



# Prevention and management of intraoperative complication during single incision laparoscopic totally extraperitoneal repair

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Serious complications related to hernia surgeries have rarely been reported. One meta-analysis comparing laparoscopic and open mesh repair reported that 0.4% of potentially serious operative complications were reported. Previous studies have reported that uncommon serious intraoperative complications more frequently occur during laparoscopic inguinal hernia repairs. One study has shown that patients with history of lower abdominal surgery are at an increased risk of visceral injury during laparoscopic hernia repair. Vascular injuries at dissection and mesh fixation or suturing in the preperitoneal space typically involve the epigastric or aberrant obturator vessels crossing the Cooper's ligament. However, complications can occur at every step of the operation, although only few are reported. Therefore, we report our experiences of intraoperative complications during single-incision laparoscopic totally extraperitoneal hernia repair and how to prevent and manage intraoperative complications.

**Keywords:** Inguinal hernia, Laparoscopy, Minimally invasive surgical procedures, Intraoperative complications

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## INTRODUCTION

Serious complications related to hernia surgeries have rarely been reported. One meta-analysis comparing laparoscopic and open mesh techniques reported that 0.4% of potentially serious operative complications (defined as bowel, bladder, and vascular injuries) [1]. Previous studies have reported that uncommon serious intraoperative complications more frequently occur during laparoscopic inguinal hernia repairs [2]. Recently, laparoscopic surgeons have been increasingly interested in single-incision laparoscopic totally extraperitoneal (SILTEP) hernia repair because of the following advantages: fewer incisions, better cosmesis, and fewer port-site-related complications when compared with multiport total extraperitoneal (TEP) hernia repair. However, the steep learning curve, in-line vision, and easy fighting of

instruments have limited the wide acceptance of SILTEP repair among surgeons. Its most common intraoperative complication is inferior epigastric vessel injury [1]. However, complications can inevitably occur at every operative step, although only few are reported. These include peritoneal injury failing to maintain the pneumoperitoneum, thereby making it difficult to continue the surgery. Although rare, iliac vessels or corona mortis can be damaged during laparoscopic hernia repair, which may cause uncontrollable bleeding, retroperitoneal hematoma, conversion to open surgery, and reoperation [3]. In surgery for recurrent hernia, tissue dissection of the preperitoneal space may be difficult because of previous mesh migration or mesh-induced fibrosis. As such, there is often a variable degree of intraoperative complications and difficulty during the SILTEP procedure. Therefore, we report our experiences of intraoperative complications during

SILTEP repair and the prevention and management of intraoperative complications.

## MATERIALS AND METHODS

### Visceral injury

Previous studies on TEP reported that 0% to 0.3% of patients had intraoperative intestinal injury, and large-scale studies involving >1,000 patients reported the incidence of 0% to 0.06% [4]. Sliding hernia or an irreducible hernial sac can predispose to visceral injury. Problems may occur when the patient is not in the Trendelenburg position. The intestines may remain in the hernial sac, increasing the risk of thermal damage. Hernia repair may be deferred depending on the amount of contamination. When bowel content spillage occurs, laparotomy merits repair of bowel injury. A 56-year-old man was diagnosed with left inguinal hernia and SILTEP repair was attempted. However, the hernial sac was extremely large and difficult to dissect. The sigmoid colon forms a part of the sliding hernial sac. Thus, the hernial sac was opened first. However, the sigmoid colon was tightly adhered to it, and thus, serosa injury of the sigmoid colon occurred during sac traction. Finally, we decided to perform open conversion. Primary repair of the sigmoid colon and Lichtenstein hernioplasty were performed. A relevant video clip is provided with this article (Supplementary Video 1).

### Bladder injury

Urinary tract injuries occasionally occur during a laparoscopic hernia repair, including bladder injuries and rarely urethral injuries [3], as manifested by the presence of urine in the dissection plane or sudden decompression of a distended bladder. Moreover, patients undergoing lengthy procedures, with irreducible large hernial sacs, with previous surgical scarring, and at the early phase of the SILTEP learning curve could be inserted with Foley catheters preoperatively. The bladder is particularly vulnerable when included as part of the direct sac. Thus, adhesion of the direct sac with the bladder can result in bladder injury. Moreover, such procedures are performed with gentle and meticulous dissection, minimizing the use of electrodiathermy. The bladder tear should be sutured in two layers with absorbable material, using additional ports, if necessary. A 59-year-old man was diagnosed with a right inguinal hernia and was attempted with SILTEP repair. However, the bladder was injured while dissecting the preperitoneal space. Therefore, an additional port was inserted into the suprapubic area. A bladder wall repair was performed. A Foley catheter was inserted until postoperative day 7.

