Clinical Case Report

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Abdominal peripheral nerve block as the only anesthetic technique for totally extraperitoneal endoscopic inguinal hernia repair

Two case reports

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Abstract

Rationale: Laparoscopic totally extraperitoneal (TEP) inguinal hernia repair is a rapidly evolving, minimally invasive treatment modality for inguinal hernia. Compared with open hernia repair, this method requires a smaller incision, has cosmetic advantages, and facilitates rapid recovery and early return to daily activities because of less postoperative pain. Because general anesthesia is essential for TEP hernia repair, it cannot be performed on patients who have an increased risk of developing complications when placed under general anesthesia.

Patient concerns: We report 2 cases of single-port laparoscopic TEP (SP TEP) that were performed using only an abdominal peripheral nerve block (PNB) at our institute. General anesthesia and neuraxial block were dangerous for both patients owing to severe heart failure and severe chronic obstructive pulmonary disease (COPD).

Diagnoses: They were diagnosed with an inguinal hernia requiring surgery.

Interventions: Hence, the anesthesiologist and surgeon decided to attempt a PNB to avoid complications from general anesthesia and allow faster recovery. An ipsilateral transversus abdominis plane block as well as a rectus sheath block and inguinal canal block were administered via ultrasound guidance.

Outcomes: The patients did not report any pain, and no rescue drug was administrated. The operation times were 65 and 62minutes in patients 1 and 2, respectively. No intraoperative complications were noted. Patient 1 was discharged the day after the surgery, whereas patient 2 was discharged on the same day as the surgery.

Lessons: TEP hernia repair using abdominal PNB anesthesia seemed to be a safe and feasible technique without causing any additional complications. However, the use of abdominal PNB anesthesia alone for TEP hernia repair as an alternative to general anesthesia requires further investigation using a larger cohort.

Abbreviations: BPH = benign prostate hyperplasia, COPD = chronic obstructive pulmonary disease, FEV1 = forced expiratory volume-one second, FVC = forced vital capacity, PNB = peripheral nerve block, RSB = rectus sheath block, SP = single port, SP TEP = single-port laparoscopic TEP, SpO_2 = oxygen saturation, TAP = transversus abdominis plane, TEP = totally extraperitoneal.

Keywords: abdominal peripheral nerve block, inguinal canal block, inguinal hernia, rectus sheath block, totally extraperitoneal, transversus abdominis plane block

1. Introduction

Laparoscopic surgery is increasingly performed for inguinal hernia repair. This is because it reduces postoperative pain, enhances cosmetic results, and facilitates faster recovery and early return to daily activities.[4,5] Recently, to maximize such advantages, the single-port (SP) technique has been adapted for laparoscopic inguinal hernia repair. This minimally invasive surgery for inguinal hernia might be a good choice for patients who present with weakened general conditions. However, considering that general anesthesia is mandatory for this surgery, surgeons and anesthesiologists should weigh the risks of general anesthesia-related complications or perform open inguinal hernia repair using local anesthesia.

Abdominal peripheral nerve block (PNB) is used to treat pain after laparoscopic surgery or chronic abdominal pain by blocking the nerves of the abdominal wall.[2,6] However, it is not used for anesthetic purposes during the surgery because laparoscopic surgery stimulates visceral pain that cannot be easily managed using a PNB. However, as the laparoscopic totally extraperitoneal (TEP) inguinal hernia repair was performed in the limited space of the preperitoneal space within the anterior lower abdominal wall, we opted to use PNB as an alternative anesthesia for patients who were at risk of developing complications from general anesthesia.

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Herein, we report 2 cases of successful SP TEP using an abdominal PNB on patients who had severe heart failure and severe chronic obstructive pulmonary disease (COPD).

2. Case reports

Written informed consent was obtained from all patients in this report. The study was approved by the ethics committee of our institution (IRB code: DC18ZESI0021).

