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A comparison of neurogenic claudication outcome score and Oswestry disability index in degenerative lumbar spinal canal stenosis post decompression, posterior stabilization and fusion

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Abstract

Degenerative lumbar spinal canal stenosis (LSCS) is a narrowing of the spinal canal or intervertebral foramina secondary to degenerative changes. Current treatments focused mainly on improving the functional outcome and quality of life. Functional outcome is assessed by measuring level of satisfaction, pain, disability, range of motion and radiographic measurements. The Neurogenic Claudication Outcome Score (NCOS) and Oswestry Disability Index (ODI) are tools commonly employed to assess the functional outcome of such patients and have been shown to strongly correlate with level of disability in a group of patients with lumbar spinal stenosis. The aim of this study is to compare the responsiveness of NCOS and ODI in measuring the functional outcome of patients with degenerative LSCS post decompression, stabilization and fusion. This is a prospective study involving 36 patients diagnosed with degenerative LSCS for a period of 5 years. Patients were assessed during pre-operation and at 3-month post-operation. We found that There are significant differences between the preoperative NCOS and ODI compared to 3 months post-operative, with effect size of 0.61 for NCOS and 0.54 for ODI. Both NCOS and ODI questionnaires exhibit good responsiveness in assessing the functional outcome of patients with degenerative LSCS, however NCOS was shown to be more responsive than ODI.

Keywords: NCOS, ODI, Degenerative lumbar spinal canal stenosis, post decompression posterior stabilization and fusion, functional outcome

1. Introduction

Degenerative conditions involving the spine are the gradual loss of normal spine structure and function over time that is commonly caused by aging, but may also be the result of tumors, infections or arthritis. This process can alter the pressure on the spinal cord and nerve roots thus causing degenerative spinal canal stenosis.

Degenerative lumbar spinal canal stenosis (LSCS) is a narrowing of the spinal canal or intervertebral foramina in the lumbar spine secondary to degenerative changes. It is a result of progressive bone or ligament hypertrophy (or both) in local, segmental, or generalized regions, which results in the compression of spinal nerves and nerve roots, causing a variable of symptoms, which includes low back pain, lower extremity radiculopathy, neurogenic claudication, and gait impairment ^[1].

The diagnosis of degenerative lumbar spinal stenosis may be considered in older patients presenting with leg pain. This presents as either neurogenic claudication or radicular leg pain. History of gluteal or lower extremity symptoms exacerbated by walking or standing, which improves or resolves with sitting or bending forward usually accompanied the leg pain. Accurate diagnosis is important in choosing the appropriate therapy and improve functional outcome of the patient. Current available therapy for degenerative lumbar spinal stenosis are non-operative and operative. Non-operative treatments involved the combination of physical therapy, medications, and spinal injections. Surgical therapy is reserved for patients with poor response towards non-operative treatments. Therefore, it is important to accurately ascertain the functional outcome of patients with such condition.

Functional outcome can be determined using objective physician-assessed outcome measures such as range of motion and radiographic measurements, or by subjective patient-assessed outcome measures such as level of satisfaction, pain, and disability. Various tools well-known instruments are available for measuring performance status or functionality in patients with LSCS, such as The Oswestry Disability Index (ODI), the Roland Morris Disability Questionnaire, the Neurogenic Claudication Outcome Score (NCOS), the Japanese Orthopaedic Association Score (JOA), the Swiss Spinal Stenosis, the Core Outcome Measures Index and the Short Form-36 scores. However, no existing standard cut-off points exist for the assessment of surgical satisfaction in these patients.

Oswestry Disability Index (ODI) is an index first published by Jeremy Fairbank *et al.* is the gold standard for measuring degree of disability and estimating quality of life in a person with low back pain [2, 3]. The use of ODI was demonstrated on patient assessment before and after surgery. The change in ODI correlated most strongly with patient satisfaction after surgery for LSCS. In assessing LSCS, a widely used generic scale for back pain such as the ODI not only gives useful information on patient outcome, but also allows for comparison of treatment interventions between different conditions such as LSCS and low back pain [4, 5]. The questionnaire consisted of 10 items designed to measure how much the pain in affecting the patient's ability in managing everyday life activities. It consisted of 10 items, scored from 0 – 5 with a maximum score 50. The obtained score is multiplied by 2 to produce a percentage score. The higher score is indicative of worsening functional status.

Neurogenic Claudication Outcome Score (NCOS) was developed by Weiner and Fraser to measure neurogenic claudication [6]. It is also used as an outcome measure of functionality in patients with LSCS. The tool is a simple and concise, self-administered outcome questionnaire, specifically tailored to address functionality in patients with neurogenic claudication [7, 8]. Several studies have employed the use of NCOS as an outcome measure of functionality in patients with lumbar spinal stenosis. It consisted of 8 questions (16 items) and the score, ranging from 0 to 100, is calculated by adding all 16 items. The higher scores indicating higher levels of functionality with better health status. The NCOS and ODI were shown to have strong correlation in measuring disability of patients with lumbar spinal stenosis [4, 9].

