



Original Article

## Validity and reliability of the Persian version of the confusion assessment method for intensive care units

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### ABSTRACT

**Background & Aim:** Delirium is prevalent in the intensive care unit, especially amongst mechanically-ventilated patients. Delirium is associated with a significant increase in adverse outcomes but it usually remains undiagnosed, making it necessary to develop and validate diagnostic tools. This study determined the validity and reliability of the Persian version of Confusion Assessment Method for Intensive Care Units in Iran.

**Materials & Methods:** This cross-sectional study was conducted in open-heart intensive care unit of three university hospitals of Tehran, Iran. After piloting the translated confusion assessment method for intensive care units on 10 patients and refining the translated scale accordingly, 40 ventilated patients were consecutively selected and screened for delirium by two independent evaluators, and one psychiatrist. Inter-rater reliability between the two evaluators was assessed by Kappa coefficient. Validity indices (i.e., sensitivity and specificity) of the Persian-CAM-ICU and 95% confidence intervals were calculated, given the psychiatrists' diagnosis as reference standard. Data were analyzed in Stata software (v. 11).

**Results:** Of 40 selected patients, CAM-ICU detected delirium in 30%. The Persian-CAM-ICU had a sensitivity and specificity of 75% and 96%, and a positive and negative predictive value of 92% and 85%, respectively. The Youden's J statistic of the scale was 71%. Each of the four domains of the CAM-ICU showed a sensitivity and specificity of more than 69% and 90%, respectively, suggesting acceptable construct validity. There was good agreement between the two evaluators in terms of delirium diagnosis with the Persian-CAM-ICU (kappa coefficient = 0.74, P<0.0001).

**Conclusion:** The Persian version of the CAM-ICU is an effective, valid and reliable diagnostic tool in critically ill ICU patients. Application of the scale is recommended for the promptly diagnosis and prevent potential delirium in ventilated patients.

### Introduction

Delirium is a disturbance of consciousness characterized by an acute onset of fluctuating and impaired cognitive functions, in a way that patient's ability to receive, process, store, and recall information is severely impaired (1).

Delirium can be subdivided to three types based on the motoric symptoms: a) hyperactive (agitated) delirium with positive symptoms; b) hypoactive (quiet) delirium with negative symptoms; and c) mixed type, if an exchange between both subtypes appears alternately over time (2). Delirium is associated with poor outcomes in hospitalized patients, including higher mortality and

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morbidity rates, increased length of hospital stay, and the need for subsequent hospitalizations (3, 4). In a systematic review of delirium outcomes in critically ill patients, patients with delirium showed also longer durations of mechanical ventilation, elongated lengths of stay in the intensive care unit and higher mortality during admission (5).

The frequency of delirium varies from 18-35% in general medical inpatients to 50% among intensive care patients (6). Delirium rate is considerably higher among ICU patients. The rate becomes even higher (close to 80%) among mechanically-ventilated patients (1, 7, 8).

Despite the high prevalence of delirium among ICU patients, it is usually overlooked during routine checkups of nurses and other non-psychiatric caregivers. Studies show that reliance on clinical judgment, either by nurses or physicians, leaves a large number of delirious patients unrecognized. In this regard, hypoactive delirium is a type that is mostly remained undiagnosed (7). This is of utmost importance, because hypoactive delirium is the most common subtype and particularly associated with adverse effects such as increased length of hospital stay and higher rate of decubitus ulcers (4). As delirium has a fluctuating yet recurrent nature, its detection requires frequent visits (9).

Delirium assessment is also time-consuming especially in patients receiving mechanical ventilation (10). Therefore, in most health care settings, especially in those hospitals where the nurse-to-patient ratio is low, it is not possible to ensure that all delirious cases are properly detected.

Accurate diagnosis is limited in the absence of a validated delirium instrument. According to a qualitative study, development and/or integration of risk

assessment and screening tools is one of the enablers to better identification of delirium symptoms (11). In a systematically review of the instruments to diagnosis the delirium, among 11 instruments used by conducted studies, the Confusion Assessment Method (CAM) had the best results, considering the ease of use and test performance (12).

