Reliability and Validity of the Thai Version of the Modified Japanese Orthopaedic Association Score (mJOA score)

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ABSTRACT

Objective: To evaluate the reliability and validity of the Thai version of the modified Japanese Orthopaedic Association scale.

Methods: The modified Japanese Orthopaedic Association scale was translated into Thai language to create the Thai version of the Modified Japanese Orthopaedic Association (Thai-mJOA) scale. Translation was performed according to international standards using a forward-backward translation protocol. Translation was performed by 2 expert translators and 1 physician, and the final version was approved by an expert committee. Thai patients with cervical spondylosis with myelopathy were enrolled and evaluated using the Thai-mJOA scale, Nurick Grading, the Thai version of the Neck Disability Index (Thai-NDI), and the Thai version of the Short Form-36 (Thai-SF-36). Reliability and validity of the Thai-mJOA were assessed via comparison with the Nurick Grading and the Thai-NDI.

Results: Ninety-two patients were included. The most common compression level was C5-C6 vertebral disc. Cronbach's alpha of the total Thai-mJOA showed excellent internal consistency (0.991). The intraclass correlation coefficient (ICC) for test-retest reliability was 0.981 (95% confidence interval [CI]: 0.972-0.988). Regarding concurrent validity, the motor dysfunction score of the lower extremities and the total score of the Thai-mJOA were strongly correlated with Nurick Grading (r=0.825, r=0.712, respectively). The total score of the Thai-mJOA was moderately correlated with the Thai-NDI (r=0.670).

Conclusion: The Thai-mJOA was found to be a valid and reliable tool for evaluating symptom severity in Thai patients with cervical spondylosis with myelopathy.

Keywords: Reliability; validity; Thai version; Modified Japanese Orthopaedic Association Score; Thai-mJOA (Siriraj Med J 2021; 73: 55-60)

INTRODUCTION

Cervical spondylosis with myelopathy (CSM) is one of the most common progressive spinal degenerative conditions in elderly patients, and the neurological symptoms of CSM include neck pain, weakness, and numbness of extremities, and gait dysfunction.[1] Functional disability plays a key role in the treatment decision-making process. Surgery is not superior to conservative treatment in patients with mild symptoms. Law, *et al.* previously described several poor prognostic factors that they found to be associated with conservative treatment, including progression of symptoms, presence of myelopathy for more than six months, a compression ratio approaching 0.4, and transverse area of the cord <40 mm.[2] However,

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these factors include the imaging of the spine, which may not be applicable in some settings.

Currently, the most commonly utilized scales for evaluating the severity of symptoms are Nurick grading,[3] the Neck Disability Index (NDI),[4] and the modified Japanese Orthopaedic Association (mJOA) scale.[5] The mJOA scale is multidimensional, and it is used to separately assess the function of upper and lower extremities and bladder function in CSM patients. The mJOA has been widely used to standardize the clinical assessment of CSM.[6]

The mJOA has been translated into several languages, including Italian[7], Brazilian-Portuguese[8], and Dutch.[9] This study aimed to translate and adapt the mJOA to the Thai language, and to determine its reliability and validity among Thai patients with CSM.

MATERIALS AND METHODS

Questionnaire

The mJOA scale was designed to assess micturition and motor function and sensation of the extremities in patients with CSM. The mJOA has an 18-point scale that consists of motor dysfunction of upper extremities (5 points), motor dysfunction of lower extremities (7 points), sensory dysfunction of upper extremities (3 points), and sphincter dysfunction (3 points). A score of 18 shows no neurological deficits, whereas an increasingly lower score represents an increasingly greater severity of functional impairment and disability.

The mJOA was translated into the Thai language according to linguistic validation guidelines using a forward-backward translation protocol to create the Thai-mJOA. This process involved independent translation of the mJOA from English to Thai by both a professional English translator and a bilingual physician. The two independent translations were then discussed and combined into a consensus version. The backward translation from Thai to English was performed by a native English speaker who is a professional translator of the Thai language to the English language. The English translation was then compared to the original mJOA questionnaire and checked for mistranslation and misunderstanding.

Participants

This study was approved by the Siriraj Institutional Review Board (SIRB) of the Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand [COA no. 328/2016(EC1)], and written informed consent was obtained from all participants. Enrolled patients were prospectively recruited from the in-hospital spinal surgery unit at Siriraj Hospital during December 2016 to November 2019. During this period, 92 patients with CSM that were scheduled for surgical treatment were enrolled. All patients were assessed using the Thai-mJOA, Nurick grading, and the Thai-NDI[4] on the day of admission, and once again 72 hours after surgery.

Outcome measurement

To assess test-retest reliability, all patients were asked to complete the Thai-mJOA on the day of admission before surgery, and then once again 3 days after surgery. Test-retest reliability was determined using intraclass correlation coefficient (ICC). Reliability was determined by calculating Cronbach's alpha. Internal consistency estimates of >0.70 were considered acceptable for group comparisons.[10]

Concurrent validity was evaluated by comparing the Thai-mJOA with the Nurick grading scale and the Thai-NDI. Validity was determined by calculating Spearman's correlation coefficient. Correlation coefficients of 0.1 to 0.3 were considered weak; 0.3 to 0.6, moderate; and >0.6, strong. All statistical analyses were performed using SPSS v.18.0.

