

A Novel Surgical Technique to Treat Primary, Recurrent & Far-Lateral Lumbar Herniated Nucleus Pulposus

Mitchell A. Hardenbrook, MD

Naval Medical Center Portsmouth, Portsmouth, Virginia

Introduction

Microdiscectomy is the surgical treatment of lumbar herniated nucleus pulposus (HNP). Indications for surgery include radicular pain unresponsive to non-operative therapy, progressive muscle weakness attributed to an involved nerve root, and cauda equina syndrome. Traditionally, the procedure is performed through a hemilaminotomy with gentle medial retraction of the affected nerve root, incision of the annulus and manual removal of disc material. This procedure provides 85 to 95% good to excellent outcomes in patients with radicular symptoms caused by lumbar disc herniation in the immediate post-operative period.

However, longer follow-up reveals recurrent symptoms of radicular pain in up to one third of the patients¹. This pain can result from recurrent disc herniation or from fibrosis of the nerve root as a result of intra-operative manipulation. Despite optimal patient selection and surgical technique, the recurrence rate of lumbar disc herniation after lumbar microdiscectomy has been reported as high as 26%². Higher rates of recurrence of herniation are reported with larger annulotomies (>6mm).

We hypothesize that the recurrence rate of lumbar disc herniation after microdiscectomy is lower in patients who have a smaller annulotomy, leaving a smaller annular defect after surgery. Additionally, the recurrence of radicular symptoms secondary to neurofibrosis in the absence of recurrent herniation can be decreased in patients who have minimal manipulation of the nerve root during resection of the herniated disc.

Hydrodiscectomy is a modification of the traditional microdiscectomy technique developed at the Naval Medical Center, Portsmouth. Decompression surgery is performed using a cannulated system and a MicroResector (HydroCision; Billerica, MA, USA). The cannula dilates the fibers of the annulus 4 mm, resulting in a decreased annular defect, and the Microresector removes disc material with minimal nerve manipulation. The purpose of this study is to describe the surgical technique and report initial results detailing the effectiveness in treating radicular symptoms secondary to lumbar HNP.

Methods

Hydrodiscectomy is a technique that utilizes a 4 mm cannula to enter the herniated nucleus pulposus, allowing insertion of the MicroResector to remove nuclear material. The technique is effective in treating posterior lateral lumbar herniated discs (contained and non-contained), recurrent herniated discs and far-lateral or extraforaminal herniated discs in the lumbar spine. The surgical approach to the disc space is the same as the traditional microdiscectomy, i.e., hemilaminotomy for posterior lateral herniations and paramedian approach for far-lateral herniations. Once the affected nerve root and herniated disc is exposed and identified, a needle is placed directly into the herniation adjacent to the nerve root (Figure 1). Care is taken to minimize manipulation of the nerve root. A dilator is passed over the needle, followed by the 4 mm working cannula to a depth of approximately 8-10 mm (Figure 2).

The needle and dilator are removed and the MicroResector is placed down the cannula. The MicroResector pulverizes and removes the disc material through an evacuation tube using a high pressure fluid jet using a variety of motions (Figure 3). Once evacuation is complete, the cannula and MicroResector are removed. Adequate decompression of the nerve root is verified with direct inspection and palpation.



Figure 1: Insertion of the needle.

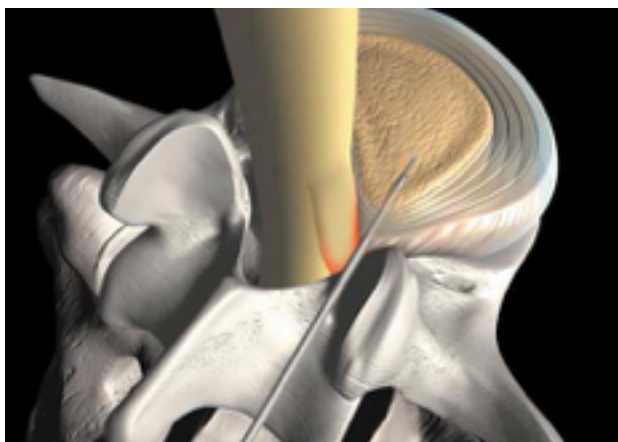


Figure 2: Insertion of the dilator and cannula.

