

Endoscopic Sacrolumbar Facet Joint Denervation in Osteoarthritic and Degenerated Zygapophyseal Joints



Sebastian G. Walter, M.D., Frank Alexander Schildberg, Ph.D., and Yorck Rommelspacher, M.D.

Abstract: Chronic low-back pain (CLBP) has an increasing incidence and yields a tremendous health economic burden. There are different anatomic structures that may be responsible for CLBP, such as lumbar intervertebral discs, sacroiliac joints, nerve root dura, fascia, ligaments, and muscles. However, to a large extent, CLBP is associated with structural changes in and around the facet (zygapophyseal) joint. If conservative treatment strategies fail, symptoms and pain can effectively be reduced by denervation or rhizotomy of the medial branch of the dorsal ramus of the spinal nerve through radiofrequency ablation. In this technical description with video, we present an endoscopic technique for radiofrequency rhizotomy. This technique has the advantage of directly visualizing the facet joint as well as its surrounding structures including the medial branches.

Chronic low-back pain (CLBP) has a prevalence of 3% to 10% and is associated with depression, immobilization, and inability to work.¹ This is particularly true for elderly patients, and thus the incidence of CLBP will further increase for demographic reasons.² Therefore, CLBP is of great health economic relevance.³

There are different structures that may be responsible for CLBP, such as lumbar intervertebral discs, sacroiliac joints, nerve root dura, fascia, ligaments, and muscles. However, the lumbar facet (zygapophyseal) joints (FJs) are a major reason for CLBP.⁴

According to the National Institute for Health and Care Excellence, patients with CLBP should primarily be provided with information and advice to self-manage at all steps of the treatment pathway and should be encouraged to return to work and normal activities of daily living. In cases of specific episodes of low-back pain, group exercise programs, manual treatment, and psychological therapy should be considered. If these

measures fail, pharmacologic therapy and concomitant physical and psychological therapy are indicated. In cases of therapy-refractory pain, radiofrequency (RF) ablation of the dorsal medial branch and surgical approaches such as fusion become relevant.⁵

Although there is almost no evidence of the effectiveness of intra-articular or periarticular FJ infiltration as treatment (steroids [e.g., cortisone] and local anesthetics [e.g., bupivacaine]), it remains a widespread standard.^{4,6,7} Yet, there is evidence that this technique may serve accurate diagnostic purposes if performed correctly.⁸ Thus, positive infiltration (i.e., essential pain relief within 3 hours after infiltration) is commonly performed before RF thermocoagulation of the FJ.

RF can be performed either under radiologic control or endoscopically. The latter poses several advantages that will be explained later.

Surgical Technique

Informed consent was obtained from the patient involved in this study. Before intervention, patients have to respond to periarticular infiltration (medial branch of the dorsal ramus of the spinal nerve blockade) with symptomatic pain relief within 3 hours after injection. Furthermore, other pathologies (vertebral body fractures, malignancies, and so on) have to be excluded clinically and radiologically before FJ denervation. In addition, contraindications have to be assessed preoperatively (Table 1).

For surgery, patients undergo local anesthesia with concomitant sedation or undergo general anesthesia.

From the Department for Orthopedic Surgery, University Hospital Bonn, Bonn, Germany.

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Address correspondence to Sebastian G. Walter, M.D., Department for Orthopedic Surgery, University Hospital Bonn, Sigmund-Freud-Strasse 25, 53127 Bonn, Germany. E-mail: Sebastianwalter01@gmail.com

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Table 1. Overview of Indications and Contraindications for Endoscopic Facet Joint Denervation

Indications	Contraindications
Chronic low-back pain	Current anticoagulation
Facet joint hypertrophy	Negative preoperative infiltration testing
Facet joint arthritis	Use of monopolar radiofrequency probe if patient has pacemaker
Postdiscectomy syndrome	Other pathologies (e.g., tumors) at indicated spine level
Cervical spinal trauma	