RESULTS

Ninety-two patients were enrolled in this study, and most subjects were male (63.04%). Approximately one-third of patients each had 1, 2, and 3 levels of cervical spinal cord compression (34.4% had 1 level, 31.1% had 2 levels, and 31.1% had 3 levels). Demographic and clinical data of patients, including scoring of the Thai-mJOA, the Nurick grading scale, and the Thai-NDI, are shown in Table 1.

The Cronbach's alpha values were acceptable for all domains of the Thai-mJOA, as follows: 0.991 for the total score, 0.990 for Motor dysfunction score of the upper extremities, 0.997 for Motor dysfunction score of the lower extremities, 0.945 for Sensory dysfunction score of the upper extremities, and 0.977 for Sphincter dysfunction score. For the test-retest evaluation, the ICC's were 0.981 (95% confidence interval [CI]: 0.972-0.988) for the total score, 0.98 (95% CI: 0.97-0.987) for the Motor dysfunction score of the upper extremities, 0.995 (95% CI: 0.992-0.997) for the Motor dysfunction score of the lower extremities, 0.896 (95% CI: 0.847-0.930) for the Sensory dysfunction score of the upper extremities, and 0.955 (95% CI: 0.933-0.97) for the Sphincter dysfunction score. These ICC values indicate good repeatability for each domain. Details of ICC and test-retest results are shown in Table 2. We also reported the Cronbach's alpha values and ICCs of a previous study compared to our values from the present study in Table 4.

TABLE 1. Demographic and clinical characteristics of the study population.

Characteristics	(N = 92)
Gender	
Male	58 (63.04%)
Female	34 (36.96%)
Number of neurological compression levels	
1	31 (34.4%)
2	28 (31.1%)
3	28 (31.1%)
4	3 (3.3%)
Level of neurological compression	
C2-C3	1 (1.1%)
C3-C4	37 (41.6%)
C4-C5	55 (61.8)
C5-C6	63 (70.8)
C6-C7	24 (27%)
C7-T1	0 (0.0%)
Thai-mJOA score	11.9±3.5 (4-18)
Nurick grading score	2.8±1.2 (0-5)
Thai-NDI score	37.7±17.4 (2-78)

Data presented as number and percentage or mean ± standard deviation (range)
Abbreviations: C = cervical; T = thoracic; Thai-mJOA = Thai version of the modified Japanese Orthopaedic Association; Thai-NDI = Thai version of the Neck Disability Index

TABLE 2. Reliability of the Thai-mJOA scale (N=92).

Scoring parameters	Cronbach's alpha	Test-retest ICC (95% CI)	Floor	Ceiling
Thai-mJOA scale				
Total	0.991	0.981 (0.972-0.988)	0.0%	5.4%
Motor dysfunction score of the upper extremities	0.990	0.980 (0.970-0.987)	0.0%	38.0%
Motor dysfunction score of the lower extremities	0.997	0.995 (0.992-0.997)	1.1%	17.4%
Sensory dysfunction score of the upper extremities	0.945	0.896 (0.847-0.930)	1.1%	14.1%
Sphincter dysfunction score	0.977	0.955 (0.933-0.970)	4.3%	73.9%

Abbreviations: ICC, intraclass correlation coefficient; CI, confidence interval; Thai-mJOA scale, Thai version of the modified Japanese Orthopaedic Association scale

TABLE 3. Correlation coefficients between Thai-mJOA score and Nurick grading score and the Thai NDI score as determined by Spearman's correlation coefficient.

Scoring system	Thai-mJOA scale				
	Total score	Motor dysfunction score of the upper extremities	Motor dysfunction score of the lower extremities	Sensory dysfunction score of the upper extremities	Sphincter dysfunction score
Nurick grading	-0.712	-0.404	-0.825	-0.273	-0.348
Thai-NDI	-0.670	-0.574	-0.570	-0.371	-0.325

Abbreviations: Thai-mJOA = Thai version of the modified Japanese Orthopaedic Association; Thai-NDI = Thai version of the Neck Disability Index

TABLE 4. Cronbach's alpha values and test-retest ICC of present study and previous study.

		Longo, *et al.* (2016)[7]	The present study
Language		Italian	Thai
Number of patients		75	92
Cronbach's alpha	Total Score	0.6	0.991
	Motor dysfunction score of the upper extremities	0.45	0.99
	Motor dysfunction score of the lower extremities	0.54	0.997
	Sensory dysfunction score of the upper extremities	0.58	0.945
	Sphincter dysfunction score	0.6	0.977
	Total score	0.91	0.981 (0.972-0.988)
Test-retest ICC (95% CI)	Motor dysfunction score of the upper extremities	0.892	0.980 (0.970-0.987)
	Motor dysfunction score of the lower extremities	0.929	0.995 (0.992-0.997)
	Sensory dysfunction score of the upper extremities	0.924	0.896 (0.847-0.930)
	Sphincter dysfunction score	0.93	0.955 (0.933-0.970)

Abbreviations: ICC = intraclass correlation coefficient; CI = confidence interval

Concurrent validity of the Thai-mJOA compared to Nurick grading and the Thai-NDI is described in Table 3. The most strongly correlated domains were Nurick grading with the Motor dysfunction score of the lower extremities of the Thai-mJOA (-0.825), and Nurick grading with the total score of the Thai-mJOA (-0.712). The Thai-NDI was also shown to be strongly correlated with the total score of the Thai-mJOA (-0.670).

