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ARTICLE

Impact of surgery on pain, disability, and quality of life of patients with degenerative lumbar disease: Brazilian data

Impacto da cirurgia na dor, incapacidade e qualidade de vida de portadores de doença degenerativa lombar: dados brasileiros

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ABSTRACT

Objective: To study the impact of surgery on pain, disability, quality of life, and patient satisfaction in a sample of patients with Degenerative Lumbar Disease (DLD). **Methods:** Retrospective analysis of prospectively collected data. Comparison between pre and postoperative (6 – 12 months) ODI and SF-36, plus postoperative Patient Satisfaction Index. **Results:** From a total of 216 patients included, improvement was observed in average scores of pain (201.2%), disability (39.7%), physical quality of life (42%), and mental quality of life (37.8%). Among these patients, 57.7% reached or surpassed the minimal clinically important difference (MCID) for ODI, 57.7% for the SF-36 pain component, 59.7% for the SF-36 physical component summary, and 50.5% achieved or surpassed the MCID for the SF-36 mental component summary. **Conclusions:** Surgery produced a significantly positive impact on pain, disability, and quality of life of patients. Overall, 82.5% of the patients were satisfied.

Keywords: spine surgery; intervertebral disc degeneration; outcome assessment (health care); disability; pain; quality of life; lumbar vertebrae; treatment outcomes; patient satisfaction; patient reported outcomes.

RESUMO

Objetivo: Descrever o impacto da cirurgia na dor, incapacidade, qualidade de vida e a satisfação global do paciente numa amostra unificada de pacientes portadores de DDL. **Métodos:** Análise retrospectiva de dados colhidos prospectivamente em pacientes operados no período de janeiro de 2014 a março de 2017, que tivessem avaliação pré-operatória e pelo menos uma avaliação pós-operatória entre 6 e 12 meses com os questionários de ODI, SF-36 e o ISP. **Resultados:** Um total 216 pacientes preenchia os critérios de inclusão. Houve melhora no escore médio de dor (201,2%), incapacidade (39,7%), qualidade de vida física (42%) e mental (37,8%). Da amostra, 57,7% alcançaram o MCID de dor, 59,7% de ODI, 59,7% 50,5% de PCS e 50,5% de MCS; 82,5% dos pacientes se consideraram "Satisfeitos". **Conclusões:** O efeito da cirurgia foi amplamente favorável na dor, incapacidade e qualidade de vida dos pacientes portadores de DDL. Estes dados podem servir de guia para aconselhamento pré-operatório quanto às perspectivas de sucesso.

Palavras-chave: cirurgia da coluna vertebral; degeneração de disco intervertebral; avaliação de resultados (cuidados de saúde); deficiência; dor; qualidade de vida; vértebras lombares; resultado do tratamento; satisfação do paciente; resultados relatados por paciente

Disc herniation, spinal stenosis, spondylolisthesis, and degenerative spinal deformity are collectively referred to as Degenerative Lumbar Disease (DLD), corresponding to the most frequent reason for elective spine surgery[1,2,3]. Although the number of surgical procedures for DLD treatment continues to increase, the interpretation of their results remains controversial[4]. The patients usually describe their expectations in absolute, broad terms, and the results are consequently described only as either "success" or "failure". DLD, however, affects health on several levels, including pain, disability, physical quality of life, and mental quality of life. These components can be evaluated using Patient Reported

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Outcome Measures (PROM) questionnaires[5]. The lack of consensus on the impact of surgical treatment of DLD is due to the diversity of possible outcomes in the components as mentioned above. Since there is an occasional improvement in only some of them[6], the subjective satisfaction of each patient regarding the results of the surgery should also be analyzed. International[7,8,9,10] and Brazilian[11] literature reports results on each of the subtypes of DLD separately. However, the patients often present different clinical conditions at the same time, including disc herniation and stenosis, stenosis in one level and spondylolisthesis in another, and so on. Recently, studies evaluating the results of surgery for DDL analyzing all patients as a single set have been published, an approach that seems realistic[12,13,14].

Preoperative counseling in DLD, as in any surgically treatable disease, ought to include information on the prognosis of success and failure. This task becomes challenging when there is no consensus on what constitutes success and failure *per se*. The low availability of data collected in our country adds difficulty to Brazilian surgeons. Thus, with the aim of providing future information for preoperative counseling, the present work describes observed variations in pain, disability, and quality of life from a sample of DLD patients surgically treated in Brazil. We also report overall patient satisfaction according to surveys.

