Reliability Comparison of Measurements of Lumbar Central Canal Stenosis

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ABSTRACT

AIM: The purpose of this study is to compare the measures in patients with lumbar central canal stenosis (LCCS).

MATERIAL and METHODS: A total of 135 patients with LCCS entered into the study. SSS, SBST, NCOS, JOA, JOABPEQ, COMI, RMDQ-24, SF-36 and ODI questionnaires were completed by patients at their first visits. Reliability was evaluated by internal consistency using the Cronbach’s alpha coefficient. Validity was evaluated by performing convergent validity between the ODI and other measures. Finally, reliability and validity of measures were compared.

RESULTS: The mean age of patients was 50.3 (SD= 10.1) years. Correlation coefficients for ODI versus other measures lending support to its good convergent validity as SSS, SBST, NCOS, JOA, JOABPEQ, COMI, RMDQ-24, and SF-36 were r = 0.87, r = 0.81, r = 0.79, r = 0.78, r = 0.77, r = 0.76, r = 0.75 (P < 0.001). Cronbach’s alpha coefficient was found to be desirable: SSS, 0.92; SBST, 0.82; NCOS, 081; JOA, 079; JOABPEQ, 0.77; COMI, ODI, 0.75; SF-36, 0.72; and RMDQ-24, 0.71.

CONCLUSIONS: Our results indicate that the SSS provides higher reliability than other measures and may thus be preferable in LCCS patients’ assessment.

KEY WORDS: Comparison, lumbar central canal stenosis, measures in spine, reliability

INTRODUCTION

Lumbar central canal stenosis (LCCS) is one of the causes of low back pain and is a narrowing of the spinal central, which places pressure on the spinal cord. It is an extensive, expensive, and weakening problem in Western countries (13). Measurement systems of spine are needed to provide a scientific basis for understanding and studying health-related states and outcomes. These data are very important both from the patients’ and clinicians’ point of view and can aid the clinician in classifying the severity of the disease for appropriate treatment planning. There are various instruments for measuring performance status or functionality in LBP patients. The Oswestry Disability Index (ODI), the Roland Morris Disability Questionnaire (RMDQ-24) (11), the Neurogenic Claudication Outcome Score (NCOS) (3), the Japanese Orthopaedic Association (JOA) (2), the Swiss Spinal Stenosis (SSS) (16), the Core Outcome Measures Index (COMI) (6,10), the STarT Back Screening Tool (SBST) (4,7), the Japanese Orthopaedic Association Back Pain Evaluation Questionnaire (JOAPEQ) (5), and the Short Form-36 scores (SF-36) (9), are among well-known instruments for measuring functionality in patients with LCCS and have been used to measure functionality in these patients. However, the validity and reliability data for comparison between measures are lacking in these patients.

The key question in this study was to determine validity and reliability of the SSS (Q1-12), SBST, NCOS, JOA, JOABPEQ (subscale of Low back pain), COMI (subscale of function), RMDQ-24, SF-36 (subscale of physical function), and the ODI in LCCS patients in order to find a more reliable tool.
METHODS

Patients and data collection

This study included 135 consecutive LCCS patients (74 females and 61 males) who were referred to our hospital between July 2008 and September 2012. As such all participants underwent a complete clinical examination for LCCS including clinical symptoms, neurological examinations, and imaging studies including plain radiography, CT and MRI of the lumbar spine. They had the typical symptoms of LCCS, such as neurogenic claudication and leg numbness and/or pain. In all of the patients, the diagnosis was definite by more than one spine surgeon. The stenotic level(s) were evaluated on the MRI or CT images. There were no restrictions on case selection with regard to level(s) of LCCS, age or other characteristics. We excluded all subjects with prior lumbar spine surgery and spinal anomalies from the study.

The characteristics including age, gender and body weight were registered. The walking distance (in meters) and duration of symptoms (in months) were evaluated. A 100 mm VAS was used to assess both leg pain and numbness.

Additional measure

1. The Iranian version of Oswestry Disability Index (ODI): This is a measure of functionality and contains 10 items. The possible score on the ODI ranges from 0 to 50, with higher scores indicating worst conditions. The psychometric properties of Iranian version of questionnaire are well documented (11).

2. The Iranian version of Roland Morris Disability Questionnaire (RMDQ-24): The RMDQ-24 is disability questionnaire most commonly used as outcome measures in patients with low back pain. It is consists of 24 items. The RMDQ-24 is scored by adding up the number of “yes” items, ranging from 0 (no disability) to 24 (maximum disability) (11).

