Trauma Mon. 2019 January; 24(1):e67090. doi: 10.5812/traumamon.67090.

Published online 2018 September 25. **Research Article**

Quality of Life and Disability in Candidates for Lumbar Spinal Fusion Surgery

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Received 2018 March 10; **Revised** 2018 May 13; **Accepted** 2018 June 02.

Abstract

Background: As life expectancy in the society increases, the rate of degenerative diseases of the spine surge dramatically. Therefore, the number of patients undergoing spinal fusion surgery rises; however, the effectiveness of this operation is still controversial.
Objectives: The aim of this study was to investigate disability and quality of life in patients undergoing spinal fusion and compare the results with a matched general population sample.
Methods: In this prospective study, which was conducted during 2015 - 2016 in Iran, data were collected from 100 patients undergoing spinal fusion surgery at Baqiyatallah and Shariati Hospitals. We also recruited 100 people from the general population in the hospital matched with the patients with regard to sex, age, and smoking status. The participants filled out the 36-item short form (SF-36) and Oswestry disability index (ODI) questionnaires. The collected data on the quality of life and disability of patients, before and three and six months after the surgery were compared.
Results: The patient and general population groups were matched in terms of sex, age, educational level, body mass index (BMI), employment status, and smoking status ($P > 0.05$). Preoperative ODI score in the patients was 54.8 (SD 15.7), and six months after the surgery, it diminished to 24.8 (SD 9.25). ODI score in the general population sample was 17.5 (SD 8.3). Although disability improved significantly six months after surgery, it did not reach the level of the general population sample ($P < 0.001$). All aspects of the SF-36 improved six months after surgery ($P < 0.05$) and the patients reached the general population sample in emotional, mental health, and vitality subscales of SF-36 ($P > 0.05$). They did not reach the general population sample in other subscales of SF-36 ($P < 0.05$).
Conclusions: Despite the significant improvement in disability and all subscales of quality of life in the patients, they did not reach the general population sample in disability index, physical function, general health, physical role, social function, and pain subscales of the SF-36. However, they reached general population sample level in emotional, mental health, and vitality subscales of the SF-36.

Keywords: Life Expectancy, Quality of Life, Spinal Fusion

1. Background

As life expectancy in the society enhances, degenerative diseases of the spine increase dramatically. Therefore, the number of patients who are undergoing surgical treatment raises (1). During the past decade, several studies have demonstrated a fast growth in the rate of lumbar spine surgery and significant geographic alternations in the application of spine surgery (1-4). Also, some epidemiological studies have suggested that the rate of spinal fusion in patients undergoing spine surgery increases faster than non-fusion surgery. Likewise, it has been demonstrated that surgical rates are significantly increasing among adults aged 60 years and over, and diagnoses of herniated disc or degenerative changes are also on a rise.

Improving the quality of life and diminishing disability are important goals in spine surgeries (3). Although spinal fusion surgery has been being performed on patients since the early 1960s, the effectiveness of this surgery is still controversial (2-4). The benefits of spinal fusion surgery in the treatment of chronic lower back pain without radiculopathy have been challenging since it can increase costs without significant efficacy. On the other hand, there are consistent results from several clinical studies that lumbar spine fusion surgery can decrease disability and pain in patients with chronic lower back pain related to degenerative diseases of the spine (5).

A good approach for assessing the outcome of surgery is using patient-reported outcomes (PROs) (6). Several questionnaires have been designed to address the abovementioned goals. 36-item short form survey (SF-36) (7) and Oswestry disability index (ODI) (8) questionnaires have been used in different studies to measure health-related quality of life and condition-specific disability, respectively. To assess clinical success after surgery, multiple ways have been tried (9, 10), one of which was to compare the results to general population scores (11). This method has been used in Mokhtar et al. (1) and Pekkanen et al. (11) studies. In Pekkanen et al. study, data from 252 patients undergoing spinal fusion and 682 age- and sex-matched population samples were collected using SF-36 and ODI questionnaires and the one-year follow-up results were compared to the general population sample (11). There has been no such assessment in the Iranian population.

