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## Surgical experience of laparoscopic retroperitoneal triple neurectomy for a patient with chronic neuropathic inguinodynia



Masato Narita\*, Shunpei Jikihara, Hiroaki Hata, Ryo Matsusue, Takashi Yamaguchi, Tetsushi Otani, Iwao Ikai

Department of Surgery, National Hospital Organization Kyoto Medical Center, 1-1 Fukakusa-mukaihata-cho, Fushimi-ku, Kyoto, 612-8555, Japan

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## ABSTRACT

**BACKGROUND:** Neuropathic inguinodynia following inguinal hernia repair sometimes becomes a disabling disease. We report a case of successful surgical treatment of chronic refractory neuropathic pain after inguinal hernia by laparoscopic retroperitoneal triple neurectomy.

**CASE PRESENTATION:** A seventy-year-old male who underwent right-side inguinal hernia repair using the Lichtenstein method revisited our hospital with inguinodynia 16 months after surgery. After a thorough assessment, the patient was diagnosed with neuropathic pain based on the following: 1) dermatomal mapping suggested ilioinguinal and iliohypogastric nerve problems, 2) pain was evoked by specific movement, 3) the site of maximum pain was slightly changed at every physical examination, and 4) no evidence of recurrence or meshoma was observed on MRI. Conservative therapies were ineffective. Surgical intervention using laparoscopic retroperitoneal triple neurectomy was performed 4 months after treatment initiation. In the lateral recumbent position, a three-port method was used. The ilioinguinal and iliohypogastric nerves and the genital branch of the genitofemoral nerves were identified and resected. Although a residual nerve emerged from L2/3 toward the inguinal region, the nerve remained in situ. Pain assessment 3 h after surgery revealed that pain was decreased but remained. Reoperation involving resection of the residual nerve was performed on the same day. Although another type of mild pain appeared 3 months after surgery, the patient resumed normal life, without any restrictions.

**CONCLUSIONS:** Laparoscopic retroperitoneal triple neurectomy is useful for treating refractory neuropathic pain. The diagnosis of neuropathic pain via thorough preoperative assessment is vital for procedure success because the procedure would not be effective for other types of pain.

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## 1. Background

Although pain after inguinal hernia repair is typically attenuated by pain killers and disappears in a time-dependent manner, certain patients have persistent pain even after a considerable amount of time. This phenomenon is referred to as “chronic inguinodynia”, which is a common and serious long-term complication after inguinal hernia repair. Chronic inguinodynia is categorized into 3 types: 1) nociceptive pain, 2) neuropathic pain, and 3) mixed-type pain. Most chronic inguinodynia cases are mild and are cured by conservative treatment, but certain cases are refractory and affect activities of daily living [1,2]. Given that the therapeutic strategy differs among individuals according to the type of pain, a systematic and thorough preoperative assessment to identify the type of pain is mandatory [3].

Herein, we report a case of successful treatment of chronic neuropathic inguinodynia by laparoscopic retroperitoneal triple

neurectomy. This case report was described according to the SCARE Statement [4].

## 2. Case presentation

A 70-year-old male with a history of lumbar disc herniation and arterial fibrillation underwent inguinal hernia repair using the Lichtenstein method (Parietex Progrid™, COVIDIEN, Japan). He experienced mild pain at the early postoperative phase that disappeared 3 months after surgery. However, he revisited our hospital due to exacerbation of the pain 16 months after surgery. The patient had walked with cane due to lumbar disc herniation since several years ago but he was able to walk a long distance without any restriction before inguinal hernia repair. However, he became unable to walk a long distance and walked very slowly due to inguinodynia, which disturbed his daily life considerably. No abnormal findings were noted on inspection. Pain assessment by dermatomal mapping, as described by Álvarez et al. [5], revealed tenderness at the level of the iliac crest and along the upper side of the surgical wound, indicating the presence of ilioinguinal nerve (IIN) and iliohypogastric nerve (IHGN) problems (Fig. 1). Tinel's sign

\* Corresponding author.

E-mail address: [narinari@kuhp.kyoto-u.ac.jp](mailto:narinari@kuhp.kyoto-u.ac.jp) (M. Narita).