Patients are then placed in the prone position, having the lower back slightly flexed by placing a pillow underneath the abdomen (Table 2). For better intraoperative orientation, the spinal axis should be positioned in a straight manner, with the spinous processes in line and centered between the pedicles in the anteroposterior projection (Fig 1). The correct FJ is located by fluoroscopy in the anteroposterior projection as well. Subsequently, an awl or trocar is inserted into the transverse process with inclination toward the FJ. This position of the trocar is controlled by fluoroscopy, and the trocar is exchanged for a working tube. Eventually, a multi-scope device (Multiscope Combo; Joimax) is introduced through the working tube (depending on the manufacturer, there may be working tubes with different apertures for better situation-adaptable handling). The opening of the working tube is oriented medially toward the FJ. For better orientation, the mamillo-accessory ligament is a suitable landmark as the FJ-innervating ramus is found medially and in a perpendicular direction (Fig 2). The medial branches of the dorsal ramus of the spinal nerve run along the medio-cranial border of the transverse process, as well as the lateral margin of the FJ, and are embedded in fatty tissue. An RF probe (Vaporflex; Joimax) is inserted. Subsequently, the nerve branches innervating the FJ are severed carefully and under visual control. In the case of a poor overview and for removal of loose, fatty tissue, forceps are the instrument of choice. Bleeding can be controlled and stopped with the RF probe by ablating and vaporizing the tissue containing the damaged blood vessels. For the success of the operation, the surgeon has to dissect the branches from both medial rami. One ramus originates at the level of the FJ, and the other descends from the level above (Fig 3-5). However, one cutaneous portal is sufficient to cover both branches and even both adjacent ipsilateral FJs by inclining and rotating the working tube. Once the FJs on 1 side are dissected, the procedure is repeated on the contralateral side. When the FJs have been liberated sufficiently and the nerve branches severed, the instruments are removed and the wound is closed by single stitches and covered with a sterile wound dressing (Video 1).

Experienced surgeons need approximately 30 minutes to perform this intervention at 4 FJs.

Postoperatively, patients are mobilized without restrictions by physiotherapy. If patients are not mobilized completely, they are prescribed low-molecular-weight heparin for thrombosis prophylaxis. The sutures are removed on the twelfth postoperative day. Patients are encouraged to strengthen their spinal and abdominal musculature and, if necessary, to lose weight to prevent further progression of degenerative processes at the lumbar spine. Furthermore, they are instructed to avoid heavy lifting.

Discussion

Different techniques have been described for the interventional treatment of low-back pain. Bogduk⁹ first described the so-called nerve-entrapping technique. In this technique, the mamillo-accessory ligament is cut under endoscopic control as it impinges on the medial branch of the dorsal ramus of the spinal nerve. Furthermore, there are reports on techniques in which the joint capsule of the FJ is opened and bony as well as soft-tissue portions can be addressed. This may be important when infection of the joint is suspected or when the joint is hypertrophic and shall be reduced in size. In addition, an endoscopically controlled puncture can be performed in cases of severe joint effusion. Haufe and Mork¹⁰ described such an endoscopically controlled technique that regularly dissected the FJ capsule and denuded the joint's surface by use of a holmium laser. They argued that their technique would result in longer-lasting pain reduction compared with other techniques because the nerve's capability of regenerating is counteracted by removing the nerve's endplate. This view is not sufficiently backed up by their data, but they found enduring pain relief only in patients treated endoscopically whereas patients undergoing RF ablation reported a return of pain some months after intervention. It is noteworthy that no single complication occurred during the endoscopic intervention itself and the rate of complications was very low overall (1.1% with failed suture). Two studies describing kryorhizotomy reported partially

Table 2. Principal Sequence of Intraoperative Steps for Endoscopic Facet Joint Denervation

1. Perform preoperative clinical and radiologic assessment
2. Place patient in prone position
3. Identify correct facet joint level by fluoroscopy
4. Insert trocar into transverse process
5. Perform insertion of Multiscope and in situ orientation
6. Perform insertion of radiofrequency probe and preparation of facet joint environment
7. Transect both dorsal medial rami innervating 1 facet joint
8. If necessary, rotate instruments through to adjacent ipsilateral facet joints or repeat procedure on contralateral side
9. Perform extrusion of instruments and wound closure
10. Perform postoperative mobilization and physiotherapy