2. Objectives

In this study, we sought to investigate disability and health-related quality of life in patients undergoing spinal fusion surgery, before, as well as three and six months after surgery and compare the results to a general population sample matched with the patients in terms of age, sex, and smoking status.

3. Methods

In this prospective follow-up study conducted during 2015 - 2016, 112 patients (72 women and 40 men) admitted to Baqiyatallah and Shariati Hospitals were eligible. The inclusion criteria were age between 45 and 70 years old and being a candidate for elective spinal fusion surgery due to degenerative spondylolisthesis, isthmic spondylolisthesis, or lumbar spinal stenosis. The exclusion criteria were prior spine surgery, spine infections, congenital spinal anomalies, and traumatic fractures of the spine. Diagnosis of each patient was confirmed by two surgeons.

Of the 112 patients, 12 did not continue participation in the study and 100 patients (63 women and 37 men) completed the study. To compare the patients with the general population values, per each patient, one control from the general population was included. The two groups were matched in terms of age, sex, and smoking status. The general population sample was selected randomly from non-patient individuals in Shariati and Baqiatallah Hospitals. They had not been hospitalized for any diseases and were not candidates for spinal fusion surgery. Thus, 100 (63 women and 37 men) people were included as the general population sample.

Spinal fusion procedure was as follows. Decompressive laminectomy and posterior lateral interbody fusion were performed. After removing the lower half of the lamina of the cephalad vertebra, performing medial facetectomy, and removing the space between the vertebrae, the patients were treated using titanium pedicle screw.

Before the surgery, demographic data including age, sex, body mass index (BMI), smoking status, employment status, educational level, and marital status were obtained from the patients. The patients were assessed using the SF-36 and ODI questionnaires to evaluate their quality of life and disability before the surgery. Three and six months post-surgery, SF-36 and ODI values were obtained again. Follow-up was carried out face to face, through telephone call, or via email. Demographic data and SF-36 and ODI values were also gathered from the general population sample.

SF-36 is a questionnaire that measures health-related quality of life. It contains eight subscales of physical function, physical role, emotional role, mental health, vitality, social function, pain, and general health. Each one is scored from 0 to 100 with the higher scores indicating better condition (7).

ODI is a questionnaire that is specifically used for back diseases and widely used in back pain research. It measures disability and categorizes patients into five groups of minimal disability (0 - 20), moderate disability (20 - 40), severe disability (40 - 60), crippled (60 - 80), and those who are either bed-bound or exaggerating their symptoms (80 - 100) (8). Higher scores in this questionnaire mean worse disability. In this study, disability was evaluated by using ODI questionnaire.

The ethics committees of Baqiyatallah University of Medical Sciences and Tehran University of Medical Sciences approved the study (ethics code: IR.BMSU.REC.1394.65). Informed consents were obtained from all the participants. The study is in agreement with the ethical guidelines of the 1975 Declaration of Helsinki.

3.1. Statistical Analysis

The data were analyzed using SPSS, version 21. Continuous variables are presented as mean $\pm$ standard deviation and categorical variables as percentage and/or frequency. The two groups were compared using *t*-test and Chi-square test. For comparison of data during follow-up, repeated measures ANOVA was run. P value less than 0.05 was considered statistically significant.

4. Results

In this six-month follow-up cohort study, 112 patients (72 women and 40 men) admitted to Baqiyatallah and

Shariati Hospitals were eligible. Eligibility was confirmed by two surgeons. Overall, 12 of the included patients did not continue participation in the study, and 100 patients undergoing lumbar spinal fusion surgery completed the study. To compare the results to the general population, a sample of the general population consisting of 100 people matched with the patients according to age, sex, and smoking status was also included. Demographic data of the participants is shown in Table 1.

