











TRANSLATION, CULTURAL ADAPTATION AND VALIDATION OF THE NURICK SCALE INTO PORTUGUESE

TRADUÇÃO, ADAPTAÇÃO CULTURAL E VALIDAÇÃO DA ESCALA NURICK PARA O PORTUGUÊS

TRADUCCIÓN, ADAPTACIÓN CULTURAL Y VALIDACIÓN DE LA ESCALA NURICK AL PORTUGUÉS

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ABSTRACT

Introduction: Degenerative cervical myelopathy stands as the primary non-traumatic cause of spinal cord dysfunction in adults. Neurological assessment tools rooted in functionality, such as the Nurick scale and the Japanese Orthopaedic Association Score (JOA), are commonly employed. The latter was revised and culturally adapted to Western norms by Chiles et al. in 1999, resulting in the modified JOA score (mJOA). This study aims to translate, cross-culturally validate, and assess the reproducibility of the Nurick scale into Brazilian Portuguese among patients with cervical degenerative myelopathy. **Material And Methods:** This study comprised two phases: initial translation, back-translation, final version assessment, and application test evaluation. A total of 70 individuals were evaluated, with 36 in the cervical myelopathy group and 34 in the control group. Subsequently, both groups underwent assessment using the mJOA and the NURICK-BRAZIL version, with data collection following. Data analysis employed Mann-Whitney tests and Spearman's correlation tests. Analyses were executed using the statistical package R, with a significance level set at 5%. **Results:** Mann-Whitney comparison tests revealed significant differences in the NURICK-BRAZIL scale between the control and patient groups. Spearman's correlation coefficient indicated a robust negative correlation between the NURICK-BRAZIL and mJOA scales. These findings suggest that the adapted Nurick scale in Brazilian Portuguese (NURICK-BRAZIL) holds potential for validation in evaluating patients with degenerative cervical myelopathy. **Conclusion:** The translation, adaptation, and validation of the original Nurick scale in Brazilian Portuguese (NURICK-BRAZIL) demonstrate similarity, applicability, good comprehension, and significant potential for widespread utilization as a valuable clinical and scientific evaluation tool for cervical myelopathy patients. **Level of evidence III; Case-control study.**

Keywords: Myelopathy; Compressive Myelopathy; Questionnaire; Cervical Spondylosis.

RESUMO

Introdução: A mielopatia cervical degenerativa é a principal causa não traumática de disfunção medular em adultos. São utilizadas escalas e escores para avaliação neurológica baseada na funcionalidade, como a escala de Nurick e a Japanese Orthopaedic Association Score (JOA). O objetivo deste estudo é traduzir, validar transculturalmente e avaliar a reprodutibilidade da escala de Nurick para o português brasileiro em pacientes com mielopatia degenerativa cervical. **Material e Métodos:** O presente estudo foi dividido em duas fases: primeira, tradução, retradução, avaliação da versão final e avaliação da prova de aplicação. No total foram avaliados 70 indivíduos, 36 pertenciam ao grupo de pacientes com mielopatia cervical e 34, ao grupo controle. Tanto a versão traduzida do Nurick-BR quanto o mJOABR-17, previamente foram aplicados em ambos os grupos e os dados foram coletados. A análise dos dados foi realizada por meio de testes de Mann-Whitney e testes de correlação de Spearman. As análises foram realizadas utilizando o pacote estatístico R e o nível de significância adotado foi de 5%. **Resultados:** A partir dos testes de comparação de Mann-Whitney que verificaram as diferenças entre os grupos controle e pacientes. Foram encontradas diferenças significativas na escala NURICK-BR entre os grupos. A correlação entre as escalas NURICK-BRASIL e mJOABR-17 foi medida através do coeficiente de correlação de Spearman que apresentou forte correlação negativa. Esses resultados sugerem que a escala Nurick adaptada para o português brasileiro (NURICK-BRASIL) pode ser validada para avaliação de pacientes com mielopatia cervical degenerativa. **Conclusão:** A tradução, adaptação e validação da versão original da escala Nurick para o português brasileiro (NURICK-BR) mostrou similaridade, aplicabilidade, boa compreensão e grande potencial de universalização desta valiosa ferramenta para avaliação clínica e científica de pacientes com mielopatia cervical. **Nível de evidência III; Estudo de caso-controle.**

Descritores: Mielopatia; Mielopatia Compressiva; Questionário; Espondilose Cervical.