2.1. Anesthetic technique

The abdominal PNB for SP TEP in both patients was performed by the same anesthesiologist, who was experienced in nerve block techniques for postoperative analgesia. After the patients were brought to the operating room, they were sedated with 50 mcg of fentanyl. Then, a dexmedetomidine (Hospira Precedex US) infusion (0.5 mcg/kg/h) was started immediately without a loading dose. All nerve blocks were performed under ultrasound guidance, and 0.75% ropivacaine (Naropin 0.75%; AstraZeneca, Australia) was diluted to 0.2% by adding normal saline (Fig. 1).

The unilateral posterior transversus abdominis plane (TAP) block was performed first. A liner probe was placed between the iliac crest and lower costal margin to scan around the posterior axially line. Three layers of abdominal wall were noted. The injection point was the intersection point of the midaxillary line and the line 2 cm above the iliac crest. Using the ultrasound-guided in-plane technique, the needle tip was placed between the transversus abdominis and the internal oblique muscle. Then, 25 mL of 0.2% ropivacaine was injected between the abdominis transversus and internal oblique.

Thereafter, rectus sheath block (RSB) was performed on both sides at the level of the umbilicus. The ultrasound-guided needle tip was placed below the rectus muscle and above the posterior rectus sheath using the in-plane technique. After a small amount of ropivacaine was evenly spread on the rectus muscle and sheath, 20 mL of 0.2% ropivacaine was injected in both sides.

Then, the inguinal canal block was performed. The deep inguinal ring is located at the branch point of the inferior epigastric artery from the external iliac artery. Hence, we traced the inferior epigastric artery under the rectus muscle until the point it encountered the external iliac artery. The inguinal canal was placed at the center of the ultrasound screen and then injected with 3 mL of 0.2% ropivacaine and 2 mL around it.

The total anesthesia time was 15 min. The dermatome of each patient was checked after about 20 minutes. Sensory loss around the umbilicus was confirmed to be approximately within a 5 cm diameter. The operation was started after confirming that T10 to L1 dermatomes were unilaterally blocked.

2.2. Surgical technique

The overall operative procedure was not different from that of the SP TEP performed under general anesthesia. Local anesthetics were not used. A 1.5-cm long subumbilical incision was made, beginning from the deepest part of the umbilicus. After dissecting the subcutaneous tissue to expose the anterior rectus sheath, a transverse incision was made on the anterior rectus sheath. We attempted to insert a commercial single port (glove port; Nelis, Korea). Pneumoperitoneum was produced, with 8 mm Hg of pressure. Preperitoneal dissection was performed using a laparoscope and 2 instruments. The surgical procedure was performed with the patient in the Trendelenburg position and the side of the hernia tilted up. A grasper and a suction device with hook tip (Surgiwand, Covidien, Mansfield, MA) were used. Both cases were direct hernias, and the pseudo-sac of the transversalis fascia was pulled inward and ligated using a vicryl Endoloop (Sejong Medical, Paju, Korea). A 15×10 cm Parietex mesh (Covidien, Dublin, Ireland) was inserted and positioned to cover the myopectineal orifices. Tissue glue (Greenplast-Q, Green Cross, Yongin, Korea) was used for mesh fixation. This glue is a mixture of fibrinogen and thrombin and was applied using a laparoscopic applicator (Duplo-catheter; Baxter Healthcare, Deerfield, IL), mainly on the inferior border of the mesh.

2.3. Patient 1

The first patient was a 69-year-old male diagnosed with a left inguinal hernia. The inguinal hernia was a direct type, and we planned to apply a 15×10 cm mesh because of a 3×4 cm size defect in the Hesselbach triangle. Because of the patient's history of diabetes mellitus, a subcutaneous insulin injection could not control his blood glucose appropriately; therefore, an insulin pump was used. Hemoglobin A1c remained at 7.2. There was an ejection fraction of 18% due to dilated cardiomyopathy, and an implantable cardioverter defibrillator was ongoing for 1 year. In addition, the patient had stage 3 chronic kidney disease due to diabetes and heart problems. He was taking medicine for benign prostate hyperplasia (BPH). The initial blood pressure was 121/109, the heart rate was 109, and the oxygen saturation (SpO_2) was 95%.