The mean ages of the patient and general population groups were 56.8 ± 5.7 and 57.1 ± 5.8 years; the two groups were not significantly different in terms of age, sex, BMI, educational level, smoking, and employment status ($P > 0.05$). Their only significant difference was in marital status; the number of singles was higher in the general population sample ($P = 0.002$). BMI of the patients was higher than the general population sample, but it was not significantly different ($P > 0.05$). ODI scores of the participants (disability index) are shown in Table 2.

According to Table 2, disability of the patients reduced significantly three months after surgery ($P < 0.001$), but there was no significant difference between six months after the surgery and three months after the surgery in ODI score ($P = 0.14$). Disability score in women was significantly higher than men in both patient and general population groups ($P < 0.001$). In patients, disability three months and six months after the surgery was moderate, which was significantly higher than the minimal disability in the general population sample ($P < 0.001$). Evaluation of the relationship between disability and demographic characteristics in patients showed an inverse relationship between age and disability before surgery and three and six months after surgery; disability was lower in patients with higher age, but this relationship was not statistically significant ($P > 0.05$). There was also a positive association between BMI and disability pre- and post-surgery; disability was significantly higher in patients with higher BMI ($P < 0.05$).

In the general population sample, there was not any significant relationship between disability and age, BMI, educational level, smoking status, marital status, and employment status ($P > 0.05$)

Three months post-surgery, the quality of life in patients improved significantly in all the aspects of SF-36 ($P < 0.05$). Comparing the results of six-month follow-up to three-month follow-up showed that three months post-operation, the patients improved significantly in the physical function, vitality, and pain subscales of SF-36 ($P < 0.05$). There were no significant differences between three-month and six-month follow-up scores in the physical role, emotional role, mental health, social function, and general health subscales of SF-36 ($P > 0.05$).

After six months of follow-up, although there were significant improvements in all the subscales, the patients reached the level of general population sample only in the emotional role, vitality, and mental health subscales of the SF-36 ($P > 0.05$), and the scores in the other subscales remained significantly lower than the general population sample ($P < 0.05$).

5. Discussion

The aim of the study was to investigate the improvement in disability and health-related quality of life of patients undergoing spinal fusion surgery during a six-month follow-up and compare the results to a general population sample matched with the patients according to age, sex, and smoking status. The Iranian version of ODI and SF-36 questionnaires were used to assess disability and health-related quality of life, respectively (12, 13). The results demonstrated that the patients had significant improvements in disability and all the aspects of the SF-36 questionnaire six months after surgery. Patients did not reach the general population sample in disability index and in the physical function, physical role, social function, pain, and general health aspects of the SF-36. They only reached the level of the general population sample in emotional role, vitality, and mental health subscales of SF-36.

In a cohort study in 2013, Pekkanent et al. (11) studied disability and quality of life in patients undergoing spinal fusion surgery during a one-year follow-up using ODI and SF-36 questionnaires, and they compared the results to an age- and sex-matched general population sample. Overall, 52 patients and 682 people as the general population sample were included. The patients showed a significant improvement in disability and quality of life after surgery, but they did not reach the level of the general population sample in disability and physical component of SF-36. The results of our study were in agreement with those of the Pekkanent et al. study.

There are other studies that used standard questionnaires to evaluate improvement after spinal fusion surgery (14-17), but their main goal was comparing different methods of spinal fusion and they did not use a matched general population sample. These studies showed improvements in the quality of life and disability after spinal fusion, although different methods of surgery showed no significant differences. The improvement in quality of life and disability was in concord with our study results.