**Fig. 1.** Dermatomal mapping indicated ilioinguinal and iliohypogastric nerve problems. Circles indicate normal sensation. Crosses are points where the patient felt pain and tenderness. The area surrounded by the square is the point of maximum tenderness.

at the site of maximum tenderness was positive. Preoperative MRI showed the presence of lumbar disc herniation but there was no evidence of its aggravation. Nonsteroidal anti-inflammatory drugs and pregabalin were prescribed, but these drugs did not decrease the pain. The effect of tramadol hydrochloride acetaminophen was also limited. Invasive conservative therapy was initiated according to our refractory chronic pain algorithm [3]. First, local anesthesia consisting of 10 mL 1% lidocaine and 10 mL 0.75% ropivacaine was injected into the site of maximal pain (trigger point block; TPB), but a minimal effect was noted. Subsequently, IIN and IHGN blocks were performed, but this treatment was ineffective. The pain was attributed to a neuropathic cause for the following reasons: 1) dermatomal mapping suggested IIN and IHGN problems; 2) the site of maximum pain was slightly altered at each physical examination; 3) pain was evoked by specific movement, including extension of the inguinal region and long-term sitting; and 4) pelvic MRI did not reveal meshoma, recurrence, or other visceral causes. The pain persisted for 3 months after the initiation of invasive conservative therapy. Thus, surgical intervention was considered. Although surgery via the anterior approach is common in patients with chronic inguinodynia, laparoscopic retroperitoneal triple neurectomy was planned for the following reasons: 1) mesh removal would be unnecessary, and 2) nerve resection at the level of the lumbar plexus would be preferable given that the percutaneous IIN and IHGN peripheral blocks were not effective [6].

Under general anesthesia, the patient was placed in the lateral decubitus position, which is similar to the position used for nephrectomy (Fig. 2A). A 12-mm transverse incision was made at the midpoint between the iliac crest and the costal margin, and the retroperitoneal cavity was accessed. An oval dissecting balloon was