### Vascular injury

Identifying normal anatomy during SILTEP can be challenging. An anatomic region in the preperitoneal space, the “Triangle of Doom,” is bounded medially by the vas deferens and laterally by the testicular vessels [3]. Its base is formed by peritoneal reflection. The triangle typically contains the external iliac vessels. Injury to these vessels can be fatal and may require urgent laparotomy. Major bleeding during laparoscopic hernia repair is a rare complication but can occur due to injury of the inferior epigastric vessels during surgical dissection or fixation of the mesh with tacks [3]. During the dissection of the preperitoneal space, the peritoneum should be dissected in a region distant from the inferior epigastric vessels. Thus, telescopic dissection under direct vision is recommended for SILTEP repair. Although balloon dissection is a fast and effective method for dissection of the preperitoneal space, recent studies have suggested that the routine use of the balloon dissector increases direct costs and does not result in meaningful operative time reduction in TEP [5]. Dissection of the extraperitoneal space under direct vision allows for preservation of the preperitoneal fascia, nerves, and blood vessels. To prevent injury, the mesh should not be tacked in the territory of the inferior epigastric vessel or corona mortis. Additionally, rough handling of cord structures can cause bleeding from the testicular and cremasteric vessels. A 50-year-old man was diagnosed with left inguinal hernia and was attempted to manage with SILTEP repair. However, the testicular vessel was injured during the hernial sac dissection. Therefore, an additional port was inserted into the suprapubic area. The testicular vessels were ligated using a surgical clip.

### Peritoneal injury

Previous studies have reported that the rate of peritoneal injury was 10% to 64% [6]. In most cases, peritoneal injury occurs due to either anatomical misrecognition or unintentional dissection. Peritoneal tearing not only affects the respiratory dynamics but also results in the loss of the working domain, making further dissection difficult and possibly dangerous. Pneumoperitoneum can also precipitate the postoperative ileus. Therefore, prevention and appropriate management of peritoneal injury are key to performing SILTEP repair. For small peritoneal tears, further dissection of the peritoneum around the defect can sometimes collapse the opening and seal off the air leak temporarily, thereby avoiding continuous loss of working space. Routine peritoneal closure may not be necessary for all peritoneal tears. The peritoneal tear is a gaping hole only if the peritoneal cavity is distended with gas. After the CO<sub>2</sub> is completely evacuated, the edges of the tear come into apposition and seal. A Veress needle may be used to decompress the peritoneal cavity in cases where the leak is small. To

repair a peritoneal injury, previous studies recommended the use of a metal clip, Hem-o-lok clip (Weck Closure Systems, Research Triangle Park, NC, USA), and pretied loop ligation [6]. Using ligation clips, the surgeon did not require additional instruments. A 22-year-old man was diagnosed with a right inguinal hernia; SILTEP repair was performed. However, the peritoneum was injured while dissecting the preperitoneal space. Thus, the working space was lost, making further dissection difficult. However, we tried to control the peritoneum with one hand to create a working space and perform a dissection with the other hand; thus, the operation can proceed without open conversion.

### Recurrent hernia

Recurrence rates after an inguinal hernia repair were as high as 10% [1], which vary depending on the length of follow-up. Treatment of recurrent inguinal hernias remains challenging. Re-recurrence and other complications can be prevented using appropriate surgical techniques, including the previously known approaches. Tissue dissection of the preperitoneal space might be more difficult in patients who have had previous hernia repairs due to previous dissection of the hernia sac near the internal ring, previous mesh migration, or mesh-induced fibrosis. The presence of mesh and scars in the preperitoneal space results in technical challenges especially for recurrence after posterior repair. Thus, there is a high probability of complications occurring during SILTEP, and more attention from the surgeon is required for recurrent hernia repair in patients with previous posterior repair. Additionally, recurrence after plug and patch repair or two-layer mesh repair may result in adhesion in the preperitoneal space. Therefore, laparoscopic repair is also regarded as an optional solution for recurrence after plug and patch repair or two-layer mesh repair. If the primary repair is either anterior or posterior, an open or laparoscopic approach can be used for recurrent hernia repair. Once an anterior repair has been performed, a laparoscopic repair will generally go through nearly undisturbed tissue planes, permitting relative ease of dissection. The patient was a 53-year-old man, with a chief complaint of right inguinal mass. The patient underwent a Lichtenstein hernioplasty due to right inguinal hernia 2 years ago, and symptoms occurred 5 months before hospital presentation. At the time of surgery, adhesions were observed between the previous operation site and the mesh. The peritoneum was incidentally opened while dissecting the hernial sac. However, the hernial sac and cord structures were easily separated. Eventually, the operation was performed using a single port without inserting an additional port or open conversion.