Few studies have utilized a general population sample as a standard for comparison, and in Iran, there has been no such studies; this is a new method for assessment, therefore, performing further studies is suggested. In Iran, this is the first time that a general population sample is used for comparison. We matched these two groups in terms of

Table 1. Demographic Data of the Participants[a]

Characteristic	Patients Group	General Population Sample	P Value
Age (y)	56.8 ± 5.7	57.1 ± 5.8	> 0.05
Sex			0.99
Male	37	37	
Female	63	63	
Body mass index	29.3 ± 3.8	28.7 ± 3.7	> 0.05
Smoking status			0.7
Smoker	3	4	
Non-smoker	97	96	
Educational level			0.58
Elementary	30	35	
Secondary	28	30	
Higher	42	35	
Employment status			0.52
Unemployed	15	21	
Employed	26	26	
Retired	59	53	
Marital status			0.002
Married	94	89	
Single	6	11	

[a] Values are expressed as mean ± SD or %.

Table 2. Oswestry Disability Index Scores of the Participants

	Average Score	Standard Deviation	Disability Status
Patients before surgery	54.6	15.7	Severe disability
Patients three months after surgery	25.6	10.8	Moderate disability
Patients six months after surgery	24.8	9.2	Moderate disability
General population sample	17.5	8.3	Minimal disability

Table 3. The SF-36 Subscales Before and After the Surgery in the Patient and General Population Groups[a]

SF-36 Subscales	Patients Before Surgery	Patients Three Months After Surgery	Patients Six Months After Surgery	General Population Sample	P Value 6-Month vs. Sample Group
Physical function	36.4 (17.4)	67.9 (15.1)	72.9 (15.2)	79.6 (14.5)	0.0009
Physical role	13.4 (17.9)	45.8 (27.3)	48.5 (29.3)	57.1 (26.8)	0.0417
Emotional role	47.3 (30.0)	66.7 (29.9)	65.9 (31.1)	70.7 (29.3)	0.13
Vitality	42.2 (16.2)	58.6 (15.3)	60.9 (15.7)	63.9 (15.9)	0.18
Mental health	53.7 (22.6)	68.1 (19.6)	67.2 (20.2)	70.5 (20.8)	0.24
Social function	41.5 (21.9)	57.6 (24.1)	58.1 (22.9)	66.4 (21.7)	0.009
Pain	27.5 (19.9)	55.4 (23.7)	60.5 (23.9)	69.5 (22.7)	0.0079
General health	55.8 (17.1)	64.2 (14.4)	63.3 (15.9)	68.5 (16.6)	0.02

[a] Values are expressed as mean (SD).

age, sex, and smoking status because these characteristics may serve a great role in the quality of life and disability.

A limitation of this study was the lack of a general population database; thus, we had to choose the samples ourselves. Another limitation was differences between educational levels that may lead to bias in answering the questions. Also, we did not exclude patients with mental diseases and it could be a confounding factor in our study.

In the present study, there were no significant improvements in six-month follow-up compared to three-month follow-up in disability index and the physical role, emotional role, mental health, social function, and general health subscales of the SF-36. It seems that a three-month recovery period can be enough for the subscales mentioned above. However, six months after the surgery, the patients still showed improvements in the other subscales of SF-36, which may suggest that a period longer than six months might be necessary for a full postoperative recovery. However, previous studies had shown that disability and the quality of life are stabilized within three months post-operation (11).

The results of this clinical study were limited to the assessment of the quality of life based on the number of fusion levels or expansion to the sacrum because it was not possible to match the extracted data of patients with etiology of the spinal disease and demographic data of the patients. Thus, further investigation is required.

Acknowledgments

We wish to thank everyone who participated in this study.

Footnotes

Authors' Contribution: Study design: Rahim Roeintan, Alireza Khoshnevisan, Ahmadreza Khoshroo; data collection: Rahim Roeintan, Alireza Khoshnevisan, Ahmadreza Khoshroo, Alireza Arefidoust; data Analyzing: Rahim Roeintan, Alireza Khoshnevisan, Ahmadreza Khoshroo, Alireza Arefidoust, Hamid Reza Rasouli; manuscript writing: Rahim Roeintan, Alireza Khoshnevisan, Ahmadreza Khoshroo, Hamid Reza Rasouli.

Financial Disclosure: The authors declare no conflict of interests.

Funding/Support: This study had no funding.

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