation time (min) | 111 (50~220) |
| Estimated blood loss (cc) |        |
| ≤50                  | 27 (77%) |
| >50                  | 8 (23%)  |
| Mean hospital stay (day) | 1.2 (0~3) |
| Pain (VAS)           |        |
| ≤4                   | 21 (60%) |
| >4                   | 14 (40%) |
| Voiding difficulty   | 13 (37%) |
| Operation day        | 5 (14%)  |
| #1                   | 8 (23%)  |
| Follow up (day, median) | 11 (1~15) |

Table 3. Mean operation time according to period

|        | Cases | Operation time (min) |
|--------|-------|---------------------|
| 2007~2008 | 5     | 150 (120~195) |
| 2009~2010 | 12    | 118 (55~220) |
| 2011~2012 | 10    | 107 (50~210) |
| 2013~2014 | 8     | 82 (55~105) |

TEP = totally extraperitoneal; TAPP = transabdominal preperitoneal; VAS = visual analog scale.
The presence of some adhesions is inevitable in patients with a previous history of lower abdominal surgery because these operations and laparoscopic TEP hernia repair share same operation field. This leads to the longer operation time and higher conversion rate and contributes to the reason laparoscopic TEP has not been recommended in these complicated cases. The first obstacle occurs when dissecting through the preperitoneal space using a balloon dissector. The dissector can easily slip onto the wrong course or damage vessels. Careful control is required when advancing the dissector and performing balloonning to create the ideal surgical space. Separating the hernia sac from the inguinal cord is the next challenging task. Usually, the sac and surrounding tissues are strongly conglomerated. The operator should gently retract and separate the herniated sac to avoid injury to adjacent structures as well as peritoneal tears.

Several studies have reported the results of laparoscopic TEP hernia repair for groin hernia on patients with a prior history of lower abdominal surgery. Operation time differs widely among these studies. Relatively long operation times were reported by most studies (Table 4). In our study, the mean operation time was 111 min, which is longer than other studies. However, this could be due to different operational settings and patient variance among studies. Operation time is also affected by the surgeon’s method and style. One more different factor is the characteristic of previous low abdominal surgery in our study group. More than half of previous operations were radical prostatectomy and patients with previous appendectomy were not included in our study.

In same period, mean operation time of our hospital for laparoscopic TEP hernia repair in patient without such an operation history was 86 minutes.

In our study, operation time gradually decreased in our study. Improvements in laparoscopic skills as well as accumulation of surgical experience are likely responsible for the reduction in operation time. Considering that numerous laparoscopic TEP hernia repairs have been performed at our hospital, the result suggests that longer learning period is required in the surgery in patients with a prior history of lower abdominal surgery than regular patients. Nevertheless, operation time is still longer when compared with patient group without previous history of lower abdominal surgery in same period. This may mean that shortening of operation time is limited and not much advantageous.

Peritoneal injury occurs commonly during laparoscopic TEP hernia repair. Minimal tearing is ignorable in most cases, but bigger one may make air leakage into abdominal cavity. It disturb maintaining ideal operation field or lead to more peritoneal injury. If the tearing is irrecoverable, conversion to other operation procedure is needed.