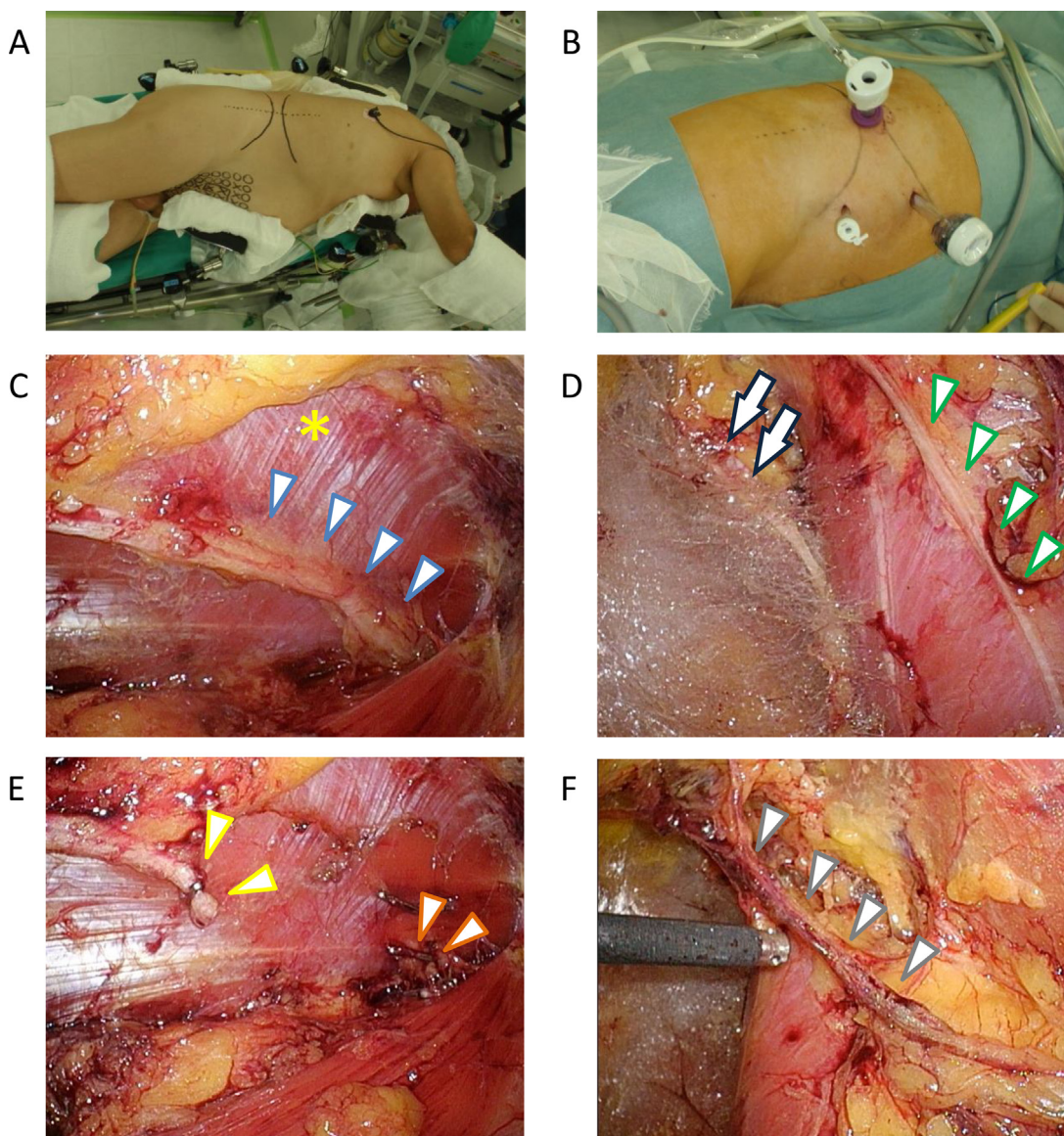
inserted into the retroperitoneal cavity and inflated under endoscopic visualization. Then, a 12-mm balloon trocar was inserted, and insufflation of carbon dioxide was initiated. Another 12-mm port and a 5-mm port were inserted, as shown in Fig. 2B. Retroperitoneal fat pads were dissected bluntly or sharply using electric cautery or an ultrasonic energy device. The quadratus lumborum and psoas muscles were exposed sufficiently, and IIN and IHGN emergence from Th12/L1 was confirmed. These nerves formed a common trunk (Fig. 2C) and passed through the retroperitoneal cavity until they perforated the transversus abdominis near the anterior part of the iliac crest. Then, the genital branch of the genitofemoral nerve (GFN) was identified in front of the psoas (Fig. 2D). The ureter was also identified as medial to the psoas. Pressing the internal ring from the outside was helpful to confirm the anatomy. After identification of all three nerves, each nerve was resected after placing a clip proximally and distally to close the neurilemmal sheath to prevent neuroma formation (Fig. 2E) [6]. All resected nerve specimens were sent to the pathology laboratory for histologic confirmation. Although a nerve emerged from L2/3 toward the inguinal region (Fig. 2F), the nerve remained in situ.

Pain assessment 3 h after surgery revealed that pain was decreased but remained. We reviewed surgical video clips and posited that the remaining nerve contributed to the residual pain and should be resected. After informed consent was obtained from the patient and his family, reoperation with clipping and resection of the remaining nerve was performed on the same day. Dermatomal mapping on postoperative day 1 revealed numbness and complete elimination of pain (Fig. 3A). The pain relief lasted for a few months; however, another type of pain appeared at the lateral side of the pubis 3 months after surgery (Fig. 3B). This pain might have been nociceptive pain because it was located deep inside the skin and was focal, in one specific place. Although the patient still uses a cane for gait due to lumbar disc herniation, he has otherwise resumed normal life, without any restrictions.