In particular, the patient did not require analgesics, and the surgeon proceeded without irregularities in the surgical field. In the middle of the operation, the patient complained of urinary discomfort such as urinary incontinence. A Foley catheter was inserted, and no specific stress symptoms were noted thereafter. Bispectral index levels were checked during surgery and remained between 65 and 85. The operation time was 1 hour and 5 minutes, and total anesthesia time was 1 hour and 50 minutes. No

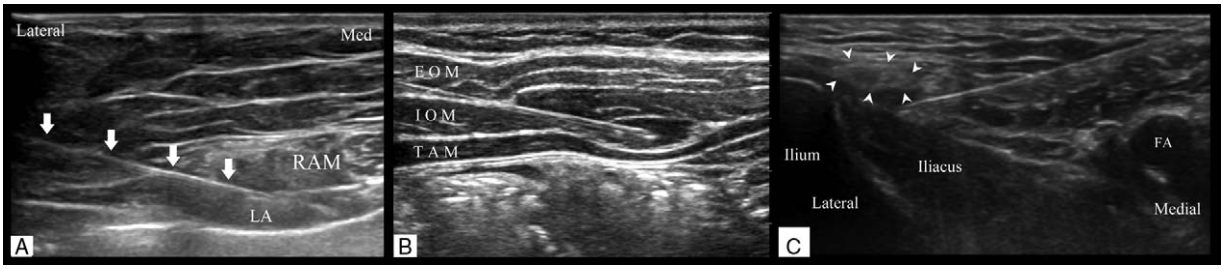

Figure 1. The ultrasound images of (A) RSB, (B) TAP block, and (C) inguinal canal block. (A) Ultrasound-guided needle insertion (arrow) below posterior rectus sheath. (C) spermatic cord (arrow head) in inguinal canal. EOM = external oblique muscle, FA = femoral artery, IOM = internal oblique muscle, LA = local anesthetic agent, RAM = rectus abdominal muscle, TAM = transversus abdominal muscle.

intraoperative complications were observed. The patient experienced almost no pain until 8-h postoperation. No major complications were noted during recovery, and he was discharged the next day. Although a postoperative hematoma was subsequently noted, this was managed conservatively in the outpatient clinic.

2.4. Patient 2

An 80-year-old man with asthma, COPD, and BPH over the last 30 years was admitted for hernia surgery. He had been diagnosed with a cerebral infarction 5 years ago, and there was no special sequestration. Although he was diagnosed with tuberculosis 20 years ago, he had been successfully cured. Chest X-ray showed some diffuse pneumonic consolidations in bilateral lower left lung fields, underlying pulmonary emphysema, and old tuberculosis foci traces. Pulmonary function test also indicated severe obstructive lung defect with forced vital capacity (FVC) of 2.98 L (80%), forced expiratory volume-one second (FEV1) of 1.25 (50%), and FEV1/FVC 42%. Continuous oxygen therapy was carried out. Upon admission, the patient was on oxygen mask. The first blood pressure reading was 150/77 mm Hg, the pulse rate was 77 beats per minute, and the SpO_2 was 92%.

The nerve block method was the same as that in case 1. Total operation time was 62 minutes, and total anesthesia time was 1 hour and 40 minutes. He did not particularly complain of pain during the operation, but also experienced urinary discomfort. After self-voiding urine, the surgery was resumed. No major abnormality was reported during recovery, and he felt no pain until 6 hours after operation. He was discharged on the same day approximately 8 hours after surgery. No postoperative complications were noted.

