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ORIGINAL ARTICLE

Single-incision laparoscopic totally extraperitoneal inguinal hernia repair with tumescent local anesthesia: report of more than 2000 procedures at a day-surgery clinic

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Abstract

Purpose The purpose of this study was to evaluate the feasibility and safety of single-incision laparoscopic surgery for totally extraperitoneal inguinal hernia repair (SILS-TEP) with tumescent local anesthesia (TLA) at a day-surgery clinic.

Methods We analyzed, retrospectively, 2148 patients who underwent SILS-TEP under general anesthesia with TLA between April, 2015 and March, 2020 at Gi surgical clinic, to evaluate their operative outcomes. The TLA agent, consisting of normal saline and lidocaine with epinephrine and ropivacaine, was injected during surgery.

Results The median operative times for unilateral and bilateral hernia were 50 min and 75 min, respectively. Blood loss was minimal in all patients. Conversion to the Lichtenstein method was required in 4% (91/2148) of patients. The median recovery room stay was 125 min and no analgesics were required in the recovery room by 75% (1613/2148) of the patients. All the patients left the clinic on the day of surgery. Complications developed in 6.5% (139/2148) of the patients, as seromas in 6% (125/2148), wound infections in 0.4% (8/2148), and hematomas in 0.2% (4/2148), respectively. Bowel injury and obstruction each occurred in 0.05% (1/2148) of the patients. There were no hernia recurrences.

Conclusion SILS-TEP with TLA can be performed safely at a day-surgery clinic.

Keywords Single-incision laparoscopic surgery (SILS) · Totally extraperitoneal repair (TEP) · Inguinal hernia · Tumescent local anesthesia (TLA) · Day surgery

Introduction

Single-incision laparoscopic surgery for totally extraperitoneal inguinal hernia repair (SILS-TEP) is now implemented as an operative procedure with better cosmetic outcomes than open or conventional laparoscopic inguinal hernia surgery. Previous reports have suggested that inpatient SILS-TEP is safe and feasible for difficult hernias, such as those in patients with previous lower abdominal surgery, after mesh hernioplasty, or in those on antithrombotic therapy [1–3]. However, no large-scale studies have evaluated the feasibility and safety of SILS-TEP at a day-surgery clinic. Tumescent local anesthesia (TLA), which provides excellent analgesia during and after surgery and enables clear distinction of the dissection layers, has been studied in inguinal hernia surgery. According to reports, TLA can be applied to both open and laparoscopic inguinal hernia surgery safely [4, 5]. Thus, we conducted this retrospective study to assess the feasibility and safety of SILS-TEP with TLA performed at a day-surgery clinic.

Methods

Clinical setting

Between April, 2015 and March, 2020, 2148 patients (1919 men; 229 women) underwent SILS-TEP at Gi surgical clinic.

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Gi surgical clinic is a purely day-surgery clinic that specializes in inguinal hernia surgery. Intra-abdominal manipulation, which might lead to bowel injury or obstruction, is not performed at Gi surgical clinic because the clinic does not have the facility to admit patients. Therefore, the procedure of SILS-TEP (95%) or the Lichtenstein method (5%) [6], which does not require intra-abdominal manipulation, is usually selected for inguinal hernia surgery at the clinic. The operator (Y. I.), who is a board-certified surgeon by the Japanese Society of Gastroenterological Surgery, performed all SILS-TEP procedures in this study. All patients received postoperative treatment with the standard best supportive care. The protocol was approved by the institutional review board of Osaka Rosai Hospital (reception number 20–10) and conformed to the standards of the Declaration of Helsinki.

Inclusion and exclusion criteria

SILS-TEP was performed for all adult patients, including those with a history of radical prostatectomy or lower abdominal surgery. SILS-TEP was not performed for patients unable to tolerate general anesthesia, or young patients with a small indirect inguinal hernia. The Lichtenstein method or Potts method [7] was indicated for patients who were not candidates for SILS-TEP.

