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Retrospective Review

A Retrospective Evaluation of the Clinical Success of Transforaminal Endoscopic Discectomy with Foraminotomy in Geriatric Patients

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Background: The elderly population is growing in the United States. As the oldest old are projected to be the fastest growing part of the elderly population, we must consider how to best treat their degenerative spine conditions when non-operative treatment fails.

Objectives: Transforaminal endoscopic discectomy and foraminotomy is an ultra-minimally invasive outpatient surgical option that does not require general anesthesia and is available to geriatric. The purpose of this study was to assess the benefit of transforaminal endoscopic discectomy and foraminotomy in geriatric patients with single level and multi-level lumbar disc herniations and lumbar radiculopathy.

Study Design: Retrospective study

Setting: Outpatient surgery center.

Methods: After Institutional Review Board Approval, charts from 50 consecutive patients aged 75 and older with complaints of lower back and radicular pain who underwent one or more endoscopic procedures between 2007 and 2011 were reviewed.

Results: The average pain relief 6 months postoperatively was reported to be 71.8%, good results as defined by MacNab. The average pre-operative VAS score was 9.04, indicated in our questionnaire as severe and constant pain. The average 6 month post-operative VAS score was 2.63, indicated in our questionnaire as mild and intermittent pain.

Limitations: This is a retrospective study and only offers 6 month follow-up data for geriatric patients undergoing endoscopic spine surgery.

Conclusions: Endoscopic discectomy is a safe and effective alternative to open back surgery. The 6-month follow-up data presented here appears to indicate that an ultra-minimally invasive approach to the geriatric spine that has a low complication rate, avoids general anesthesia, and is outpatient might be worth studying in a prospective, longer term way.

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Key words: Endoscopic discectomy, minimally invasive, transforaminal, geriatric

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In the United States the rate of growth of the elderly population has greatly exceeded the growth rate of the population as a whole, and according to the Census Bureau's projections, about one in 8 Americans were elderly in 1994, but about one in 5 would be elderly in 2020 (1). From 1960 to 1994 the oldest old (persons 85 years old and over) increased by 274% versus an increase of 45% for the total population (1). As the oldest old are projected to be the fastest growing part of the elderly population, we must consider how to best treat their degenerative spine conditions when non-operative treatment fails.

With aging, a degenerated intervertebral disc bulges posteriorly, which combined with the thickened

infolding of the ligamentum flavum and hypertrophy of the facets posteriorly, results in narrowing of the lumbar neural foramen and concomitant lumbar radiculopathy in the elderly. When nonsurgical treatment fails, geriatric patients usually only have surgical options that involve general anesthesia available to them.

Transforaminal endoscopic lumbar discectomy is a minimally invasive spinal surgery procedure that was introduced by Kambin and Gellman in 1973 (2). Advances in endoscopic visualization and instrumentation, as well as increased patient demand for more minimally invasive procedures, have lead to an increased popularity of the technique, particularly outside of the United States. Other studies have shown that endoscopic discectomy is a safe and effective alternative to conventional procedures, and has the advantages of being a truly minimally invasive procedure (3-5). The authors describe here their experience with treating geriatric patients, who present with persistent lumbar radiculopathy despite conservative non-operative treatment, with endoscopic discectomy and foraminotomy. A retrospective study on average patient pain relief up to 6 months post-endoscopic discectomy and foraminotomy in patients 75 years old and older is presented.

Methods

Participants

After Institutional Review Board approval, charts from 50 consecutive patients aged 75 and older (mean age of 79.9, 24 women [48%] and 26 men [52%]) with complaints of lower back and radicular pain who received endoscopic discectomy procedures between 2007 and 2011 were reviewed.

Transforaminal Endoscopic Discectomy and Foraminotomy

Patients were selected for treatment based on the results of their MRI, physical exam, dermatomal pain pattern, and favorable response to transforaminal injection. Multilevel cases had multilevel clinical pathology and beneficial responses to multilevel injections.

