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ORIGINAL ARTICLE

Chinese translation of the Coma Recovery Scale—Revised

Haibo Di^a, Minhui He^a, Ying Zhang^a, Lijuan Cheng^a, Fuyan Wang^a, Yunzhi Nie^a, Wangshan Huang^a, Steven Laureys^b, and Caroline Schnakers^c

^aInternational Vegetative State and Consciousness Science Institute, Hangzhou Normal University, Hangzhou, Zhejiang, China; ^bComa Science Group, GIGA-Research and Cyclotron Research Centre, University and CHU University Hospital of Liege, Liege, Belgium; ^cDepartment of Neurosurgery, University of California Los Angeles, Los Angeles, CA, USA

ABSTRACT

Background: Misdiagnosis rate is high in patients with disorders of consciousness, potentially leading to an inappropriate clinical management of these patients. Sensitive standardised rating scales offer some protections from these diagnostic errors. In this context, the use of the Coma Recovery Scale-Revised (CRS-R) has strongly been recommended by the American Congress of Rehabilitation Medicine. **Objective:** Here, we present the work that has been performed to translate this important diagnostic tool in Chinese.

Methods: The scale has been translated from its original English version to Chinese by a team of native Chinese speakers in agreement with an expert highly trained in the use of the original version of the CRS-R and, then, back-translated to English by four independent translators blinded to the original version. The resulting translation has been sent to the original author for final approval.

Results and conclusion: The Chinese version of the CRS-R is now available for use in clinical practise. Further investigations will nevertheless be needed in order to show that its psychometric properties are identical to the original English version.

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Brain injury; consciousness; vegetative state; minimally conscious state; behavioural scale; translation

Introduction

In the nineties, Childs and Andrews showed that detecting signs of consciousness in patients with severe brain injury can be challenging as voluntary and reflexive behaviours may be difficult to distinguish, and subtle signs of consciousness may be missed [1,2]. They found that around 40% of the patients diagnosed as being in a vegetative state (VS) were actually misdiagnosed and should have been considered as conscious. In 2002, the development of clear diagnostic criteria for the minimally conscious state (MCS) would have been reasonably expected to reduce the incidence of misdiagnosis relative to the rates reported before these criteria were established [3]. However, recent studies [4,5] have shown similar misdiagnosis rates, comparing standard bedside examination to examination with a standardised bedside tool such as the Coma Recovery Scale-Revised (CRS-R) [6]. These findings are particularly concerning as clinical management, from treatment of pain to rehabilitative therapies and end-of-life decision making, often depends on behavioural assessments and on the diagnosis of the patient's clinical status. In this context, the use of a sensitive standardised rating scale offers some protection from these diagnostic errors [7,8]. In 2010, the American Congress of Rehabilitation Medicine published the results of the first evidence-based review of neurobehavioural rating scales designed specifically for patients with disorders of consciousness [9]. Six of the 13 scales that qualified for the review were recommended for use in clinical practise. Among these,

the CRS-R received the strongest recommendation with minor reservations, based on its performance across a large panel of psychometric quality indicators. The CRS-R is currently one of the traumatic brain injury (TBI) common data elements suggested by the US National Institute of Neurological Disorders and Stroke and the method of choice for monitoring recovery of consciousness in TBI research [10,11]. The scale has already been translated in several languages including French [12], Norwegian [13], Italian [14,15], Portuguese [16], German [17], and Spanish [18]. Here, we present the work that has been performed to translate this important diagnostic tool in Chinese. Indeed, only two behavioural scales aiming to assess the level of consciousness in patients with severe brain injury have been translated and currently exist in Chinese, the Full Outline of UnResponsiveness (FOUR) score and the Glasgow Coma Scale (GCS) [19]. Besides the fact that both the scales are mainly designed for acute settings, previous studies have shown that they have a lower sensitivity to detect signs of consciousness than the CRS-R, stressing further the need to translate such a useful tool [7,12].