### 3. Discussion

The pathophysiology of chronic inguinodynia differs among patients. Therefore, a systematic and thorough preoperative evaluation to identify the potential causes of pain is mandatory [6,7]. Since 2013, we have treated patients with chronic inguinodynia who had no response to medical treatment according to our refractory chronic pain algorithm, which focuses on distinguishing the type of pain and which may be helpful for simplifying therapeutic intervention [3]. When invasive conservative therapy, including TPB and/or nerve block, is not effective, surgical intervention should be considered. No standardized surgical procedure is available for patients with chronic inguinodynia, and the surgical procedure should be selected according to original repair technique, the patient's conditions, and the nature of the pain. In the presented case, laparoscopic retroperitoneal triple neurectomy effectively reduced pain. The surgical technique details and postoperative outcomes of this procedure have been reported by hernia-specialized centers in the US [6], but there has been no report regarding this procedure in Japan to date.

Neurectomy via the anterior approach is a standard procedure for treating chronic inguinodynia because it allows for simultaneous management of most potential coexisting problems, including allowing removal of mesh and sutures. However, this procedure remains challenging. The risk of vascular and/or vas deferens injuries, disruption of the prior hernia repair, an inability to identify the nerves, and exacerbation of the pain by inadequate surgery represent potential limitations of this procedure [8]. Neurectomy via a laparoscopic retroperitoneal approach offers an advantage in terms of nerve treatment and can be performed proximally to the scarred



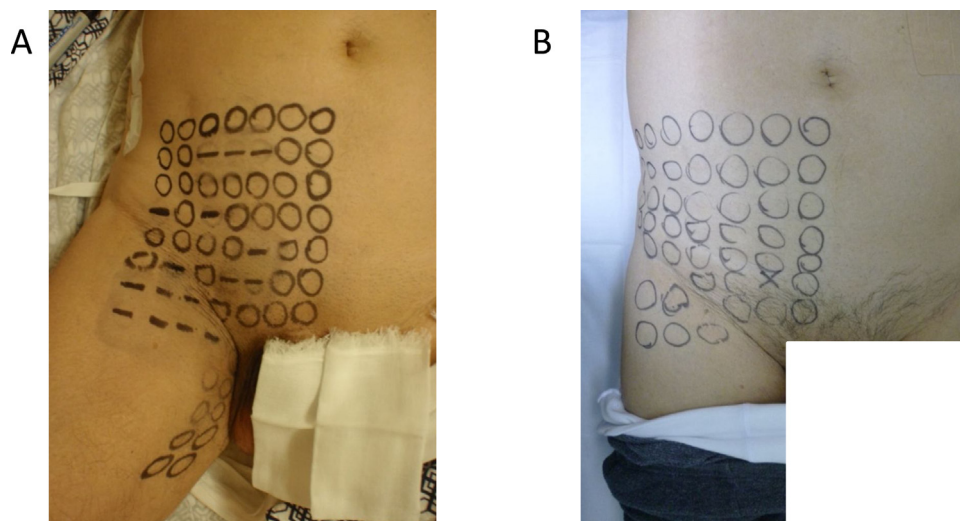
**Fig. 2.** Operative position of the patient (A). A three-port method was used (B). Blue-encircled arrowheads indicate the ilioinguinal and iliohypogastric nerves, which formed a common trunk. The asterisk indicates the quadratus lumborum muscle (C). Green-encircled arrowheads indicate the genital branch of the genitofemoral nerve coursing in front of the psoas. Arrows indicate the ureter (D). Yellow-encircled and orange-encircled arrowheads indicate the distal and proximal stumps of the common trunk of the ilioinguinal and iliohypogastric nerves, respectively (E). Gray-encircled arrowheads indicate the residual nerve emerging from L2/3 and running toward the inguinal region (F).

area. However, this procedure is not effective for patients with meshoma, nociceptive pain, or orchialgia. Furthermore, retroperitoneal neuroanatomy is complicated, and collateral damage due to denervation often develops following surgery. Therefore, the surgical approach and procedure should be selected by taking into account each benefit and shortcoming.

