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Long-Term Results of Various Operations for Lumbar Disc Herniation: Analysis of over 39,000 Patients

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Key Words

Lumbar disc herniation · Lumbar disc surgery · Long-term follow-up · Lumbar disc operations · Operations for lumbar disc herniation · Results of lumbar disc surgery

Abstract

Objective: To determine the long-term follow-up of the various operations for lumbar disc herniation in a large patient population. ***Subjects and Methods:*** Patients who had operations for lumbar disc herniation (microdiscectomy, endoscopic microdiscectomy and the 'classical operation', i.e. laminectomy/laminotomy with discectomy) were collected from the world literature. Patients who had follow-ups for at least 2 years were analyzed relative to the outcome. The outcome was graded by the patients themselves, and the operative groups were compared to one another. ***Results:*** 39,048 patients collected from the world literature had had lumbar disc operations for disc herniations. The mean follow-up period was 6.1 years, and 30,809 (78.9%) patients reported good/excellent results. Microdiscectomy was performed on 3,400 (8.7%) patients. The mean follow-up was 4.1 years with 2,866 (84.3%) good/excellent results, while 1,101 (3.6%) patients had endoscopic microdiscectomy. There, the mean follow-up was 2.9 years with 845 (79.5%) good/excellent results. The classical operation was performed on 34,547 (88.5%) patients with a mean follow-up period of 6.3 years, and 27,050 (78.3%) patients had good/excellent results. These results mirror those with discectomy and the placement of prosthetic discs. ***Conclusions:*** The analysis of 39,048 patients with various operations for lumbar disc herniation revealed the same pattern of long-term results. Patients who had microdiscectomy, endoscopic microdiscectomy or the classical operation (laminectomy/laminotomy with discectomy) all had approximately 79% good/excellent results. None of the operative procedures gave a different outcome.

Introduction

Operations for lumbar disc herniation are numerous [1–56] and have been performed since the 1934 publication by Mixter and Barr [33]. Indeed, operations for lumbar disc herniation are the most frequently done neurosurgical procedures. However, unlike the long-term success rate of posterior operations for cervical disc herniation, which is 94%, the overall long-term success rate for operations for lumbar disc herniations is considerably lower. For this reason, various operations were done with the hope that the long-term success rate would improve.

Since the 'classical operation' (laminectomy/laminotomy with discectomy), other approaches have been used.

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Of these, the most popular are 2 operative procedures: (a) microdiscectomy and (b) endoscopic microdiscectomy. The average size of the published series of operations (classical, microdiscectomy and endoscopic microdiscectomy) is only several hundred patients/series, and most series did not attempt assessing the long-term outcome. The purpose of the present study was to analyze the long-term outcome of operations for lumbar disc herniation and then, specifically, the outcomes for each of the following: microdiscectomy, endoscopic microdiscectomy and the classical operation. To nullify the occasional unusual result, the goal of the study was to analyze the largest number of such patients published to date.

Subjects and Methods

All patients operated on for lumbar disc herniation with radiculopathy and followed for a minimum of 2 years postoperatively were collected from the world literature (using references cited in published studies, the studies themselves and the website PubMed, the search was complete). Good/excellent outcome was measured by the patients' own analyses because the best outcome measure is most simply what the patient thinks about the outcome [19, 24]. Hobbs et al. [19] noted that the patient's perception was the 'true measure of success'. Then, the operations with good/excellent outcomes were tabulated. The patients were divided into groups by the type of operative procedure, i.e. microdiscectomy, endoscopic microdiscectomy and the classical operation, and were analyzed by the time of follow-up and by which patients had good/excellent results by the patients' own assessment.

Results

Thirty-nine thousand forty-eight patients collected from the world literature had had operations for lateral lumbar disc herniation with radiating pain and met the follow-up requirement of at least 2 years. Of the 39,048 operations, 95% of lumbar disc herniations were at the lowest 2 levels of the lumbar spine, and 49 and 46% were at $L_{4–5}$ and $L_5–S_1$, respectively. Of the remaining 5% lumbar disc herniations, 0.15% were at $L_{1–2}$, 0.65% were at $L_{2–3}$ and 4.2% were at $L_{3–4}$ (table 1). The mean follow-up period in this series was 6.1 years. Of all the patients, 30,809 (78.9%) had good/excellent outcomes (table 2). Microscopic discectomy was performed on 3,400 (18.7%) patients with a mean follow-up of 4.1 years. Good/excellent results occurred in 32,917 (84.3%) patients (table 3). The endoscopic microdiscectomy group consisted of 1,101 (3.6%) patients with a mean follow-up period of 2.9 years, and 845 (79.5%) patients had good/excellent results (table 4). Of the 39,048 patients, 34,547 (88.5%) had the classical operation (laminectomy/laminotomy with discectomy). The mean follow-up was 6.3 years. The patients had 78.3% good/excellent results (table 5).