Patients were positioned in the lateral decubitus position with the operating room table reversed and the flank over the break in the table. A roll was placed under the flank and the table flexed to open the disc space. Anesthesia consisted of mild sedation using Versed (midazolam) and fentanyl and 1% lidocaine local anesthetic. The level of anesthetic was titrated so the patient was able to communicate with the surgeon throughout the procedure. The Joimax TESSYS endoscopic system was used for the procedure. Percutaneous entry was established entering through the skin 8 - 18cm lateral to the midline Using intermittent fluoroscopic guidance, alternating between tunnel view (bull's eye), lateral and anterior-posterior (AP) view, a 25 cm 18 gauge needle was advanced and placed in the disc space through Kambin's triangle, between the exiting and traversing nerves. An AP fluoroscopic view was used so the disc space was not entered before the needle was past medial border of the pedicle. Sequential reemers and, if needed, the Joimax Shrill® shaver drill system were used to enlarge the neural foramen by removing the ventral aspect of the superior facet (Fig. 1). The beveled canula working channel was placed over the sequential dilators. Rotating the canula and endoscope allowed for 360-degree visualization of the annulus and exiting and traversing nerve roots. The technical success of the foraminotomy procedure was

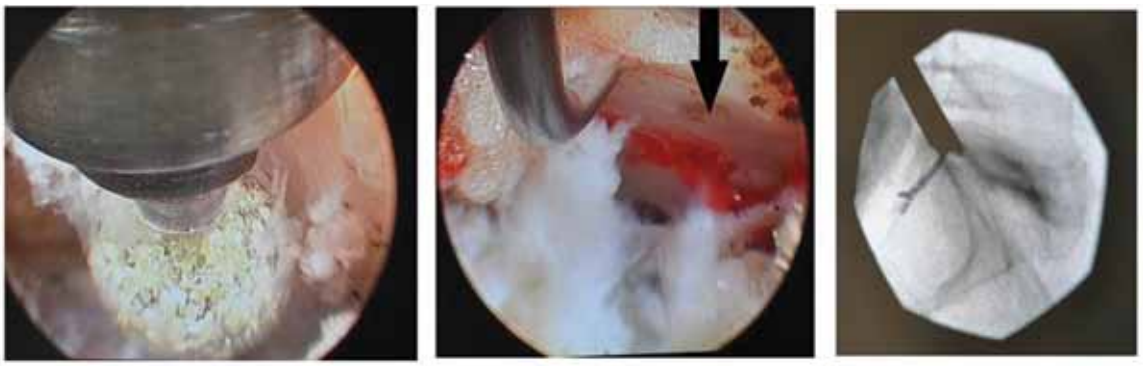

Fig. 1. *Intraoperative views obtained in transforaminal endoscopic discectomies. The left screen shot shows the Shrill® drill enlarging the foramen. The middle screen shot is the scope focused on the nerve (down arrow) and the disc material below. The right fluoroscopic image is the semi-bendable grasper in the epidural space removing and extruded disc fragment behind the sacrum.*

determined by the visualization of the traversing nerve root (Fig. 1). Discectomy was performed with straight, upgoing, and bendable graspers.

Measures

Follow-up sheets were filled out by the patient with each visit indicating the location, severity, and duration of pain. Patients were asked to rate their pain using a 0 – 10 scale, a modified form of the Visual Analog Scale (VAS). Each patient had MRI confirmation of disc herniation or protrusion prior to the procedure. Comparison was made between 4 groups of patients: receiving endoscopic discectomies at one, 2, 3, or 4 levels. The overall pain relief in patients was calculated as a percentage of improvement between the pre-operative and the 6 month post-operative VAS score. Overall success rate was then calculated on each of the 50 patients disregarding the number of levels performed. MacNab criteria was applied to each patient by characterizing pain relief of 75 - 100% as excellent, 50 - 74% as good, 25 - 49% as fair, and 0 - 24% as poor (6). Success is based on an excellent, good, or fair outcome.

Results

Of the 50 patients, 75 and older, undergoing endoscopic discectomy procedures, 47 (84%) had MRI evidence of multilevel herniated lumbar discs. The single level endoscopic discectomy group included 52% of the patients treated and 88% of those had multilevel herniations on MRI. Table 1 shows the average pain relief in 26 patients receiving a single level endoscopic discectomy correlated to the number of diagnosed herniated levels. The 3 patients with only a single level herniated disc on MRI and who underwent discectomy at only a single level had an average percentage pain relief of 71.7%. Patients with multi-level pathologies receiving one procedure had an average relief of 75.3% attributed to correct diagnosis of the inflicting level. Overall, patients with one or more diagnosed herniated levels undergoing a single level discectomy had an average pain relief of 74.6%, good results as defined by MacNab.