The IIN, IHGN, and GFN emerge from the lumbar plexus, are distributed to the inguinal region and pass through the retroperitoneal space. The neuroanatomy of the retroperitoneal space is complicated given the variation in nerve topography [9]. Retroperitoneal fat pads should be dissected sufficiently to expose the quadratus lumborum muscle and the psoas muscle because the IIN and IHGN run along the anterior surface of the quadratus lumborum muscle [9] and because the GFN is always found directly overlying the psoas muscle [6]. In the present case, the IIN formed a common trunk with the IHGN. Reinpold et al. reported a common trunk for the IIN and IHGN in 18% of 30 formalin-fixed human anatomic specimens [9]. The present case exhibited another retroperitoneal nerve anomaly,

indicating the presence of a nerve that emerged from L2/3 and was distributed to the inguinal region. This nerve might be a branch of the lateral femoral cutaneous nerve, and preservation of this nerve resulted in residual pain and necessitated reoperation. It was unclear whether this nerve was mainly responsible for the chronic inguinodynia. However, all nerves distributed to the inguinal region should be resected given the significant anatomic variation and cross-innervation of the inguinal nerves in the retroperitoneum and inguinal canal [10]. In this context, a thorough understanding of the anatomy of the inguinal nerves is the most important prerequisite for a successful outcome for this surgery. Before performing the procedure, surgeons should attain a thorough understanding of the retroperitoneal neuroanatomy by studying the literature and performing mock surgeries using cadaver models and laparoscopic retroperitoneal nephrectomy.

Potential side effects of this procedure include numbness, abdominal wall laxity from partial denervation of the oblique muscles, hypersensitivity due to deafferentation, testicular atrophy,



**Fig. 3.** Dermatomal mapping on postoperative day 1. Circles indicate normal sensation. Minuses indicate numbness. (A). Dermatomal mapping 3 months after surgery. Circles indicate normal sensation. Crosses are points where the patient felt pain and tenderness (B).

numbness in the labia in females that can interfere with sexual sensation, and loss of the cremasteric reflex in male patients [6,7]. In the present case, numbness and hypersensitivity appeared at the early phase after surgery but gradually diminished in a time-dependent manner. Abdominal wall laxity was not observed on inspection. Pain, which seemed to have a nociceptive cause, appeared 3 months after surgery but did not interfere with the patient's daily life. Moore and Chen reported the outcomes of 62 patients who underwent laparoscopic retroperitoneal triple neurectomy. Narcotic and neuropathic pain medications were eliminated completely in 44 cases, and complete pain relief was achieved in 13 (21%) cases [7]. Hence, pain sensitivity was increased in patients with chronic pain due to the long-term consequences of pain, and therapeutic intervention, including surgery at a high-volume center, did not always result in pain elimination. In the treatment of patients with chronic refractory neuropathic pain and chronic inguinodynia, we should let patients know that surgical intervention does not always result in pain elimination. The treatment goal should be clearly identified by patients and physicians at the initiation of therapy.

In conclusion, we report a successful case of laparoscopic retroperitoneal triple neurectomy. A thorough understanding of the neuroanatomy of the inguinal nerves is necessary to perform safe and effective surgery. Diagnosis of neuropathic pain by thorough preoperative assessment is also vital for the success of this procedure because it is not effective for other types of pain.

#### Conflict of interests

Narita and other co-authors have no conflict of interest.

#### Funding

Narita and other co-authors do not have any sources of funding for our research.

#### Ethical approval

We have already had the written informed consent from the patient for publication of this case report and any accompanying images.

The ethics committee in our hospital considers that it is not necessary to have an ethical approval in such case.

Therefore, we do not have an ethical approval to publish this case report.

#### Consent

Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor of this journal.

#### Authors contribution

- 1) Study conception and design; Narita, Jikihara, and Ikai.
- 2) Drafting manuscript or critical revision of the manuscript; Narita, Jikihara, Ikai, Matsusue, Hata, Yamaguchi, Otani.
- 3) Final approval of the manuscript; Narita, Jikihara, Matsusue, Hata, Yamaguchi, Otani, Ikai.

#### Guarantor

Masato Narita, MD, PhD

Department of Surgery, National Hospital Organization Kyoto Medical Center, 1-1 Fukakusa-mukaihata-cho, Fushimi-ku, Kyoto, 612-8555, Japan.

E-mail: [narinari@kuhp.kyoto-u.ac.jp](mailto:narinari@kuhp.kyoto-u.ac.jp).

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