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THE EFFECTIVENESS OF A FAR LATERAL L5-S1 MICRODISCECTOMY IN PAIN REDUCTION

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ABSTRACT

Diagnosis of far lateral disc herniations has become more common in recent years. This study describes the surgical procedure used for L5-S1 far lateral disc herniations, shows the benefits derived from a far lateral approach and retrospectively evaluates the outcome of the surgery. Eight patients were included in the study, five females and three males. The mean age was 62 years (range, 45-77 years). VAS pain scale, OSW index and SF-36 forms were used to evaluate the surgical outcome. Both the VAS pain scale and OSW index were improved postoperatively. The SF-36 scores were significantly lower ($p<0.05$) for the far lateral patients compared to both the low back pain population and the U.S. aged 55-64 year population.

INTRODUCTION

The vertebral spine is divided into three sections: cervical, thoracic and lumbar with a total of seven, twelve, and five vertebrae respectively. Each vertebra consists of a rounded body anteriorly and a vertebral arch posteriorly. The space formed between the vertebral body and arch is called the vertebral foramen and is the area through which the spinal cord travels, while intervertebral foramens are found between vertebrae and allow nerve roots to branch off laterally from the spinal cord. The vertebral body increases in size as progression occurs down the spinal column, making the lumbar vertebrae massive and kidney-shaped. The spinous process of a lumbar vertebra is short and projects directly backward, while the transverse processes are long and slender. The fifth lumbar vertebra (L5) articulates inferiorly with the upper border of the sacrum (9).

A semielastic intervertebral disc, which serves as a shock absorber and allows the vertebra to move upon each other, is located between each adjacent vertebra. The disc consists of

the anulus fibrosus and the nucleus pulposus. The nucleus pulposus is a gelatinous material in the center of the disc, while the anulus fibrosus is composed of fibrocartilage and surrounds the nucleus pulposus. As weight is applied to the spinal column, the nucleus pulposus flattens and expands, and is usually contained by the anulus fibrosus. When the force of the expansion of the nucleus pulposus is too great for the anulus fibrosus, the anulus fibrosus ruptures and allows the nucleus pulposus to herniate (9).

Disc herniations most often occur where a mobile part of the spinal column joins a rather immobile part, such as the lumbosacral junction. The lumbar vertebrae account for the highest incidence of disc herniations, occurring most often either between the fourth and fifth lumbar vertebrae or between the fifth lumbar vertebrae and the sacrum (9). The herniation of the nucleus pulposus often impinges upon a spinal root. This is turn radiates pain to the corresponding nerve region, most often the leg or foot region when dealing with the sensory roots of the fifth lumbar and first sacral.

Initially, disc herniations can be treated conservatively to promote healing. However, if conservative treatment fails, microdiscectomy is often used to alleviate the pain (9). Originally, herniated discs were treated through a wide muscle/fascial exposure with generous bone removal, but have now evolved into a minimally invasive microsurgical approach aided by the microscope (7). Depending on the location of the herniation, several different surgical approaches may be used, one of which is the far lateral approach.

Diagnosis of far lateral lumbar disc herniations (FLLDH) has become more common in the past five years with the use of computerized tomography (CT) and/or magnetic resonance imaging (MRI). Previously, myelography was used to diagnose FLLDH, but this technique was unable to show accurate results (4). However, with the use of CT and/or MRI, FLLDH have

become a customary surgical procedure performed today. Surgical findings support MRI diagnosis with a 90% rate of accuracy, and the CT with a rate of 77% (6). In 1995, Epstein reported that far lateral disc herniations, located beyond the neural foramen and lateral to the pedicles (Fig. 1), constitute from 7% to 12% of all herniated lumbar discs (3).

Originally, far-lateral disc herniations were treated surgically through a midline approach combined with facet joint destruction to decompress the nerve root. However, the unilateral facet joint destruction resulted in severe instability syndromes, defined as abnormal motion between two or more vertebrae, and persistent severe low back pain (2,5). A modified muscle-splitting approach, that later utilizes the operating microscope, is the method of choice today. This technique allows for less destruction of tissue and results in less instability of the spine. The purpose of this study is to describe the surgical procedure used for L5-S1 far lateral disc herniations, show the benefits derived from a far lateral approach, and to retrospectively evaluate the outcome of surgery.

