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HOW I DO IT - SPINE - OTHER

How I do it? Full endoscopic lumbar rhizotomy for chronic facet joint pain due to failed back surgery syndrome

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Abstract

Background Failed back surgery syndrome (FBSS) is a general term for persistent postoperative back pain with or without accompanying radicular pain. FBSS may present as chronic facet joint pain.

Methods We introduced full endoscopic lumbar rhizotomy for patients suffering from facet joint pain due to FBSS. Facet joint block was introduced into the facet joint to determine whether pain improved after the injection.

Conclusion With full endoscopic lumbar rhizotomy, the surgeon can identify the regions involved more clearly and directly. Although it is an invasive procedure, it provides a more effective and safe treatment for patients with FBSS-related facet joint pain.

Keywords Facet joint pain · Failed back surgery syndrome · Endoscopic lumbar rhizotomy · 3D navigation

Relevant surgical anatomy

1. The facet joint provides stability to the whole vertebral complex and may serve as the potential source of pain after any lumbar spinal surgery [1, 2]. Each facet joint is innervated by the medial branch from two adjacent dorsal rami (Fig. 1).
2. The medial branch runs tightly at the lateral border of the superior articular process of the lower vertebra then enters the fibro-osseous canal bounded by the accessory process, the mammillary process, and the mamillo-accessory ligament (Fig. 1). Finally, it descends laterally along the lamina and supplies the medial and superior aspects of the facet joints [6].
3. Before exiting the fibro-osseous canal, the medial branch also contributes small branches, innervating lateral and inferior aspects of the facet joint [6].

Description of the technique

Preparation

The operation is performed in a hybrid operating room with a three-dimensional robotic arm system (ARTIS pheno, Siemens Healthineers, Erlangen, Germany). The patient lies prone on a radiolucent table. Only local anesthesia is required during the whole operation. After draping following aseptic technique, iodine-impregnated incision drapes fix the reference frame layer by layer on the surgical drapes firmly to ensure navigational accuracy (Fig. 2a).

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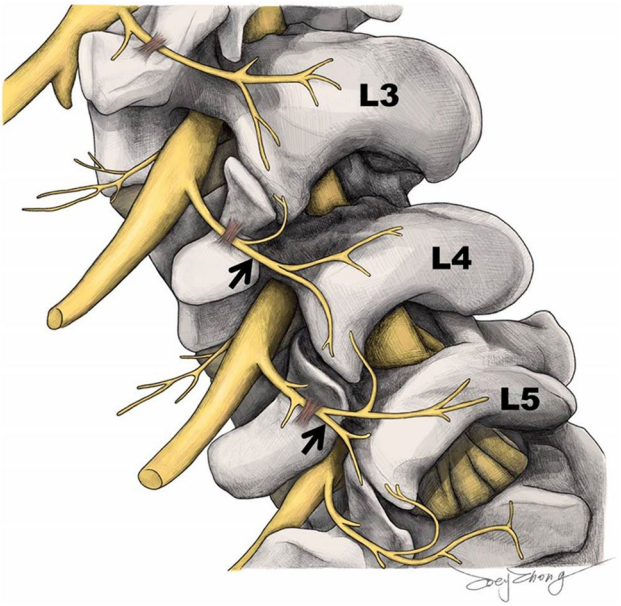

Fig. 1 Relative anatomy of the medial branch from the dorsal ramus. Each facet joint is innervated by the medial branch (arrow) from two adjacent dorsal rami that runs tightly at the lateral border of the superior articular process of the lower vertebra then enters the fibro-osseous canal under the mamillo-accessory ligament

Imaging and image processing

The patient is asked to stay still when the three-dimensional robotic arm system (ARTIS pheno, Siemens Healthineers) is working. Constructed intraoperative virtual images of the lumbar spine are automatically registered into the image-guided surgery platform (Buzz™ Digital O.R, Brainlab, Munich, Germany).