3. Discussion

According to Parviz et al., local infiltration is recommended in cases of open hernia repair because field block is time-consuming and requires large amounts of local anesthetics.[1] However, in laparoscopic hernia surgery, the local infiltration from the umbilicus to the inguinal area is too extensive, complications from systemic absorption due to increased use of local anesthetics may occur, and more time is required for local infiltration. Unlike conventional methods, laparoscopic hernia surgery requires a field block to cover a wide range of operations.

Laparoscopic surgery absolutely required general anesthesia. Because pneumoperitoneum with CO_2 gas precede the surgical procedure, they tend to worsen the pulmonary mechanics, resulting in patients feeling very uncomfortable on receiving the neuraxial block.[8] Furthermore, high levels of neuraxial blockade are required to obstruct noxious stimulations from the intestinal autonomic nervous system. However, as the laparoscopic hernia operation enters the abdominal walls rather than via the peritoneal cavity, this inconvenience can be minimized. Although spinal anesthesia can block these nerves, other problems might occur. First, spinal anesthesia can cause urinary complications such as urinary retention, difficultly in voiding urine, blood pressure fluctuations, and absolute bedridden state for 8 hours to prevent postdural puncture headaches.[7] Second, sympathetic pain (T9, 10) due to pulling of the spermatic cord in the inguinal canal may be felt during surgery. Therefore, the level of the spinal block should be raised above T8 to block the sympathetic nerve in the inguinal canal.

Parviz et al who have conducted >1000 cases of open inguinal hernia using only local anesthetics, after removal of external oblique aponeurosis, injected 10 mL of local anesthetics under the aponeurosis on the outer corners, so that the local anesthetic was contained in the inguinal canal.[1] The reason for this was to block the 3 important nerves to attain complete anesthesia and to separate the ilioinguinal nerve from the aponeurosis so as to minimize nerve damage during incision. In addition, local anesthetic was injected into the inguinal canal before closing the aponeurosis for postoperative prolonged analgesic effect.

Moreover, the inguinal canal block is important in laparoscopic and open hernia repair because these procedures can cause pain when removing and manipulating the vas deferens during surgery. Tanaka reported success in hernia surgery through TAP block and RSB.[10] However, a complete anesthetic block may not be enough because TAP block cannot obstruct the genital branch of the genitofemoral nerve (L2) and visceral sympathetic nerve. Furthermore, TAP block can impede only 50% of the ilioinguinal–iliohypogastric nerve.[9]

In this report, SP TEP using abdominal PNB anesthesia alone in 2 patients was successful. During surgery, the patients did not complain of pain associated with surgery, and no other local anesthetic was added. The operative space was well exposed and stable except when the patient coughed. In older patients, lower body mass index and weaker abdominal muscles should be considered to ensure a stable operative field. With regard to postoperative pain and recovery, our results showed no increase in visual analogue scale score, analgesic requirements, and days to return to activities of daily living compared with those previously reported for SP TEP under general anesthesia (Table 1).[3]

One interesting condition was that both patients complained of urinary discomfort during surgery. Perhaps during TEP surgery, extraperitoneal CO_2 gas insufflation was produced while stimulating the bladder wall. Patient 1 was inserted with a Foley catheter during surgery, and patient 2 was released from stimulation by self-voiding. Therefore, in the next operation, self-voiding should be performed before surgery.

Furthermore, RSB is recommended in the lateral border of the rectus muscle rather than in the medial area to minimize ensuing misunderstanding during intra-abdominal entry that the local anesthetic between the rectus muscle and the rectus sheath can flow along the umbilical laparoscopic port when RSB is

Table 1

Demographics and perioperative data of patients undergoing single-port laparoscopic totally extraperitoneal inguinal hernia repair using an abdominal peripheral nerve block anesthesia.

