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Clinical Study

Surgery for lumbar disc herniation: Analysis of 500 consecutive patients treated in an interdisciplinary spine centre

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ABSTRACT

Surgical removal of a symptomatic herniated lumbar disc is performed either with or without the support of a microscope. Up to the time of writing, the literature has reported similar clinical outcomes for the two procedures. Five hundred consecutive patients, operated upon for primary single-level lumbar disc herniation in our University Spine Center between 2003–2011, with (n = 275), or without (n = 225), the aid of a microscope were included. Data were retrospectively analyzed, comparing the primary endpoint of clinical outcome and the secondary endpoints of complications, surgical time and length of hospitalization. Clinical outcomes and reoperation rates were comparable in both groups. Surgical time was significantly shorter with a mean time of 47 minutes without use of the microscope compared to the mean time of 87 minutes ($p < 0.001$) with the use of the microscope. Mean length of hospitalization was shorter in those operated with the microscope (5.3 days) compared to those without (6.1 days, $p = 0.004$). There was no difference in rates of complications. Microdiscectomy *versus* open sequestrectomy and discectomy for surgical treatment of lumbar disc herniation is associated with similar clinical outcomes and reoperation rates. Open sequestrectomy is associated with shorter operation times. Microdiscectomy is associated with shorter hospitalization stays.

1. Introduction

In 1934 Mixter and Barr first described herniated disc material as a cause of neural compression in the lumbar spine [1]. Initially, surgical removal was performed as an open procedure. In the 1970s the microscopic approach was introduced and a sequestrectomy alone was proven to show even better clinical outcomes compared to conventional disc removal on the supposition that it caused less surgical collateral tissue damage by removing only the damaged herniated part of the disc [2–7]. The aim of this new approach was to achieve less postoperative low-back pain and prevent potential segmental instability caused by an aggressive discectomy.

Currently, open sequestrectomy and discectomy (OD) as well as sequestrectomy and discectomy with the aid of a microscope (MD) for lumbar disc herniation are both considered as well established treatment options for lumbar disc herniation in patients with sciatica. Large systematic reviews comparing both procedures have identified no differences in clinical outcomes. Additionally it has to be kept in mind that often these procedures are performed by residents under guidance of a board certified spine surgeon. The advantages of using a microscope for OD are better visualization of the deep surgical field and the anatomical structures in order to identify the cause of compression of the neural structures and to avoid nerve root damage. On the contrary OD without the aid of a microscope is reported to require less time and surgical equipment [4,8]. With a complication rate for dural tears or wound infections between 1–5%, studies with several hundred patients are needed to show a statistical difference. Jacobs et al. recommended in his 2012 systematic review to perform such a study with several hundred patients [8]. Therefore, the purpose of this study was to compare clinical outcome, reoperation rate, surgical time and length of hospital stay postoperatively between lumbar disc herniation patients treated surgically with or without the use of the microscope.

2. Materials and methods

2.1. Clinical evaluation

Patients who were operated upon between 2003 and 2011 at our University Spine Center, Switzerland, were screened for single-level symptomatic radiculopathy caused by a disc herniation by retrospectively reviewing their patient records. Ethics committee approval was not necessary for this retrospective review in

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which data were collected from patients who were treated by the authors before January 2014.

Patients with a multisegmental lumbar disc herniation and recurrence of a single-level lumbar disc herniation were excluded. After a thorough case history and clinical workup all patients underwent an MRI of the lumbar spine in addition to standard anteroposterior and lateral lumbar radiographs for preoperative evaluation. The type of lumbar disc herniation was classified as medial/paramedial, foraminal or extraforaminal by experienced musculoskeletal radiologists. All patients underwent conservative treatment for 6 weeks, if red flags were not present, consisting of analgesic drugs, physiotherapy and partially CT-guided steroid epidural or periradicular infiltrations. Indications for surgery were in accordance with the current consensus [4,8,9] with an acute occurrence of weakness along the lower limb with a corresponding neural compression on MRI or persisting radiculopathy pain syndrome despite advanced conservative treatment. Five hundred patients with a symptomatic, single-level lumbar disc herniation treated surgically were identified; 225 patients were operated upon with an open approach for sequestrectomy and discectomy by the same orthopaedic surgeon, who used a headlight but no magnification (operating loupes) for surgery. Two hundred and seventy-five patients were operated upon with the use of a microscope by two experienced board certified neurosurgeons. All surgeries were performed under general anesthesia in the prone position.