Registration of the navigation system

For registration, a 5-mm obturator with navigating trackers was inserted into the relevant size of the calibrating device. After registration, the navigating pointer was placed near the reference frame to confirm navigational accuracy (Fig. 2b) [5].

Working cannula docking

An entry point was determined at the root of the L3 transverse process with a navigating pointer. After local anesthesia was injected, an approximately 6-mm stab incision was made at the entry point. A working cannula (inner diameter, 5.4 mm) was integrated with the obturator. The obturator-working cannula composite was then inserted toward the fibro-osseous canal. The tip of the obturator was positioned upon the transverse process. After re-confirming the insertion at the appropriate location with the navigation system (Fig. 3), the obturator was removed. A 30° spinal endoscope with a diameter of 5.3 mm (SpinEndos GmbH, Munich, Germany) was inserted.

Fig. 2 Confirming the navigational accuracy. **a** The reference frame (arrowhead) was fixed on the surgical drapes by the layers of iodine-impregnated incision drapes. **b** The navigating pointer (arrow) was placed near the reference frame to confirm the navigational accuracy. Cr, cranial side; Ca, caudal side

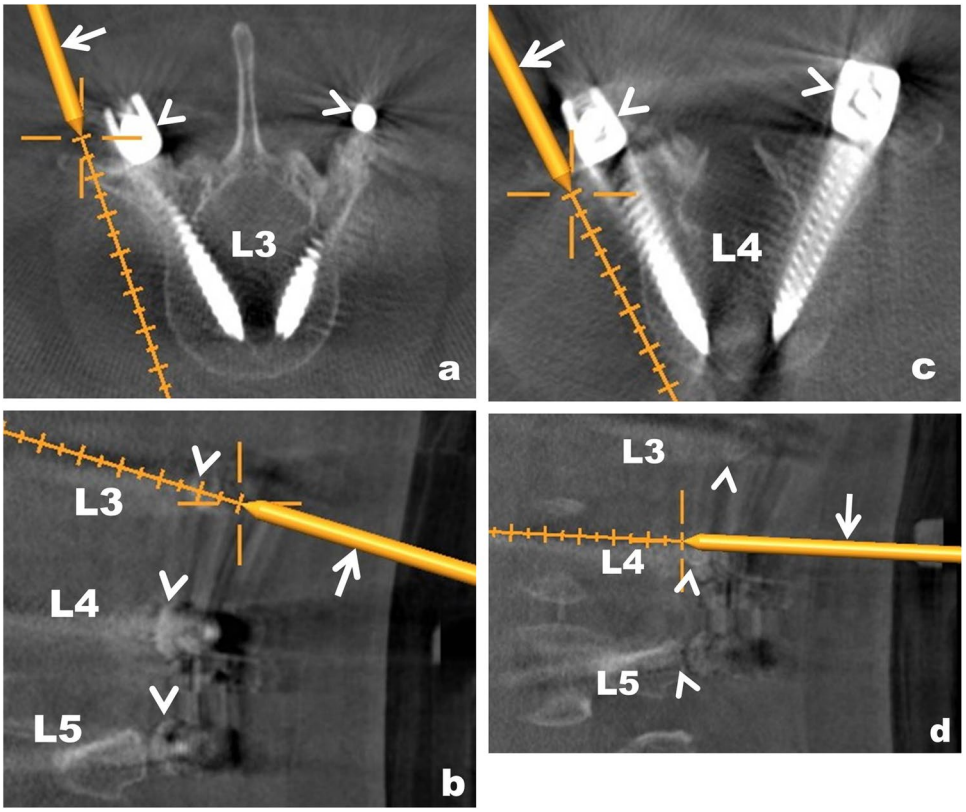

Fig. 3 Axial (**a**, **c**) and sagittal (**b**, **d**) views of the lumbar. These views ensure the proper positioning of the obturator tip (arrow) on the transverse process toward the fibro-osseous canal. Arrowhead indicates the previous pedicle screw