METHODS

A retrospective analysis was conducted on clinical results prospectively collected from DLD patients surgically treated at the Neurosurgery service at São José Hospital, Santa Casa de Misericórdia Hospital Complex (ISCMPA) in Porto Alegre, Brazil, between June 2013 and April 2017. The patients were asked to fill out the Oswestry Disability Index (ODI)[15] and the Short Form 36 health survey (SF-36)[16] questionnaires during the preoperative assessment. These same questionnaires were applied in the postoperative assessments at the first, sixth and 12th months after surgery, along with the Patient Satisfaction Index (PSI) questionnaire (Figure). All DLD patients for whom preoperative and postoperative (from six to 12 months after surgery) data were available were included in our analysis. ODI scores were estimated following the original recommendations[13]. SF-36 scores were grouped in three constructs: physical component summary (PCS), mental component summary (MCS), and pain (PAIN)[16,17]. The minimal clinically important difference (MCID) score was estimated as described by Copay[18,19], primarily based on the satisfaction group 4 of the PSI. Patients in groups 4 and 5 of the PSI were grouped as "satisfied" for discussion purposes.

Patient Satisfaction Index	*Would you consider to undergo again to surgery to achieve the same result?*
5	Undoubtedly yes
4	Probably yes
3	I am unsure
2	Probably not
1	Undoubtedly not

Figure. Patient Satisfaction Index (PSI).

This research was approved by the Ethics and Research Committee at ISCMPA, and all patients signed a term of informed consent.

Statistical analysis

The variables are presented as mean (M) and SE values, or absolute (n) and relative (%) frequencies. Patients were divided into two groups: i) ***satisfied***, who presented a PSI of 5 or 4 (who would undergo surgery again); and ii) ***dissatisfied***, who filed a PSI of 3, 2 or 1 (who would not undergo surgery again or are unsure). Chi-square and t-tests were used to compare variables and define groups. The statistical analyses were performed using SPSS software version 20.0.

RESULTS

A total of 444 patients underwent surgery for treatment of DLD during the data sampling period. Among these patients, 216 filled in the inclusion criteria as described in the methods section, and were included in the analysis sample.

The characteristics of the patients included and excluded in the final analysis are presented in Table 1. No significant differences between the groups were observed. In the studied group, 115 patients (53.2%) were female. The mean age was 52.6 +/- 14.4 (SD) year old. Surgical instrumentation was required in 83 cases (38.4%). Eighty patients (37.0%) were from the Unified Health System (Sistema Único de Saúde, SUS), and 136 (63.0%) from private health plans. A total of 21 patients presented Diabetes Mellitus (9.8%), 76 (35.3%) were hypertense, and four (1.9%) presented alcoholism. At the

Table 1. Comparison between patients included and excluded.

Scale	Excluded (n = 228)	Included (n = 216)	p-value
Clinical characteristics			
Age (in years)	51.4 ± 1.0	52.6 ± 1.0	0.38
Body Mass Index	27.4 ± 0.3	27.0 ± 0.3	0.44
Pre-operative of the evaluated scales			
SF-36 PCS	28.1 ± 0.5	28.6 ± 0.4	0.45
SF-36 MCS	39.8 ± 1.0	40.5 ± 1.0	0.64
SF-36 BP	20.7 ± 1.0	29.6 ± 1.0	0.18
ODI	27.3 ± 0.05	26.8 ± 0.06	0.55

SF-36: short form-36; PCS: physical component summary; MCS: mental component summary; BP: Bodily Pain; ODI: Oswestry Disability Index.

time of surgery, 53 (24.5%) were on medication for depression and 34 (15.8%) for anxiety. Previous lumbar spine surgery had been performed on 23 patients (10.9%), and 30 (13.9%) were submitted to surgery through minimally invasive methods during this period.

Our initial protocol assumed that patients would be operated upon for one single subtype of DLD. According to this protocol, the patients where distributed as follows: lumbar disc herniation (n = 98, 5%); foraminal and/or extraforaminal disc herniation (n = 16, 7.5%); lumbar stenosis (n = 55, 25.8%); spondylolisthesis (n = 35, 16.4%); lumbar degenerative deformity (n = 9, 4.%). When the surgical technique used on each case was reviewed, it became evident that a large part of the sample harbored more than one subtype of DLD (for example: disc herniation on one level and stenosis on another, spondylolisthesis on one level and disc herniation or stenosis on another, and so on). Therefore, we believe these numbers are unreliable.

