



## Video Article

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# C7–T1 Full-Endoscopic Posterior Foraminotomy and Sequestrectomy Using Navigation

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The main objective of this case and video is to demonstrate the surgical technique of navigated full-endoscopic decompression and sequestrectomy at the C7–T1 level to alleviate C8 nerve root compression and manage cervicobrachialgia. Cervicobrachialgia resulting from C7–T1 disc herniation is a quite rare yet painful condition that can significantly impair motor function in the upper limb. Traditionally, open surgeries can be invasive, with prolonged recovery times and/or fusion of the level with adjacent segment disease. Posterior full-endoscopic approach offers a minimally invasive alternative that allows for quicker recovery, less postoperative pain, and improved outcomes. By preserving motion, it also prevents adjacent segment disease. A 72-year-old female presented with sudden-onset cervicobrachial pain radiating to the ulnar side of the right arm, coupled with paresthesia and weakness of the flexors/interosseous muscles (Medical Research Council = M3). Magnetic resonance imaging confirmed a large right-sided C7–T1 disc herniation compressing the C8 nerve root. A full-endoscopic C7–T1 posterior foraminotomy and sequestrectomy was performed with navigation. The patient experienced immediate relief from pain and improved motor function in the right hand postoperatively. Posterior full-endoscopic foraminotomy and sequestrectomy of the C7–T1 disc herniation is effective for treating cervicobrachialgia due to C8 nerve compression. The minimally invasive approach demonstrated in this video highlights the technique and stresses the advantage of navigation in the lower cervical spine.

**Keywords:** C7–T1 disc herniation, Cervicobrachialgia, Endoscopic sequestrectomy, Minimally invasive surgery, Navigation

## INTRODUCTION

Cervical disc herniations are a common cause of radiculopathy. Although anterior approaches are frequently performed to decompress the nerve root while removing the intervertebral disc (IVD), posterior approaches may spare the IVD. Full-endoscopic posterior foraminotomy (FEPCF) has recently been introduced as the most minimally invasive posterior approach. We describe a case of cervicothoracic disc herniation treated by FEPCF under navigation.

## CASE REPORT

### 1. Patient History

A 72-year-old female, was known for hypertension, hypothyroidism, allergic asthma, and previous lumbar disc herniation surgery (L4–5). She presented with a sudden onset of cervicobrachial pain 2 weeks prior, radiating from the cervical spine to the ulnar aspect of her right arm. The pain was accompanied by paresthesia in the ring and little fingers (C8 nerve distribution). She reported progressive difficulty gripping objects and performing daily activities, including holding utensils. The patient denied any traumatic incident preceding the symptoms.

## 2. Diagnosis and Preoperative Evaluation

Clinical examination revealed motor weakness in the right arm, particularly in the wrist extension (M4), finger flexion and abduction (Medical Research Council = M3). Sensory testing showed hypoesthesia in the ulnar aspect of the forearm and hand. The absence of myelopathy signs (e.g., negative Hoffman sign) was noted.

A magnetic resonance imaging (MRI) of the cervical spine confirmed the diagnosis of a large right-sided C7–T1 disc herniation compressing the C8 nerve root. There were no signs of myelopathy or spinal cord compression. Conservative management, including analgesics and physical therapy, failed to relieve symptoms, prompting the decision for semiurgent surgical intervention considering the motor impairment.

## 3. Surgical Approach and Procedure

### 1) Preoperative planning

The surgical team opted for a full-endoscopic posterior foraminotomy and sequestrectomy, which allows for faster recovery and prevents fusion. Due to the lower cervical level, as well as patient's anatomy, navigation was used (O-arm, Medtronic, Dublin, Ireland). Detailed review of the MRI ensured proper localization of the disc herniation.

### 2) Patient positioning

The patient was placed in the prone position with the head fixed in a Mayfield clamp, positioned in slight flexion and neck extension ("military tuck") to maintain optimal exposure of the C7–T1 region. A reference frame was attached to the Mayfield clamp, and an O-arm acquisition was made in a nonsterile fashion. Then, O-arm was placed aside and the patient was prepped and draped.

## 4. Surgical Technique

A small (8–10 mm) incision was performed at the C7–T1 level, right-sided just next to the midline under navigation, the dilator was introduced together with the working cannula to create a working channel for the endoscope. To be able to navigate, a "SureTrak" (Medtronic) was attached to both the dilator and the endoscopic drill.

After introducing the endoscope, the C7–T1 joint was identified by removing muscle and identifying the superior and inferior articular process. Then, the medial third of the joint was drilled, keeping the ligamentum flavum as a protection. The facet joint was followed towards the roof of C8 foramen, with the diamond drill. Then, Kerrison punches were used to perform a

FEPF. In order to access the sequester in the axilla of the nerve root, a very small amount of T1 pedicle was then drilled, just enough to place an instrument in the axilla of the exiting nerve root. The posterior longitudinal ligament was opened with a full-endoscopic scissor, and the herniated disc material compressing the nerve root was visualized and carefully removed with a pituitary rongeur. A pituitary rongeur is the preferred instrument, with the mouth oriented towards posteriorly, in order to avoid pinching the dura. Importantly, no ligamentum flavum was removed during the surgery. Hemostasis was achieved with Surgiflow (Johnson and Johnson, Zuchwil, Switzerland) applied through the working cannula under vision, and the incision was closed with absorbable sutures.

