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Research Article

Functional Outcomes After Lumbar Fusion for Degenerative Spine Using Oswestry Disability Index. A Retrospective Observational Study

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Abstract

Methods: Retrospective cohort data of 673 (out of which 597 were included in the data) patients was taken, with a diagnosis of degenerative spinal stenosis and had undergone spinal decompressive laminectomy with pedicle screw instrumentation. The data was taken from February 2007 till December 2017 of surgeries which took place in Dr. Ziauddin University hospital Karachi. The follow up of the patients was for up to 2 years. All patients were judged on the outcomes of satisfaction by using the Oswestry disability index (ODI) and those who had already filled the ODI pamphlet preoperatively. The data included of patients who had already filled the ODI Performa till 2 years postop for the assessment of patient's disability. Factors evaluated and variables included were age, gender, BMI, comorbidities, smoking, spondylolisthesis, scoliosis, level of fusion and number of fused levels, S1 involved in fusion.

Results: Total of 673 patients underwent posterior spinal instrumentation and fusion. No statistically significant results were found between other variables regarding patient outcomes. Higher ODI scores were found in desk job occupations. Significant improvements were observed in ODI scores of pre-op and 3 months post-op, 6 months to 12 months and 12 months to 24 months. VAS showed a significant improvement, $P < 0.001$, from a preoperative mean of 5.5 to a mean score of 1.7 at 6months postoperatively. Majority of patients 267 (44.7%) saw a major improvement from Severe Disability to Moderate disability, with a significant association was found between number of levels and ODI score ($p < 0.05$). Significant improvement found at 6month follow up ($p < 0.05$) with a 29.4% ($n = 176$) decrease in the frequency of severe disability and an improvement towards minimal disability of 45.4% ($n = 271$), in patients with Spondylolisthesis.

Conclusion: The Oswestry disability index is an excellent tool in measuring the patient's outcomes of the level of satisfaction after undergoing a lumbar spinal decompressive laminectomy for spinal stenosis. Older age patients and those with long segment fusion fared far less than the patients with short segment fusions.

Keywords: *Spinal Decompressive Laminectomy; Oswestry Disability Index; Spinal Stenosis; Pedicle Instrumentation; Fusion Levels; Transverse Processes*

Introduction

The lumbar spinal stenosis is a condition of when the lumbar spinal canal narrows as a result of facets hypertrophy, hypertrophy of the ligamentum flavum, and/or bulging intervertebral discs, causing compression of spinal nerves, cauda equina, and/or blood vessels [1]. It produces leg pain (unilateral or bilateral) and low back pain, especially while walking (intermittent neurogenic claudication), and

It has the potential to reduce walking distance profoundly leading to severely limited ambulation and effects quality of life [2]. Generally regarded as most common condition affecting elderly population in > 60 years of age especially in US and by 2025, it will affect about 64 million population [3]. If significant clinic-radiological correlation of spinal stenosis findings is present then patient significantly improves after decompression surgery whether instrumented or non-instrumented fusion technology is utilized.

Traditionally, the success of lumbar spinal fusion surgery has been determined primarily by the patient's ability to establish a firm radiographic fusion. Other metrics of success, including as patient-based health status and quality of life ratings, have recently become an important aspect of postoperative evaluation. [4]. Frequently used patient reported outcome scores for lumbar spine surgery includes Oswestry disability index (ODI) and Numeric rating score (NRS) for LBP and leg pain [5]. The Oswestry disability index (ODI), which was developed by J Fairbank [6] in 1980 and is the current standard for assessing low back pain-related disability, is the best way to assess surgical outcomes in spinal fusion surgery. It is both valid and reliable. The ODI is simple and straightforward to complete, comprising of ten questions with six options allocated scores ranging from 0 to 5. To calculate the percent disability, double the total score from all sections. The percent disability is then classified as follows: 0 - 20%: minimal disability; 21 - 40%: moderate disability; 41 - 60%: severe disability; 61 - 80%: crippled; 80 - 100%: bed bound or exaggerating. In a part where a patient has marked two boxes, the greater of the two is used. The average ODI in the ''normal" population was 10.19% [6].

