

## Original article

# Japanese Orthopaedic Association Cervical Myelopathy Evaluation Questionnaire (JOACMEQ): Part 2. Endorsement of the alternative item

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## Abstract

**Background.** A new self-administered questionnaire as an outcome measure for patients with cervical myelopathy was drawn up in Part 1 (Japanese Orthopaedic Association Cervical Myelopathy Evaluation Questionnaire, JOACMEQ). Because a question with regard to driving a car (C-41) was not suitable for this patient group, the authors composed an alternative question related to neck motion (C-41-2). The purposes of the present study were to perform a secondary survey on patients with cervical myelopathy and to statistically analyze the responses to validate the JOACMEQ, and also to determine if it was possible to convert item C-41 to the alternative question.

**Methods.** A member of the Subcommittee on Low Back Pain and Cervical Myelopathy Evaluation from each hospital administered the questionnaire to more than 50 patients with cervical myelopathy in each hospital. The questionnaire consisted of 25 questions, 24 of which were extracted in the primary survey. The authors statistically examined whether it was possible to convert question C-41 to C-41-2.

**Results.** Three hundred and sixty-eight patients with cervical myelopathy were enrolled in the present study. No questions elicited no answer or “I am not sure” in more than 5% of patients except question C-41. There were no questions that the patients answered with difficulty. There was no tendency that

was concentrated on one option as an answer to questions. There was a high correlation between questions C-41 and C-41-2. Spearman’s correlation coefficient and  $\kappa$  value showed that there was high coincidence between the two questions C-41 and C-41-2. It is possible to convert the question C-41 to the alternative question C41-2.

**Conclusion.** The questionnaire has sufficient reliability for clinical use. It is possible that the JOACMEQ will prevail and become a global standard to evaluate outcomes in patients with cervical myelopathy.

## Introduction

The members of the Subcommittee on Evaluation for Low Back Pain and Cervical Myelopathy, who belong to the Clinical Outcomes Committee of the Japanese Orthopaedic Association, have composed a new self-administered questionnaire as an outcome measure for patients with cervical myelopathy<sup>1</sup> to solve problems of the Japanese Orthopaedic Association score (JOA score) proposed by the Japanese Orthopaedic Association in 1975,<sup>2</sup> which was revised in 1994.<sup>3</sup> The features of this new outcome measure are that the outcomes are not influenced by the examiner because it is a self-administered questionnaire, and that it results in

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possible evaluation of the functional capacity of the cervical spine, the physical function of the upper and lower extremities, and bladder function, which might be disturbed by cervical myelopathy, and health-related quality of life (QOL). In Part 1, the authors performed a primary survey on healthy volunteers and patients with cervical myelopathy and statistically analyzed the responses to the questionnaire. The authors extracted 24 questions, which consisted of 13 questions with regard to the physical functions of the cervical spine and the spinal cord and 11 questions derived from the Medical Outcome Study Short-Form 36-Item Health Survey (SF-36, Japanese version),<sup>4</sup> respectively (Table 1). In question C-41 (“Can you turn your head when you back your car?”), approximately 22% of the patients and 10% of the normal volunteers responded “I am not sure” or “I do not drive”. Because some older patients no longer drive a car, the authors devised an alternative question to C-41, “While in the sitting position, can you turn your head toward the person who is seated behind you and speak to him/her while looking him/her in the face?” The purposes of the present study were to perform a secondary survey on patients with cervical myelopathy and to statistically analyze the responses to validate this new JOA Cervical Myelopathy Evaluation Questionnaire (JOACMEQ), which consisted of 24 items, and also to examine if it is possible to convert item C-41 to the alternative question.

## Methods

The Clinical Outcomes Committee of the Japanese Orthopaedic Association conducted this study together with eight university hospitals and their affiliated hospitals from November 2002 to April 2003 to develop an objective tool to measure outcomes in patients with cervical myelopathy. Another purpose of this study was to verify if question C-41-2, “While in the sitting position, can you turn your head toward the person who is seated behind you and speak to him/her while looking him/her in the face?”, can replace C-41 without disturbing the reliability of the questionnaire. A member of the Subcommittee on Low Back Pain and Cervical Myelopathy Evaluation from each hospital administered the questionnaire to more than 50 patients with cervical myelopathy in each hospital. The questionnaire consisted of 25 questions, 24 of which were extracted in the primary survey (Table 1).