## 5. Rationale and Alternatives

The full-endoscopic posterior approach was chosen for its advantages over traditional open surgery, including less muscle dissection, reduced postoperative pain, and faster recovery. Alternative approaches, such as open decompression or anterior cervical discectomy and fusion (ACDF), were considered less valuable options. Because of the lower cervical level and patient's anatomy, making x-ray guidance suboptimal, O-arm navigation was used.

This technique allowed effective and safe decompression of the C8 nerve root with the most minimal invasiveness, ensuring a positive outcome.

We obtained consent of the patient for the use of the surgical video.

## DISCUSSION

### 1. Clinical Relevance of the Procedure

The full-endoscopic C7–D1 foraminotomy and sequestrectomy demonstrated in this video is highly relevant for the management of cervicobrachialgia due to C8 nerve root compression. Disc herniation at the C7–D1 level, although less common, can result in significant upper extremity dysfunction and pain, as seen in this patient.<sup>1,2</sup>

The endoscopic approach offers a minimally invasive solution, allowing for precise decompression of the nerve root with minimal collateral tissue damage, faster recovery, and prevents unnecessary fusion compared to traditional open surgeries.<sup>2–8</sup> O-arm navigation is used for cases where fluoroscopy does not permit to safely and precisely monitor the operated level. This is mainly the case for lower cervical spine (especially in short-neck, obese patients) or in the thoracic spine.

## 2. Advantages of the Endoscopic Approach

The primary advantage of the endoscopic technique is its minimally invasive nature, which results in:

- Reduced postoperative pain: muscle dissection is minimized, leading to less tissue trauma and quicker pain resolution.<sup>1,2</sup>
- Faster recovery: patients typically experience shorter hospital stays and quicker return to daily activities,<sup>2</sup> as seen in this case where the patient was discharged 2 days postoperatively and began rehabilitation soon after.
- Lower risk of complications: endoscopic procedures typically reduce the risk of complications such as infection, scarring, and adjacent segment disease compared to more invasive techniques.<sup>2,3,9</sup>

## 3. Comparison with Alternative Techniques

ACDF is a common alternative for treating cervical disc herniation. While effective, it involves greater tissue disruption and the need for fusion, which may result in reduced neck mobility and a longer recovery time. Studies suggest that endoscopic foraminotomy offers comparable relief of radicular pain with less postoperative disability.<sup>3,5,10</sup> However, compared to ACDF, where the segment is fused, recurrence can occur in posterior approaches. Previous papers<sup>9,11,12</sup> showed that foraminal restenosis happens in more than 73% of operated foramina. This is mainly due to bone regrowth, especially if a considerable amount has been resected during surgery.<sup>12</sup> Recurrence of cervical disc herniation is less predictable, although may be increased in very mobile segments (C5–6) and cervicothoracic junction.<sup>9,11,12</sup>

The biportal (endoscope-assisted) technique is an alternative to the monoportal (full-endoscopic) posterior foraminotomy. However, muscle damage is more important than in monoportal foraminotomy. Nevertheless, the impact on postoperative outcome has to be proven.<sup>12</sup> Open posterior foraminotomy is another option, but it requires a larger incision and more extensive muscle dissection, leading to longer recovery times. Recent literature shows that the endoscopic technique provides equivalent outcomes with reduced morbidity and faster recovery.<sup>7,13</sup>

## 4. Challenges and Management

One of the main challenges encountered during endoscopic spine surgery is the limited visualization of the involved level in this case; we used O-arm navigation guidance to ensure precise localization of the herniated disc and nerve root. The surgical team maintained meticulous control of the endoscopic instruments to avoid damaging the spinal cord or exiting nerve root.

Ligamentum flavum preservation and minimal T1 pedicle drilling permitted to ensure maximal safety. Because bone hemostasis may be difficult to perform endoscopically, Surgiflow was used.

## 5. Postoperative Outcome

The patient's postoperative course was uneventful. She reported significant relief from pain and improvement in motor function within days of the procedure. At her follow-up appointment 6 weeks postoperatively, her grip strength and dexterity had improved, and she was able to resume normal activities. Postoperative MRI was satisfactory. There were no complications such as infection, and she continued with physical therapy to further enhance her recovery.

## 6. Educational Value and Impact on Clinical Practice

This video is a valuable educational tool for surgeons learning minimally invasive spine surgery techniques. It highlights the key steps of posterior full-endoscopic foraminotomy and sequestrectomy, demonstrating the precision and control required in such procedures. The video reinforces the importance of preoperative planning, and highlights the use of navigation system for guidance. Endoscopic spinal surgery is gaining popularity due to its favorable outcomes and patient-centered benefits. Videos like this can enhance surgical training, encouraging more widespread adoption of these techniques in the management of cervical disc herniation. This has the potential to improve patient care by offering quicker recovery and reduced postoperative complications compared to traditional surgical approaches.

## NOTES

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