METHODS

Patient Population

All patients who had undergone lumbar microdiscectomy of the L5-S1 level through a far lateral approach between August 1994 and May 2000 were included in the study. Eight patients met the requirements for this study and all agreed to participate. There were five females (63%) and three males (37%), and the mean age was 62 years (range, 45-77 years). Four were smokers (50%) and two (25%) drank alcohol. None of the patients were involved with workers' compensation or litigation. The mean postoperative follow-up period was 3 years (range 3-54 months).

Survey Instrument

Results were assessed using the visual analog pain scale (VAS), the Oswestry functional capacity questionnaire (OSW) and the Short Form-36 Health Survey Questionnaire (SF-36). Patients completed the VAS and OSW form pre- and post-operatively, while the SF-36 was completed only post-operatively. Data from the VAS and OSW was analyzed using a paired t-test to reveal any significant changes following surgery. The SF-36 was evaluated and compared against national averages for patients with low back pain and to the older U.S. population (ages 55-64) for an objective analysis.

Surgical Procedure

Antibiotics were given as prophylaxis prior to surgery. General anesthesia and endotracheal intubation were administered. The patient was placed in the kneeling position on the Andrews' spine frame and the bony prominences were carefully padded. The thoracolumbar spine was scrubbed with Betadine scrub and solution and sterile drapes were applied in the usual fashion.

An intraoperative x-ray was taken with the needle at the L5-S1 level. A two to three inch incision was carried out about 2.5 cm on the appropriate side of the midline. The fascia was incised in line with the skin incision. The interval between the longissimus and the multifidi muscles was identified proximally. The lateral facet joint of L5-S1, as well as the transverse process of L5 and the proximal sacrum was identified. The microscope was sterilely draped and used for the remainder of the procedure.

Meticulous hemostatis was obtained throughout the entire procedure with the bipolar cautery. In most cases, a portion of the inferior edge of the transverse process of L5 was removed

with a Kerrison rongeur. The L5 nerve root was identified and gently retracted to display the L5-S1 disc. The disc herniation was removed with pituitary rongeurs. The disc space was entered and any remaining loose fragments of the disc were also removed. A Murphy ball was passed through the neural foramen to confer that the nerve root was completely free of compression. The wound was then irrigated and 1 cc of Depo-Medrol was placed over the nerve root. Standard layered closure was completed.

RESULTS

The chief complaint consisted of leg pain, or for some patients, a combination of both leg and buttock pain. All patients had failed conservative care and required surgery. Two patients had developed such severe pain that immediate surgery was required.

In all cases, the surgery was successful and few complications were encountered. Four patients did develop radiculitis that was later resolved and one developed a post-operative seroma. The mean change in VAS was –1 ($p=0.15$) and the mean change in OWS was –12% ($p=0.08$). While these changes were not statistically significant, the results do show that both the VAS pain scale and OSW index were improved postoperatively (Table 1). The SF-36 scores were significantly lower ($p<0.05$) for the far lateral patients compared to both the low back pain population and the U.S. aged 55-64 year population (Table 2).

DISCUSSION

Various surgical approaches have been used to treat far lateral disc herniations in an attempt to determine the most effective technique. Careful attention should be given to complicating factors such as spinal stenosis, spondyloarthrosis, and degenerative

spondylolisthesis as well (3). Total facetectomy is the only approach that allows for direct visualization of the nerve root both medially and laterally, but also increases the chance of developing instability. Laminotomy and medial facetectomy uncover the lateral and subarticular recess and preserve stability, but fail to visualize the far-lateral compartment adequately, increasing the risk of retained fragments. The intertransverse approach maintains stability and allows for excision of the disc and fragments, but fails to visualize medially into the subarticular neural foramen (3).

The extreme lateral approach used in this study allows for extraction of single-fragment, far lateral disc extrusions, but does not provide medial access to the spinal canal, foramen, or disc (3). However, the exposure and excision of the intertransverse ligament and fascia medially define the lateral aspect of the facet joint, the pars interarticularis, the pedicle, and the transverse process, allowing for exposure of the lesions and involved nerve root (3). While this approach offers a low rate of instability in most cases, it should be avoided when spinal stenosis or spondyloarthrosis are present (3).

Results from the study showed that statistically there was no significant change in VAS scores. According to the VAS scores, five of the patients (62.5%) indicated a reduction in pain, one (12.5%) evaluated the pain level to remain the same, and two (25%) indicated an increase in pain (Table 1). The increase in the pain level of patient seven might be explained as a result of unresolved irritation of the nerve root due to the fact that only about three months had passed since surgery. Other factors that might be considered in evaluating the changes of the pain scale could include overall pain tolerance of the individual patient and whether other health problems and factors were being included in the pain scale specifically targeted for problems relating to spinal surgery and discomfort.