Full endoscopic lumbar rhizotomy

The endoscopic procedure was performed with continuous saline irrigation. A bipolar coagulation system (Vantage Biotech Co., Ltd., Taoyuan, Taiwan) is used to achieve hemostasis. First, the soft tissue was dissected medially through the root of the transverse process toward the fibro-osseous canal. While the median branch was visible, the endoscopic punch is used to cut the nerve (Fig. 4a, b). If the median branch could not be visualized due to scar tissue from a previous operation, more soft tissue was removed to identify the mamillo-accessory ligament and the pedicle screw that was fixed at the mamillary process (Fig. 4c, d). The residual nerve stump and the surrounding soft tissues were also ablated with the bipolar tip and cut with the endoscopic punch until the patient reported that the triggered pain had subsided. Since the patient presented symptoms with L4–L5 facet joint pain, the same technique was performed at the L3 and L4 medial branches that innervated the affected facet joint (Fig. 1).

Endpoint of the procedure

After repeated procedures, we checked the triggered pain by pressing the location immediately over the facet joints to confirm low back pain relief, as conveyed by the patient during the operation. The incision wound was closed with a simple suture with 4–0 vicryl.

Indication

The patient was diagnosed with FBSS due to facet joint syndrome and underwent treatment failure after 6-week conservative treatment such as medial branch block and medication control [7].

Limitations

1. Other causes of FBSS still need to be ruled out. The efficacy of the procedure may be limited due to the potential risk of multifactor FBSS.
2. A navigation system was acquired to ensure precise positioning.

How to avoid complications?

1. Clear communication to the patient for them to stay still during the operation.
2. Ensure that the navigated reference is fixed by the drapes and does not shift during the operation.

