The Reliability of an Arabic Version of the Modified Japanese Orthopaedic Association Score for Cervical Myelopathy

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Abstract:
Introduction: The modified Japanese Orthopaedic Association (mJOA) score is considered to be among the most comprehensive scores in the assessment of patients with cervical myelopathy. Hence, providing reliable, translated, and cross-culturally adapted versions in different languages is required to standardize the evaluation of patients. This study aimed to translate a reliable Arabic version of the mJOA score.

Methods: A total of 65 patients of variable age and with etiologies for compressive cervical myelopathy were recruited. Both forward and backward translations were performed. Then, intraobserver and interobserver reliabilities were measured using the intraclass correlation coefficient and Cronbach’s alpha coefficient.

Results: The mean age of the patients was 58.08 years, and most of them were male (69.2%). The intraobserver and interobserver reliabilities were almost in perfect agreement for the different sections and the total score, which were 96.8% and 97.4%, respectively.

Conclusions: In this study, a reliable, cross-culturally adapted Arabic version of the mJOA score for patients with cervical myelopathy is provided. Although the study was conducted on Egyptian patients, we believe that it could be implemented in majority of the Arabic-speaking population.

Keywords:
mJOA score, cervical myelopathy, Arabic language, reliability

Introduction

Cervical myelopathy is a clinical syndrome that is characterized by spinal cord dysfunction. The signs and symptoms differ according to the location and severity, ranging from trouble with balance and dexterity to paralysis and incontinence⁵. Due to its degenerative nature and its relation to advanced spondylosis, older patients are at a higher risk⁶. In fact, it is the most commonly acquired cause of spinal cord dysfunction in patients above 55 years old⁷.

Accordingly, several different specialties are involved in the assessment and management of these patients, including rheumatologists, rehabilitation physicians, neurologists, orthogeriatricians, and spine surgeons⁸. Thus, appropriate assessment of the functionality and pain in those cases is an essential part of the clinical practice. Having the ability to use a standardized tool ensures that across the continuum of care, the same language is spoken.

The Japanese Orthopaedic Association scoring system (JOA score) is among the most well-known scores for the assessment of the symptom severity of patients with cervical myelopathy, both in research and clinical practice. It scores six domains: motor dysfunction in the upper extremities, motor dysfunction in the lower extremities, sensory function in the upper extremities, sensory function in the lower extremities, sensory function in the trunk, and bladder function⁹. Because it evaluates the involvement of the upper limb with the ability to use chopsticks, its use was limited to East Asian Countries. As such, a modified version (mJOA score) has been developed to apply the score at an interna-
The English mJOA score for cervical myelopathy as proposed by Benzel et al. 6). The Arabic version translated by the authors is available at https://mfr.osf.io/render?url=https%3A%2F%2Fosf.io%2Fsqr86%2Fdownload

tional level, thus replacing the use of chopsticks with spoons to assess upper limb dysfunction. The mJOA score also removed the sensory examination of the trunk and the lower limbs, making it a more precise and yet highly reliable modified version of the JOA score 5,6).

The mJOA score is presented in the English language. However, several translations have been validated, such as the Dutch 7), Persian 8), and Portuguese versions 9,10). But to date, no Arabic version is available. Thus, this study aimed to translate a reliable Arabic version of the mJOA score to enable its usage for the standardization of care among the Arabic-speaking population worldwide.

**Materials and Methods**

The study was conducted in compliance with the principles of the Declaration of Helsinki. The ethics committee of the authors’ affiliated institution approved the protocol prior to the initiation of this study. In addition, a written informed consent was obtained from each patient prior to enrollment.

This cross-sectional study included a total of 65 patients of variable age and with etiologies for compressive cervical myelopathy. They were all recruited between June 2019 and February 2020 from the orthopedics and spine clinics of the authors’ affiliated institution. Patients with any etiology hindering effective communication were excluded, as well as those exhibiting any other neurological or psychiatric condition.

