Predictive Factors for Outcomes Following Surgical Treatment of Lumbar Disc Herniation

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Background & Objective

- Lumbar disc herniation (LDH) commonly causes radicular pain.
- LDH annual incidence of 5-20 per 1000 adults.
- Can be treated surgically with microdiscectomy.
- More than 300,000 performed annually (USA).
- 25-33% patients report poor surgical outcomes.

Objective:

To analyze and report LDH patient outcomes who underwent microdiscectomy with Stony Brook Medicine.

Methodology

- Retrospective study from 2017-2022.
- 241 total patients from Stony Brook Medicine patients evaluated, 124 were retained.
- Mean follow-up time 366 days with all patients followed for at least 90 days.
- Data included demographics, medical/surgical history and surgical methodology.
- Good outcomes were defined as:

(1) Satisfy Absolute Change Threshold (ACT) of –3.5 points reported by Numerical Rating System (NRS).
(2) Resolution of radicular pain or neurological symptoms.

Results

Univariate Analysis:

Failed to Meet ACT

- Prior spine surgery 92.3% (p = 0.006), prior spine fusion 100% (p = 0.019, N=98), pre-operative physical therapy (PT) 73.2% (p = 0.011).
- 79.1% (p=0.019) and 82.8% (p=0.015) of PT patients had residual radicular pain and neurological symptoms, respectively.

Multivariate Analysis:

- Confirmed correlations between pre-operative PT and failure to meet the ACT (P=0.016, OR=0.217), and resolution of radicular (P=0.012, OR=0.280) and neurologic (P=0.038, OR=0.287) complaints.
- ACT also significantly correlated with higher pre-operative NRS scores in both univariate (P=0.0002, N=98) and multivariate (P=0.001, OR=1.652) analyses.

Conclusions

(1) Higher preoperative NRS scores, pre-operative PT, and prior spine surgery, are associated with poor outcomes.
(2) While PT is considered a viable non-operative treatment for LDH, our findings suggest detrimental effects when preceding surgery.
(3) Patients with higher NRS pain scores were more likely to improve after surgery.

Table 1: Patient Characteristics at Baseline

	N (%)
Demographics	
Age, mean [SD]	47.0 [15.5]
Female Sex	54 (43.9%)
BMI, mean [SD]	28.8 [5.3]
Caucasian	104 (84.6%)
Hispanic	10 (8.1%)
Asian	2 (1.6%)
African American	2 (1.6%)
Native Hawaiian or other Pacific Islander	3 (2.4%)
Medical History	
Diabetes Mellitus	15 (12.2%)
Liver/Kidney Disease	6 (4.9%)
Current Smoker	18 (14.6%)
Osteoporotic Disease	4 (3.3%)
Surgical History	
Prior Spine Surgery	17 (13.8%)
Prior Decompression	6 (4.9%)
Prior Fusion	9 (7.3%)
Prior "Other Spine Surgery"	2 (1.6%)
Cervical	6 (4.9%)
Thoracic	1 (0.8%)
Lumbar	8 (6.5%)
Operative Time (minutes), mean [SD]	79.0 [38.1]

	N (%)
Level of Injury	
L1-L2	1 (0.8%)
L2-L3	6 (4.9%)
L3-L4	16 (13.0%)
L4-L5	39 (31.7%)
L5-S1	53 (43.1%)
History of Injury	
Pre-Operative Back Pain	91 (74.0%)
Pre-Operative Radicular Pain	116 (94.3%)
Pre-Operative Neurologic Symptoms	90 (73.2%)
Pre-Operative NRS, mean [SD]	7.0 [2.4]
Time from Symptom Onset to Surgery (weeks), mean [SD]	39.7 [56.8]
Prior Management	
Procedural Intervention	89 (72.4%)
Physical Therapy	47 (38.2%)
Acupuncture	9 (7.3%)
Chiropractic	19 (15.4%)
Surgical Technique	
Open Microdiscectomy	103 (83.7%)
Tubular (MIS) Microdiscectomy	15 (12.2%)
Decompression w/out Discectomy	3 (2.4%)
Fat Graft	45 (36.6%)
Dural Tear/CSF Leak	3 (2.4%)