### Table 4. Mean operation time and conversion rate in other studies

| Case                        | Operation time (min) | Conversion |
|-----------------------------|----------------------|------------|
| Paterson HM et al. (2005)   |                      |            |
| Appendectomy                | 20 (43%)             | 2 (4%)     |
| Lower midline incision      | 10 (21%)             |            |
| Suprapubic incision         | 18 (38%)             |            |
| Paramedian incision         | 5 (11%)              |            |
| Dulucq JL et al. (2006)     |                      |            |
| Appendectomy                | 9 (35%)              | 2 (7%)     |
| Hysterectomy                | 6 (23%)              |            |
| Aortobifemoral bypass      | 2 (8%)               |            |
| Radical prostatectomy       | 10 (38%)             | 2          |
| Al-sahaf O et al. (2007)    |                      |            |
| Open appendectomy           | 11 (65%)             | 0          |
| Laparoscopic appendectomy   | 2 (12%)              |            |
| Hysterectomy                | 1 (6%)               |            |
| Prostatectomy               | 1 (6%)               |            |
| Colectomy                   | 2 (12%)              |            |
| Park JH et al. (2010)       |                      |            |
| Appendectomy                | 24 (60%)             | 1          |
| Prostatectomy               | 6 (15%)              | 6          |
| Gynecologic surgery         | 2 (5%)               | 2          |
| Panperitonitis              | 5 (13%)              | 2          |
| Rectal cancer               | 1 (3%)               |            |
| Renal stone                 | 2 (5%)               | 1          |
| Chung SD et al. (2011)      |                      |            |
| Appendectomy                | 14 (61%)             | 1 (4%)     |
| Radical prostatectomy       | 1 (4%)               |            |
| Cesarean surgery            | 1 (4%)               |            |
| High ligation for varicose vein | 1 (4%)               |            |
| Hysterectomy                | 1 (4%)               |            |
| Colon cancer surgery        | 1 (4%)               |            |
| Ovarian teratoma surgery    | 1 (4%)               |            |
| Urinary bladder repair      | 1 (4%)               |            |
| Ureterolithotomy            | 1 (4%)               |            |
repair in our study. In TAPP conversion cases, TEP procedure was discontinued due to severe adhesion and accompanied peritoneal tear. In open conversion cases, TEP was held while making operation space, due to severe adhesion. Numerous conversion cases have been reported in other reports (Table 4).\(^5\)\(^6\)\(^10\)\(^13\) Mainly reasons are severe adhesion on operation field or peritoneal injury. Conversion rate shown in our study is higher than other reports. Similar to difference in operation time, the rate should be considered together with patient variance and operational settings.

Generally small hernia sac could be easily dissected in most cases, but huge hernia sac is not. In a huge scrotal hernia the sac is very difficult to dissect and this can be lead to peritoneal injury and conversion to other method. It is necessary to resect the sac whenever we meet some difficulty to dissect the sac.\(^17\) In our cases, hernia sacs were successfully detached in all cases.

Pain control is not routinely administered to all patients after laparoscopic TEP hernia repair in our hospital. Intravenous or intramuscular injection of a pain reliever is provided if the patient complains of pain. There was no case of uncontrolled pain prolonged until postoperative day in our hospital. Laparoscopic TEP hernia repair is known to be less painful than other procedures for treating an inguinal hernia.\(^4\)\(^5\) Chung et al.\(^13\) reported that postoperative pain during 1 week after surgery didn’t differ among study and control groups.

Minimal complications were reported in most studies. Paterson et al.\(^6\) reported 2 seromas, 2 urinary retention, 2 chronic groin pain and 1 transient neuropathy in 47 cases. Dulucq et al.\(^9\) reported 1 case of trocar site bleeding in 26 cases. Chung et al.\(^13\) reported 3 hematomas and 2 seromas. In our study, 1 case of seroma and 1 case of surgical site infection occurred and well treated with conservative management. No major complications leading to morbidity were observed. It is difficult to measure the amount of bleeding accurately. Usually, bleeding is minimal or limited to the regional field. (Paragraph emerged) A total of 13 patients (37%) experienced voiding difficulties after the operation. Urinary retention is known to be a frequent complication after laparoscopic TEP hernia repairs, occurring in 2~8% of cases.\(^4\)\(^18\)\(^19\) The rate of urinary retention in our study was therefore relatively high. However, all urinary retentions were resolved in one day without recurrence during follow up period. There was no case of hernia recurrence within 24 hours after surgery. Follow up was planned within 5~7 days after surgery and annually afterward. Median follow up period was 5 years (1~15).

There are several limitations in our study. The number of included patients is still small and the study was single-centered retrospective design. Laparoscopic TEP hernia repair in a patient with previous prostatectomy is known to be difficult than one with other previous low abdominal surgery.\(^10\)\(^17\)

Although we included much cases of patients with previous prostatectomy compared with other studies (Table 4), larger volume would be necessary to establish more accurate results.

In conclusion, laparoscopic TEP hernia repair for patients with previous history of lower abdominal surgery has been reported to be a safe. Postoperative pain and rate of complication are similar between previous studies and ours. However, longer operation time and higher conversion rate are limitations of the procedure, especially in cases with previous radical prostatectomy. Despite much learning period and experiences, it may be difficult to achieve favorable feasibility among various treatment options for inguinal hernia.

Laparoscopic TEP hernia repair for a patient with previous history of radical prostatectomy or lower abdominal surgery except for appendectomy can be performed safely by an experienced surgeon, but is not recommended as a standard choice. The operation should be carefully considered among various treatment options.

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