Tables 2, 3, and 4 show the averages of pain relief in patients with multiple herniated lumbar discs after 2, 3, and 4 level endoscopic discectomies. Two-level discectomies were performed on 18 patients (36%) with an average pain relief of 77%. Three and 4 level cases only represented 8 and 4% of the cases with percentage pain relief of 48% and 62%, respectively.

The average pre-operative VAS score was 9.04, indicated in our questionnaire as severe and constant pain. The average 6 month post-operative VAS score was 2.63, indicated in our questionnaire as mild and intermittent pain. Independent from the above calculations, each patient is evaluated regardless of number of discectomy levels or herniated levels seen on MRI in order to determine overall success. Patients receiving relief of over 25% after 6 months are considered to be successful cases. Table 5 and Fig. 2 indicate the overall success rates defined by the McNab criteria.

One patient (2%) had an unchanged average VAS score signifying no pain relief. Five patients underwent a subsequent endoscopic discectomy at the same level

Table 1. *Average pain relief in patients receiving one endoscopic discectomy.*

Number of Herniated Levels	Number of Patients	Average Percentage Pain Relief
1	3	71.7 %
2	4	82.5 %
3	8	75.0 %
4	6	89.2 %
5	5	54.5 %

Table 2. *Average pain relief in patients receiving 2 endoscopic discectomies.*

Number of Herniated Levels	Number of Patients	Average Percentage Pain Relief
2	6	88.6 %
3	6	50.8 %
4	3	86.3 %
5	3	83.3 %

Table 3. Average pain relief in patients receiving 3 endoscopic discectomies.

Number of Herniated Levels	Number of Patients	Average Percentage Pain Relief
3	4	58.8 %
4	5	58.0 %
5	2	96.5 %

Table 4. *Average pain relief in patients receiving 4 endoscopic discectomies.*

Number of Herniated Levels	Number of Patients	Average Percentage Pain Relief
4	1	95.0%
5	1	30.0 %

by the same surgeon in order to remove a reherniation. This reherniation rate of 10% is similar to that for a traditional microdiscectomy approach (7). The only outcome measure studied here was a measurement of pain. No other functional measures, including walking and claudication measures, were collected or investigated.

Complications

There were no reports of infection, dural tear, thrombophlebitis, spinal instability, or vascular injury. There were no serious complications such as cauda equina syndrome or nerve damage resulting in paralysis. Five patients reherniated and had a subsequent endoscopic discectomy to treat the reherniation. The complication rate was 0% and the reherniation rate was 10%. One patient reported 0% relief. No patients reported having worse pain post-procedure. There were not issues with post-operative instability during this short follow-up, but surveillance flexion-extension x-rays were not performed. Previously reported complications can include infection, dysesthesia, thrombophlebitis, dural tear, vascular injury, and death (5).

Table 5. *Success of endoscopic discectomy defined by MacNab Criteria.*

MacNab Ranking	# Patients / Total Patients
Excellent	30/50
Good	10/50
Fair	7/50
Poor	3/50

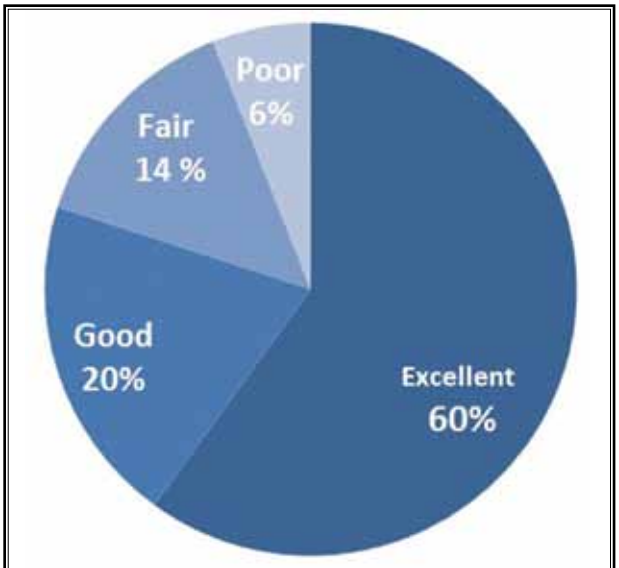

Fig. 2. *Success of endoscopic discectomy defined by MacNab criteria. Fair, good, and excellent outcomes were achieved in 94% of patients. Pain relief less than 25% was seen in 6% of patients.*