### *Survey of patients with cervical myelopathy*

Patients answered each question by themselves. This study included patients with cervical myelopathy secondary to cervical disc herniation, spondylosis, and ossification of the posterior longitudinal ligament. Among

these patients, only patients whose clinical symptoms were likely to be unchanged during the course of the survey were finally included. Patients with the following disorders were excluded: cervical spondylotic amyotrophy, cervical radiculopathy, disorders of the upper cervical spine such as atlantoaxial subluxation, spine and spinal cord tumors, vascular lesions of the cervical spinal cord, syringomyelia, multiple sclerosis, motor neuron disease, myelitis, and spinal cord injury. Patients with disturbances of the central nervous system, such as cerebral infarction, combined cervical and thoracic spine lesion, orthopedic disorders except cervical myelopathy, and cognitive disorders, and patients who could not complete the questionnaire because of defects of the arm, fingers, or foot, were also excluded. Patients whose condition resulted from occupational or traffic accidents were excluded. Patients who had a surgical history of cervical spine surgery and those who participated in the primary survey were also excluded. All patients were asked to participate in the second survey and were told that the questionnaire would be used to develop a new JOACMEQ. Only patients who agreed to join the study answered the questionnaire.

### *Analysis of the distribution of answers to the questionnaire*

The distribution of answers to the questionnaire was analyzed. In Part 1, the authors excluded a question for which 80% of the answers were concentrated on one choice. In the present study, the authors reevaluated if there was a question in which the answer concentrated on one option. Reliability of this questionnaire as an outcome measure for patients with cervical myelopathy was verified.

### *Endorsement of the alternative question*

The authors examined if it was possible to convert the question C-41 to the alternative question C-41-2. For statistical analysis, data were analyzed using STATISTICA for Windows (1988) (StatSoft, Tulsa, OK, USA) and SPSS software (version 12; Chicago, IL, USA). The  $\kappa$  coefficient and Spearman's correlation coefficient were calculated to detect the correlation between the two questions.<sup>5</sup>  $P < 0.05$  was considered significant. According to the results of the statistical analysis, the authors finalized the questionnaire as an outcome measure for patients with cervical myelopathy.

## Results

Three hundred and sixty-eight patients with cervical myelopathy were enrolled in the present study. The

**Table 1.** Twenty-four items and one alternative remained as candidates for the questionnaire

Recall your physical condition during the last week and circle the item number of each of the following questions that applies. If your condition changes depending on the day or the time, circle the item number of your worst condition.

C-1. Can you fasten the front buttons of your blouse or shirt using both hands?

- 1) I can do it without difficulty.
- 2) I can do it if I spend time.
- 3) I cannot do it.
- 0) I am not sure.

C-7. Can you eat a meal using a spoon or a fork with your right hand?

- 1) I can do it without difficulty.
- 2) I can do it if I spend time.
- 3) I cannot do it.
- 0) I am not sure.

C-13. Can you raise your right arm?

- 1) I can raise it straight upward.
- 2) I can raise it upward when flexed a little.
- 3) I can raise it halfway (up to shoulder level).
- 4) I cannot raise it.

C-18. Can you walk on a flat surface?

- 1) I can do it without difficulty.
- 2) I can do it slowly.
- 3) I can do it with support (of a handrail, a stick, or a walker).
- 4) I can do it only slowly even with support.
- 5) I cannot do it.
- 0) I am not sure.

C-21. Can you stand on your right leg without the support of your hand?

- 1) I can do it for more than 10 seconds.
- 2) I can do it for less than 10 seconds.
- 3) I can hardly do it.
- 0) I am not sure.

C-28. Do you have urinary incontinence?

- 1) No.
- 2) I have it when I sneeze or strain myself.
- 3) I have it when I do not release urine over a period of more than two hours.
- 4) Frequently.
- 5) Always.

C-30. How often do you go to the bathroom (to void urine) at night?

- 1) Hardly ever.
- 2) Once or twice.
- 3) Three times or more.

C-31. Do you have a feeling of residual urine even after voiding of urine (urination)?

- 1) I rarely have such a feeling.
- 2) I sometimes have such a feeling, and sometimes not.
- 3) I usually have such a feeling.
- 0) I am not sure.

C-32. Can you void urine immediately in the toilet?

- 1) I almost always can do it immediately.
- 2) I sometimes can do it immediately, and sometimes not.
- 3) I usually cannot do it immediately.
- 0) I am not sure.

C-35. While in the sitting position, can you look up at the ceiling by drawing your head directly backward?

- 1) I can do it without difficulty.
- 2) I can do it with some effort.
- 3) I cannot do it.

C-37. Can you drink a glass of water in one gulp?