A forward translation was performed for the mJOA score, modified by Benzel et al. 6, by three independent bilingual translators (Arabic and English) whose native language was Arabic. These translators were aware of the study objectives. Two of these translators were physicians who were expert in assessing spinal cord disorders (SIF and HEZ); the third one was another spine surgeon (MAG). The backward translation into English was performed by a fourth translator whose native language was English. This translator was a geriatrician (HGS) and did not participate in the initial translation. They aimed to identify any inconsistencies in the translation (Fig. 1).

Intraobserver reliability was measured by comparing the two scores obtained by the examiner (SIF) 1 week apart. Conversely, the interobserver reliability was measured by comparing the scores of the two examiners (SIF and HEZ) obtained in the same day.

Data analysis was conducted using the SPSS software version 23. Quantitative data were expressed as mean±SD, whereas qualitative data were expressed as count and percentage. The intraclass correlation coefficient (ICC) was utilized to measure the intra- and interobserver agreement for different scores, with a confidence interval (CI) of 95%. ICC values of 0.00 to 0.20 were considered to be in slight agreement; 0.21 to 0.40, fair agreement; 0.41 to 0.60, moderate agreement; 0.61 to 0.80, substantial agreement; and 0.81 to

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| Motor dysfunction score of the upper extremity |
|-----------------------------------------------|
| 0: Inability to move hands                     |
| 1: Inability to eat w/ a spoon, but able to move hands |
| 2: Inability to button shirt, but able to eat w/ a spoon |
| 3: Able to button shirt w/ great difficulty    |
| 4: Able to button shirt w/ slight difficulty   |
| 5: No dysfunction                              |

| Motor dysfunction score of the lower extremity |
|-----------------------------------------------|
| 0: Complete loss of motor and sensory function |
| 1: Sensory preservation w/o ability to move legs |
| 2: Able to move legs, but unable to walk       |
| 3: Able to walk on flat floor w/ a walking aid (cane or crutch) |
| 4: Able to walk up and/or down stairs w/ hand rail |
| 5: Moderate-to-significant lack of stability, but able to walk up and/or down stairs w/o hand rail |
| 6: Mild lack of stability but walks w/ smooth reciprocation unaided |
| 7: No dysfunction                              |

| Sensory dysfunction score of the upper extremities |
|---------------------------------------------------|
| 0: Complete loss of hand sensation                |
| 1: Severe sensory loss or pain                    |
| 2: Mild sensory loss                              |
| 3: No sensory loss                                |

| Sphincter dysfunction score                      |
|------------------------------------------------|
| 0: Inability to micturate voluntarily           |
| 1: Marked difficulty w/ micturation             |
| 2: Mild to moderate difficulty w/ micturation   |
| 3: Normal micturation                           |
1.00, almost perfect agreement. Cronbach’s alpha coefficient was also used to measure the intraobserver and interobserver reliabilities.

**Results**

The 65 patients [female, 20 (30.8%); male, 45 (69.2%)] included in our study varied in age, with a mean of 58.08 (+/-7.09) and range of 37-74 years.

**Intraobserver reliability**

Table 1 presents the results of the two assessments conducted by the same examiner, both for the total score and each individual part. The ICC value for the motor dysfunction of the upper limbs was 89.5%, which is considered to be in almost perfect agreement (95% CI: 83.3%-93.4%), whereas that for the motor dysfunction of the lower limbs was 94.4% (95% CI: 91%-96.5%). The ICC value for the sensory dysfunction of the upper limbs was 93.2% (95% CI: 89.1%-95.8%), whereas that for the sphincter dysfunction was 97.6 (95% CI: 96.2%-98.6%). Moreover, the ICC value for the total score was 96.8 (95% CI: 94.8%-98%). All the results of Cronbach’s alpha coefficient were above 0.70, indicating adequate reliability.

**Interobserver reliability**

Table 2 presents the differences in the assessment results between the two examiners, both for the total score and each individual part. The ICC value for the motor dysfunction of the upper limbs was 89.6%, which is considered to be in almost perfect agreement (95% CI: 83.5%-93.5%), whereas that for the motor dysfunction of the lower limbs was 94.3% (95% CI: 90.9%-96.5%). The ICC value for the sensory dysfunction of the upper limbs was 84.4% (95% CI: 75.7%-90.2%), whereas that for the sphincter dysfunction was 97.6 (95% CI: 96.2%-98.5%). Moreover, the ICC for the total score was 97.4 (95% CI: 95.7%-98.4%). All the results of Cronbach’s alpha coefficient were above 0.70, indicating adequate reliability.

