

HOW I DO IT

Three-step tumescent local anesthesia technique for inguinal hernia repair

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Abstract

The optimal method of anesthesia for inguinal hernia repair is still controversial. We have developed “three-step tumescent local anesthesia (TLA) technique” for inguinal hernia repair, and recently showed that this technique is acceptable in view of short- and long-term clinical outcomes. Our study included 273 consecutive cases (290 sides) of elective inguinal hernia repair performed under the newly developed technique between September 2003 and May 2019, and overall clinical outcomes were considered to be safe and feasible. Herein, we report the surgical procedure of “three-step TLA technique.” Briefly, we rapidly inject the diluted solution of local anesthetic and epinephrine step-by-step into the three following closed tissue space. Initially, 80 mL injection into the subcutaneous tissue before skin incision (Step 1). After the external oblique fascia is exposed, injection of 20 mL into the inguinal canal before the external oblique fascia is incised and opened (Step 2). The hernia sac and spermatic cord are then dissected, and the blunt dissection of the preperitoneal space is made by injecting 20 mL under the internal inguinal ring (Step 3), followed by placing a gauze into the preperitoneal space, creating the space for mesh placement. We consider that the most important point of this technique is achieved through the rapid injection of TLA solution into each closed tissue space, which makes for easier dissection, hemostasis, and good pain control.

KEYWORDS

inguinal hernia, local anesthesia, mesh plug, tumescent local anesthesia

1 | INTRODUCTION

Tumescent local anesthesia (TLA) is a variant form of local anesthesia in which a large volume of diluted solution of local anesthetic and epinephrine is injected into the tissue. The TLA method has been utilized in various surgical procedures, such as liposuction,¹ varicose vein treatment,² and cardiac pacemaker implantation.³ However, applying TLA to inguinal hernia repair has been reported only by a

limited number of authors.^{4–6} There are several methods of analgesia for inguinal hernia repair; however, recent reports have supported the effectiveness of local anesthesia in view of less invasiveness, cost-effectiveness, and good clinical outcomes. We recently reported safety and feasibility of TLA method for inguinal hernia repair with the experience of 273 patients.⁷ We report our surgical procedure, which we have named “three-step TLA technique,” for easier understanding.

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2 | MATERIALS AND METHODS

2.1 | Patients

We retrospectively reviewed the medical charts of 273 consecutive cases (290 sides) of inguinal hernia repair performed under TLA between September 2003 and May 2019 at the Hokkaido Cancer Center. The emergency cases, such as incarcerated hernias, were excluded from the study.

2.2 | Surgical technique

All the surgical procedures were performed with a "three-step TLA technique." The novel surgical procedure of inguinal hernia repair is performed as described below.

Before starting the operation, we prepare two types of diluted mixtures of local anesthetics (liquid A: 1% lidocaine with epinephrine 20 mL + normal saline 200 mL; and liquid B: 1% lidocaine 10 mL + 0.2% bupivacaine 10 mL). Liquid A is mainly used for tumescent purposes, and liquid B is used for skin anesthesia and a nerve block at the root of the spermatic cord to avoid pain and discomfort while dissecting the inguinal canal.

The patient is placed in a supine position. Before making the incision, which extended 5 cm along the Langer line above the inguinal canal, 80 mL of liquid A is rapidly injected into the subcutaneous tissue with an 18-gauge needle (Step 1; Figure 1). Subcutaneous tissue and Scarpa's fascia are then opened by sharp and blunt dissection in a bulged tissue. After the external oblique fascia and external inguinal ring are exposed, 20 mL of liquid A is rapidly injected into the inguinal