Anesthesia

The SILS-TEP procedure was performed under general anesthesia with TLA. Airway management for general anesthesia included a facemask, laryngeal mask airway, or intubation, as decided by the attending anesthesiologist. The TLA agent (normal saline 160 ml, 1% xylocaine with epinephrine 20 ml, 0.75% ropivacaine 20 ml, total 200 ml) was prepared before surgery. Online Resource 1 shows the injection site and volume of TLA agent administered.

Surgical technique

Under general anesthesia, the patient was placed in the supine Trendelenburg position with both arms adducted. We injected 20 ml of the TLA agent around the umbilicus before making the skin incision and then made a single vertical incision inside the umbilicus, followed by dissection of the subcutaneous tissue down to the rectus abdominis sheath. Next, we injected 3 ml of the tumescent local anesthetic agent below the anterior sheath and then incised the anterior sheath. The rectus abdominis muscle on the side of the hernia was displaced laterally, and 25 ml of the TLA agent was injected between the rectus abdominis muscle and the posterior sheath laparoscopically through the dilator (Create Medic Co., Ltd., Kanagawa, Japan). Using a finger, we performed blunt dissection to create a space. After placing a Lap-Protector Mini Mini (Hakko Co., Nagano, Japan) in this space, we inserted three 5-mm trocars and one 10-mm trocar using the glove technique (Fig. 1). The three 5-mm trocars were used for the insertion of a 5-mm flexible scope, laparoscopic coagulation shears, and forceps. The 10-mm trocar was used for mesh insertion. Occasionally, additional forceps were inserted through the 10-mm trocar. We dissected the preperitoneal space gradually, using conventional straight laparoscopic instruments with the injection of the TLA agent via the dilator (Fig. 2). Typically, the hernia sac was not cut in the middle, but dissected to the end. We used an ENDOLOOP Ligature (Ethicon Inc., NJ, USA) to ligate the cut end of the hernial sac when the sac was cut. We placed three-dimensional contoured mesh [3-D Max L size, BD (Becton, Dickinson and Company), NJ, USA] in this preperitoneal space, covering the inguinal floor, and fixed it with a permanent tacker (PermaFix, BD, NJ, USA) to the pubic bone, Cooper's ligament, and above the iliopubic tract, respectively. After 55 ml of the TLA agent was sprayed, the preperitoneal space was carefully deflated to avoid displacing the mesh. Finally, we injected 20 ml of the TLA agent around the umbilicus after skin closure (Fig. 3).

Recovery room stay

The patients rested in the recovery room after surgery and were given analgesics and antiemetics as needed. Analgesics included intravenous flurbiprofen axetil or acetaminophen, oral loxoprofen sodium hydrate, or a diclofenac sodium suppository. Antiemetic therapy included intravenous metoclopramide or intramuscular injection of domperidone. Patients were permitted to leave the clinic when their scores according to the criteria for discharge from the clinic (see Online Resource 2) were ≥ 11.