**Discussion**

As one of the most comprehensive scores used to assess the need for surgery in patients with cervical myelopathy, the mJOA score became a target for translation into different languages to provide a more comprehensive assessment for patients with cervical myelopathy across different cultures. In a previous study, the original JOA score and the mJOA
score proposed by Benzel\textsuperscript{7} exhibited good correlation in terms of their total scores and recovery rates\textsuperscript{7}. To the best of our knowledge, to date, there is no Arabic version of this modified score. Hence, this study aimed to provide a validated and a cross-culturally adapted Arabic version of the mJOA.

Although the mJOA scale facilitated the improvement in the global adoption of spinal assessment and outcome, it has some intrinsic limitations, regardless of the language. The mJOA scale depends on the use of some terms in assessing the degree of a patient’s myelopathy as “great difficulty” or “slight difficulty” as well as “severe sensory loss” or “mild sensory loss.” These terms allow room for subjective interpretation, which hinders its validation as a measuring instrument. This problem was encountered when translation into English\textsuperscript{11} and other languages\textsuperscript{7} was performed. Notwithstanding, the mJOA scale is still regarded as one of the best tools for assessing patients with cervical myelopathy, as it evaluates the motor function of the upper limbs, motor function of the lower limbs and ambulation, sensory function of the upper limbs, and sphincter function as separate items.

This Arabic version of the scale used a similar systematic approach to those used in previous studies, thus validating the different translations of the mJOA score\textsuperscript{7,10}. Hence, the consistency of this Arabic version is confirmed by the high degree of reliability of cervical myelopathy cases on the mJOA score.

In this study, the Arabic mJOA score was tested on patients with etiologies for compressive cervical myelopathy, giving it a wide range of clinical presentations to further validate the translation. Due to variations in the level of education of the Egyptian population, clear instructions were always required by physicians to avoid any subjective interpretation by the patients, as well as to provide a more reliable and consistent score.

This study used Cronbach’s alpha coefficient and exhibited adequate reliability for both the total score and the different sections. Azimi et al. did the same when they translated the mJOA score into the Persian language\textsuperscript{5}. The intraobserver reliability was also assessed using the ICC, which was considered to be in almost perfect agreement, similar to the Dutch and Brazilian versions\textsuperscript{7,10}.

The ICC was also used to determine the inter-rater reliability between the examiners, which was considered to be in almost perfect agreement in all items, as well as the total value of the score as in the Brazilian validity study by Pratati et al.\textsuperscript{10}.

One of the strengths of this study was that the samples were not limited to a certain age group. However, further research is required to promote the translation of the mJOA score on a larger scale.

The limitations of this study are discussed as follows. A validation study is further required for the proposed Arabic version within the Arabic-speaking population. Moreover, we have translated the mJOA score for cervical myelopathy, not the Japanese Orthopaedic Association Cervical Myelopathy Evaluation Questionnaire (JOACMEQ). This questionnaire is a more recent self-administered questionnaire that considers the effect of cervical myelopathy on the daily activities and quality of life of the patients. In addition, the JOACMEQ is superior in that it could further evaluate the severity and treatment of cervical myelopathy by providing specific outcome measures, such as handicaps, disability, and general health\textsuperscript{11}.

The results of this study indicate that the proposed Arabic version of the mJOA score is a reliable tool for measuring the motor, sensory, and sphincter dysfunctions of patients with cervical myelopathy. Although the study was conducted on Egyptian patients, we believe that it could be implemented in majority of the Arabic-speaking population in the Middle East and North Africa.

Conflicts of Interest: The authors declare that there are no relevant conflicts of interest.

Ethics Approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study was approved by the ethics Committee of Ain Shams University, Cairo, Egypt. Approval code: FMASU/319/2019. Informed consent was obtained from every participant.

Author Contributions: All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Sherene I. Fawaz, Hany El Zahlawy, Haba G. Saber and Mohamed A. Elgebely. The first draft of the manuscript was written by Sherene I. Fawaz and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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