canal with an 18-gauge needle (Step 2; Figure 2). The external oblique fascia is incised and opened, and then the content of the inguinal canal, including the spermatic cord and hernia sac, is mobilized and taped *en bloc* just above the pubic tubercle. The hernia sac is separated from the cremasteric muscle with attention not to damage the nerves. To avoid pain and discomfort, a nerve block using liquid B is performed at the root of the spermatic cord. When an indirect hernia was confirmed, the hernia sac is dissected from the surrounding tissue to the level of the internal inguinal ring and pushed into the preperitoneal space. If the sac is large, it is then excised and ligated before being pushed back. The fragility of the floor of the inguinal canal is tested by instructing the patient to increase their intra-abdominal pressure (Valsalva maneuver). When the direct hernia sac is present, it is repaired concurrently as well. The blunt dissection of the preperitoneal space is achieved by injecting 20 mL of liquid A with a tightly attached syringe onto the edge of the internal inguinal ring, followed by placing a gauze into the preperitoneal space (Step 3; Figure 3). Either a mesh plug or direct Kugel patch is chosen as the mesh. A mesh plug, which is a cone-shaped mesh made of polypropylene, is chosen for cases with massive adhesion in the preperitoneal space, for instance, postprostatectomy patients.⁸ Otherwise, a direct Kugel patch, which is a self-expandable mesh made of polypropylene, is chosen for its extensive coverage of the hilum of direct, indirect, and femoral hernias.⁹ We routinely place an onlay patch for both, which is deployed and sutured on the floor of the inguinal canal.

2.3 | Ethical considerations

This study was conducted in accordance with the Declaration of Helsinki, and approved by the ethical review board of

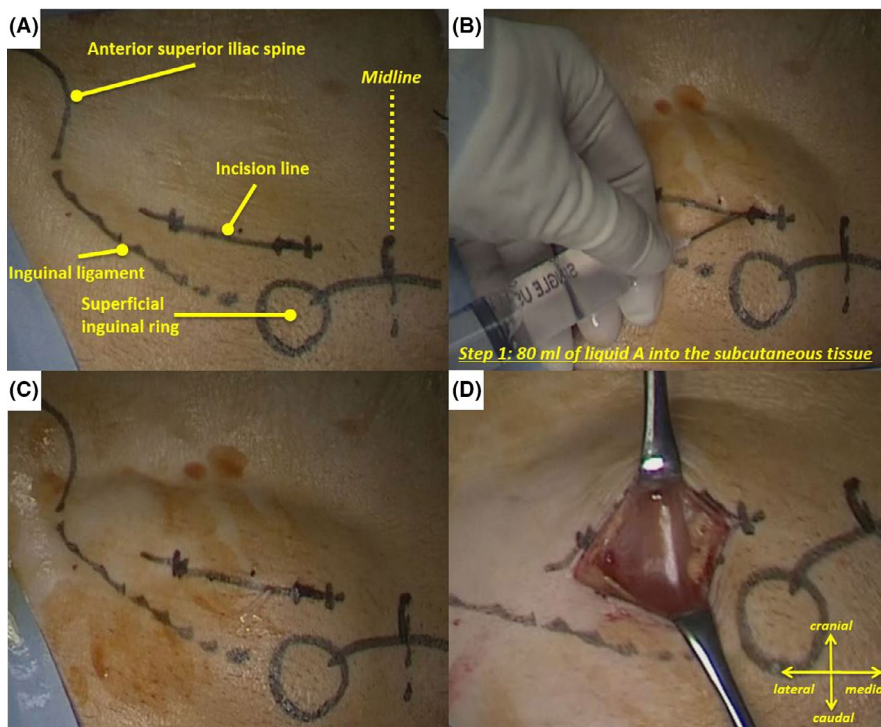


FIGURE 1 A, The surgical landmarks are shown. B, C, Before making the incision, 80 mL of liquid A is rapidly injected into the subcutaneous tissue with an 18-gauge needle, and the bulging is confirmed (Step 1). D, The Subcutaneous tissue and Scarpa's fascia are then dissected in a bulged tissue

FIGURE 2 A, B, After the external oblique fascia and external inguinal ring were exposed, 20 mL of liquid A is rapidly injected into the inguinal canal with an 18-gauge needle, and the bulging of external oblique fascia is confirmed (Step 2). C, The content of the inguinal canal is mobilized and taped. The nerve block by liquid B is performed at the root of the spermatic cord to avoid pain and discomfort during this maneuver. D, Then the hernia sac is dissected from the surrounding tissue to the level of the internal inguinal ring [Colour figure can be viewed at wileyonlinelibrary.com]