The PSI questionnaire scores ranked 113 patients (53.5%) as satisfaction level 5 (*definitely would undergo surgery again)*, and 61 (28.9%) as level 4 (*probably would undergo surgery again*). The combination of these two categories indicates that 174 patients (82.5%) could be described as *„satisfied"* with the outcome. The *„dissatisfied"* patients amounted to 37 (17.5%), of which 23 (10.9%) were included in satisfaction level 3 (*unsure about undergoing surgery again*), nine (4.3%) in satisfaction level 2 (*probably would not undergo surgery again*), and five (2.4%) in satisfaction level 1 (*definitely would not undergo surgery again*) (Table 2).

The MCID scores for pain (pain component SF-36), disability (ODI), and quality of life (SF-36 PCS and SF-36 MCS) were, respectively, 24.5 (3.2), 8.4 (1.3), 6.8 (1.2), and 7.6 (2.5).

Table 2 presents the average raw scores, mean variation between pre- and postoperative assessment scores (D), average percentage variation (D%), and percentage of patients who reached the MCID for the ODI, SF-36 pain component, SF-36 PCS, and SF-36 MCS. These scores are presented for the entire patient group at pre and postoperative conditions. Table 2 also shows the number and percentage of patients in each of the five categories of the PSI. Mean values, D, D% and % of the subgroup who reached MCID in each PROM and corresponding PSI are also indicated in Table 2. The scores are presented as mean + standard error (SE).

Table 3 shows a comparison of the satisfied (groups 5 and 4) and dissatisfied patients (groups 3, 2 and 1) regarding their average raw scores, mean variation between pre and postoperative assessment scores (D), average percentage variation (D%), and percentage of patients who reached the MCID for the ODI, SF-36 pain component, SF-36 PCS, and SF-36 MCS. The scores are presented as mean + standard error (SE).

Table 2. Results of Pain, ODI, SF-36 PCS and SF-36 MCS according to the Patient Satisfaction Index (PSI).

Evaluated scales	Total		PSI*				
	Pre-operative	Post-operative	5**	4**	3	2	1
	(n = 216)	(n = 216)	(n = 113)	(n = 61)	(n = 23)	(n = 9)	(n = 5)
Pain SF average raw score	22.6 ± 1.0	54.5 (1.7)	64.1 (2.3)	48.6 (2.7)	32.5 (4.1)	37.2 (8.0)	43.4 (9.1)
D Pain SF		31.9 (1.8)	40.5 (2.5)	24.5 (3.2)	15.6 (4.5)	21.8 (8.1)	19.6 (8.9)
D% Pain SF		201.3 (2.1)	239.0 (0.2)	173.0 (0.2)	135.1 (0.4)	171.7 (0.8)	83.8 (0.4)
(% of the subgroup reaching MCID)		123 (57.7%)	82 (73.2%)	27 (45.8%)	6 (26.1%)	3 (33.3%)	2 (40.0%)
ODI average raw score†	26.8 ± 0.6	15.1 (0.7)	11.1 (0.9)	18.2 (1.0)	22.3 (1.5)	22.9 (3.6)	19.6 (4.2)
D ODI		-11.5 (0.8)	-15.0 (1.1)	-8.4 (1.3)	-7.4 (2.0)	-6.6 (2.5)	-3.0 (5.3)
D% ODI		-39.7 (2.7)	-55.2 (3.4)	-22.7 (6.3)	-21.2 (5.4)	-23.5 (8.9)	-10.8 (19.5)
(% of the subgroup reaching MCID)		116 (57.7%)	73 (69.5%)	30 (53.6%)	8 (36.4%)	2 (22.2%)	1 (25.0%)
PCS average raw scores‡,§	28.6 ± 0.4	38.4 (0.7)	41.8 (1.0)	35.5 (1.0)	32.6 (1.9)	36.1 (3.42)	35.21 (2.77)
D PCS		10.0 (0.8)	13.7 (1.1)	6.8 (1.2)	3.2 (2.07)	8.4 (3.9)	8.8 (2.8)
D% PCS		42.0 (3.5)	56.31 (5.24)	30.62 (5.87)	17.91 (9.62)	36.28 (13.6)	33.4 (10.4)
(% of the subgroup reaching MCID)		117 (59.7%)	72 (72.0%)	29 (50.0%)	8 (38.1%)	5 (62.5%)	2 (40%)
MCS average raw score‡	40.5 ± 1.0	49.2 (1.0)	53.0 (1.24)	47.0 (2.0)	42.00 (3.7)	37.4 (5.9)	45.7 (7.7)
D MCS		8.7 (1.2)	10.8 (1.5)	7.6 (2.5)	7.9 (3.9)	2.6 (5.9)	-3.6 (8.4)
D% MCS		37.8 (0.05)	40.8 (0.06)	39.1 (0.09)	44.8 (0.2)	12.3 (0.2)	-3.9 (0.2)
(% of the subgroup reaching MCID)		99 (50.5%)	56 (56%)	30 (51.7%)	8 (38.1%)	2 (25.0%)	2 (50.0%)