- 1) I can do it without difficulty.
- 2) I can do it with some effort.
- 3) I cannot do it.
- 0) I am not sure.

C-38. Can you see your feet when you walk down the stairs?

- 1) I can do it without difficulty.
- 2) I can do it with some effort.
- 3) I cannot do it.
- 0) I am not sure.

C-41. Can you turn your head when you back your car?

- 1) I can do it without difficulty.
- 2) I can do it with some effort.
- 3) I cannot do it.
- 0) I am not sure. I do not drive a car/I do not drive these days.

C-41-2. Alternative question

While in the sitting position, can you turn your head toward the person who is seated behind you and speak to him/her while looking him/her in the face?

- 1) I cannot do it.
- 2) I can do it with some effort.
- 3) I can do it without difficulty.

QOL-1. What is your present health condition?

- 1) Excellent
- 2) Very good
- 3) Good
- 4) Not very good
- 5) Poor

QOL-3. The following are ordinary daily activities. Please indicate if you have difficulty doing them because of your poor health condition and, if so, how difficult you think it is to do them. Circle the item number that most applies.

5. Climbing the stairs to one floor above

- 1) I have great difficulty
- 2) I have some difficulty
- 3) I do not have any difficulty

6. Bending forward, kneeling, and stooping

- 1) I have great difficulty
- 2) I have some difficulty
- 3) I do not have any difficulty

7. Walking a kilometer

- 1) I have great difficulty
- 2) I have some difficulty
- 3) I do not have any difficulty

**Table 1.** *Continued*

QOL-4. When you engaged in your work or daily activities (including housework) during the last month, did you have any of the problems listed below because of your physical condition? (Circle the item number in each topic that best applies.)	7. Were you exhausted?
2. I could not do my work or daily activities as well as I expected.	1) Always
1) Always	2) Almost always
2) Almost always	3) Sometimes
3) Sometimes	4) Rarely
4) Rarely	5) Not at all
5) I was able to do my work or daily activities as well as I expected.	8. Did you feel pleasant?
QOL-8. How severely was your work (including housework) hindered during the last month because of the pain?	1) Always
1) Not at all	2) Almost always
2) A little	3) Sometimes
3) Slightly	4) Rarely
4) Fairly	5) Not at all
5) Greatly	QOL-11. Circle the item number of each of the following topics that best applies to your condition.
QOL-9. The following are questions about your feelings during the last month (circle the item number of each question that best applies).	2. I am in decent health.
6. Were you discouraged and depressed?	1) Completely yes.
1) Always	2) Almost yes.
2) Almost always	3) I am not sure.
3) Sometimes	4) I hardly think so.
4) Rarely	5) I do not think so.
5) Not at all	3. I feel my health will get worse.
	1) Completely yes.
	2) Almost yes.
	3) I am not sure.
	4) I hardly think so.
	5) I do not think so.

patients comprised 247 men and 121 women. Cervical myelopathy was secondary to a herniated disc in 52 patients, spondylosis in 239 patients, ossification of the posterior longitudinal ligament in 76 patients, and combined disorders in 1. Table 2 shows the age and sex distribution of patients. The authors then excluded individuals with other orthopedic disorders, giving a total of 333 patients whose data were analyzed.

The distribution of the revised JOA score,<sup>3</sup> shown in Table 3, revealed that patients with mild to severe myelopathy were involved in the present study. The distribution of this patient group was not anomalous as a group of patients with cervical myelopathy.

Table 4 shows the distribution of the answers for the questionnaire. No questions elicited no answer or “I am not sure” in more than 5% of patients except question C-41. There were no questions that the patients answered with difficulty. For question C-41 (“Can you turn your head when you back your car?”), more than 30% of patients responded “I am not sure. I do not drive a car/I do not drive these days” or “no answer.” There was no tendency for concentration on one option as an answer to questions. The distribution of the answers to question C-41 and the alternative question for

C-41 (C-41-2) was analyzed. Table 5 shows the distributions of answers to these two questions by patients with cervical myelopathy. When the choice of “no answer” and “I am not sure” were excluded for statistical analysis, Spearman’s correlation coefficient and  $\kappa$  value were 0.795 and  $\kappa$  0.630, respectively. These results indicated that there was a high correlation between questions C-41 and C-41-2. In one hundred five patients who chose “no answer” or “I am not sure” as the answer to question C-41, 50 patients answered “I can do it with some effort” to question C-41-2. In patients who responded “I cannot do it” or “I can do it without difficulty” as an answer to question C-41-2, there was high agreement in the distribution of the answers to question C-41. However, the agreement in patients who responded “I can do it with some effort” as an answer to questions C-41 and C-41-2 was relatively low.