Table 2:Bivariate Analysis

Variable	Outcome								
	Absolute Change Threshold (3.5pt)			Resolution of Radicular Pain			Resolution of Neurologic Symptoms		
	Success	Failure	P-Value	Success	Failure	P-Value	Success	Failure	P-Value
Total	42 (41.2%)	60 (58.8%)	--	43 (37.1%)	73 (62.9%)	--	31 (34.4%)	59 (65.6%)	--
Age	47 ± 15.1	48 ± 16.6	0.8776§	48 47 ± 15.7	47 ± 15.6	0.6518§	43 ± 17.9	49 ± 13.7	0.0611§
Female Sex	18 (41.9%)	25 (58.1%)	1.000‡	20 (40.8%)	29 (59.2%)	0.560‡	16 (39.0%)	25 (61.0%)	0.505‡
BMI	28 ± 5.0	29 ± 5.3	0.4132§	29 ± 5.2	29 ± 5.5	0.7526§	28 ± 4.4	29 ± 5.7	0.3399§
Medical/Surgical History									
Diabetes Mellitus	4 (28.6%)	10 (71.4%)	0.388‡	6 (40.0%)	9 (60.0%)	0.783‡	2 (22.2%)	7 (77.8%)	0.713‡
Current Smoker	5 (35.7%)	9 (64.3%)	0.774‡	9 (56.3%)	7 (43.8%)	0.101‡	3 (33.3%)	6 (66.7%)	1.000
Osteoporotic Disease	2 (50.0%)	2 (50.0%)	1.000‡	4 (100.0%)	0 (0.0%)	**0.017**‡	3 (100.0%)	0 (0.0%)	**0.038**‡
Prior Spine Surgery	1 (7.7%)	12 (92.3%)	**0.013**‡	5 (29.4%)	12 (70.6%)	0.592‡	5 (33.3%)	10 (66.7%)	1.000‡
Prior Fusion Surgery	0 (0.0%)	7 (100.0%)	**0.039**‡	4 (44.4%)	5 (55.6%)	0.724‡	4 (50.0%)	4 (50.0%)	0.439‡
Prior Cervical Surgery	0 (0.0%)	5 (100.0%)	0.076‡	2 (33.3%)	4 (66.7%)	1.000‡	3 (60.0%)	2 (40.0%)	0.337‡
Level of Injury									
L2-L3	3 (60.0%)	2 (40.0%)	0.400‡	3 (50.0%)	3 (50.0%)	0.669‡	1 (50.0%)	1 (50.0%)	1.000‡
L3-L4	4 (26.7%)	11 (73.3%)	0.265‡	8 (50.0%)	8 (50.0%)	0.274‡	6 (50.0%)	6 (50.0%)	0.327‡
L5-S1	21 (52.5%)	19 (47.5%)	0.068‡	14 (28.0%)	36 (72.0%)	0.085‡	15 (39.5%)	23 (60.5%)	0.501‡
History of Injury									
Pre-Operative Back Pain	27 (37.5%)	45 (62.5%)	0.275‡	36 (42.4%)	49 (57.6%)	0.055‡	23 (35.4%)	42 (64.6%)	0.810‡
Time from Symptom Onset to Surgery (weeks)	28 ± 31.8	55 ± 72.3	0.0584§	38 ± 59.4	37 ± 49.6	0.5971§	33 ± 39.2	25 ± 26.0	0.5034§
Pre-Operative NRS	8 ± 1.7	6 ± 2.6	**0.0002**§	7 ± 2.6	7 ± 2.3	0.1886§	7 ± 2.4	7 ± 2.5	0.9548§
Pre-Operative Physical Therapy	11 (26.8%)	30 (73.2%)	**0.032**‡	9 (20.9%)	34 (79.1%)	**0.021**‡	5 (17.2%)	24 (82.8%)	**0.026**‡
Operative Time (minutes)	72 ± 40.6	84 ± 38.6	**0.016**§	80 ± 37.8	79 ± 39.5	0.5932§	71 ± 24.3	81 ± 40.1	0.4085§

‡ = Fisher Exact
§ = Mann-Whitney U Test

Table 3: Multivariate Analysis

Variable	Outcome					
	Absolute Change Threshold (3.5pt)		Resolution of Radicular Pain		Resolution of Neurologic Symptoms	
	OR (95% CI)	P-Value	OR (95% CI)	P-Value	OR (95% CI)	P-Value
Age	1.003 (0.966 to 1.041)	0.866	0.995 (0.961 to 1.031)	0.793	0.952 (0.910 to 0.995)	**0.030**
Prior Spine Surgery	0.119 (0.011 to 1.231)	0.074	-------	-----	-------	-----
L5-S1	-------	-----	0.483 (0.153 to 1.529)	0.216	-------	-----
Pre-Operative Back Pain	0.559 (0.154 to 2.029)	0.377	-------	-----	-------	-----
Time from Symptom Onset to Surgery (weeks)	0.987 (0.971 to 1.004)	0.136	1.000 (0.988 to 1.012)	0.982	1.013 (0.992 to 1.035)	0.219
Pre-Operative NRS	1.554 (1.182 to 2.041)	**0.002**	1.214 (0.985 to 1.497)	0.069	1.126 (0.877 to 1.445)	0.352
Pre-Operative Physical Therapy	0.252 (0.073 to 0.873)	**0.030**	0.196 (0.062 to 0.621)	**0.006**	0.177 (0.037 to 0.842)	**0.030**
Operative Time	0.991 (0.977 to 1.005)	0.211	0.994 (0.983 to 1.006)	0.350	0.989 (0.969 to 1.008)	0.256

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