Methods

The CRS-R: Description and psychometric properties

The scale has originally been developed by investigators from the JFK Johnson Rehabilitation Institute in 1991 [20]. The scale has

been revised and published in 2004 as the JFK CRS-R [6] to directly incorporate the existing diagnostic criteria for coma, VS and MCS into the administration and scoring scheme. The CRS-R is the only existing scale to address all Aspen Workgroup criteria for the diagnosis of MCS and has therefore been considered as having excellent content validity [9]. The scale consists of 23 items that includes six subscales addressing auditory, visual, motor, oromotor, communication and arousal functions. Administration and scoring procedures are highly standardised and based on the presence or absence of operationally-defined behavioural responses to specific sensory stimuli. The scale is accessible and can be administered in a reasonable time [9]. In their original validation study, the concurrent validity of the CRS-R as well as its inter-rater and test-retest reliability were proven to be good [6], which have been replicated later in a series of studies [8,12,16,18]. CRS-R subscales include hierarchically-arranged items associated with brainstem, subcortical and cortical processes. The lowest item on each subscale represents reflexive activity while the highest items represent cognitively-mediated behaviours. Gerrard and colleagues [21] have confirmed the hierarchical structure of the CRS-R subscales as well as its high internal consistency. Laporta and colleagues [22] also showed a high internal consistency as well as a consistence of the CRS-R scores across gender, age, time post-injury and setting. Finally, Giacino and colleagues [6] have compared the diagnostic sensitivity of the CRS-R to the Disability Rating Scale (DRS) in 80 patients with disorders of consciousness (DOC). They found that although the two scales produced the same diagnosis in 87% of cases, the CRS-R identified around 12% of patients in MCS who were classified as VS on the DRS. There were no cases in which the DRS detected features of MCS missed by the CRS-R. Schnakers and colleagues [7] also showed the diagnostic superiority of the scale while administering the CRS-R in parallel to the GCS and the FOUR score to 60 patients with acute (i.e. trauma centre) and subacute (i.e. rehabilitation centre) brain injury resulting in disturbance of consciousness. Among the 29 patients diagnosed with VS on the GCS, 38% were found to have at least one sign of consciousness on the CRS-R. Besides, the CRS-R detected evidence of MCS in 24% patients diagnosed with VS on the FOUR.

Translation procedure

In an effort to develop a Chinese version of the CRS-R that mirrors the structure and content of the original version, we used the following methodology:

The scale has been translated from its original English version to Chinese by a team of native Chinese speakers (HD, MH and YZ). A series of video conferences have been organised with an expert highly trained in the use of the original version of the CRS-R (CS) in order to discuss any issues or to answer any questions as regards the administration or scoring guidelines of the scale.

When a consensus has been reached on the Chinese translation, that version (including the administration and scoring guidelines as well as the record forms) has been sent to CS. CS then asked three independent professional translators to translate the guidelines and forms back to English. This back-translation has been performed in order to detect any errors and to ensure

that there was no misinterpretation of the original version. None of the translators were aware of the original version of the CRS-R.

Then, CS and HD have reviewed the back-translation and discussed each of the consistent discrepancies between the back-translation and the original version of the CRS-R. A discrepancy has been considered as consistent if two of the three translations differed from the original version.

The Chinese translation has been modified by HD, consequently to this discussion. The modified version has been sent back to CS, who asked a fourth independent translator with a medical background to translate this version back to English. This translator also had no knowledge of the original version of the CRS-R.

This last back-translation has been sent to the original author of the scale [6] in order to be reviewed. The original author asked for a series of changes which were performed consequently and a final version consistent with the original English text received the final approval.

Conclusion

The Chinese version of the CRS-R is now available for use in clinical practise. Further investigations will nevertheless be needed in order to show that its psychometric properties are identical to the original English version. Further investigation will also have to evaluate how difficult it will be to implement and to disseminate a scale written in traditional Chinese in a country where many dialects are spoken.

Supplemental Materials

The Supplemental materials include the final and approved Chinese translation of the CRS-R. Supplemental data can be accessed on the publisher's website.

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Declaration of interest

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