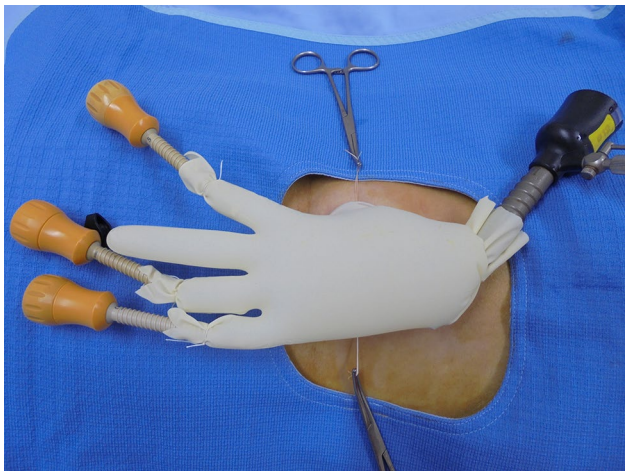

Fig. 1 Glove method of laparoscopic hernia repair

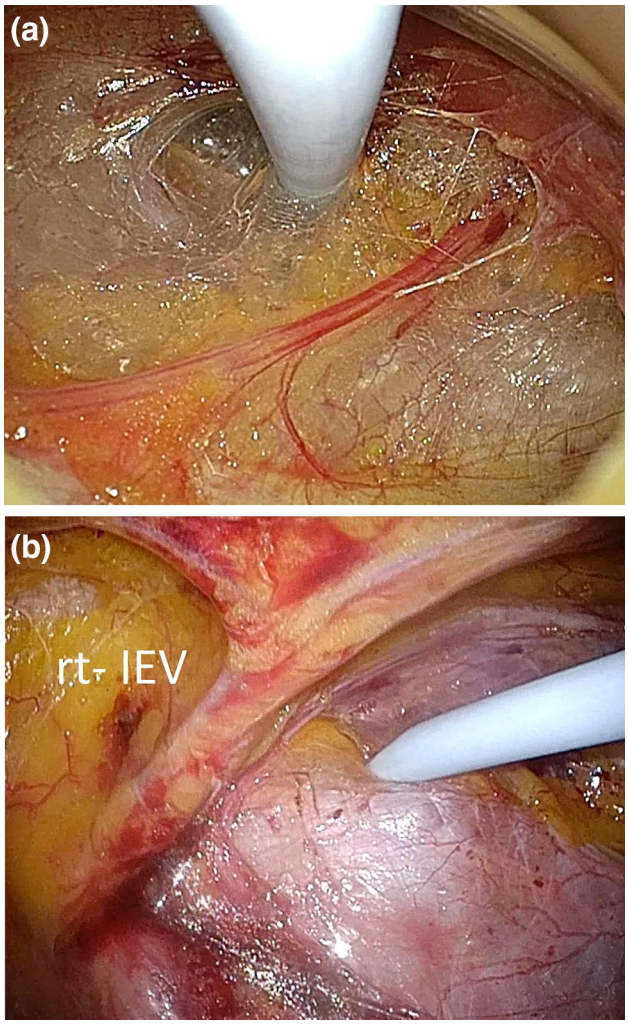

Fig. 2 Injection site and volume of tumescent local anesthetic agent injected during the operation. **a** Injection between the rectus abdominis muscle and the posterior sheath. **b** Injection into the ventral part of the lateral triangle. *rt.-IEV* right inferior epigastric vessels

Follow-up and data collection

The patients visited the clinic 1 week after surgery, and then 1, 6, and 12 months postoperatively. We recorded information on age, sex, body mass index (BMI), American Society of Anesthesiologists (ASA) physical status, site and type of hernia, previous history of lower abdominal surgery and antithrombotic therapy, operative time, blood loss volume, conversion to Lichtenstein method, recovery room stay, timing of analgesic and antiemetic administration, postoperative complications, follow-up rate, and hernia recurrence. The Clavien–Dindo classification [8, 9] was used to evaluate postoperative complications.

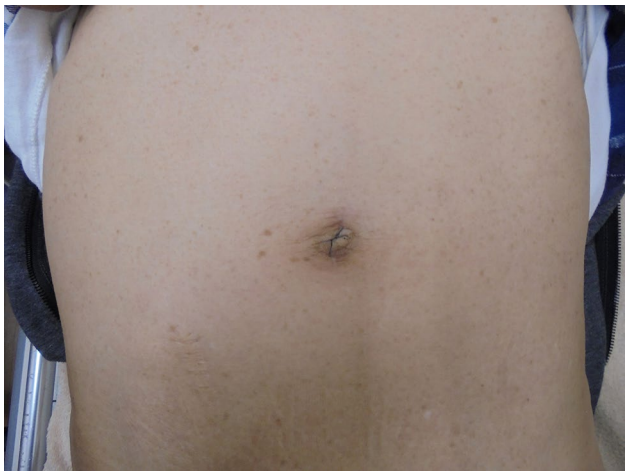

Fig. 3 The postoperative scar 1 month after SILS-TEP repair for bilateral inguinal hernias