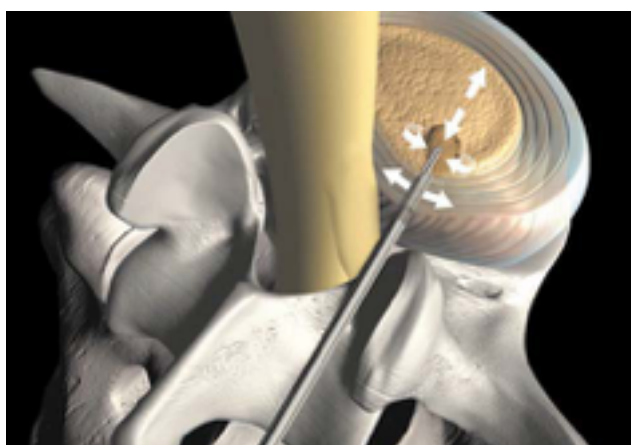


Figure 3: Decompression using the HydroDissectomy system.

initial radiculopathy. Minimization of the need to manipulate the nerve root during decompression may reduce the incidence and severity of epidural scarring. The cannulated system employed in hydrodissectomy allows adequate decompression via a relatively small annular defect (4 mm) and obviates the need to manipulate the nerve root. This potentially reduces the risk of recurrent herniation and epidural scarring. High velocity water pulverizes tissue and removes it via an evacuation tube (Figure 6 and 7). This controlled tissue removal allows safe and effective decompression of HNP to address multiple specific anatomical defects.

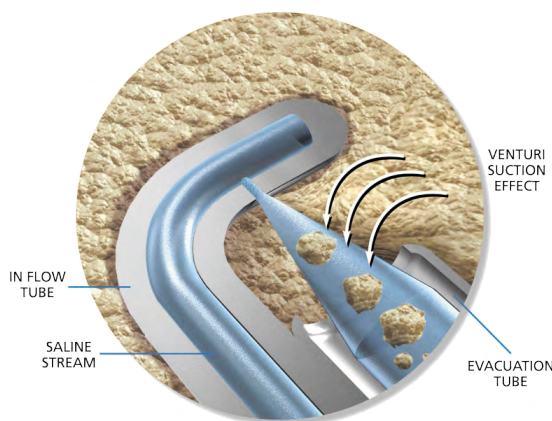


Figure 7: The HydroDissectomy System.

Discussion

More than 60 hydrodissectomy procedures have been performed to date. A review of short-term results on 26 patients, when compared to our series of 34 patients undergoing traditional microdissectomy³, demonstrates a significant decrease in recurrent herniation from 17% to 0%, and a decrease in radicular pain in absence of recurrent herniation from 21% to 4%.

Recurrent leg pain may or may not be indicative of hernia recurrence following microdissectomy. In our series of 34 patients undergoing traditional microdissectomy, 13 (38%) complained of leg pain within one year of follow-up. MRI revealed recurrent hernia in 6 of these patients (17% recurrence rate overall), all of whom required revision microdissectomy, while the remaining 7 patients (21%) had radicular pain with no recurrent herniation. Gadolinium-enhanced MRI confirmed absence of herniation and scarring from epidural fibrosis.

Recurrent leg pain in the absence of recurrent herniations usually begins approximately 6 months following surgery, presenting with symptoms similar to but not as severe as the