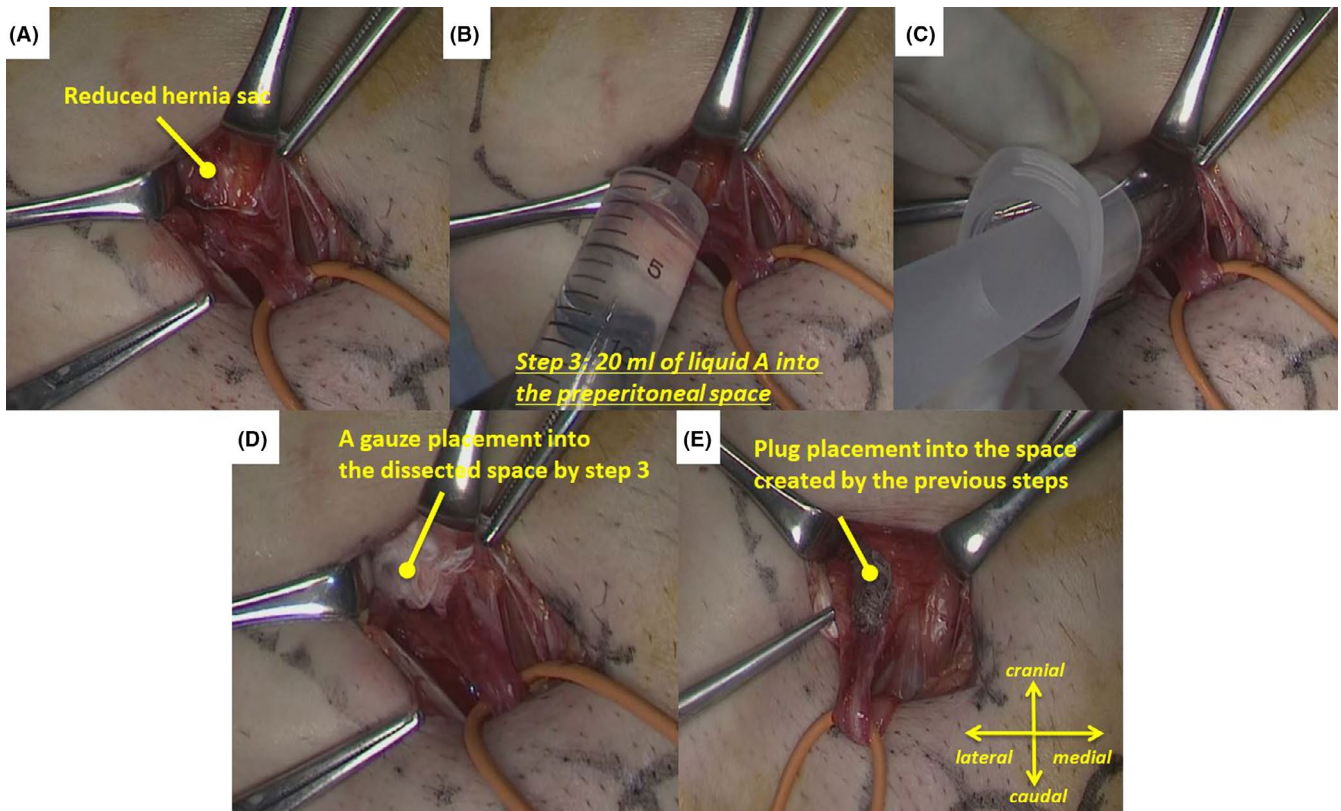
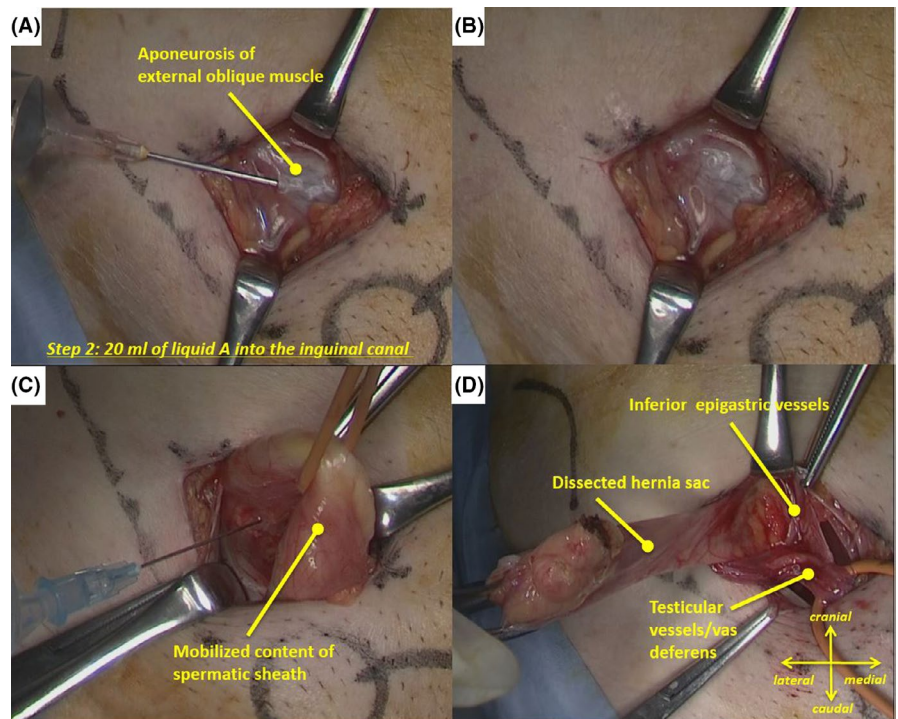