Aim of the Study

The goal of this study was to use the ODI and VAS scores to assess patient reported outcomes after lumbar decompression surgery with fusion for lumbar canal stenosis.

Methods

Total of 673 patients diagnosed with lumbar spinal stenosis who underwent spinal decompression surgery from 2007 to 2017 were enrolled in study, out of which 81 were lost to follow up or not followed and filled ODI scoring form. Remaining 592 patients were included in study. We included those patients who needed decompression and instrumented fusion using pedicle screws i-e those with radiological signs of micro and macro instability on X ray or MRI, per-operatively if wide decompression needed instrumentation (> 50% bilateral or complete unilateral facetectomy or pars removal). Patients with history of spinal surgery were excluded. The preoperative variables were obtained from the data base, which included age, gender, BMI, comorbidities, smoking, spondylolisthesis, scoliosis, level of fusion and number of fused levels, S1 involved in fusion, visual analog pain scores (VAS), walking capacity, working status, Oswestry Disability Index (ODI).

All patients underwent Posterior spinal instrumentation using pedicle screws by free hand technique, followed by wide pedicle to pedicle decompression followed by use of synthetic and autogenous bone graft placed around transverse processes to achieve solid postereolateral fusion. On Follow up visits at 6 weeks, 3,6,12 and 24 months, data on ODI scores, VAS scores, patient satisfaction, walking capacity and current working status was recorded.

SPSS version 23 was utilized to calculated mean+/-SD of categorical variables. Independent sample t-test and Pearson correlation was utilized to see correlation between different variables. P-value <0.05 was considered significant.

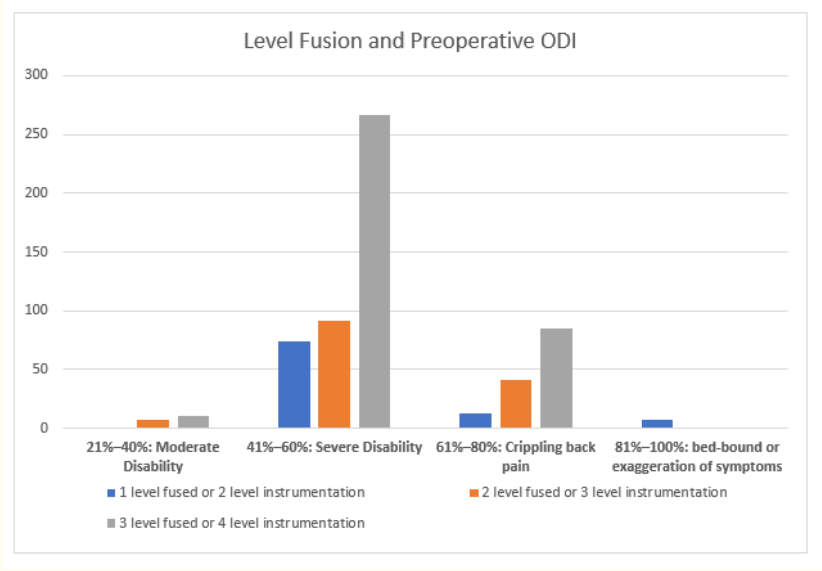
Results

673 patients in total underwent posterior spinal instrumentation and fusion, out of which 81 were lost to follow up or did not fulfil ODI forms. 57.1% were females and 42.9% were males. Mean age of patients was 55±19 years. 32.8% of the total sample were smokers and 67.5% were non-smokers. No statistically significant results were found between age, gender, ethnicity, and smoking regarding patient

outcomes. Higher ODI scores were found in occupations that involved a desk job than those that required fieldwork; however, no statistical significance was achieved. Significant incremental improvements were noted in ODI scores of pre-ops and 3 months post-op, 6 months to 12 months and 12 months to 24 months ($p < 0.001$, $p < 0.001$, $p < 0.05$ respectively). VAS showed a significant improvement, $P < 0.001$, from a preoperative mean of 5.5 to a mean score of 1.7 at 6months postoperatively.