Table 1. Level of herniated lumbar discs

L_{1-2}	0.15%
L_{2-3}	0.65%
L_{3-4}	4.2%
L_{4-5}	49%
$L_5–S_1$	46%

Discussion

In the 8 decades since the publication by Mixter and Barr [33], many studies of the surgical management of lumbar disc herniation with radiculopathy have been published showing the results of laminectomy/laminotomy with discectomy. Another operative approach was described over 4 decades later, i.e. microdiscectomy [7, 52, 55]. Later still, another surgical approach to lumbar disc herniation was developed with the advent of endoscopic microdiscectomy [17]. Many series were published about the above 3 surgical techniques. Significantly fewer publications dealt with the long-term results of these different operative approaches.

In studies focused on the long-term results of the surgical management of lumbar disc herniation, most series that were published averaged several hundred patients. In the 45 studies analyzed here, the mean number of patients was 382/series. This study analyzes 39,048 patients operated for lumbar disc herniation with radiculopathy and followed for over 6 years.

Approximately 79% of the outcomes, graded by the patients, were good/excellent. A series of this size is not affected by slight variations in technique with various surgeons and by variations in the patients' ages and gender.

Each of the operations for this problem was an attempt to improve the outcome by using different operative approaches and techniques; however, as is shown in the present analysis, there is no real difference in the long-term outcome with the above operations. Good/excellent outcomes were 79% overall and 84% for microdiscectomy, 80% for endoscopic microdiscectomy and 78% for the classical operation (laminectomy/laminotomy and discectomy). Another attempt at improving the outcome was the use of the prosthetic disc; however, in long-term

Table 2. Long-term results of operations for lumbar disc herniation

Authors [Ref.]	Patients, n	Mean follow-up, years	Good/ excellent results, %
Asch et al. [2]	212	2	80
Atlas et al.[3]	217	10	69
Bakhsh [4]	39	10	79
Butterman [5]	100	2.5	92
Casal-Moro et al. [6]	120	5	95
Chang et al. [8]	26	3	Not given
Cooper and Feuer [10]	100	2	94
Davis [11]	984	10.8	89
Dewing et al. [12]	183	2.1	85
Dvorak [14]	371	10.5	72
Ebeling et al. [15]	485	2	73
Findlay et al. [16]	79	10	83
Gurdjian et al. [18]	623	9	74
Hsu et al. [20]	226	2	82
Jansson et al. [21]	22,261	6	78
Jensdottir et al. [22]	134	20.7	91
Kotilainen et al. [23]	237	2	92
Lewis et al. [26]	83	7.5	89
Liu et al. [27]	82	6.4	84
Loupasis et al. [28]	109	12.7	64
Mariconda et al. [29]	201	27.8	90
Marin [30]	600	10	83
Martinez Quinones et al. [32]	142	5	93
Moore et al. [34]	100	8.6	93
Naylor [35]	204	17.5	79
Nykvist et al. [36]	197	12.9	81
Österman et al. [37]	28	2	93
Padua et al. [38]	120	12.1	77
Papavero and Caspar [39]	200	Not given	79
Pappas et al. [40]	654	1.5	96
Parker et al. [41]	111	3.1	68
Peul et al. [42]	125	2	81
Salenius and Laurent [43]	695	6	63
Schoeggl et al. [44]	672	6.3	77
Schramm et al. [45]	3,238	4	80
Silverplats et al. [46]	140	7.3	70
Spangfort [47]	2,503	Not given	77
Tregonning et al. [48]	91	9.7	63
Vik et al. [49]	124	8.5	81
Weber [50]	56	4	86
Weinstein et al. [51]	245	4	84
Williams [52]	530	3	91
Woertgen et al. [53]	98	2.3	66
Wu et al. [54]	1,231	2.3	77
Yorimitsu et al. [56]	72	14.3	87
Total	39,048		
Mean		6.1	78.9