FIGURE 3 A-C, The blunt dissection of the preperitoneal space is achieved by rapidly injecting 20 mL of liquid A with tightly attaching a syringe onto the edge of the internal inguinal ring. D, Subsequent placement of a gauze into the preperitoneal space creates a space for mesh plug. E, A mesh plug is placed into the space created by the previous steps [Colour figure can be viewed at wileyonlinelibrary.com]

the Hokkaido Cancer Center (approval number 31-55). We obtained written informed consent prior to the surgery from all patients.

3 | RESULTS

The characteristics of the patients, and the clinical outcomes were shown in the recently published article.⁷ In summary, 273 patients (290 sides) had undergone inguinal hernia repair by the three-step TLA method. More than half the patients had a medical history of malignancy (185 cases, 67.8%). To delve into the feasibility for the postprostatectomy patients, we compared the control group (C group; 188 cases, 198 sides) and the postprostatectomy group (P group; 85 cases, 92 sides). Although indirect hernia, lidocaine usage, and mesh plug were significantly more frequent for the P group, no other difference in the intra- and postoperative outcomes were found. Of comorbidities other than malignancy, 10 patients had psychoneurological problems including dementia (six cases, 2.2%). For the operative data, the overall operation time was 67.9 minutes (range, 32-150 minutes), and blood loss was 2.6 mL (range, 0-66 mL). No local anesthetics systemic toxicity was observed.

No recurrence was found during the mean overall follow-up period of 1631 days (range, 5-4549 days). The confirmation of recurrence was to be made by physical examination, and P group follow-up was significantly longer than the C group follow-up possibly due to the postoperative follow-up of prostate cancer ($P = .002$). The postoperative complications occurred in 12 patients; however, no case required reoperation. Importantly, no intraoperative sedation or conversion to general anesthesia for any reason was needed, and we successfully performed all operations solely under this novel technique.

4 | DISCUSSION

Inguinal hernia is a common occurrence with an incidence of 0.5%-1.0% in adult males.¹⁰ The treatment is solely surgical; however, the optimal surgical approach and methods of analgesia are still controversial. The surgical approach is mainly either anterior or laparoscopic; however, the recent international guidelines state that the differences in best outcomes for the Lichtenstein technique and TEP/TAPP were too small to conclude which was better, and more problematically, the fact that no standardized technique exists makes applying a randomized control trial to a clinical setting more difficult.¹¹ The use of mesh is universally accepted for its lower recurrence rates, and this is based on a long-term follow-up study (10 year cumulative recurrence rate of 17% vs 1%, $P = .005$).¹² They also showed that there was no causal relationship between age, the surgeon's expertise, and prostate disease and recurrence.¹² The choice of mesh is also controversial. Although the international guideline strongly recommends Lichtenstein's repair as the first choice for anterior approach,¹¹ a study including 10 RCTs with 2708 patients revealed that the recurrence rate was similar for Lichtenstein's repair vs mesh plug repair, or prolene hernia system repair,¹³ implying the choice of