2. Material and Methods

This is a prospective study involving 36 patients diagnosed with degenerative LSCS at Sanglah General Hospital who underwent posterior decompression and instrumented posterolateral fusion using transpedicular systems between January 2012 and December 2016. The diagnosis of LSCS was established based on the clinical symptoms, neurological examinations, and imaging studies which includes plain radiography and MRI of the lumbar spine. All 36 patients presented with typical symptoms of LSCS, such as neurogenic intermittent claudication and leg pain and/or numbness. The diagnosis was confirmed by a single spine surgeon. The exclusion criteria were prior lumbar spine surgery and congenital spine anomalies. Patients were assessed at two points in time: during pre-operation and at 3-month post-operation by documenting their Neurogenic Claudication Outcome Score (NCOS) and Oswestry Disability Index (ODI) at each point in time. The NCOS ranges from 0 to 100, with higher scores indicative of better

clinical outcome. The ODI score consist of 10 sections called pain, personal care, lifting, walking, sitting, standing, sleeping, sex life, social life and traveling. Each section scale is grade 0-5, with 5 showing maximum disability and 0 showing minimum disability. The ODI ranges from 0 to 100, with higher scores indicating severity. All statistical analyses were performed using SPSS version 17 with Wilcoxon non parametric test.

3. Results

The characteristics of patients with degenerative lumbar spinal stenosis and their scores on the NCOS are shown in Table 1. The mean age of patients was 58 ± 11 years, comprising of mostly male (61%). The mean NCOS score at preoperative and postoperative assessments were 20.1 ± 8.5 and 54.6 ± 14.5 respectively (Table 1). The NCOS score ranges from 0 to 100, with higher scores indicating less severe symptoms. The mean ODI score at preoperative and postoperative assessments were 52.9 ± 19.9 and 34.5 ± 19.2 respectively (Table 1). The ODI score ranges from 0 to 50, with higher scores indicating severe conditions. The score for each sections were tabulated and calculated for descriptive statistical analysis and Saphiro Wilk test to test for normality. The scores of all parameters was not normally distributed. Responsiveness was then assessed using Wilcoxon test. In all instances, the NCOS was responsive to the clinical intervention. In fact, the results indicated that patients' functionality was significantly improved following surgery and the questionnaire was able to specify these improvements. There are significant differences between both NCOS and ODI at pre-operative and 3-months post-operative with effect size of 0.61 for NCOS and 0.54 for ODI (Table 2). Both NCOS and ODI questionnaires showed good responsiveness of more than 0.5 (Effect size 0.1 = little effect, EZ 0.3 = Moderate Effect, EZ 0.5 = high effect) and the result indicate that NCOS is slightly more responsive than ODI.

Table 1: Demographics and Clinical Characteristics of the participants (n=36)

Characteristics	No	%
Age		
30 – 54	12	33.3
55 – 64	10	27.8
>65	14	38.9
Gender		
Male	22	61.1
Female	14	38.9

Table 2: Comparison between Pre-Operative and Post-Operative values between NCOS and ODI

	Pre-Operative (n = 36)		Post-Operative (n = 36)	
	Mean (SD)	Range	Mean (SD)	Range
NCOS	20.1 (8.5)	7 – 41	54.6 (14.5)	29 – 89
ODI	52.9 (19.9)	29 – 96	34.5 (19.2)	10 - 70

Table 3: Wilcoxon Test for responsiveness between NCOS and ODI

Variable	Effect Size	p-value
NCOS	0,61	0,000
ODI	0.54	0,000

4. Discussion

Many related studies found that ODI Questionnaire has good reliability, validity and responsiveness that is commonly used for clinical practice [10, 11]. On the other hand, there are limited studies that convey NCOS as a tool for measuring

functional status in patients with lumbar spinal stenosis. The NCOS showed strong correlation for measuring disability in a group of patients with lumbar spinal stenosis when used together with other questionnaires, namely, RMDQ-24, JOA, SSS and COMI^[4].

Our study found that there are significant differences between the preoperative NCOS and three-month postoperative NCOS with $p=0,000$ ($p<0, 05$). The same result was obtained from the preoperative ODI and three-month postoperative ODI with $p=0,000$ ($p<0, 05$).

The effect size of NCOS and ODI is 0.61 and 0.54 respectively, which indicate great effect of response for both questionnaires. The result also showed that NCOS is more responsive than ODI in measuring functional outcome.

A study conducted by Goni *et al.* reported that ODI questionnaire was easily comprehended and had a response rate of 91% in patient with low back pain but not predictive for the underlying patho-morphology^[12]. Another study by Azimi *et al.* on the use of NCOS for lumbar canal stenosis patients with neurogenic claudication showed that NCOS is a reliable and valid instrument for measuring functionality with coefficient 0.77 and 0.91 at pre- and post-operation^[9].

As far as we know, this is the first study that aim to evaluate the responsiveness of NCOS compared with ODI in Indonesia, especially in Bali. There's no comparable study known that compare the differences of the responsiveness between NCOS and ODI questionnaires specifically.

However, there are frequent errors in score calculation with the use of ODI questionnaire as an outcome measure. If the questions cannot be asked, the divisor is reduced by 5 points in each section that are not answered. Most people ignore the rule and immediately divide the numerator with 50 as the divisor. As a result, the number obtained would be smaller than the actual number^[5].

The weaknesses of this study are the limited sample size and the short duration of observation (only up to three months after operation). Longer observational time with bigger number of samples could more accurately describe the differences in responsiveness between the two questionnaires. In addition, a comparison between NCOS and other outcome measurement tools could be assessed to see whether NCOS is more superior to other questionnaires.

Both the NCOS and ODI questionnaires that were used in this study were in English. A questionnaire in Indonesian language will serve the population better and avoid misinterpretation of questions. A study by Azimi *et al.* stated that NCOS in Iranian Version is reliable and valid for measuring functional status in patients with lumbar spinal stenosis. The study opens up possibility for creating the questionnaires in other languages without diminishing the intended meaning and enable the patients to answer and understand the questions in their own language.

5. Conclusion

Both NCOS and ODI shows good responsiveness in measuring the functional outcome of patients suffering from degenerative LSCS, whether they are treated conservatively or through surgical therapy. The NCOS score was shown to be more responsive than ODI in such assessment.

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