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RESUMEN

Introducción: La mielopatía cervical degenerativa es la principal causa no traumática de disfunción medular en adultos. Se utilizan escalas y puntajes para la evaluación neurológica basada en la funcionalidad, como la escala de Nurick y la Japanese Orthopaedic Association Score (JOA). El objetivo de este estudio es traducir, validar transculturalmente y evaluar la reproducibilidad de la escala de Nurick al portugués brasileño en pacientes con mielopatía degenerativa cervical. **Materiales y Métodos:** El estudio se dividió en dos fases: primero, traducción, retrotraducción, evaluación de la versión final y evaluación de la prueba de aplicación. En total, se evaluaron 70 individuos, 36 pertenecían al grupo de pacientes con mielopatía cervical y 34 al grupo de control. Tanto la versión traducida de Nurick-BR como el mJOABR-17 previamente se aplicaron en ambos grupos y se recopiló los datos. El análisis de los datos se realizó mediante pruebas de Mann-Whitney y pruebas de correlación de Spearman. Los análisis se llevaron a cabo utilizando el paquete estadístico R y el nivel de significancia adoptado fue del 5%. **Resultados:** A partir de las pruebas de comparación de Mann-Whitney que verificaron las diferencias entre los grupos de control y los pacientes, se encontraron diferencias significativas en la escala NURICK-BR entre los grupos. La correlación entre las escalas NURICK-BRASIL y mJOABR-17 se midió a través del coeficiente de correlación de Spearman, que mostró una correlación negativa fuerte. Estos resultados sugieren que la escala de Nurick adaptada al portugués brasileño (NURICK-BRASIL) puede ser validada para la evaluación de pacientes con mielopatía cervical degenerativa. **Conclusión:** La traducción, adaptación y validación de la versión original de la escala de Nurick al portugués brasileño (NURICK-BR) mostró similitud, aplicabilidad, buena comprensión y gran potencial de universalización de esta valiosa herramienta para la evaluación clínica y científica de pacientes con mielopatía cervical. **Nivel de evidencia III; Estudio de casos y controles.**

Descriptor: Mielopatía; Mielopatía Compresiva; Cuestionario; Espondilosis Cervical.

INTRODUCTION

Degenerative cervical myelopathy, also known as cervical spondylosis, is the main non-traumatic cause of spinal cord dysfunction in adults, manifested as narrowing of the vertebral canal by osteophytes, ossification of the posterior longitudinal ligament, or central disc herniation.^{1,2}

Cervical spondylosis is a natural aging process mainly seen in patients aged 50 years or older.³ Radiographic signs suggesting degenerative cervical myelopathy are observed in about 85% of individuals over 60 years old.⁴ The most affected spinal level is C6-C7, followed by C5-C6. The most common symptom is axial cervicalgia, mainly occurring when the patient is in an orthostatic position, with improvement upon lying down.⁴ The progression of the degenerative condition is characterized by structural changes in the cervical spine, such as loss of disc height, ligamentous laxity, formation of osteophytes, loss of cervical lordosis, and spinal stenosis. Such changes can lead to radiculopathy and/or cervical myelopathy, as well as axial cervicalgia.⁴

Myelopathy is characterized by the mechanical compression of the afferent or efferent pathways of the spinal cord, which can be static when caused by cervical spondylosis or cervical disc herniation and/or dynamic when caused by post-trauma instability.⁵⁻⁷

The normal anteroposterior diameter of the cervical vertebral canal is 17 to 18mm in adults, with the vertebral column being 10mm.⁸ Symptoms and signs of cervical spinal compression may begin to manifest if the cross-sectional area of the spinal cord is reduced by 30%. The resulting cross-sectional area is less than 60mm.^{2,9} The Torg-Pavlov ratio, which is the ratio between the anteroposterior diameter of the vertebral canal and the anteroposterior diameter of the vertebral body at the same level as the vertebral column, shows congenital cervical narrowing if its value is less than 0.8. Other than that, a ratio less than 0.4 has a histological correlation with severe spinal cord injuries.^{2,5,6-8}