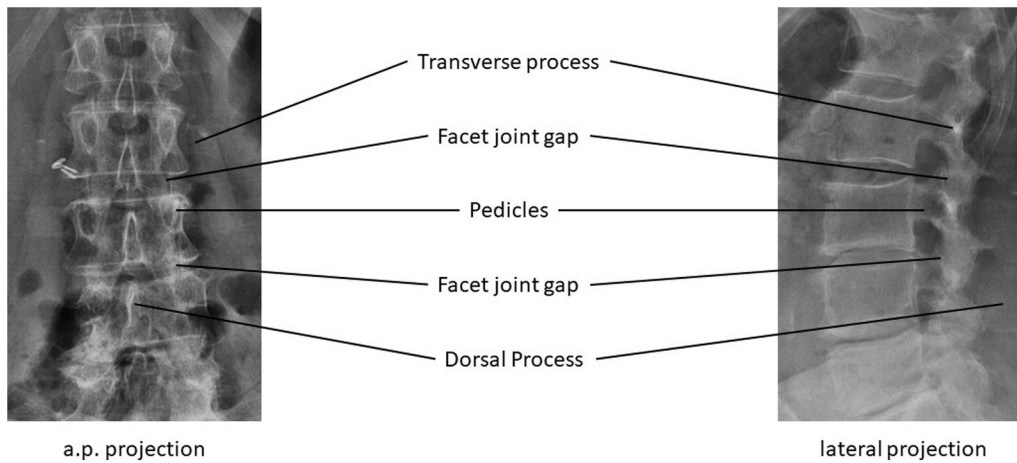


Fig 1. The patient is placed in a prone position. Anteroposterior (a.p.) and lateral radiographs showing principal landmarks for intraoperative orientation when performing endoscopic facet joint denervation. These are essential for the correct placement of the Multiscope and Vaporflex.

dissenting postoperative pain reduction rates^{11,12}: Pain relief was reported in 85% versus 40% of all patients who had not undergone previous spine surgery. However, both studies described a significantly diminished analgesic effect of kryorhizotomy when repeated. Similar pain reduction rates were observed in studies reporting on classic RF ablation.¹³⁻¹⁵ In these studies, 41% to 71% of patients reported sustained pain relief for up to 22 months. In addition, similar pain reduction or relief (81% at 1-year follow-up) was observed in CLBP patients treated by laser irradiation of

the FJ capsule.¹⁶ A more recent study experimented with 3-dimensional navigation for endoscopic rhizotomy, yet it remains unclear whether this technique yields better outcomes.¹⁷

From the current point of research, it remains questionable whether these studies are truly comparable. First, regarding the inclusion criteria, the definition of CLBP was interpreted liberally and preoperative diagnostics were different. Thus, the patient groups may not be comparable. Second, the study designs differed, and studies were performed in a time frame of 30 years in which technology has vastly developed.¹⁸

The endoscopic technique described in this report is predestinated as virtually the complete environment of the zygapophyseal joint is featured and thus anatomic abnormalities as well as small side branches of the dorsal ramus of the spinal nerve can be detected and



Fig 2. Anteroposterior projection of the lumbar spine. The correct positions of the trocar (T) and, eventually, the Multiscope and Vaporflex are controlled by fluoroscopy. The landmarks are in a straight, nonrotated line built by the dorsal process (D), as well as the transverse process (asterisk).

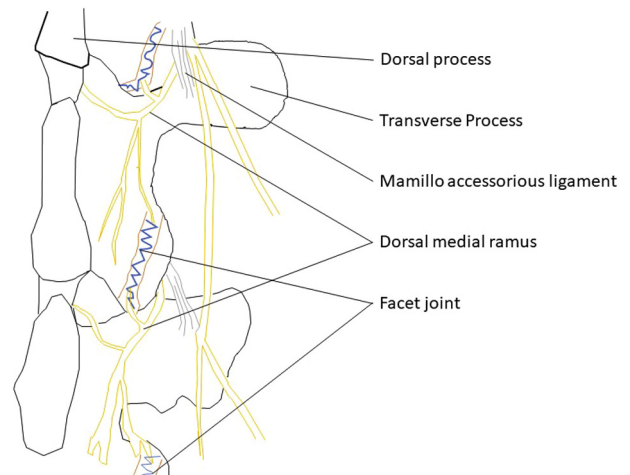


Fig 3. Innervation of zygapophyseal joints by 2 medial branches: 1 originating at same level and 1 descending from level above. As a result, rhizotomy at the same level may not be sufficient for complete pain relief.