Collectively, it was possible to convert question C-41 to the alternative question C-41-2. A final questionnaire as an outcome measure for patients with cervical myelopathy consisted of 24 questions, which consisted of 13 items from the questions about the physical functions of the cervical spine and the spinal cord and 11 items from SF-36.

**Table 2.** Demographic data in the primary survey

	Patients with cervical myelopathy		
	Male	Female	Total
<i>n</i>	247	121	368
Age (years)			
20–29	2	1	3
30–39	7	6	13
40–49	20	7	27
50–59	61	25	86
60–69	74	30	104
70–79	70	45	115
80–89	13	7	20
90 and more			
Disorders of the cervical spine			
Disc herniation			52
Spondylosis			239
Ossification of the posterior longitudinal ligament			76
Combined			1
Other orthopedic disorders			
Yes			35
No			333

## Discussion

The authors statistically selected questions to evaluate the physical function of the cervical spine and spinal cord and health-related QOL, and finally composed a questionnaire, which consisted of 24 questions, as an outcome measure for patients with cervical myelopathy.<sup>1</sup> In the present study, the authors found that there were no questions for which the distribution of answers was concentrated on one option, and that the distribution of the answers was not statistically different from those obtained in Part 1, with the exception of question C-41. These results suggest that the questionnaire has sufficient reliability for clinical use. With regard to the distribution of answers for question C-41, the authors found in Part 1 that approximately 22% of patients responded “I am not sure” or “I do not drive”,<sup>1</sup> whereas in the present study, more than 30% of patients responded “I am not sure”, “I do not drive a car/I do not drive these days”, or “no answer.” Therefore, this question was not reliable as a question to evaluate the physical function of the cervical spine. The authors then devised the alternative question C-41-2 and statistically evaluated if it was possible to convert question C-41 to question C-41-2. As a result, it was determined that question C-41 could be exchanged with the alternative question, C-41-2.

As a statistical analysis, it is often the case that the  $\kappa$  coefficient is used for a test of coincidence if true and/or alternative values are categorical values. To demonstrate the coincidence, the value of the  $\kappa$  coefficient

should be at least 0.4 or more, and preferably more than 0.6.<sup>4</sup> In the present study, the authors found that  $\kappa$  value coincidence between questions C-41 and C-41-2 was more than 0.6. This result indicated that question C-41-2 is acceptable in place of question C-41.

The authors then finalized the self-administered questionnaire, which consists of 24 questions with regard to cervical spine function, motor functions of the upper and lower extremities, bladder function, and health-related QOL. Phraseology, such as words, language, and phrasing, was examined and modified by conference with the medical specialists’ group, and the questionnaire was finally completed.

Most Japanese orthopedic spine surgeons have evaluated the severity of cervical myelopathy using the conventional JOA score, in which the points can be calculated.<sup>2,3</sup> Especially in the clinical situation, it is very easy to examine the recovery of neurological function in patients with cervical myelopathy after conservative and/or surgical treatments because of this scoring system. Therefore, it is desirable to statistically establish a scoring system using this new questionnaire, JOACMEQ. In addition, it is important to evaluate whether the JOACMEQ measures the outcomes for all patients with cervical myelopathy in whom the symptoms are mild to severe. Therefore, the authors must verify whether this questionnaire can measure severity of cervical myelopathy. Because there is no standard value for this questionnaire, appropriate statistical analyses such as factor analysis to consolidate the information are needed. In addition, considering the clinical use of

**Table 3.** The distribution of revised Japanese Orthopaedic Association (JOA) scores

<i>n</i>			Patients with cervical myelopathy	
			Score	333
Motor function	Upper extremity	Finger	0	3
			1	18
			2	67
			3	136
			4	108
			Unknown	1
Motor function	Upper extremity	Shoulder/elbow	-2	12
			-1	15
			-0.5	37
			0	268
			Unknown	1
Motor function	Lower extremity		0	3
			0.5	4
			1	20
			1.5	37
			2	55
			2.5	28
			3	75
			4	110
			Unknown	1
Sensory	Upper extremity		0	10
			0.5	46
			1	152
			1.5	81
			2	43
			Unknown	1
Sensory	Trunk		0	2
			0.5	6
			1	50
			1.5	12
			2	261
			Unknown	2
Sensory	Lower extremity		0	4
			0.5	23
			1	100
			1.5	56
			2	149
			Unknown	1
Bladder function			0	4
			1	37
			2	68
			3	223
			Unknown	1

this questionnaire, reliability or reproducibility of the questionnaire should be verified by two investigations at different time points. Responsiveness of this questionnaire also must be evaluated by undertaking surveys before and after specific medical treatments.