Variable		Preoperative	Postoperative	P-Value
		(μ ± σ)	(μ ± σ)	
Oswestry Disability Index		27.3 ± 5.1	_	_
3 months		_	16.4 ± 5.0	< 0.001*
6 months		_	16.0 ± 6.4	< 0.001*
1 year		_	14.7 ± 5.0	< 0.001*
2 year		_	14.5 ± 4.8	< 0.001*
Visual Analog Scale		5.5 ± 0.7	1.7 ± 0.7	< 0.001*
Key: μ = Mean, σ = Standard Deviation		asterisk (*) = Significant P-Values (Paired T-test)		

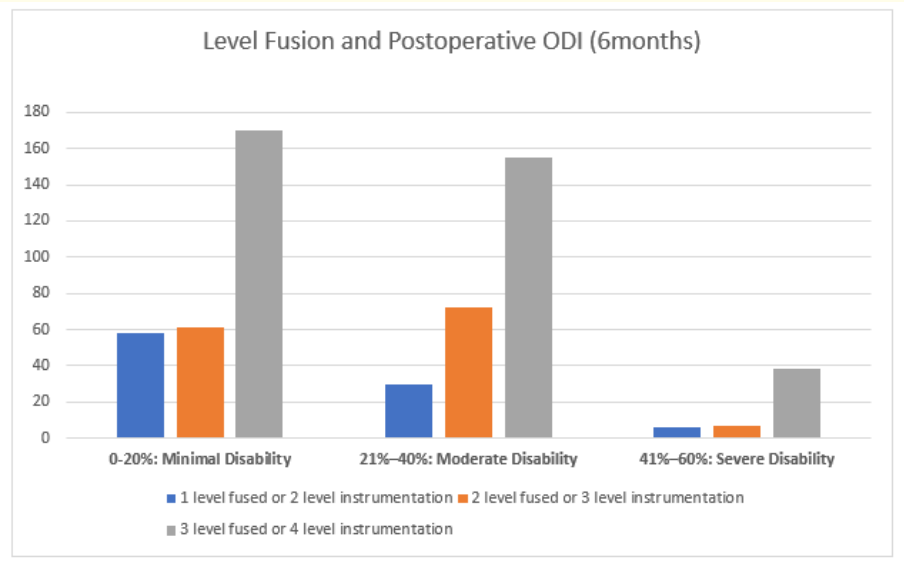
Table 1: *Patient outcomes after lumbar fusion.*



Graph 1: *Lumbar fusion levels and preop ODI.*

ODI and lumbar factors

Significant association was found between number of levels and ODI score ($p < 0.05$). Majority of patients 267 (44.7%) saw a major improvement from Severe Disability to Moderate disability. A trend of higher percentage improvement 30% was seen in individuals with less than 2 level fusions (Graph 2).