A Bland-Altman plot showing the difference between the pre-operative mJOA and post-operative mJOA plotted against the mean of the two scores is shown in Fig 1. The arithmetic mean difference between the two score (the bias) was 0.1648 (95% CI: -0.01191 to 0.3178). The upper and lower limits of agreement were 1.6041 and -1.2744, respectively.

DISCUSSION

In the present study, the modified Japanese Orthopaedic Association scale was translated into Thai language using a forward-backward translation protocol to create the Thai-mJOA. The results showed good reliability and validity of the Thai-SSS questionnaire, which correlated with both the Nurick grading scale and the Thai-NDI.

The Cronbach's alpha of total score and each domain ranged from 0.945-0.997, which demonstrate excellent internal consistency, and these values are consistent with the Cronbach's alpha values (range: 0.813-0.826) previously reported by Yonenobu, *et al.*[11] We also found that the Thai-mJOA has excellent reliability. The ICCs for test-reliability for all domains ranged from 0.896 to 0.995, which also agreed with the previous findings of Yonenobu, *et al.*[11] Our analysis for concurrent validity revealed a significant strongly negative correlation between the Nurick grading scale and the total score of Thai-mJOA, and with the Motor dysfunction score of the lower extremities domain of the Thai-mJOA (Spearman's correlation coefficient: -0.712 and -0.825, respectively). The Thai-NDI was also found to be strongly negatively correlated with the total score of the Thai-mJOA (Spearman's correlation coefficient: -0.67). These findings resulted from differences in interpretation between the Thai-mJOA and the Nurick grading scale, and between the Thai-mJOA and the Thai-NDI. More specifically, severe functional disability is indicated by a lower score on the Thai-mJOA, but by a higher score on the Nurick grading scale and the Thai-NDI.

CONCLUSION

The original modified Japanese Orthopaedic Association scale was successfully translated to Thai language to create the Thai-mJOA. The Thai-mJOA was found to be a valid and reliable tool for evaluating symptom severity in Thai patients with cervical spondylosis with myelopathy.

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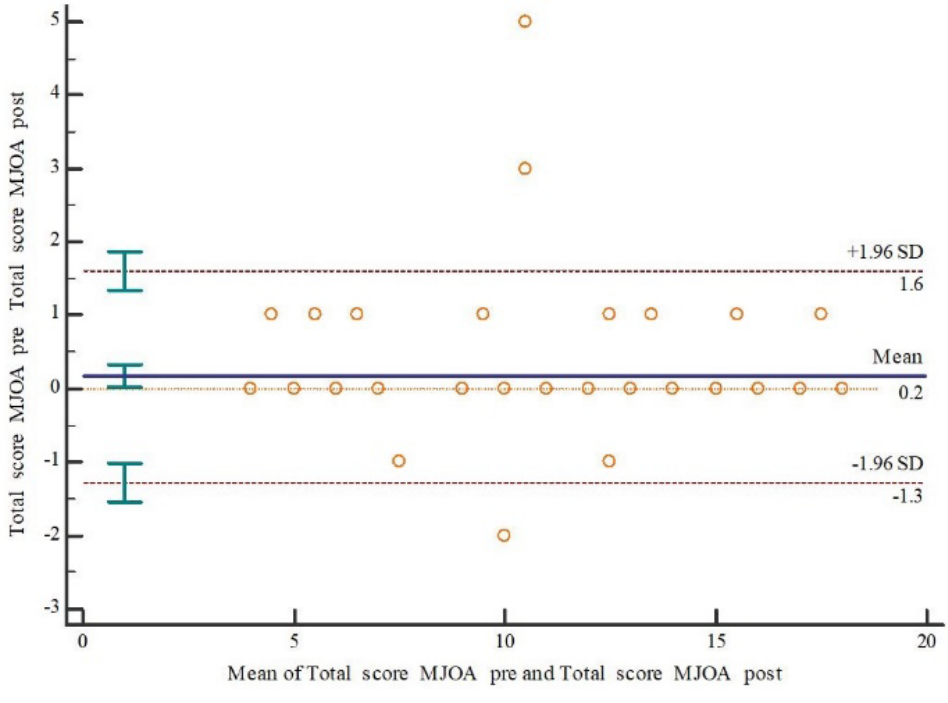

Fig 1. Bland-Altman plot showing the difference between the pre-operative mJOA and post-operative mJOA plotted against the mean of the two scores

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Conflict of interest declaration

The authors hereby declare no personal or professional conflicts of interest relating to any aspect of this study.

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