The members of the Subcommittee on Low Back Pain and Cervical Myelopathy Evaluation hope that this questionnaire prevails and becomes a global standard to evaluate outcomes in patients with cervical myelopathy.

**Table 4.** The distribution of answers to residual 24 questions and 1 alternative question

	Patients with cervical myelopathy ( <i>n</i> = 333)						No answer
	0	1	2	3	4	5	
C-1		150 45.0%	153 45.9%	30 9.0%			
C-7		244 73.3%	74 22.2%	11 3.3%			4 1.2%
C-13		215 64.6%	80 24.0%	25 7.5%	10 3.0%		3 0.9%
C-18		165 49.5%	124 37.2%	25 7.5%	12 3.6%	5 1.5%	2 0.6%
C-21		156 46.8%	100 30.0%	73 21.9%	1 0.3%		3 0.9%
C-28		246 73.9%	48 14.4%	20 6.0%	17 5.1%	1 0.3%	1 0.3%
C-30		94 28.2%	178 53.5%	59 17.7%			2 0.6%
C-31		195 58.6%	117 35.1%	20 6.0%			1 0.3%
C-32		217 65.2%	96 28.8%	19 5.7%			1 0.3%
C-35		190 57.1%	102 30.6%	40 12.0%			1 0.3%
C-37		234 70.3%	69 20.7%	28 8.4%			2 0.6%
C-38		249 74.8%	58 17.4%	25 7.5%			1 0.3%
C-41	98 29.4%	100 30.0%	88 26.4%	38 11.4%			9 2.7%
C-41-2 (Alternative question to C-41)		108 32.4%	142 42.6%	80 24.0%			3 0.9%
		1	2	3	4	5	No answer
QOL-1		4 1.2%	40 12.0%	153 45.9%	115 34.5%	19 5.7%	
QOL-3-5		41 12.3%	133 39.9%	156 46.8%			3 0.9%
QOL-3-6		41 12.3%	124 37.2%	162 48.6%			6 1.8%
QOL-3-7		70 21.0%	100 30.0%	153 45.9%			10 3.0%
QOL-4-2		35 10.5%	49 14.7%	102 30.6%	63 18.9%	78 23.4%	6 1.8%
QOL-8		25 7.5%	58 17.4%	88 26.4%	66 19.8%	93 27.9%	3 0.9%
QOL-9-6		6 1.8%	26 7.8%	106 31.8%	70 21.0%	122 36.6%	3 0.9%
QOL-9-7		13 3.9%	29 8.7%	114 34.2%	90 27.0%	85 25.5%	2 0.6%
QOL-9-8		32 9.6%	59 17.7%	138 41.4%	57 17.1%	41 12.3%	6 1.8%
QOL-11-2		24 7.2%	81 24.3%	136 40.8%	63 18.9%	27 8.1%	2 0.6%
QOL-11-3		18 5.4%	55 16.5%	176 52.9%	58 17.4%	22 6.6%	4 1.2%

**Table 5.** The distribution of answers to question C-41 and the alternative question (C-41-2)

		C-41-2			Total
		1	2	3	
C-41	I am not sure. I do not drive a car/I do not drive these days.	22	50	33	105
	1. I can do it without difficulty.	78	22	0	100
	2. I can do it with some effort.	8	63	16	87
	3. I cannot do it.	0	7	31	38
	Total	108	142	80	330

## References

1. The Study Group for new JOA score. An outcome measure for patients with cervical myelopathy: New Japanese Orthopaedic Association score: Part 1. *J Orthop Sci* 2007;12:227–40.
2. Japanese Orthopaedic Association score for cervical spondylotic myelopathy. *J Jpn Orthop Assoc* 1975;99: prefatory note (in Japanese).
3. Revised Japanese Orthopaedic Association scores for cervical myelopathy. *J Jpn Orthop Assoc* 1994;68:490–503 (in Japanese).
4. Fukuhara S, Suzugamo Y, Bito S, Kurokawa K. *Manual of SF-36: Japanese version 1.2*. Tokyo: Public Health Research Foundation; 2001 (in Japanese).
5. Fukui M, Hirota Y. Basic knowledge to establish criteria for the assessment of medical treatment. *Spine Spinal Cord* 2004;17:18–25 (in Japanese).