ODI: Oswestry Disability Index; SF-36: short form-36; PCS: physical component summary; MCS: mental component summary; MCID: minimal clinically important difference; * PSI data was not available for five patients; † seven patients did not fill out the ODI questionnaire; ‡ 20 patients did not fill out the SF-36 PCS and SF-36 MCS questionnaire; § three patients did not fill out the SF-36 pain component questionnaire; ** For the descriptive analysis, we considered the combination of groups 4 and 5 as the patients who would undergo surgery again (satisfied).

Table 3. Comparison between the satisfied and dissatisfied groups using the scores of the Oswestry Disability Index (ODI), and physical component summary (PCS), mental component summary (MCS) and Pain constructs of the SF-36.

Evaluated scales	Grouped Patient Satisfaction Indexes		p-value
	5 or 4 (n = 174)	3, 2 or 1 (n = 34)	
ODI average raw score	13.6± 0.7	22.0 ±1.4	< 0.001
D ODI	-12.7 ± 0.9	-6.7 ±1.5	0.003
D% ODI	-43.9 ± 3.3	-20.6 ± 4.5	0.002
(% of the subgroup reaching MCID)	103 (64%)	11 (31.4%)	< 0.001
PCS average raw score	39.5 ± 0.8	33.8 ±1.5	0.002
D PCS	11.2 ± 0.9	5.3 ±1.6	0.004
D% PCS	46.9 ± 4.1	24.5 ± 6.9	0.018
(% of the subgroup reaching MCID)	101 (63.9%)	15 (44.1%)	0.032
MCS average raw score	50.8 ± 1.1	41.4 ± 2.9	0.001
D MCS	9.7 ± 1.3	5.0 ± 3.1	0.146
D% MCS	40.2 ± 5.3	30.0 ±16.0	0.458
(% of the subgroup reaching MCID)	86 (54.4%)	11 (32.4%)	0.020
Pain SF average raw score	58.8 ± 1.9	35.1 ± 3.4	< 0.001
D Pain SF	35.0 ± 2.0	17.7 ± 3.5	< 0.001
D% Pain SF	216.3 ± 0.2	137.1 ± 32.6	0.043
(% of the subgroup reaching MCID)	109 (63.7%)	11 (29.7%)	< 0.001

MCID: minimal clinically important difference.

DISCUSSION

The data from the present study showed that 82.5% of the patients undergoing surgical treatment for DLD were satisfied with the result of the surgery between six and 12 months after the intervention, i.e., they would consider undergoing surgery again to achieve the same results.

The impact of surgery in our case study was positive since there was an improvement in the average scores of pain (201.3%), disability (39.7%), physical quality of life (42%), and mental quality of life (37.8%). Our data revealed that 57.7% reached or surpassed the MCID for the ODI, 57.7% for the SF-36 pain component, 59.7% for the SF-36 PCS, and 50.5% achieved or surpassed the MCID for the SF-36 MCS (Table 2).

Pain relief is usually the primary goal of patients who elect surgical treatment for DLD. The quality of life scores associated with pain (SF-36 pain component) for the general Brazilian population is 76.7[20], while for our sample, the average preoperative score was 22.6, showing the significant impact of pain on their quality of life. After surgery, the average scores increased to 54.4. If we subdivide the patients according to their postoperative satisfaction, these scores improve significantly in satisfaction groups 5 (64.1), 4 (48.6), and 4+5 (58.8), although they remain below the global Brazilian average[20]. The MCID for the SF-36 pain component was reached by 73.2% of the patients in the satisfaction group 5, and by 63.7% of the patients in the group 4+5. It should be noted that the use of the SF-36 pain component to evaluate treatment results is not widespread in the literature; most often, the reported scores are based on the visual analogue scale (VAS)[21,22,9,23,8] and numerical rating scale (NRS)[13,24,7,10,12]. However, a few authors have recently been opting for the SF-36 pain component[25]. An advantage of this approach is the fact that this pain score is based on two questions, both referring to the impact of pain on the patient's quality of life[16], which may improve its reliability.