Dynamic factors also contribute to the onset of cervical myelopathy. Hyperextension of the neck is associated with flexion of the yellow ligament within the spinal canal.¹⁰⁻¹² In the case of cervical spine retrolisthesis, neck extension leads to medullary compression between the postero-inferior wall of the vertebral body and the superior edge of the lamina of the lower segment.¹¹ Breig et al. showed that the blood flow of the anterior spinal artery and the radicular arteries can decrease when pulled towards a spinal disc or vertebral body.¹³ In particular, the intramedullary transverse arteries are considered the most vulnerable to obstructive vascular disease, but also responsible for the perfusion of the gray matter and the adjacent lateral columns.¹⁴ Due to the interruption of the arterial and/or venous blood supply to the column, demyelination occurs due to apoptosis of the oligodendrocytes, leading to irreversible

neurological deficit.¹⁵

The insidious onset usually occurs when the patient shows decreased dexterity, mainly in the upper limbs, resulting in difficulty buttoning, tying shoes, and picking up small objects. Gait may become spastic, and patients may indicate weakness and atrophy of the lower limbs.^{4,16-20} Severe chronic myelopathy can result in loss of proprioception, ataxic gait, and eventually, tetraplegia. Urinary symptoms may be present, although less commonly, in less than 20% of cases, usually starting in the later stages of disease progression.^{4,16-20}

Signs and symptoms in the hands are present in about 80% of patients^{21,22} and can often characterize the main complaint that leads the patient to seek medical help. Ono et al.²³ presented two specific signs of the "myelopathic hand": the "escaped finger sign", where the patient tries to fully extend the finger with the palm facing down, and after 30 seconds, the 4th and 5th fingers end up abducted and flexed, and the grip and release test, with a decrease in the ability to quickly open and close the fist.²⁴

This is a progressive and degenerative pathology, and with the aging of the global population, it becomes more prevalent.² Alongside this epidemiological transition, which is associated with a better understanding of this disease's pathophysiology and natural history, the number of surgical indications for treating this pathology also increases. In 2009, Lad et al., based on national data in the USA, showed an increase from 3.73 to 7.88 hospitalized patients for this condition per 100,000 people from 1993 to 2002.²⁵ In Brazil, we do not have data to know the correct prevalence of the disease.²⁶

The diagnosis is made clinically; however, imaging tests should be requested to confirm and assess the size of nerve structure compression. Surgery is the treatment of choice, as demonstrated in several medical literature studies, due to its potential to promote clinical improvement and maintain these results after a long follow-up period.²⁷

Considering the need for surgical treatment, the severity of the disease, and the increase in cases, a more objective way to assess and evaluate neurological function is done using scales and scores for neurological assessment based on functionality to assist in the decision-making process by doctors and, for researchers, with quantification and comparison of results from different studies, also being useful as tools to monitor disease progression, and compare deficits in preoperative and postoperative states, analyzing whether there was clinical improvement or not.²⁴⁻²⁹

The authors of this article did not find any literature study on the translation and validation of the Nurick (Figure 1) scale into Brazilian Portuguese.

This study aims to translate, cross-culturally validate, and assess the reproducibility of the Nurick scale into Brazilian Portuguese in patients with degenerative cervical myelopathy.

Grading	NURICK clinical scale
Grade 0	Signs and symptoms of root involvement but without evidence of spinal cord disease.
Grade 1	Signs of spinal cord diseases but no difficulty walking.
Grade 2	Slight difficulty in walking which does not prevent full-time employment.
Grade 3	Extreme difficulty in walking that requires assistance and prevents full-time employment and occupation.
Grade 4	Able to walk only with someone else's help or with the aid of a walker.
Grade 5	Chairbound or bedridden.

Figure 1. Nurick functional scale.³⁰

MATERIALS AND METHODS

In the present study, the translation of the Nurick scale was carried out following the methodology proposed by Beaton et al.³¹ This study was divided into two phases, the first being the translation, back-translation, evaluation of the final version, and evaluation of the application test. This phase was conducted by two Brazilian translators fluent in English independently and without knowledge of the study's objective. Conceptual translation was carried out, avoiding the literal use of words or phrases. Next, both versions were compared and conducted by the two translators and two researchers, a doctor, and a physiotherapist, reaching a consensus for the first Brazilian Portuguese version of the instrument.

The retranslation stage began after the first version was defined in Brazilian Portuguese. In this stage, the Brazilian version was translated into English independently by two native English-speaking translators fluent in Brazilian Portuguese, without knowledge of the original English questionnaire and unaware of the study's objective. Again, as in the initial translation stage, the two versions were compared, producing the back-translated version by consensus.

After 30 days, the back-translated version, in English, was again sent to the two Brazilian translators, who translated the two versions into Portuguese. The researchers again compared the two versions, resulting in the translated version of the Nurick-Brazil Scale (Figure 2).