Table 3. Long-term results of operations for lumbar disc herniation: microdiscectomy

Authors [Ref.]	Patients, n	Mean follow-up, years	Good/ excellent results, %
Asch et al. [2]	212	2	80
Cooper and Feuer [10]	100	2	94
Dewing et al. [12]	183	2.1	85
Ebeling et al. [15]	485	2	73
Findlay et al. [16]	79	10	83
Jensdottir et al. [22]	134	20.7	91
Kotilainen et al. [23]	237	2	92
Moore et al. [34]	100	8.6	93
Österman et al. [37]	28	2	93
Papavero and Caspar [39]	100	Not given	79
Pappas et al. [40]	353	1.5	96
Peul et al. [42]	125	2	81
Schoeggl et al. [44]	672	6.3	77
Vik et al. [49]	62	8.5	81
Williams [52]	530	3	91
Total	3,400		
Mean		4.1	84.3

Table 4. Long-term results of operations for lumbar disc herniation: endoscopic microdiscectomy

Authors [Ref.]	Patients, n	Mean follow-up, years	Good/ excellent results, %
Casal-Moro et al. [6]	120	5	95
Chang et al. [8]	26	3	Not given
Liu et al. [27]	82	6.4	84
Wu et al. [54]	873	2.3	77
Total	1,101		
Mean		2.9	79.5

Table 5. Long-term results of operations for lumbar disc herniation: laminectomy/laminotomy with discectomy

Authors [Ref.]	Patients, n	Mean follow-up, years	Good/ excellent results, %
Atlas et al. [3]	217	10	69
Bakhsh [4]	39	10	79
Butterman [5]	100	2.5	92
Davis [11]	984	10.8	89
Dvorak [14]	371	10.5	72
Gurdjian et al. [18]	623	9	74
Hsu et al. [20]	226	2	82
Jansson et al. [21]	22,261	6	78
Lewis et al. [26]	83	7.5	89
Loupasis et al. [28]	109	12.7	64
Mariconda et al. [29]	201	27.8	90
Marin [30]	600	10	83
Martinez Quinones et al. [32]	142	5	93
Naylor [35]	204	17.5	79

Table 5 (continued)

Authors [Ref.]	Patients, n	Mean follow-up, years	Good/ excellent results, %
Nykvist et al. [36]	197	12.9	81
Padua et al. [38]	120	12.1	77
Papavero and Caspar [39]	100	Not given	79
Pappas et al. [40]	301	1.5	96
Parker et al. [41]	111	3.1	68
Salenius and Laurent [43]	695	6	63
Schramm et al. [45]	3,238	4	80
Silverplats et al. [46]	140	7.3	70
Spangfort [47]	2,503	Not given	77
Tregonning et al. [48]	91	9.7	63
Vik et al. [49]	62	8.5	81
Weber [50]	56	4	86
Weinstein et al. [51]	245	4	84
Woertgen et al. [53]	98	2.3	66
Wu et al. [54]	358	2.3	77
Yorimitsu et al. [56]	72	14.3	87
Total	34,547		
Mean		6.3	78.3

studies (46 patients at 3.2 years of follow-up; 105 patients at 4.3 years of follow-up), the good/excellent results were 77 and 79%, respectively [9, 25]. All of the operations analyzed have good/excellent results of around 79%. Different approaches and different techniques do not appear to have made any real difference in the long-term outcome.

The results of posterior operations for lumbar disc herniation are not as good as the results of posterior operations for cervical disc herniation. An analysis of over 3,000 such posterior operations for cervical disc herniation with an 8.5-year mean follow-up revealed 94% good/excellent results [13]. Why is there this difference of 79% versus 94%? Surely the operative procedures were successful in both groups, but much more so in the cervical spine. The reason for this difference needs further analysis and, perhaps, yet another approach, surgical or otherwise, to the problem of lumbar disc herniation with radiculopathy.

Conclusion

Each of the operations for lumbar disc herniation (microdiscectomy, endoscopic microdiscectomy and laminectomy/laminotomy with discectomy) had approximately 79% good-to-excellent results. There was no difference in the long-term follow-up in any of the operative groups, including the use of a lumbar disc prosthesis ('artificial disc').

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