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Unilateral Biportal Endoscopy for Lumbar Spinal Stenosis and Lumbar Disc Herniation

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Published outcomes of this procedure can be found at: *Clin Orthop Surg*. 2019 Mar;11(1):82-8, *J Orthop Surg Res*. 2018 Jan 31;13(1):22, and *Spine J*. 2020 Feb;20(2):156-65.

Investigation performed at Beaumont Hospital, Royal Oak, Michigan

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Abstract

Background: Unilateral biportal endoscopy (UBE) is a novel minimally invasive technique for the treatment of lumbar spinal stenosis and lumbar disc herniations. Uniportal endoscopy was utilized prior to the advent of UBE and has been considered the workhorse of endoscopic spine surgery (ESS) for lumbar discectomy and decompressive laminectomy. However, there are theoretical advantages to UBE compared with traditional uniportal endoscopy, including that the procedure utilizes typical spinal equipment that should be readily available, requires less capital cost and optical instrumentation, and provides greater operative flexibility as a result of utilizing both a working and a viewing portal[7,8].

Description: A 0-degree arthroscope is typically utilized for discectomy and lumbar laminectomies. The use of a radiofrequency ablator is critical to help coagulate osseous and muscle bleeders. For irrigation, gravity or a low-pressure pump, typically <40 mm Hg, can be utilized[9,10]. Further details regarding irrigation pressure are provided in "Important Tips." The use of a standard powered burr is typical to help osseous decompression, and Kerrison ronguers, pituitaries, osteotomes, and probes utilized in open or tubular cases suffice. Two incisions are made approximately 1 cm lateral to the midline. If working from the left side for a right-handed surgeon, the working portal is typically made at the lower laminar margin of the target level. The camera portal is then made typically 2 to 3 cm cephalad. A lateral radiograph is then utilized to confirm the portal placements. From the right side, the working portal is cephalad and the camera portal is caudal. Because of the switch, the portals may be shifted more distally.

The first step is creating a working space because there is no true joint space in the spine. With use of radiofrequency ablation, a working space is created in the interlaminar space. Next, with use of a powered burr or a chiseled osteotomy, the base of the cephalad spinous process is thinned until the insertion of the ligamentum flavum is found. Next, the ipsilateral and contralateral laminae are thinned in a similar fashion. Once the osseous elements are removed, the ligamentum flavum is removed en bloc. The traversing nerve roots are checked under direct high-magnification visualization to ensure that

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they are decompressed. If a discectomy is necessary, standard nerve-root retractors can be utilized to retract the neural elements. With use of a blunt-tip elevator, the anular defect can be incised and the herniated disc can be removed under direct high-power visualization. In addition, a small curet can be utilized to create a defect in the weakened anulus or membrane covering the extruded disc material in order to help deliver the herniated disc material. Epidural veins are coagulated typically with use of a fine-point bipolar radiofrequency device.

Alternatives: Nonoperative treatments include oral anti-inflammatory drugs, physical therapy, and epidural injections; if these fail, alternative surgical treatments include open lumbar laminectomy and/or discectomy, tubular lumbar laminectomy and/or discectomy, and other minimally invasive techniques, such as microendoscopy, uniportal endoscopy, and microscopy-assisted decompression.

Rationale: UBE is a minimally invasive surgical procedure that better preserves osseous and muscular structure compared with open and tubular techniques. Conventional lumbar laminectomy involves dissection and retraction of the multifidus muscle from the spinous process to the facet joint. This exposure can damage the delicate posterior dorsal rami. Long retraction time can also lead to pressure-induced muscle atrophy and potentially increased chronic low back pain. Alternatively, smaller incisions and shorter hospital stays are possible with UBE.

Similar to UBE, tubular surgery can minimize soft-tissue damage compared with open techniques; however, in a randomized trial assessing techniques for spinal stenosis surgery, Kang et al. found that UBE and tubular surgery had similarly favorable clinical outcomes at 6 months postoperatively but UBE resulted in decreased operative time, drain output, opiate use, and length of hospital stay[5].

Furthermore, the use of an endoscope in the biportal technique allows ultra-high magnification of the spinal pathology, decreased capital costs, and the ability to use 2 hands with freedom of movement. UBE provides clear visualization of the neural elements while keeping maximal ergonomic efficiency with the surgeon's head looking straight forward, the shoulders relaxed, and the elbows bent to 90°. Continuous irrigation through the endoscope also helps with bleeding and decreasing the risk of infection.

Expected Outcomes: Long-term outcomes do not differ substantially between discectomies performed with use of the presently described technique and procedures done with more traditional minimally invasive (i.e., tubular) techniques; however, visual analogue scale scores for back pain may be better in the short term, and there is evidence of a shorter hospital stay with UBE[2]. Complication rates did not differ from other minimally invasive techniques. When comparing UBE and stenosis, Aygun and Abdulshafi found that UBE was associated with decreased hospital stays, operative time, and blood loss and better clinical outcomes up to 2 years postoperatively compared with tubular laminectomy[12].

Important Tips:

- The optimal hydrostatic pressure is 30 to 50 mm Hg. Pressure is determined by the distance between the fluid source and the working space. Because the working space does not change, the height of the bag decides pressure. A simple formula for pressure is calculated by dividing the distance from the working field to the irrigation source by 1.36. A rule of thumb is that if the bag is 50 to 70 cm above the patient's back, the pressure should be adequate. The advantages of using gravity rather than a pressure pump are that excessive fluid solution pressure in the epidural space can cause neurological issues such as nuchal pain, headache, and seizure[11]. Additionally, if the intertransverse membrane or the lateral margins of the disc are violated, hydroperitoneum can occur unknowingly due to the high-pressure system.
- Gravity or pump pressure of >40 mm Hg may elevate epidural pressure and mask operative bleeding. When the pump is turned off at the end of the surgical procedure, a postoperative epidural hematoma may occur because the bleeding source may not have been recognized while the pump pressure was on.
- Excessive pump pressure may lead to an increase in intracranial pressure, causing headache or delayed recovery from general anesthesia with stiff posture and hyperventilation.
- Make sure fluid is emerging from the working portal and the muscle area is not swelling to prevent soft-tissue fluid extravasation.

- Epidural veins are coagulated typically with a fine-point bipolar radiofrequency device.
- Osseous bleeding can be controlled with bone wax or a high-speed burr.

Acronyms and Abbreviations:

- MRI = magnetic resonance imaging
- RF = radiofrequency
- AP = anteroposterior

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