The population chosen to participate in the equivalence study was the one that, at the time, was diagnosed with cervical myelopathy and consecutively recruited in the Locomotor Program Department of the Albert Einstein Israelite Hospital (HIAE). Adult patients over 18 years of age, of both sexes, literate in Brazilian Portuguese and Brazilian, who had complaints of neck pain associated with signs and symptoms of cervical myelopathy with topographic diagnosis confirmed by magnetic resonance imaging, were included in the study. The exclusion criteria included the presence of cognitive deficits and diagnosed neurological diseases, communication disability (visual, verbal, and/or motor), the presence of neurological losses due to causes other than cervical myelopathy, the evident risk of bias resulting from the presence of confounding factors, and patient refusal. A control group composed of healthy volunteers or patients without spinal symptoms, neurological deficits of any kind, or known tumors were subjected to the Nurick scale and mJOA17, simultaneously with the patients included in the study, matched by sex and age.

A total of 70 individuals were evaluated, of which 36 belonged to the group of patients with cervical myelopathy and 34 belonged to the control group. At this stage, the scale was applied to 10 patients, 5 with myelopathy and 5 in the control group. Next, the examiners answered

whether they understood each item or not. They commented discursively, and when two or more examiners did not understand a certain item, it was reformulated until the final version of NURICK – BRAZIL (Figure 2).

Next, the mJOA and the final version of NURICK-BRAZIL were applied to both groups, and the data were collected. Data analysis was performed, and the variables were described using mean, standard deviation, median, interquartile range (1st and 3rd quartiles), and minimum and maximum values.³²⁻³⁴ The difference between the measurements taken in the control group and those taken in the patients was compared using Mann-Whitney tests. The relationship between the Nurick and mJOA scales was measured using Spearman's correlation.³⁵ The analyses were performed using the R statistical package,³⁶ and the significance level adopted was 5%.

The research was approved by the Research Ethics Committee of the Albert Einstein Israelite Hospital (59169016.7.0000.0071). All participants consented to the study and signed the Free and Informed Consent Form.

RESULTS AND DISCUSSION

The present study included 70 participants, 34 of whom belonged to the control group and 36 to the group of patients with cervical myelopathy. Table 1 presents the summary measures of the age of the study participants, which showed that there was no statistically significant difference between the groups, therefore, in homogeneous groups.

From the Mann-Whitney comparison tests that verified the differences between the control and patient groups, we found a significant difference in the NURICK-BRASIL scale, as shown in Table 2.

ESCALA DE NURICK - BRASIL	
<input type="checkbox"/>	GRAU 0: Sinais e sintomas de acometimento da raiz cervical, porém sem evidência de doença da medula espinal.
<input type="checkbox"/>	GRAU 1: Doenças da medula espinal, porém sem dificuldade na deambulação.
<input type="checkbox"/>	GRAU 2: Dificuldade na deambulação, porém não impede trabalho em período integral.
<input type="checkbox"/>	GRAU 3: Grande dificuldade na deambulação (requer ajuda) e que impede trabalho e ocupação em período integral.
<input type="checkbox"/>	GRAU 4: Consegue deambular apenas com ajuda de outra pessoa ou com ajuda de um andador, não impede trabalho ou ocupação.
<input type="checkbox"/>	GRAU 5: Confinado a uma cadeira de rodas ou acamado.

Figure 2. NURICK-BRAZIL Scale.

Table 1. Summary measures of the age of study participants.

Variables	Total	Control	Patient	Value-p
Mean (Standard deviation)	59.74 (11.62)	62.45 (11.42)	56.90 (11.41)	0.120
Median [IQR]	61.00 [52.00; 68.00]	62.00 [56.50; 69.25]	57.00 [48.00; 62.00]	
Minimum - Maximum (n)	35.00 - 86.00 (43)	36.00 - 86.00 (22)	35.00 - 79.00 (21)	

Table 2. Differences between the control and patient groups on the Nurick scale.

Variables	Total	Control	Patient	Value-p
Mean (Standard deviation)	0.79 (1.20)	0.09 (0.51)	1.44 (1.30)	<0.001
Median [IQR]	0.00 [0.00; 1.00]	0.00 [0.00; 0.00]	1.00 [1.00; 2.00]	
Minimum - Maximum (n)	0.00 - 5.00 (70)	0.00 - 3.00 (34)	0.00 - 5.00 (36)	