## RESULTS

Laparoscopic repair resulted in new and unique complications [3]. Based on our previous experience, complications can occur at every surgical step. Results of the SILTEP repair improved with time. Previous studies have suggested that this risk can be reduced with increased experience and technique modifications. Felix et al. [7] reported that experience was the most important factor influencing the occurrence of complications. They suggested that complication rates decreased over time, just as recurrences were reduced by experience. Recently, Park et al. [8] reported that approximately 60 cases are needed to overcome the learning curve for SILTEP, in terms of both reducing operation time and achieving a surgical failure rate of <10%, for an experienced laparoscopic surgeon. In accordance with previous reports, most of our complications occurred in the early period after SILTEP repair. Modification of the surgical technique, included Fuentes et al.'s suggestion that a 5-mm, 30°-scope, and a mix of straight and prebended/curved graspers, can avoid clashing between instruments and telescopes [9]. Tran et al. [10] suggested that telescopic dissection under direct vision minimizes accidental tearing of the peritoneum, bladder, bowel, or large blood vessels due to potential adhesions from a previous anterior repair. Thus, complications may be decreased by modifying the surgical technique and accumulating laparoscopic hernia repair experiences.

## DISCUSSION

In summary, complications during the SILTEP repair can occur every step of the operation. Additionally, complication during SILTEP repair is sometimes challenging. However, the current study suggest that with experience and modifications in technique, this risk can be reduced even further. Once the learning curve is through and meticulous attention is paid to prevent intraoperative complication, surgical outcomes can be delivered with results comparable and even better than those of conventional repair.

## NOTES

### Ethical statements

We followed the principles of the Declaration of Helsinki for health, and the study was reviewed and approved by the Institutional Review Board of our institution, which waived the need for informed consent because of the retrospective nature of the study (No. 2021-06-027).

## Authors' contributions

Conceptualization: JHL, JUC, HSL

Writing—original draft: SJ, HSL

Writing—review & editing: All authors

All authors read and approved the final manuscript.

## Conflict of interest

All authors have no conflicts of interest to declare.

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## Supplementary materials

Supplementary materials can be found via <https://doi.org/10.7602/jmis.2022.25.1.36>.

## REFERENCES

1. HerniaSurge Group. International guidelines for groin hernia management. *Hernia* 2018;22:1-165.
2. Schmedt CG, Sauerland S, Bittner R. Comparison of endoscopic procedures vs Lichtenstein and other open mesh techniques for inguinal hernia repair: a meta-analysis of randomized controlled trials. *Surg Endosc* 2005;19:188-199.
3. Lomanto D, Katara AN. Managing intra-operative complications during totally extraperitoneal repair of inguinal hernia. *J Minim Access Surg* 2006;2:165-170.
4. Weyhe D, Tabriz N, Sahlmann B, Uslar VN. Risk factors for perioperative complications in inguinal hernia repair - a systematic review. *Innov Surg Sci* 2017;2:47-52.
5. Tastaldi L, Bencsath K, Alaadeen D, et al. Telescopic dissection versus balloon dissection for laparoscopic totally extraperitoneal inguinal hernia repair (TEP): a registry-based randomized controlled trial. *Hernia* 2019;23:1105-1113.
6. Nitta T, Kataoka J, Ohta M, Fujii K, Takashima Y, Ishibashi T. Usefulness of repair using Hem-o-lok™ for peritoneal tear as a complication of totally extraperitoneal repair: Case series. *Ann Med Surg (Lond)*. 2019;49:5-8.
7. Felix E, Scott S, Crafton B, et al. Causes of recurrence after laparoscopic hernioplasty. A multicenter study. *Surg Endosc* 1998;12:226-231.
8. Park YY, Lee K, Oh ST, Lee J. Learning curve of single-incision laparoscopic totally extraperitoneal repair (SILTEP) for inguinal hernia. *Hernia* 2021 Jun 7 [Epub]. DOI: 10.1007/s10029-021-02431-7.
9. Fuentes MB, Goel R, Lee-Ong AC, et al. Single-port endo-laparoscopic surgery (SPES) for totally extraperitoneal inguinal hernia: a critical appraisal of the chopstick repair. *Hernia* 2013;17:217-221.
10. Tran H, Tran K, Turingan I, Zajkowska M, Lam V, Hawthorne W. Single-incision laparoscopic inguinal herniorrhaphy with telescopic extraperitoneal dissection: technical aspects and potential benefits. *Hernia* 2015;19:407-416.