mesh is largely dependent on each patient's condition and the surgeon's experience. For instance, postprostatectomy patients have a tendency toward development of inguinal hernias that are approximately 10%-20%.^{10,14} The etiology is still unclear; however, previous studies have supported the hypothesis that intraoperative damage to the internal inguinal ring with a subclinically existing patent processus vaginalis leads to the clinical presentation of a postoperative inguinal hernia.^{15,16} This explains the higher incidence of an indirect hernia in postprostatectomy patients; conversely, a lower incidence of direct hernia might be due to postoperative adhesion around the floor of the inguinal canal. Hence, for postprostatectomy patients, mesh plug repair seems to be the optimal method since there is no need to repair a direct inguinal hernia. Indeed, the combination of our TLA technique and mesh plug repair fit well especially in the procedure of step 3 (dissection of preperitoneal space and mesh plug placement). It is easier and faster when these techniques are combined, and more importantly, we showed it with good outcome.

In terms of methods of anesthesia, local anesthesia has many advantages over general anesthesia or spinal/epidural anesthesia, because of its simplicity, early ambulation, and cost-effectiveness with no adverse events that are potentially induced by other types of anesthesia. Local anesthesia is also beneficial for medically unfit patients who cannot tolerate general anesthesia.¹⁷⁻²¹ TLA is a variant of local anesthesia. TLA involves injecting a large volume of diluted solution of local anesthetics and epinephrine into the tissue, which increases the pressure in the tissue (hydropressure), making hemostasis, dissection (hydrodissection), and pain control easier. The increased amount in the tissue and the addition of epinephrine together assist with less bleeding because the microvessels are pressed flat and epinephrine causes vasoconstriction. The addition of epinephrine also prolongs the duration of pain control by delaying the absorption of local anesthetics. TLA is utilized in other surgical areas; however, an appliance with inguinal hernia repair is not broadly performed. Only three English literature reports were uncovered with a Pubmed search (keywords: "tumescence local anesthesia" and "inguinal hernia").⁴⁻⁶ Our study included the largest number of patients to date and showed the effectiveness of TLA in short- and long-term outcomes. The procedure was carried out with a uniform method in every case, with no intraoperative sedation or conversion to general anesthesia.

The TLA solution included lidocaine (short-acting) and bupivacaine (long-acting). Such a mixture of short- and long-acting local anesthetics has been reported to be effective as a nerve block in the area of ophthalmology²² and neurosurgery,²³ which prolonged the duration of pain control.²⁴ In addition, direct infusion of the local anesthetics into the surgical field has been shown to reduce postoperative pain in itself,^{25,26} synergically contributing to postoperative pain control. Another advantage is that a urinary disorder is less common.^{27,28} In our study, only one patient required urinary catheter insertion.

Conversely, local anesthetic systemic toxicity should be considered.²⁹ Extremely large volumes of diluted solution with lidocaine are used and can potentially be infused into the bloodstream with TLA. In the field of liposuction surgery where TLA is generally used, it is recommended that the maximal dose of lidocaine should be 28-55 mg/kg.³⁰⁻³² In our study, the mean lidocaine dosage was 206.1 mg, which

was lower than any of the recommended maximal doses. However, any unusual symptoms must be noticed when operating under TLA.²⁹

In conclusion, TLA is a safe and feasible method of anesthesia for inguinal hernia repair. There seems to be no clear contraindication even with patients that have severe systemic complications. Irrespective of the backgrounds of the patients, we successfully performed inguinal hernia repairs with no sedation nor conversion to general analgesia, and importantly, we saw no recurrence in the long-term follow-up.

DISCLOSURE

Conflict of Interest: None of the contributing authors have any conflict of interest

Author Contributions: Ryota Koyama and Toshiki Shinohara are the primary investigators of the study. Ryota Koyama searched for the literature and drafted the manuscript. All authors read and approved the manuscript.

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