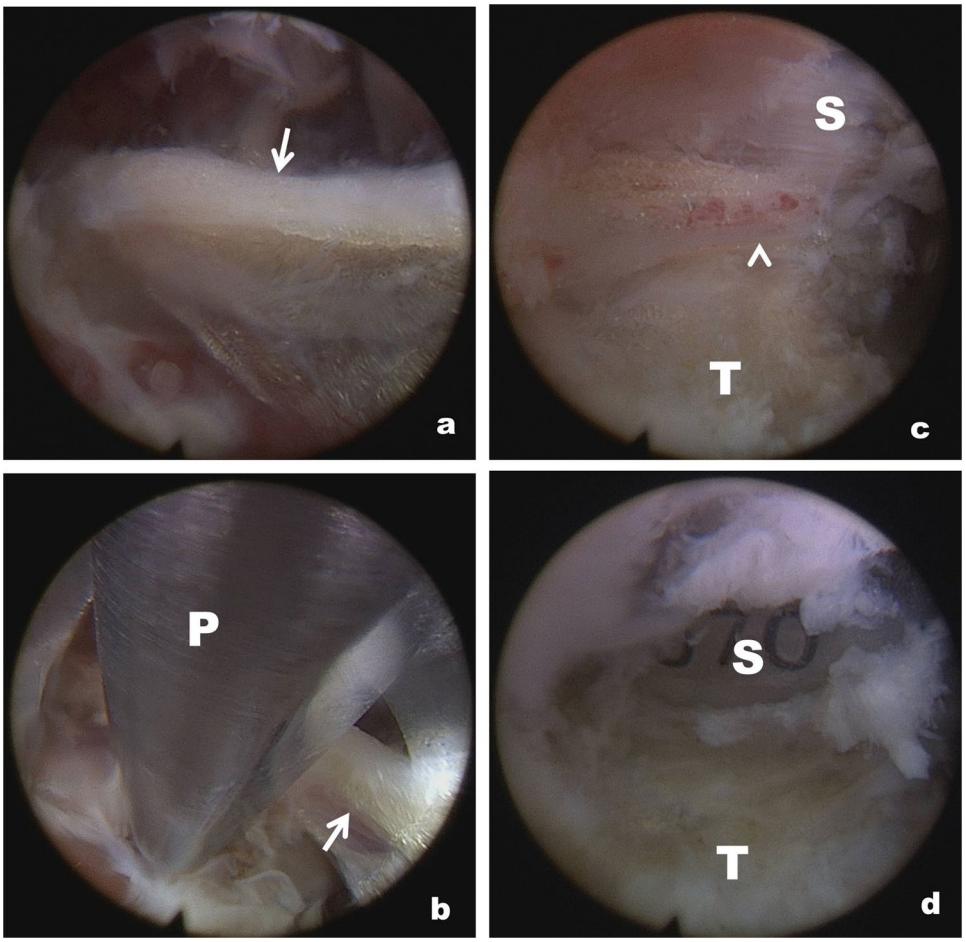

Fig. 4 Intraoperative endoscopic view. **a** The medial branch (arrow) is confirmed by endoscopic visualization. **b** The micropunch (P) is used to perform rhizotomy on the nerve (arrow). **c** The surrounding soft tissues and the nerve stump (arrowhead) involved by the pedicle screw (S) are also visible. **d** After adequate tissue removal, the pedicle screw (S) was more clearly visualized. T, transverse process

3. If the patient complains of extra pain or numbness that radiates to the lower extremities during the operation, stop the operation immediately and reevaluate the orientation of the insertion.

Specific perioperative considerations

1. A complete history and physical examination should be performed at the outpatient department. A response of pain relief to facet joint block can help the diagnosis.
2. If the patient can ambulate immediately after the operation, he/she may be discharged after a short observation period conducted to rule out any immediate complications.

Specific information to give to the patient about surgery and potential risks

1. Possible complications, such as prolonged hematoma, wound infections, or injury to adjacent motor nerves, should be clearly communicated to the patient.
2. The medial branch still innervates the multifidus muscles that contribute to lumbar stability. Postoperative low back pain may occur with prolonged periods of standing and bending [3, 4]. Referred to the rehabilitation outpatient care for muscle reinforcement may be considered after the surgery.

Conclusion

Facet joint pain due to FBSS may be difficult to approach due to its complicated anatomy. With full endoscopic lumbar rhizotomy, the operator can identify the involved anatomical regions more clearly and directly. Although it is more invasive compared with other therapies, it provides a safer and more effective treatment for patients with FBSS-related facet joint pain.

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Declarations

Conflict of interest The authors declare no competing interests.

Disclosure The corresponding author is the director of the Taiwan Society of Minimally Invasive Spine Surgery.

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Key points 1. Chronic facet joint pain is a potential cause of FBSS. Improved low back pain after facet joint block may help in the diagnosis.

2. Each facet joint is innervated by the medial branch from two adjacent dorsal rami that runs tightly at the lateral border of the superior articular process of the lower vertebra, then enters the fibro-osseous canal under the mamillo-accessory ligament.

3. The indication for full endoscopic lumbar rhizotomy requires that the patient was diagnosed with facet joint syndrome and experienced treatment failure after a 6-week conservative treatment.

4. With the navigation guidance system, the operator can confirm the insertion at the correct position safely and efficiently.

5. The incision is determined at the root of the lumbar transverse process, then the obturator-working cannula composite is placed through the incision toward the fibro-osseous canal.

6. While the median branch is visible through the endoscope, the endoscopic punch is used to cut the nerve.

7. If the median branch could not be visualized due to scar tissue from a previous operation, additional portions of the surrounding soft tissue and nerve stump involved by pedicle screws need to be removed.

8. The end point of the operation was to check the triggered pain by pressing on the spot immediately over the facet joint to confirm low back pain relief as reported by the patient.

9. After the operation, the patient can ambulate immediately.

10. The medial branch still innervates the multifidus muscles that contribute to lumbar stability. Postoperative low back pain may still occur if standing for long periods. Referred to the rehabilitation outpatient care for muscle reinforcement may be considered after the surgery.