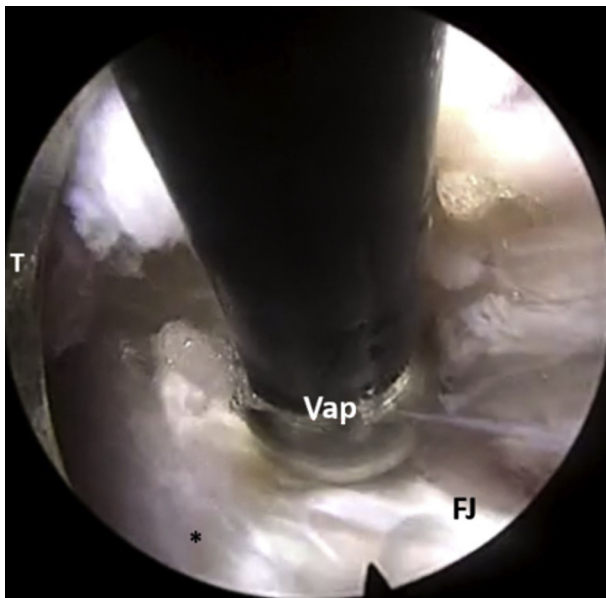


Fig 4. Intraoperative view of the facet joint (FJ), which is denervated by the Vaporflex (Vap) radiofrequency probe. The latter is introduced through a 7-mm trocar (T) into the transverse process (asterisk). The intraoperative measure of operative success is the liberation of soft tissue and thus the medial branch of the dorsal ramus of the spinal nerve from the FJ.

severed (Table 3). Studies investigating the long-term results of this technique are ongoing. Further research is needed comparing other described techniques and endoscopic rhizotomy for cost-effectiveness.

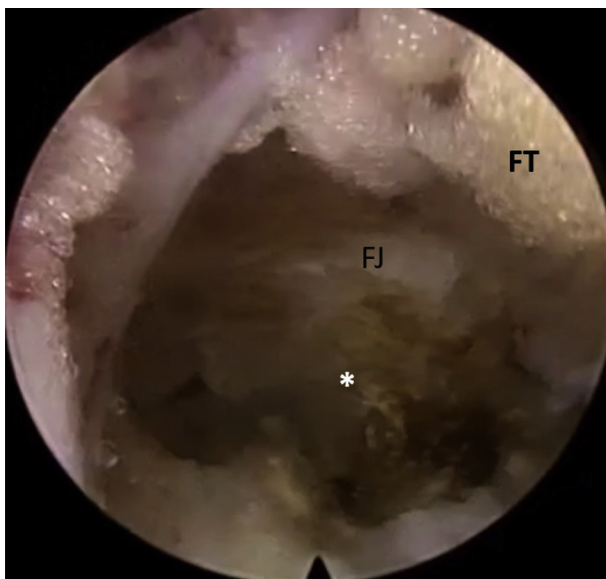


Fig 5. Intraoperative view after successful denervation of facet joint (FJ). Soft tissue and fatty tissue (FT) have been removed from the joint, and the transverse process (asterisk) can be seen clearly. Some surgeons prefer to release the FJ capsule to ensure enduring denervation, whereas others prefer to leave the capsule intact for biomechanical reasons.

Table 3. Pearls and Pitfalls of Endoscopic Facet Joint Denervation

Pearls	Pitfalls
Short and minimally invasive intervention	Possible recurrence of symptoms
Outpatient surgery possible	Possibility of infections
No or minimal blood loss	Possible damage to blood vessels as well as nerves with sensorimotor deficits
Possibility of sustained therapeutic success for years	Postoperative wound pain for a few days
Local anesthesia possible	
Direct visual control and ensured denervation of both medial branches	

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