3. The Iranian version of Neurogenic Claudication Outcome Score (NCOS): The NCOS is a specific measure of functionality in patients with neurogenic claudication. It consists of 16 items (8 questions). Each item is rated on a four-point scale with 2 point intervals ranging from 0 - 6 (0-2-4-6), worst to best conditions respectively expect for pain intensity where a 100-mm visual analogue scale is used. The scale score then is calculated by summation of all the scores of 16 items ranging from 0 to 100 with higher scores indicating higher levels of functioning and/or better health status (3).

4. The Iranian version of Japanese Orthopedic Association (JOA): The JOA score assesses functionality and pain of low back pain and contains 4 sections (14 items): Overall score on the questionnaire ranges from -6 to 29, with higher scores indicating better conditions (2).

5. The Swiss Spinal Stenosis (SSS): The Swiss Spinal Stenosis Score (SSS): it was designed for the purpose of evaluating LSS patients. The questionnaire consists of 18 questions. There are 12 questions for all patients, and a further 6 questions for those who receive treatment. It has three domains: the severity of symptoms (questions 1 to 7), physical functioning (questions 8 to 12) and patient’s satisfaction (questions 13 to 18) after treatment. Possible score for the symptom severity subscale ranges from 1 to 5. Possible score for the physical functioning subscale ranges from 1 to 4. Possible score for the satisfaction (with treatment) ranges from 1 to 4. In each scale, the un-weighted mean provides an overall score. Lower scores represent best conditions on all three subscales (16). We used the SSS (Questions 1–12) for pre-operative and the SSS (Questions 13–18) for post-operative assessment.

6. The Core Outcome Measures Index (COMI): The COMI is a short and multidimensional outcome instrument. It consists of 5 sections including 7 questions that evaluate pain (2 items), function (1 item), well-being (1 item), disability (2 items) and satisfaction (1items). The scores of the questionnaire range from 1 to 5, with 1 being the best possible result. The total COMI score is the average of the 5 dimensions. It was designed for a simpler but effective standardized evaluation of outcome in patients with low back pain (6, 10).

7. The Iranian version of the STarT Back Screening Tool (SBST): It was designed for the purpose of evaluating LBP. It consists of 9 questions and includes radiating leg pain, pain elsewhere, disability (2 items), fear (1 item), anxiety (1 item), pessimistic patient expectations (1 item), and low mood (1 item), and how much the patient is bothered by their pain. All 9 items use a response format of ‘agree’ or ‘disagree’, with exception to the bothersomeness item, which uses a Likert scale. It is designed to classify patients into 3 categories for targeted primary care management: low risk, medium risk (physical indicators) and high.
The SBST produces two scores: overall scores and distress subscale scores. The overall score is used to separate the “low risk” patients from the “medium-risk” subgroup. Scores range from 0-9 and are produced by adding all positive items. Patients who achieve a score of 0-3 are classified into the low-risk subgroup and those with scores of 4-9 into the medium-risk subgroup. The distress subscale score is used to identify the high-risk subgroup. To score this subscale, add the last 5 items consisting of fear, anxiety, catastrophising, depression and bothersomeness (bothersomeness responses are positive for ‘very much’ or ‘extremely’ bothersome back pain). Subscale scores range from 0 to 5 with patients scoring 4 or 5 being classified into the high-risk subgroup (4,7).

8. The Japanese Orthopaedic Association Back Pain Evaluation Questionnaire (JOAPEQ) score for assessing low back pain was designed. It is a disease-specific tool and contains 25 items tapping into five subscales: social function (four items), mental health (seven items), lumbar function (six items), walking ability (five items), and low back pain (four items). The score for each subscale range from 0 to 100, with higher scores indicating better conditions (5). In this study subscale of low back pain was calculated for assessment.

9. Short Form-36 scores (SF-36) questionnaire. The Iranian version of SF-36 consists of 36 questions grouped into 8 domains social functioning, physical functioning, role limitations related to physical problems, role limitations related to emotional problems, mental health, vitality, bodily pain and general health perception. The score for each subscale range from 0 to 100, with higher scores indicating better conditions (9). In this study subscale of physical functioning was calculated for assessment.

Statistical analysis

All statistical analyses were performed using the PASW Statistics 18 Version 18 (SPSS, Inc., 2009, Chicago, IL, USA) and several statistical tests were used.

1. Reliability: Reliability was assessed by internal consistency using the Cronbach’s alpha coefficient and alpha value of 0.7 or above was considered satisfactory (12).

2. Validity: To test validity of the instruments Criterion validity (convergent validity) were used: the correlation between the ODI and other instruments was assessed using Pearson’s correlation coefficient and values of 0.40 or above were considered satisfactory (r ≥ 0.81-1.0 as excellent, 0.61- 0.80 very good, 0.41-0.60 good, 0.21-0.40 fair, and 0.0-0.20 poor) (12).