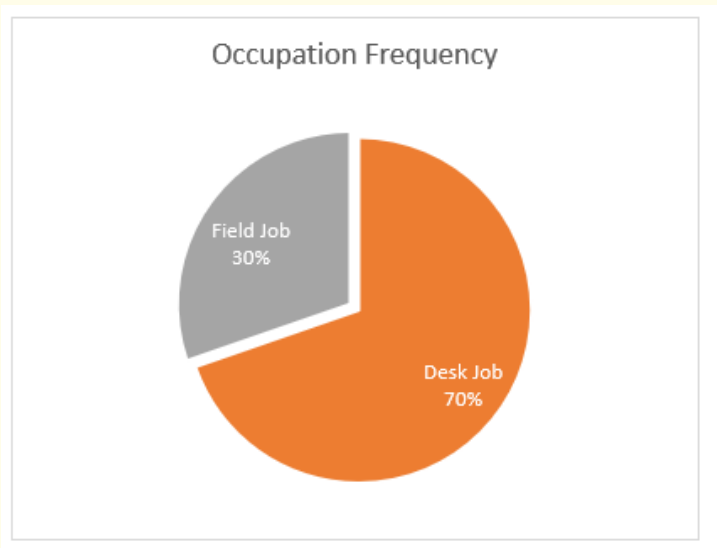


Graph 2: *Level fusions and post-op ODI.*

Spondylolisthesis

Significant improvement found at 6month follow up ($p < 0.05$) with a 29.4% (n = 176) decrease in the frequency of severe disability and an improvement towards minimal disability of 45.4% (n = 271).

Significant association was also found between patients in relation to job, with 70% of the patients were doing desk-jobs and 30% of them were with field work (Graph 3).



Graph 3: *Occupational frequency related ODI.*

Discussion

Degenerative spine disease (DSD) of the lumbar spine is a prevalent cause of disability. One of the treatment modalities is spinal fusion which reduces movement between vertebrae and consequently prevents unnecessary stretching of the surrounding muscle and nerves. It is a major surgical procedure that is used in cases where motion is the pain source, as in arthritic or unstable joint. As medical and surgical treatments become increasingly costly for patients with long term disability, any intervention's value should be measured from the patient's point of view, in terms of improved quality of life [4]. Patient-reported outcome (PRO) questionnaires are an essential tool in a physician's arsenal. Such PROs include Oswestry Disability Index (ODI) and the Visual Analog Scale (VAS), both of which are recognized as valuable tools in effectively quantifying patient outcomes [7].

The mean ODI and back/leg pain levels decreased dramatically in all three BMI groups following surgery, according to Sorimachi., *et al*. however, the obese group had a trend toward severe impairment and slightly greater pain levels. Their findings show that obese patients should not be rejected conventional spinal fusion surgery only because of their weight; nevertheless, prior to surgery, we recommend obese patients to undergo rehabilitation, which may include weight loss. In addition, we should identify individuals with significant levels of disability early in the recovery process so that adequate rehabilitation therapy may be provided [8].

Farrar., *et al*. and Bolton., *et al*. attempted to define the minimal clinically significant difference as an ODI decrease of 4 - 10s points as clinically relevant to the patients [9,10]. Crawford., *et al*. summarized a postoperative symptoms state with ODI < 20 and Pain NRS < 2 as a feasible threshold for patient satisfaction [5].

Our study noted a significant ODI improvement ($p < 0.05$) from a preoperative mean of 27.3 points (severe disability) to postoperative scores of 16.0 points (moderate disability), 14.7 points and 14.5 points (mild disability) at 6 months, 1 year and 2 years respectively. The mean VAS scores decreased from 5.5 (severe pain) to 1.7 (mild/moderate pain), indicating a notable average improvement in patient outcomes post lumbar fusion. In the end, a collection of outcome instruments may be more useful than a single outcome measure.

There was a minor statistical significance (p 0.05) in ODI score discrimination between the numbers of level fusion subgroups, with a trend toward better ODI outcomes in the single to 1 - 2 level fusion subgroups compared to 2+ level fusions. Slightly better ODI outcomes with single-level lumbar fusion could result from less back stiffness, and more lumbar flexibility than individuals with multiple fusions and consecutively produce less impediment of daily function [11]. Our study noted significant statistically differences when fusions were compared to post-op pain.