The scores obtained from the OSW form did not show a statistically significant change. Five patients (62.5%) showed an increase in functional capacity, two (25%) remained at the same level, and one (12.5%) showed a decrease in functional capacity (Table 1). Again, for the patient who showed a decrease in functional capacity, it could be assumed that the follow-up period of three months had not allowed for adequate recovery. The elderly state of most patients and additional health problems might have contributed to the generally small increase seen in functional capacity.

A study done by Silvers and Lewis on lumbar microdiscectomy of the elderly patient stated that none of the geriatric population long-term outcomes differed significantly from those observed for the comparison group (8). It was found however, that "return to normal activities" had the highest failure rate when compared among the geriatric population and the younger comparison group. But, as the current study also suggests, it is hard to determine whether this is a reflection of the surgery itself, or a result of physical and degenerative defects that tend to restrict the normal activity of older individuals (8). In addition, it is known that some of the elderly population is in a state of mental and physical decline (8). Perhaps then, the small sample size of this study included such individuals who were already experiencing mental and physical decline, leading to a moderate level of postoperative improvement.

The results of the SF-36 form indicate that even after surgery the far lateral patients are functioning at a level lower than that of both the general population (ages 55-64) and of patients with low back pain. As previously mentioned, such scores may be reflective of the general health decline seen in the elderly. If the patients were already experiencing physical problems with normal functions before the surgery and illness, it would only make their recovery even more difficult. Therefore, such scores may not be a direct influence of the surgery, but rather the

surgery caused an increase in a physical decline that had already been set in motion by the natural aging process.

A final point to be considered in the evaluation of this surgery is the method of patient selection for the surgery. Apostolides et al (1996) reported that the most common cause of failure after lumbar disc surgery remains poor patient selection. Only 5 to 10% of patients with sciatica will eventually require an operation (1). Silvers and Lewis concluded that most patients with low back pain and sciatica may be treated conservatively and do not require surgery (8). Such reports indicate that patients selected for surgery must display the necessary symptoms and not choose surgery because it brings quicker pain relief. Poor patient selection then remains another option for the relatively low recovery results seen in this study.

The study has shown the far-lateral approach to be an effective surgical method that provides patient improvement in functional capabilities and a reduction in pain. Although the majority of the patients remain at a functional level below that of the general population and patients with low back pain, the surgery was effective in achieving a general health increase as demonstrated by the pre- and post-operative VAS and OSW scores. A larger population sample would allow for the possibility of statistically significant results and provide more detailed information as to the effectiveness of a L5-S1 far-lateral microdiscectomy.

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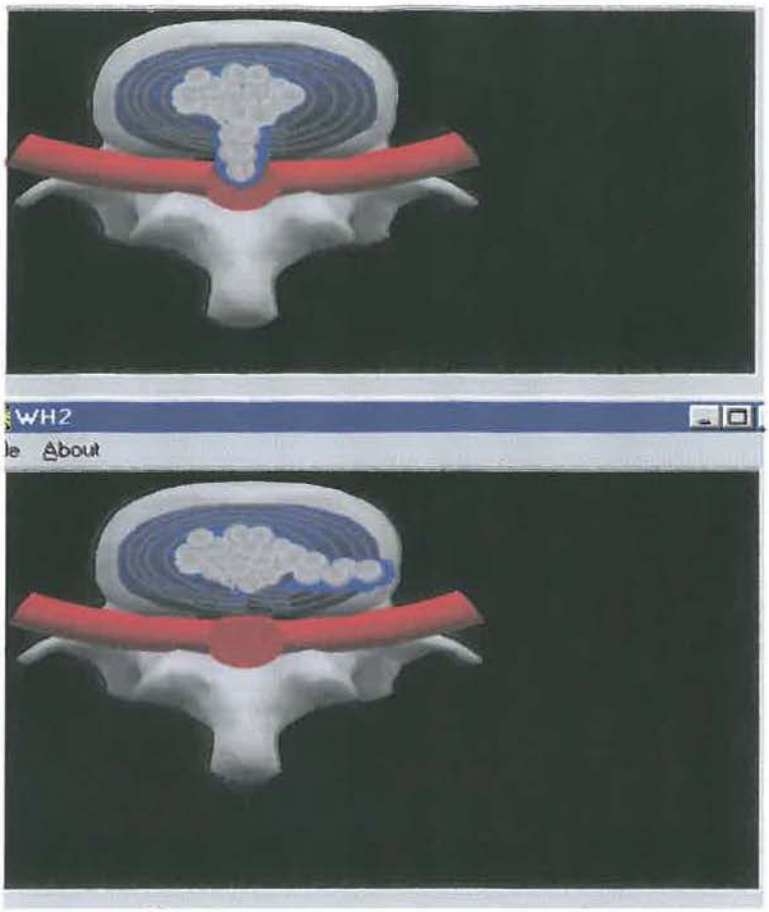