Results

Table 1 summarizes the patients' demographic and hernia characteristics. The median patient age was 65 years (range 16–102 years), 12% (259/2148) of the patients had diseases with an ASA score ≥ 3, and 5% of the patients (109/2148) underwent SILS-TEP for recurrent hernias, including 2% (42/2148) of the patients after mesh hernioplasty. A history

Table 1 Patient demographic and hernia characteristics

Variable	$n = 2148$
Age, *years*	65 (16–102)
Male sex	1919 (89)
BMI, kg/m^2	22.9 (13.7–35.7)
ASA score ≥ 3	259 (12)
Site of hernia	
Unilateral	2022 (94)
Bilateral	126 (6)
Type of hernia	
Direct hernia	821 (38)
Indirect hernia	1230 (57)
Femoral hernia	62 (3)
Mixed type hernia	152 (7)
Others	9 (0.4)
Recurrent hernia	109 (5)
Hernioplasty with mesh	42 (2)
Previous abdominal surgery	595 (28)
Antithrombotic therapy	191 (9)

Data are expressed as medians (range) or numbers (%), unless otherwise specified

BMI body mass index, *ASA* American Society of Anesthesiologists

of lower abdominal surgery was noted in 28% (595/2148) of the patients and 9% (191/2148) of the patients had received antithrombotic therapy before surgery.

Table 2 summarizes the perioperative data. Facemask anesthesia was given to 65% (1403/2148) of the patients. The median operative time for unilateral and bilateral inguinal hernia was 50 min (range 30–210 min) and 75 min (range 52–147 min), respectively. Blood loss was minimal in all patients. Peritoneal injury occurred in 18% (387/2148) of the patients, conversion to the Lichtenstein method was required in 4% (91/2148) of the patients, and the median recovery room stay was 125 min (range 20–480 min). No analgesics were required by 75% (1613/2148) of the patients, and no antiemetics were required by 94% (2011/2148) of the patients. All the patients left the clinic on the day of surgery.

Table 3 summarizes the postoperative complications. Postoperative complications developed in 6% (139/2148) of the patients and included seromas, wound infections, and hematomas in 6% (125/2148), 0.4% (8/2148), and 0.2% (4/2148) of the patients, respectively. Seromas and hematomas were managed conservatively. Wound infections required open drainage of the umbilical wound and oral antibiotics. Bowel injury and obstruction occurred in one patient each (0.05%, 1/2148). Both patients were transferred to another hospital for surgery. No cases of chronic pain or mesh infection were seen in this study. Table 4 summarizes the follow-up and hernia recurrence rates. The follow-up rate at 12 months after surgery was 47% (1003/2148). There were no hernia recurrences.

Table 2 Perioperative data

Variable	$n=2148$
Airway management	
Facemask	1403 (65)
Laryngeal mask	358 (17)
Intubation	387 (18)
Operative time, *min*	
Unilateral	50 (30–210)
Bilateral	75 (52–147)
Bleeding volume, *ml*	Minimal
Peritoneal injury	387 (18)
Conversion to Lichtenstein method	91 (4)
Recovery room stay, *min*	125 (20–480)
Analgesic requirements, *times*	
None/1/2/3	1613 (75)/462 (22)/65 (3)/8 (0.4)
Antiemetic requirements, *times*	
None/1/2	2011 (94)/125 (6)/12 (0.6)

Data are expressed as medians (range) or numbers (%)