Discussion

Lumbar degenerative disc disease studied in this population of patients 75 and older was, not surprisingly, seen to be multi-level in 84% of the patients treated. After 75 years or more, degenerative changes are occurring at multiple levels and the challenge for the spine interventionalist (interventional pain management specialist, radiologist, neurosurgeon, or orthopedic surgeon) can be which level to treat. From 2002 to 2007 a study of Medicare patients showed a 15-fold increase in the frequency of complex spinal fusions performed in this elderly population — these included 360 degree and multilevel lumbar spinal fusions (8). Multilevel complex spinal fusions represent a complex solution to the problem of the aging spine. Endoscopic discectomy is an ultra-minimally invasive spine surgery procedure that does not require general anesthesia and can be performed successfully on a wide range of patients, including those from ages 75 to 89 with back and radicular pain originating from central, paracentral, far lateral, and sequestered herniated discs.

The level or levels of discectomy were targeted based on physical exam, clinical presentation, MR imaging, and response to transforaminal epidural steroid injection. The multilevel cases represented patients with clinical presentations of radiculopathy spanning multiple dermatomal levels. As part of the pre-operative discussion, more traditional standard open surgical options were discussed. The overwhelming response from this group was an aversion to more open surgical approaches especially if those approaches involved general anesthesia. The 50 patients treated included cases in which sequestered herniated discs seen cephalad or caudal to the disc space were removed using specialized flexible instruments. The instruments enabled the surgeon to circumnavigate and reach into the epidural space and as far as the mid-vertebral body (Fig 1). The unique surgical method and instrument design allowed for high success even in the elderly population presented here. The patients were sedated intraoperatively but conscious so nerve damage could be avoided. The patient was asked throughout the procedure if he or she was experiencing leg pain, characteristic of manipu-

lation of the nerve root. This nerve could be viewed and identified endoscopically allowing for further caution when working in the epidural space, adding to the safety of the procedure.

Other studies have shown that endoscopic spine surgery is an effective procedure for treating multiple pathologies in the lumbar spine including lateral, paracentral, central, extruded, and even contralateral herniated discs, as well as lateral recess stenosis (3,9-11). Patients with single level lumbar disease would intuitively be the best candidates for open or endoscopic spine surgery. The single level endoscopic discectomy group presented here demonstrates that patients with multilevel herniations can receive marked relief with just one procedure. In this aspect, endoscopic discectomy could be successful in treating a significant segment of the back and radicular pain population without the complications of open back surgery.

Studies have shown in a prospective fashion the utility of endoscopic lumbar surgery as an effective treatment for disc herniations and foraminal stenosis (3,10). This study, on one hand, is only a retrospective investigation that offers 6 month follow-up data for geriatric patients undergoing endoscopic spine surgery. On the other hand, the 6-month data appear to indicate that an ultra-minimally invasive approach to the geriatric spine that has a low complication rate, avoids general anesthesia, and is outpatient might be worth studying in a prospective, longer term way much like MiDAS I (mild Decompression Alternative to Open Surgery) which demonstrated the efficacy of percutaneous laminectomy in a prospective way using mobility and pain measures (12).

Conclusion

Endoscopic surgery for complicated multilevel lumbar degenerative disease is not proposed as a cure or solution to the aging spine but as a palatable remedy for the geriatric patient who wants some improvement without going through a surgery that requires general anesthesia and an inpatient hospital stay. Endoscopic discectomy is proposed as a safe and effective alternative to open back surgery. As the elderly demographic increases in number and gets older, spine physicians need to consider treatment paradigms that factor in risk, patient down-time, and health care costs, and that are specifically tailored to this older population.

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