Fig. 1 – Comparison of a central disc herniation (a) and a far lateral disc herniation (b). (taken from www.chiroman.com)

Table 1 - Age, pre- and postoperative scores of all patients in study.

Patient	Age at time of surgery	Pre-VAS	Post-VAS	Pre-OSW	Post-OSW
1	45	8	6	56%	26%
2	50	8	8	54%	34%
3	58	9.4	7.4	40%	40%
4	63	10	5.7	50%	6%
5	67	7.5	7	51%	51%
6	69	9.8	10	75%	73%
7	70	1	5	10%	35%
8	77	10	6.6	72%	46%

Table 2 – Comparison of SF-36 scores of far lateral patients, people with back pain, and the average U.S. population (age 55-64).

Test	Far Lateral Patients	Back Pain Average *	US (Age 55-64) Average **
Physical functioning	30.54	66 (54-78)	76 (64-88)
Role – physical	12.14	47 (24-70)	74 (51-97)
Bodily pain	31.25	59 (44-74)	68 (53-83)
General health	42.13	58 (40-76)	65 (47-83)
Vitality	32.92	52 (36-68)	60 (44-76)
Social functioning	47.81	81 (55-100)	81 (55-100)
Role – emotional	35.00	71 (43-99)	80 (52-100)
Mental health	58.00	75 (61-89)	75 (61-89)
Physical component summary	27.90	40 (34-46)	46 (40-52)
Mental component summary	39.57	51 (45-57)	51 (45-57)

Mean (95% confidence interval) scores for * generalized population with back pain and for the ** U.S. population ages 55-64 years

All values for far lateral patients were significantly lower (lower level of functioning) than for either the generalized patient with back pain or the U.S. population age 55-64 years ($p<0.05$).

SOUTHERN SCHOLARS SENIOR PROJECT

Name: Jamie Griffin Date: 1-16-02 Major: Biology

SENIOR PROJECT

A significant scholarly project, involving research, writing, or special performance, appropriate to the major in question, is ordinarily completed the senior year. The project is expected to be of sufficiently high quality to warrant a grade of A and to justify public presentation.

Under the guidance of a faculty advisor, the Senior Project should be an original work, should use primary sources when applicable, should have a table of contents and works cited page, should give convincing evidence to support a strong thesis, and should use the methods and writing style appropriate to the discipline.

The completed project, to be turned in in duplicate, must be approved by the Honors Committee in consultation with the student's supervising professor three weeks prior to graduation. Please include the advisor's name on the title page. The 2-3 hours of credit for this project is done as directed study or in a research class.

Keeping in mind the above senior project description, please describe in as much detail as you can the project you will undertake. You may attach a separate sheet if you wish:

Signature of faculty advisor Linda Ann Foote Expected date of completion April 10, 2001

Approval to be signed by faculty advisor when completed:

This project has been completed as planned: Yes LAF

This in an "A" project: Yes LAF

This project is worth 2-3 hours of credit: Yes LAF

Advisor's Final Signature Linda Ann Foote

Chair, Honors Committee _____ Date Approved: _____

Dear Advisor, please write your final evaluation on the project on the reverse side of this page. Comment on the characteristics that make this "A" quality work.

Jamie Griffin

The research project I will be undertaking will be a research study on the effectiveness of a L5-S1 microdiscectomy using a far lateral approach. I will work with Dr. Hodges of the Chattanooga Orthopaedic Group to complete part of my project. The project will include determining which patients have undergone this surgery by researching patient files. It will include evaluation of pre-operative pain scores and functional capabilities. These same forms will again be sent to the patients to complete to determine whether improvement has been made after the surgery. A third additional form will also be included to compare their current capabilities with that of other patients nationwide. The data returned will be analyzed to determine if there is any significance and will be evaluated to determine whether the surgery was effective.