Regarding degenerative conditions such as Lumbar Degenerative Spondylolisthesis (LDS) and Degenerative Scoliosis, Lumbar fusion has remained somewhat controversial in its efficacy in bringing improved quality of life [12]. Gaetani., *et al*. reported functional impairment in 76 surgically treated LDS individuals in 2006 [13]. After surgical treatment of LDS, Weisskopf., *et al*. reported an 81% decrease rate, 100% bone union, and quality of life being significant improvement [14]. Cole., *et al*. reported decreased frequency and severity of back pain in scoliosis patients with lumbar fusion than those without fusion [15]. We discovered a statistically significant improvement in patient satisfaction, pain, and total clinical outcome in the spondylolisthesis group but not in the preexisting scoliosis group, despite an overall ODI improvement in both groups. Pain scores also showed no statistical improvement in patients with scoliosis despite a trend towards decreased pain frequency. Possible factors for decreased outcomes include hospital factors, surgeon factors, and level of discretionary use of operative features [16]. Nevertheless, there is a consensus in the literature concerning value in restoring normal anatomy [12].

Our study found no significant differences in outcomes regarding gender, ethnicity and smoking. In any outcome measure, age did not explain any distinct variance, as per Mannion., *et al* [17]. Noticeably higher ODI scores were found in occupations that involved a desk job than those that required fieldwork; however, no statistical significance was achieved. This could be because desk jobs require less movement than fieldwork and hence conform better to the post-op stiffness after lumbar fusion. Patients cared more about their unique

desired outcomes than a standardised PROM score, according to Whitebird., *et al*. and their preferred outcomes centered on pain relief, returning to daily life, and returning to an active lifestyle [18]. This may explain why the desk group had higher patient satisfaction than the active fieldwork group.

Our study found a mean overall decrease in ODI and VAS scores in individuals of all BMI groups. Pain and Post-op outcome improved statistically in all BMIs. However, a trend towards higher disability was noted with increasing BMI. Our analysis confirms prior research found no significant differences in outcomes between obese and non-obese patients, and that both groups reaped equivalent benefits [19]. Current literature notes that most adverse outcomes in obese patients are increased inoperative complications [20] rather than adverse post-op outcomes. Therefore, individuals with high BMI should not be excluded from lumbar fusion procedures wholly based on their BMI. Prior research has linked comorbidity to an increased risk of complications after spine surgery and a poorer treatment outcome [21]. Our analysis found that the number of comorbidities did not significantly impact patient outcome; however, the type of comorbidity did ($p < 0.5$). Moreover, surgical intervention on top of existing systemic comorbidities may burden the patient's body and decrease function, quality of life, and recovery in some patients [21]. Slover., *et al*. [22] suggested that, contrary to popular belief, medical and psychosocial comorbidities had a detrimental impact on the Oswestry Disability Index. Notably, comorbidities had no discernible impact on patient satisfaction: all patients showed a general trend towards overall mean satisfaction. In contrast, prior studies also noted decreased satisfaction, presumably due to inappropriate patient expectations [23].

This study's strengths include the large numbers of patients, number of variables covered, adequate compliance to follow-up, and the use of multiple PROMs: producing a complete overall patient assessment. The limitation is its retrospective design: long period for sample collection could cause variations in data recording techniques in the hospital registry. Moreover, PROMs are subjective, thus underreporting and accuracy are often questionable. Our study focused on too many factors instead of giving an in-depth analysis of narrowly outlined pathology and related outcomes. In the future, such issues could be minimized by using a prospective study design with narrowly described study objectives and pathology. However, as a whole, our study managed to produce a well-rounded evaluation of outcomes after lumbar fusion.

Conclusion

In conclusion, the Oswestry disability index is an excellent tool in measuring the patient's outcomes and corresponding levels of satisfaction after undergoing a lumbar spinal decompressive laminectomy for spinal stenosis.

Bibliography

1. Ahmed SI., *et al*. "Comparison of decompression alone versus decompression with fusion for stenotic lumbar spine: a systematic review and meta-analysis". *Cureus* 10.8 (2018): e3135.

2. Försth P., *et al*. "A randomized, controlled trial of fusion surgery for lumbar spinal stenosis". *New England Journal of Medicine* 374.15 (2016): 1413-1423.