Discussion

There were three important clinical observations in this study. First, SILS-TEP can be performed safely at a day-surgery clinic; second, TLA might be useful when performing SILS-TEP at a day-surgery clinic; and third, SILS-TEP with TLA can be safely performed in difficult cases. We demonstrated that SILS-TEP could be performed safely at a day-surgery clinic. Several reports have shown that inpatient SILS-TEP is safe and feasible [1–3]. However, no large-scale studies have evaluated the feasibility and safety of performing SILS-TEP at a day-surgery clinic. In Japan, day surgery

Table 4 Follow-up and hernia recurrence rates

Variable	$n=2148$
Follow-up period	
1 week	2124 (99)
1 month	1985 (92)
6 months	1383 (64)
12 months	1003 (47)
Hernia recurrence	0

Data are expressed as numbers (%)

Table 3 Postoperative complications

	Clavien-Dindo classification grade						Total
	I	II	IIIa	IIIb	IV	V	
Complications, total	129 (6)	8 (0.4)	0	2 (0.1)	0	0	139 (6)
Seroma	125 (6)	0	0	0	0	0	125 (6)
Wound infection	0	8 (0.4)	0	0	0	0	8 (0.4)
Hematoma	4 (0.2)	0	0	0	0	0	4 (0.2)
Bowel injury	0	0	0	1 (0.05)	0	0	1 (0.05)
Bowel obstruction	0	0	0	1 (0.05)	0	0	1 (0.05)
Chronic pain	0	0	0	0	0	0	0
Mesh infection	0	0	0	0	0	0	0

Data are expressed as numbers (%)

is not common due to restrictions by the health insurance system. Although there are currently several day-surgery clinics for inguinal hernia surgery in Japan, they usually perform open inguinal hernia surgery, whereas laparoscopic inguinal hernia repair is rarely performed to avoid general anesthesia. In this study, surgical outcomes were comparable or better than in previous reports on inpatient SILS-TEP [1–3]. The median operative time for unilateral and bilateral inguinal hernia was 50 min and 75 min, respectively. All the patients left the clinic on the day of surgery and complications developed in only 6%.

Our study showed that TLA might be useful when performing SILS-TEP at a day-surgery clinic. TLA has been used widely for a variety of surgical procedures and provides excellent analgesia compared with conventional local anesthesia. TLA is safer because there is less lidocaine absorption and toxicity, sufficient analgesia during surgery, and long-lasting analgesia after surgery [10]. Previous reports showed that TLA could be safely applied to a PROLENE Hernia System and TAPP [4, 5]. In this study, 75% (1613/2148) of the patients did not require analgesics in the recovery room. Thus, TLA injection during surgery might contribute to minimizing postoperative pain and reducing the need for analgesics in the recovery room, thereby promoting patient discharge on the day of surgery.

In the present study, SILS-TEP with TLA was performed safely even in difficult cases. Previous reports showed that SILS-TEP without TLA could be applied in difficult cases, such as those of patients with previous lower abdominal surgery, after mesh hernioplasty, or those on antithrombotic therapy [1–3]. For patients whose preperitoneal space has fibrotic adhesions or a previous mesh implant, injection of the TLA agent enables the plane of dissection to be viewed clearly and facilitates dissection of the preperitoneal space [5]. For patients on antithrombotic therapy, the vasoconstrictive effect of epinephrine in some TLA agents inhibits intraoperative bleeding, helping maintain a good surgical field and create a proper layer of dissection [4].

The present study has several limitations: First, it was retrospective in nature. Second, a single experienced laparoscopic surgeon specialized in inguinal hernia surgery operated on all the patients. Third, the follow-up rate was low. Despite these limitations, we believe that the present analysis, including more than 2000 patients, demonstrates that SILS-TEP with TLA can be performed safely at a day-surgery clinic.

Conclusions

This series of more than 2000 SILS-TEP procedures offering good cosmetic results demonstrates that SILS-TEP with TLA can be performed safely at day-surgery clinics. SILS-TEP with TLA might be applicable in difficult cases.

Compliance with ethical standards

Conflict of interest The authors have no potential conflicts of interest to declare.

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