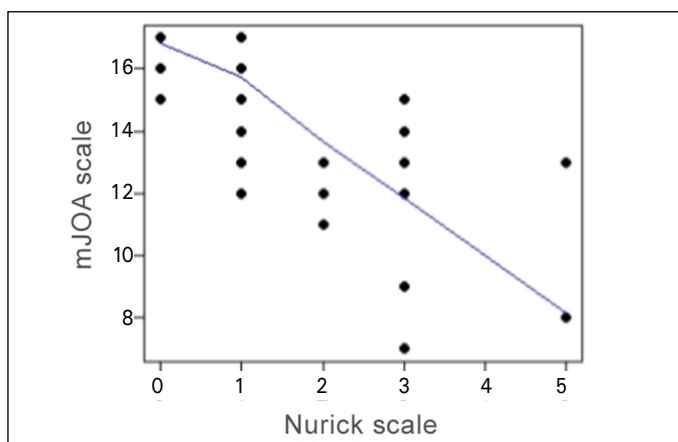


Figure 3. Scatter plot of mJOA and Nurick scales accompanied by the smoothed LOWESS curve. The correlation between variables is equal to -0.81.

The correlation between the NURICK-BRASIL and mJOA scales was measured using Spearman's correlation coefficient, which showed a strong negative correlation. The higher the score on the Nurick scale, the lower the mJOA score. Figure 3 presents the scatter plot of the points of the two scales, which reinforces the behavior indicated by the correlation coefficient.

Analyzing the results of surgical treatment and follow-up of the progression of myelopathy requires adequate standardization and universalization of the analyzed outcomes. It is essential that different centers have a universal language and that the results of independent studies can be compared and/or combined in meta-analyses or through multicenter studies. For Brazilian studies to be comparable with studies from other countries, we must use the same outcome tools.

Several scores/questionnaires are described in the literature for a more objective pathology assessment. The Nurick, Cooper, Neck Disability Index (NDI), and mJOA stand out. The JOA score, described by the Japanese Orthopaedic Association in 1976 to analyze upper and lower limbs in terms of motor function, sensory function, and sphincter function in patients with cervical myelopathy, ranges from 0 to 17 points, where 0 is the lowest score with the greatest functional impairment, and 17 is the expected score for normal individuals. Originally, the JOA questionnaire was developed according to the culture of Japanese society, where the most commonly used utensils for eating are chopsticks and/or spoons. When modified and adapted to Western culture, the fork and knife replaced the chopsticks, becoming mJOA. This is the only difference between the original questionnaire in Japanese and the one adapted to Western

culture and described in English by Chiles et al. in 1999,²¹ having been validated for Portuguese by Augusto et al.²⁴

The Nurick scale, widely used worldwide, primarily assesses the patient's gait. It comprises six grades (0 to 5), with 0 being the patient who presents signs and symptoms of radiculopathy but without evidence of medullary pathology.

Several guidelines exist for translation, cross-cultural adaptation, health scales, and psychometric instrument validation. Although many studies use different or adapted protocols, creating heterogeneity in the literature, we used the flowchart of Beaton et al.³¹ which most authors follow; a systematic review revealed no standardized protocol for this purpose.²⁴

By discussing only changes involving the lower limbs and gait, the Nurick scale can often underestimate the patient's postoperative improvement, mainly because it does not assess the symptomatology and functionality of the upper limbs.

Despite this, several studies have tested and proven the validity of Nurick's classification. In 2007, in a retrospective study of 43 patients diagnosed with cervical spondylotic myelopathy published by the European Spine Journal, Vizthum et al. showed a good correlation between pre- and postoperative scores using the Nurick scale and the JOA scoring system.³⁶ In 2011, another study with 93 patients diagnosed with cervical spondylotic myelopathy published by the European Spine Journal, Revanappa et al.³⁷ found data demonstrating a good correlation between the Nurick scale and the mJOA. Other previous studies, such as those published by Singh and Crockard et al.³⁸ and King et al.³⁹ also demonstrate a good correlation between the Nurick scale, mJOA, and other functional assessment scales for patients with cervical spondylotic myelopathy. These findings are similar to our study, which found a strong negative correlation between the NURICK - BRAZIL scale and the mJOA.

These results suggest that the Nurick scale adapted for Brazilian Portuguese (NURICK-BRASIL) can be validated for evaluating patients with degenerative cervical myelopathy.

CONCLUSION

The translation, adaptation, and validation of the original version of the Nurick scale to Brazilian Portuguese (NURICK-BRASIL) showed similarity, applicability, good understanding, and great potential for universalization of this valuable tool for clinical evaluation and outcomes of patients with cervical myelopathy.

All authors declare no potential conflict of interest related to this article.

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