A patient with an ODI score less than or equal to 20 is considered as presenting "no disability". For ODI scores between 20 and 40, patients are considered to be "mildly disabled".[15] The mean score for preoperative ODI in our sample was 26.0, placing the average DLD patient who elected lumbar surgery treatment in the latter group. After treatment, the average disability degree was reduced in 39.6%. Final mean values were less than 20 in satisfaction groups 5 (11.0), 4 (18.2), and 4+5 (13.6). The MCID for ODI was reached by 69.5% of the patients in the satisfaction group 5, 53.6% of the patients in the satisfaction group 4, and 64% of the patients in the group 4+5. Therefore, the absolute majority of the satisfied patients (82% of the sample) recovered to a "no disability" state after surgery. Patients in the satisfaction groups 3 and 2 presented average values within the range of disability, whereas patients in the group 1 were in borderline ranges. In other studies where preoperative ODI scores were assessed, some reports included higher scores than the ones reported here[24,26,27], whereas other reports were closer to our results[12,14]. Some authors described the improvement in disability based on the percentage of the patients reaching the MCID for ODI[6,13], while others took into consideration the average variation of the disability score[12,28,8,27].The percentage improvement for our

dataset was around 40%, which is similar to the reports for other patient sets[29], as well as an increase of 11.5 points[26,7].

The mean score for the physical quality of life component (SF-36 PCS) for the general Brazilian population is 49.3[20]. The mean preoperative PCS score for the present case study was 28.6, which is significantly lower. Even though the surgical treatment allowed for an increase of 10.0 score points and an improvement of 42% in the studied group, the final score for SF-36 PCS (38.4) was still below the average for the general Brazilian population. For patients of the satisfaction groups 4+5, 63.9% reached MCID.

Although DLD is a primarily physical problem, the mental quality of life of patients suffering from this disease is significantly impaired. It is sometimes believed that mental aspects might be boosting or causing pain, therefore justifying the failure of physical treatments[5]. The preoperative score for the mental component (SF-36 MCS) for the present patient sample was 40.5, which is significantly lower than the average for the general Brazilian population (51.1). However, a significant improvement was observed after treatment, with an average postoperative score of 49.2. Considering the "satisfied" group (82% of the total sample), the average postoperative score was 50.80, which is very close to the average for the general population[20]. Our findings suggest that pain and disability resulting from DLD impaired the mental quality of life before surgery and that surgical treatment led to its significant improvement (Table 2).

The meaning of a "satisfactory result" for DLD is still controversial. Several authors have arbitrarily defined what they would consider as being a "satisfied" patient. In the present work, we opted to consider the patients from satisfaction levels 4 and 5 as "satisfied". The comparisons between groups 5+4 ("satisfied") and 3+2+1 ("dissatisfied") revealed significant differences in virtually all parameters analyzed (Table 3), supporting our choice of group 4 as a threshold.

A few caveats were detected in the course of this study: first, only about 50% of the patients could be included in the study due to lack of follow-up, which is a common problem in DLD studies. However, for the present work, as well as in other previous reports[22,30], data from the included patient group did not seem to present significant differences as compared to data from the excluded patients (Table 1). Second, the use of the SF-36 pain component score instead of VAS or NRS impacted our ability to compare our results with those obtained in previous studies. Even if one assumes that the "Pain component" of the SF-36 allows for a more precise estimate of the pain level than the VAS[25] this problem still deserves to be mentioned.

Finally, the clustering of different pathologies under a single group (i.e., DLD) could be criticized. A clear distinction between cases that exclusively harbor disc herniations, stenosis, spondylolisthesis or deformity may be challenging when we consider a large sample[7]. Our database was set up with the aim of presenting a clear-cut distinction between these four subtypes of DLD. As the study developed, however, overlapping of different pathologic subtypes in the same patient became so frequent as to justify studying the group as a whole. A tendency to combine data for the different types of DLD for such analyses has also been observed in other recent publications [12–14].

In conclusion, surgical treatment for DLD presented widely positive results, as demonstrated by the following improvement statistics: a) 201% improvement in pain-related quality of life scores, with 57.7% of the patients reaching MCID; b) 39.6% improvement in disability, with 57.7% of the patients reaching MCID; c) 42% improvement in physical quality of life scores, with 59.7% of the patients reaching MCID; and d) 37.8% improvement in mental quality of life, with 50.5% of the patients reaching MCID. Based on these developments, about 82.5% of the patients declared themselves as satisfied with the outcomes of the surgery.

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