Ethics

The Ethics Committee of Shahid Beheshti University of Medical Sciences approved the study.

RESULTS

The characteristics of the LCCS patients and their scores on the SSS, SBST, NCOS, JOA, JOABPEQ, COMI, RMDQ-24, and SF-36 are shown in Table 1.

One hundred and thirty five cases were eligible to enter into the study during the four-year course of study. The mean age of the patients was 50.3 ± 10.1 (ranging from 44 to 81) years. Correlation coefficients for ODI versus other measures lending support to its good convergent validity as SSS, SBST, NCOS, JOA, JOABPEQ, COMI, RMDQ-24, and SF-36 were r = 0.87, r = 0.81, r = 0.79, r = 0.78, r = 0.78, r = 0.77, r = 0.76, r = 0.75 (P < 0.001). Cronbach’s alpha coefficient was found to be desirable: SSS, 0.92; SBST, 0.82; NCOS, 081; JOA, 079; JOABPEQ, 0.78; COMI, ODI, 0.75; SF-36, 0.72; and RMDQ-24, 0.71.

DISCUSSION

The results of this study indicated that the SSS score has higher reliability than other measures and may thus be preferable in LCCS patients’ assessment.

Many studies have reported relationship between measure functional outcomes in lumbar spinal stenosis (LSS) patients. Pratt RK et al were found that the SSS has more precise than the Oxford Claudication Score (OCS), and ODI questionnaires (14). Recently, Azimi reported that RMDQ-24, NCOS, ODI, JOA, SSS and COMI scores have a strong correlation in measuring disability in these patients (1). However, this is the first study to compare validity and reliability the SSS, SBST, NCOS, JOA, SSS and COMI scores in LCCS patients. In addition in this study only LCCS patients were considered.

In general, the findings from the current study indicated that all the questionnaires are similar. However, the SSS score had higher reliability than other measures.

To identify ways to improve care, we need more specific tools for patients’ assessment. However, additional research is required to assess the discriminant power of the measures for specific diagnostic entities.
Table 1: Demographic data and pre-treatment status of patients with lumbar central canal stenosis (n=135).

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Mean ±SD</th>
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<tbody>
<tr>
<td>Age (Year)</td>
<td>50.3 ± 10.1</td>
</tr>
<tr>
<td>Gender (Male %)</td>
<td>45.2%</td>
</tr>
<tr>
<td>Body weight (kg)</td>
<td>86.9 ± 10.9</td>
</tr>
<tr>
<td>Symptoms</td>
<td></td>
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<tr>
<td>Duration of symptoms (months)</td>
<td>39.7 ± 24.3</td>
</tr>
<tr>
<td>Walking distance (m)</td>
<td>267.8 ± 153</td>
</tr>
<tr>
<td>VAS of leg pain (mm)</td>
<td>39.1 ± 21.4</td>
</tr>
<tr>
<td>VAS of leg numbness (mm)</td>
<td>62.1 ± 18.3</td>
</tr>
<tr>
<td>Screening tool score by SBST</td>
<td></td>
</tr>
<tr>
<td>Overall (Q1-9)</td>
<td>3.9 (2.5)</td>
</tr>
<tr>
<td>NCOS score</td>
<td>24.3 ±11.7</td>
</tr>
<tr>
<td>ODI</td>
<td>31.8 ±11.5</td>
</tr>
<tr>
<td>RMDQ-24 score</td>
<td>17.7 ±3.1</td>
</tr>
<tr>
<td>SSS (Questions 1–12)</td>
<td>2.84 ±0.61</td>
</tr>
<tr>
<td>JOA score</td>
<td>8.1 ± 4.3</td>
</tr>
<tr>
<td>JOABPEQ</td>
<td></td>
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<tr>
<td>Low back pain</td>
<td>41.6 ± 32.1</td>
</tr>
<tr>
<td>SF-36 subscales</td>
<td></td>
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<tr>
<td>Physical function</td>
<td>36.1 (17.4)</td>
</tr>
<tr>
<td>COMI</td>
<td>3.31 ±0.9</td>
</tr>
</tbody>
</table>

*Values are mean ± SD or percentage.

### Study limitations

First, the study had little power to enter all questionnaires reported in literature in measure of LCCS such as classification according to the International Classification of Functioning, Disability and Health (ICF) [8] and other measures. However, further studies are needed to elucidate reliability of ICH compared to other tools. Second, we were unable to find a correlation between subscales of measures. Further studies are needed on this issue for clarification.

### Conclusion

Our results indicate that SSS provides higher reliability than other measures and may thus be preferable in LCCS patients’ assessment.

### Competing Interests

The authors declare that they have no competing interests.

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### References


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