2.2. OD

Palpation is used to determine the spinous processes and fluoroscopy used to verify them. A midline skin incision is performed and the subcutaneous tissue dissected. The thoracolumbar fascia is then incised, the paravertebral muscle is dissected lateral from the bone and the interlaminar window of the affected level is identified. An angled curette is used to dissect the flaval ligament from the lamina for its subsequent removal. After the laminectomy of the caudal edge of the superior lamina, the flaval ligament is carefully dissected avoiding an injury to the dural sac and nerve root with an angled curette to mobilize the dural sac. The nerve root is then identified and gently manipulated with an atraumatic root retractor. If the longitudinal ligament is intact an incision is performed and the removal of the herniated part of the disc is carried out. Only the portions that are diseased and loose are removed. After disc removal the epidural space is explored with careful attention directed to the foramen to ensure that the nerve root has unrestricted passage. Wound closure is performed by suturing the thoracolumbar fascia and skin closure.

2.3. MD

The procedure for lumbar MD is performed similar to the lumbar discectomy but with the aid of a microscope. After having identified the interlaminar window of the affected level, the microscope is introduced into the surgical field. The identification of the herniated disc, the removal of the herniated part and control of the unrestricted passage of the nerve root is performed in a neurosurgical fashion. After disc removal the epidural space is explored with careful attention directed to the foramen to ensure that the nerve root has unrestricted passage. Wound closure is performed by suturing the thoracolumbar fascia and skin closure.

2.4. Definition of primary and secondary endpoints

As primary endpoints the clinical findings addressing postoperative pain, sensory or motor deficit and any recurrence of lumbar disc herniation with need of a revision surgery were documented, and this information was retrospectively retrieved from the patient files by one of the authors.

As secondary endpoints the duration of the procedure, intraoperative specific complications (for example dural tears or root injuries), duration of hospital stay and postoperative complications were analyzed. These data were also retrospectively retrieved from the patient files and surgical report by one of the authors.

2.5. Statistical analyses

The Statistical Package for the Social Sciences software version 21 (IBM, Armonk, NY, USA) was used for analysis. Descriptive statistics were used to report mean, standard deviation (SD) and range of data. A two-sided unpaired Student's t-test, Mann–Whitney U test or chi-squared test was used for intergroup comparison depending on expected distribution of the data. A p value of <0.05 was considered statistically significant.

3. Results

3.1. Preoperative clinical findings and patient demographics

There were 225 patients (mean age 49 years [range 14 to 87], 119 [53%] male, 106 [47%] female) who underwent resection of their lumbar disc herniation without use of a microscope. The duration of preoperative pain averaged 17.6 ± 24 weeks. All patients (100%) suffered from low-back pain, 122 (54%) had a corresponding sensory radiculopathy and 100 (44%) had a corresponding muscular weakness. The disc herniation level was L4/L5 or L5/S1 in 79% and in 84% located medial or paramedial.

In contrast, 275 patients (mean age 54 years [range 14 to 86], 156 [57%] male, 119 [43%] female) underwent removal of their disc herniation in a microsurgical fashion. The duration of pain in this group averaged 20 ± 28 weeks which was not statistically significantly different compared to the patients operated upon without the use of a microscope (p = 0.601). All patients (100%) suffered from low-back pain, 176 (64%) had a corresponding sensory radiculopathy (p = 0.051 OD *versus* MD) and 116 (42%) had a corresponding muscular weakness (p = 0.611). The disc herniation level was L4/L5 or L5/S1 in 86% and in 91% located medial or paramedial (Table 1).

3.2. Primary endpoints

3.2.1. Clinical outcome

At a mean follow-up time of 54 months (range 26 to 125 months), 11 (5%) of the patients operated on without

Table 1
Demographics of patients with herniated lumbar disc and operated with (MD) or without (OD) a microscope

	OD	MD	p value
Patients, n	225	275	
Sex			
Male	119 (53%)	156 (57%)	
Female	106 (47%)	119 (43%)	
Mean age, years	54	49	<0.001
Mean duration of pain, weeks	17.6	20	0.602
Level			
L1/L2	3 (1.3%)	2 (0.7%)	
L2/L3	11 (4.9%)	5 (2.5%)	
L3/L4	34 (15.1%)	28 (10.5%)	
L4/L5	79 (35.1%)	127 (46.5%)	
L5/S1	98 (43.6%)	113 (39.6%)	
Type of herniated disc			
Median/Paramedian	188 (83.6%)	251 (91.3%)	
Foraminal	35 (15.6%)	13 (4.7%)	
Lateral	2 (0.7%)	11 (4%)	

MD = microscopic sequestrectomy and discectomy, OD = open sequestrectomy and discectomy.