	Patient 1	Patient 2
Age, y	69	80
Sex	Male	Male
Body mass index, kg/m^2	21.2	22.68
Operative time, min	65	62
Postoperative length of stay, d	1	0.6
Intraoperative complication	None	None
Postoperative complication	Hematoma	None
Postoperative pain score (VAS)		
2 h	3	2
24 h	2	1.5
Analgesics requirement (no.)		
0 d postoperative	1 (tramadol, 50 mg)	0

VAS = visual analog scale, no. = number.

performed in the medial side. In addition to avoiding the risk of general anesthesia, the present study revealed several positive points regarding the field of laparoscopic hernia repair. First, day care surgery without admission is possible. Patients can be less anxious about hospitalization as well as general anesthesia, which will also have a positive influence on cost-effectiveness. Second, similar to our cases, laparoscopic hernia repair can be advantageous for direct inguinal hernia with large defects. That is why a defect in the Hesselbach triangle can be covered more broadly and easily using laparoscopic hernia repair. These advantages of laparoscopic hernia repair are also applicable to patients who are burdened with general anesthesia.

Both patients underwent fentanyl administration in the operating theater as well as an infusion of dexmedetomidine during surgery. The sedation levels during surgery were equivalent to the light sedation score (−2) on the Richmond Agitation-Sedation Scale, which was a step to answer the call and to appeal to discomfort. Although we ensured the patient was sedated and stabilized during the procedure, as both drugs have analgesic effects, it was possible that minimal pain experienced by the patient could have been overlooked. Thus, more studies using nonsedative drugs are needed.

In conclusion, in the hands of an experienced anesthesiologist and laparoscopic surgeon, TEP hernia repair using abdominal PNB anesthesia was safe and feasible without resulting in any additional complications. However, the use of abdominal PNB anesthesia alone for TEP hernia repair as an alternative to general anesthesia warrants further investigation using larger cohorts.

Author contributions

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References

[1] Amid PK, Shulman AG, Lichtenstein IL. Local anesthesia for inguinal hernia repair step-by-step procedure. Ann Surg 1994;220:735–7.
[2] Baeriswyl M, Kirkham KR, Kern C, et al. The analgesic efficacy of ultrasound-guided transversus abdominis plane block in adult patients: a meta-analysis. Anesth Analg 2015;121:1640–54.
[3] Choi BJ, Jeong WJ, Lee IK, et al. Single-port versus conventional three-port laparoscopic totally extraperitoneal inguinal hernia repair: a randomized controlled trial. Hernia 2016;20:789–95.
[4] Kehlet H, Kingsnorth A. Meta-analysis of randomized clinical trials comparing open and laparoscopic inguinal hernia repair (Br J Surg 2003; 90: 1479-1492). Br J Surg 2004;91:509.
[5] Langeveld HR, van't Riet M, Weidema WF, et al. Total extraperitoneal inguinal hernia repair compared with Lichtenstein (the LEVEL-Trial): a randomized controlled trial. Ann Surg 2010;251:819–24.
[6] Meyer A, Bonnet L, Bourbon M, et al. Totally extraperitoneal (TEP) endoscopic inguinal hernia repair with TAP (transversus abdominis plane) block as a day-case: a prospective cohort study. J Visc Surg 2015;152:155–9.
[7] Miller R, Eriksson L, Lee Fleisher. Miller's Anesthesia. 8th ed. Brull R, MacFarlane AJR, Chan VWS, editors. Philadelphia, PA: Saunders; 2014.
[8] Nguyen NT, Anderson JT, Budd M, et al. Effects of pneumoperitoneum on intraoperative pulmonary mechanics and gas exchange during laparoscopic gastric bypass. Surg Endosc 2004;18:64–71.
[9] Stav A, Reytman L, Stav MY, et al. Transversus abdominis plane versus ilioinguinal and iliohypogastric nerve blocks for analgesia following open inguinal herniorrhaphy. Rambam Maimonides Med J 2016;7: e0021.
[10] Tanaka M, Azuma S, Hasegawa Y, et al. [Case of inguinal hernia repair with transversus abdominis plane block and rectus sheath block]. Masui 2009;58:1306–9.