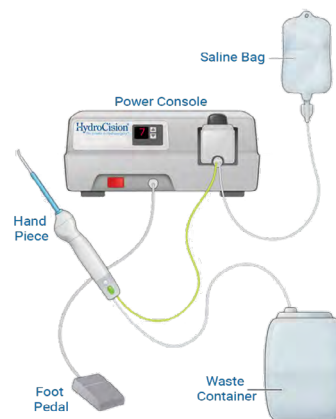


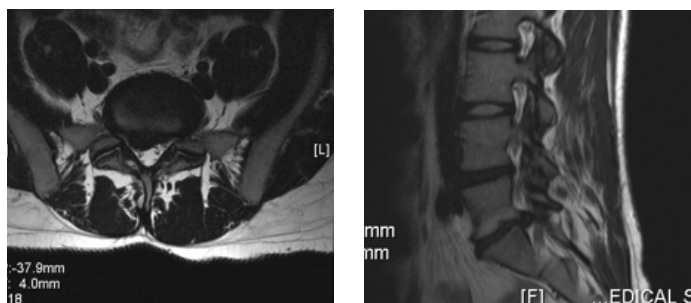
Figure 7: The HydroDissectomy System.

Case Examples

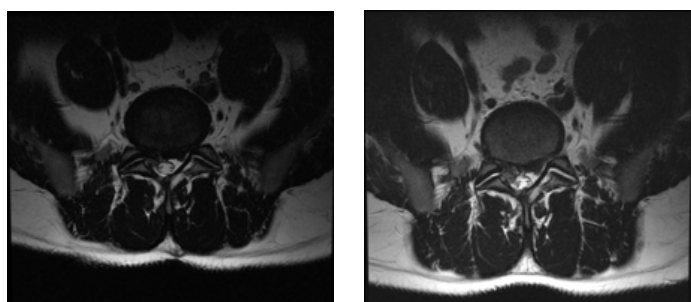
Case 1 is a 34 year old female with a 5 month history of severe right radicular pain. MRI revealed right non-contained L5-S1 HNP with compression of the S1 nerve root (Case Figures 1, 2). She failed to improve with conservative management. Patient underwent hydrodissectomy via a midline incision and left hemilaminotomy. Postoperatively, patient had complete resolution of radicular symptoms.

Case 2 is a 44 year old male complaining of back pain radiating to the right leg. MRI revealed right far-lateral L3-4 HNP with compression of the exiting L3 nerve root. He failed to improve with conservative management. Patient underwent Hydrodiscectomy via a paramedian approach through a tube retractor. Post-operatively, patient had complete resolution of radicular symptoms.

Case 3 is 24 year old male status post traditional right L5-S1 microdiscectomy 9 months previously with recurrence of right leg pain. MRI revealed recurrent right L5-S1 HNP with compression of the S1 nerve root (Case Figures 3, 4). He failed to improve with conservative management. Patient underwent revision hydrodiscectomy through the previous incision and approach. Postoperatively, patient had complete resolution of symptoms.



Case Figures 1 & 2



Case Figures 3 & 4

Conclusion

Hydrodiscectomy successfully and safely decompresses nerve root compression secondary to herniated nucleus pulposus in the lumbar spine. Utilizing this new technology, the size of the annulotomy can be decreased and manipulation of the nerve root is minimized. Hydrodiscectomy successfully resects herniated nucleus pulposus resulting from primary, recurrent or far-lateral disc herniations. Longer term data and prospective controlled trials are needed to confirm these initial results.

References

1. Carragee, et al. A Prospective Controlled Study of Limited Versus Subtotal Posterior Discectomy: Short-Term Outcomes in Patients With Herniated Lumbar Intervertebral Discs and Large Posterior Anular Defect. *Spine* 31(6), 2006
2. Carragee, et al. Clinical Outcomes After Lumbar Discectomy for Sciatica: The Effects of Fragment Type and Anular Competence. *Journal of Bone and Joint Surgery*, 2003;85-A:1:102-108
3. Hardenbrook M, White S, Sukovich W. Hydrodiscectomy: A Novel Approach to Lumbar Microdiscectomy. *AANS/CNS Section on Disorders of the Spine and Peripheral Nerves*, 2007.

Notes

Presented as an educational service by HydroCision, Inc. All trademarks are the properties of their respective owners. Refer to the Instructions for Use before using the SpineJet HydroSurgery System.

Data presented at International Society for Minimal Intervention in Spinal Surgery (ISMISS), Zurich 2007.

The views expressed in this article are those of the authors and do not reflect the official policy or position of the Department of the Navy, Department of Defense or the United States Government.