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Different [Minimally Invasive Spine Surgery](#) are used to treat [lumbar disc herniation](#). It is important to differentiate these techniques due to their specific effects and the disparate technical issues associated with each. This report describes a successful case involving the use of mechanical decompression in conjunction with [radiofrequency](#) ablation to treat a patient with pain and neurological deficits due to an extruded disk hernia.

A 43-year-old male had magnetic resonance imaging (MRI) demonstrating an extruded disk herniation in the left foraminal region, compression at the left spinal nerve root, and obliteration of the left foraminal entrance of the L5-S1 distribution. In the operating room, sufficient disk material was removed using grasping forceps, and then, the Disc-FX system with a Trigger-Flex probe (Elliquence, Baldwin, NY, U.S.A.) was inserted. Modulation of the annulus was performed in bipolar hemo mode, and nucleus ablation was conducted in bipolar turbo mode within a 1.7-MHz frequency range. Among the available minimally invasive techniques, newly developed technologies may become important treatment options if they enable faster rehabilitation, lower rates of recurrence, shorter hospital stays, and reduced medical costs ¹⁾.

Conventional fluoroscopically guided continuous radiofrequency (CRF) and [pulsed radiofrequency](#) (PRF) lesioning of the medial branch, dorsal ramus, a standard technique to treat facet pain, is compared to an endoscopic visually guided technique.

The endoscopic technique is designed to ablate a larger area of the transverse process where the medial branch crosses to innervate the facet. Endoscopically guided visualization provides confirmation of nerve ablation or transection in the most common location of the branches of the

dorsal ramus innervating the facet joint. Fig. 1 Surgical setup for ablation of the medial, intermediate and lateral branches of the dorsal ramus.

A retrospective non randomized study of 50 initial patients assessed the efficacy of endoscopic rhizotomy. Patients with lumbar spondylosis and facet arthrosis who had at least 50% pain relief by medial branch blocks met the inclusion criteria for the visualized, surgically directed endoscopic technique. A specially designed cannula and endoscope (Richard Wolf, GmbH) (Figure 2) was developed specifically for this purpose. After completion of the initial 50 patient pilot study in 2005, utilizing a low-temperature, ultra-high frequency (1.7-4.0 MHz) bipolar energy radiofrequency source (Elliquence Int, Hewlett, NY) that demonstrated efficacy, 400 subsequent patients were added to this retrospective study by May 2013. The surgical technique refinement was guided by cadaveric variations observed from additional cadaver dissections (Figure 3) and endoscopic visualization of foraminal nerves that revealed variable locations of the dorsal ramus, including the medial branch. The anatomic variations supported a need for visualized rhizotomy. The inclusion criteria also involved increasing the percentage of back pain relief from medial branch blocks to a base of 75% estimated improvement in order to overcome the variable subjectiveness of a 50% improvement threshold that served to disappoint a small percentage of patients who overestimated the reported 50% improvement in hopes that they would qualify for the endoscopic guided procedure. Fig. 2 Richard Wolf YESS Rhizotomy Set. The cannulas, endoscope, bitip and surgical bipolar RF probes by Elliquence are configured ergonomically to provide excellent focal length imaging to keep image in focus with the endoscope scope resting on cannula. The bitip probe cuts tissue, and the RF probe thermally ablates tissue efficiently. Fig. 3 Cadaver dissection of the dorsal ramus and its branches outlining the areas where branches of the dorsal ramus may be visualized and ablated before it reaches the facet joint.

At one year follow-up in the initial study design, VAS improved 6.2-2.5, and ODI 48-28. All patients had VAS improvement equal or greater than injection. The results remained constant with additional surgical cases that continued to improve when technique and visualized rhizotomy allowed for greater surgical exploration and ablation of the targeted zone where more than just the medial branch could be ablated. Approximately 10 percent of the patients returned at one and two year follow-up with mild recurrence of their axial back pain, but none to the original level of pain. Additional rhizotomy of the upper lumbar facets provided additional relief in selected patients. CONCLUSIONS / LEVEL OF EVIDENCE 3: The cadaver studies demonstrated considerable variability in the location of the medial and lateral branches of the dorsal ramus. Variability was most common cephalad to L3-4. The dorsal ramus and its nerve branches can also be visualized in the foramen ventral to the intertransverse ligament. Neuromas and entrapment of the dorsal ramus has been identified endoscopically, and confirmed by H and E slides (Figure 4). In the upper lumbar spine, we were not able to find the medial branch to the facets consistently at same location. The nerve to the facet joint did not always cross the transverse process. Some branches enter the facet joint before crossing the transverse process adjacent to the tip of the SAP (Figure 5). The nerve can be mistaken for a furcal nerve or foraminal ligament. Nerve Ablation at above L3-4 levels may require lesioning of the dorsal ramus or targeting the nerve innervation on the facet wall, pedicle or capsule. Fig. 4 This H and E slide of the biopsied specimen is consistent with a peripheral nerve fiber. Fig. 5 This foraminal view of a branch of the dorsal ramus is in the foramen at the level of the SAP. The nerve runs along the ventral lateral aspect of the superior facet to the tip, and can also run in the vicinity of the foraminal ligament. Endoscopic rasps, trephines, Kerrisons, and burrs can be used for foraminoplasty. The nerve should be preserved, if possible, but transection of a branch of the dorsal ramus contributes to axial back pain relief. Branches of the dorsal ramus originates in the foramen before exiting to traverse the transverse process. These nerves are difficult to differentiate from furcal nerves arising from the spinal nerves. Palpating the nerve using local anesthesia can sometimes demonstrate a pain response, but not always, depending on the level of sedation and anesthetic use. CLINICAL RELEVANCE: Endoscopically

guided facet rhizotomy provides more consistent ablation of the medial and lateral branches of the lumbar dorsal ramus compared to radiographically guided pulsed radiofrequency. The variations in the location of facet innervation can explain the variability of clinical results in fluoroscopically guided RF lesioning. This observation dictates a need for visually guided MIS procedure for best results ²⁾.

1)

Beyaz SG, Inanmaz ME, Zengin EŞ, Ülgen AM. Combined Use of High Radiofrequency Disk Ablation, Annulus Modulation, and Manual Nucleotomy in a Patient with Extruded Disk Herniation. Pain Pract. 2016 Jun;16(5):E74-80. doi: 10.1111/papr.12426. Epub 2016 Mar 15. PubMed PMID: 26991910.

2)

Yeung A, Gore S. Endoscopically guided foraminal and dorsal rhizotomy for chronic axial back pain based on cadaver and endoscopically visualized anatomic study. Int J Spine Surg. 2014 Dec 1;8. doi: 10.14444/1023. eCollection 2014. PubMed PMID: 25694936; PubMed Central PMCID: PMC4325504.

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