3. Wu AM., *et al*. "A rethink of fusion surgery for lumbar spinal stenosis". *Journal of Evidence-Based Medicine* 9.4 (2016): 166-169.

4. Glassman S., *et al*. "MOS short form 36 and Oswestry Disability Index outcomes in lumbar fusion: a multicenter experience". *The Spine Journal* 6.1 (2006): 21-26.

5. Crawford III CH., *et al*. "Prognostic factors associated with best outcomes (minimal symptom state) following fusion for lumbar degenerative conditions". *The Spine Journal* 19.2 (2019): 187-190.

6. Fairbank JC and Pynsent PB. "The Oswestry disability index". *Spine* 25.22 (2000): 2940-2953.

7. Zanoli G., *et al*. "Visual analog scales for interpretation of back and leg pain intensity in patients operated for degenerative lumbar spine disorders". *Spine* 26.21 (2001): 2375-2380.

8. Sorimachi Yasunori MD., *et al*. "Effect of Obesity and Being Overweight on Disability and Pain After Lumbar Fusion". *Spine* 41.9 (2016): 772-777.

9. Farrar JT., *et al*. "Defining the clinically important difference in pain outcome measures". *Pain* 88.3 (2000): 287-294.

10. Bolton JE. "Sensitivity and specificity of outcome measures in patients with neck pain: detecting clinically significant improvement". *Spine* 29.21 (2004): 2410-2417.

11. Fan H., *et al*. "Comparison of functional outcome and quality of life in patients with idiopathic scoliosis treated by spinal fusion". *Medicine* 95.19 (2016).

12. Omidi-Kashani F., *et al*. "Surgical outcome of reduction and instrumented fusion in lumbar degenerative spondylolisthesis". *Iranian Journal of Medical Sciences* 41.1 (2016): 13.

13. Gaetani P., *et al*. "Functional disability after instrumented stabilization in lumbar degenerative spondylolisthesis: a follow-up study". *Functional Neurology* 21.1 (2006): 31-38.

14. Weißkopf M., *et al*. "Reposition der Spondylolisthese durch temporäre Distraktion im angrenzenden Segment". *Zeitschrift für Orthopädie und Ihre Grenzgebiete* 144.05 (2006): 511-515.

15. Cole AA., *et al*. "The effect of spinal fusion on the long-term outcome of idiopathic scoliosis". *The Journal of Bone and Joint Surgery British Volume* 85.2 (2003): 307.

16. Martin BI., *et al*. "Hospital and surgeon variation in complications and repeat surgery following incident lumbar fusion for common degenerative diagnoses". *Health Services Research* 48.1 (2013): 1-25.

17. Mannion AF., *et al*. "The quality of spine surgery from the patient's perspective. Part 1: The Core Outcome Measures Index in clinical practice". *European Spine Journal* 18.3 (2009): 367-373.

18. Whitebird RR., *et al*. "What Outcomes Matter to Patients After Joint or Spine Surgery?" *Journal of Patient-Centered Research and Reviews* 7.2 (2020): 157.

19. Djurasovic M., *et al*. "The effect of obesity on clinical outcomes after lumbar fusion". *Spine* 33.16 (2008): 1789-1792.

20. Vaidya R., *et al*. "Lumbar spine fusion in obese and morbidly obese patients". *Spine* 34.5 (2009): 495-500.

21. Mannion AF., *et al*. "The influence of comorbidity on the risks and benefits of spine surgery for degenerative lumbar disorders". *European Spine Journal* 23.1 (2014): 66-71.

22. Slover J., *et al*. "The impact of comorbidities on the change in short-form 36 and oswestry scores following lumbar spine surgery". *Spine* 31.17 (2006): 1974-1980.

23. Mannion AF., *et al*. "Great expectations: really the novel predictor of outcome" (2009).

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