A number of delirium assessment tools have been introduced for hospitalized and ICU patients. These instruments, however, do not consider communication limitations of non-verbal and ventilated patients (13).

The confusion assessment method for the intensive care unit (CAM-ICU), however, has been developed in English for the assessment of delirium in ventilated patients (7) and is commonly used in the studies carried out on these patients (14, 15). A distinct advantage of this tool is that it suits mechanically ventilated patients as patients must show a response to mild or moderate stimulation and it does not require the patient to speak (16). It is also a fast and simple tool which can be used as a routine assessment tool in the daily practice of nurses.

The instrument has been adapted to numerous languages (17-25) showing high sensitivity and specificity to identify delirium in ICU patients. For example, the Arabic CAM-ICU appeared to be valid and reliable tool for diagnosing delirium in Geriatric, Emergency and Surgical intensive care units with a sensitivity of 81% (60%-93%) and specificity of 81% (62%-92%). Sensitivity and specificity measures for mechanically ventilated patients were 100% (21).

However, to the best of our knowledge, there are no published reports on the validity and reliability of the CAM-ICU in the Persian language. Therefore, the aims of the present study were to: a) develop a Persian

version of the CAM-ICU and make it available to the Iranian non-psychiatric clinicians, as well as to the scientific community for research purposes; and b) investigate the psychometric properties of the Persian-CAM-ICU on a sample of open-heart ICU patients due to the high prevalence of delirium in these patients.

## **Methods**

### *Sampling*

This was a cross-sectional study. The sensitivity of the English CAM-ICU has been reported to range from 70% to 90% (7, 10, 26). Considering a minimum acceptable sensitivity of 75%, a delirium prevalence of 40% for ICU (10), and an alpha level of 5%, the minimum sample size was calculated as 40 patients. To collect study samples, we consecutively included all patients admitted to open-heart ICUs after heart surgery in three university hospitals of Tehran, Iran. Participants should be mechanically ventilated and post-surgery patients for no more than 10 days. To recruit individuals with minimum level of consciousness, we included those patients who had a Richmond Agitation Sedation Score (RASS) (27) of more than -3, could react to vocal stimuli (calling patient's name), and were able to make eye contact and obey simple tasks. They should not suffer audiovisual complications (which was assessed through observation) with no background history of cerebrovascular disease, psychosis and other mental disorders (checked in patient's medical record).

The RASS score is a standard method for scoring patients' agitation level, and was used by the psychiatrist to include individuals with a minimum level of consciousness who could fulfill the CAM-ICU assessment. In this system, calm

patients receive a score of Zero, while the scores of -1 to -4 are given to patients with different levels of sedations. On the other hand, the more the patient gets agitated, the higher scores (in a range of +1 to +4) he/she will receive (27).

As delirium has a fluctuating nature and is more prominent in the second half of the day, all participants went under delirium assessment between 4-6 PM. The time interval between the two assessments should not take more than 1 hour. In average, about three patients were assessed each day by the two evaluators. Informed consent was verbally obtained from all patients.

### *The questionnaire*

The CAM-ICU was originally developed and validated by Ely, et al. (7, 28) to screen delirium in intubated patients. Compared with the reference standard for identifying delirium, using the CAM-ICU showed sensitivities of 100% and 93% and specificities of 98% and 100% for 2 study nurses and high interrater reliability ( $\kappa=0.96$ ) (7) CAM-ICU comprises four features, including: a) acute onset of change or fluctuation in mental status; b) inattention; c) altered level of consciousness; and d) disorganized thinking. Under each feature, a number of symptoms presenting that feature are checked, and its presence/absence is determined.

For feature a, the scores included in the 10-point Richmond Agitation-Sedation Scale (RASS), range from a high of 4 to a low of -5. For feature b, the visual or auditory components of the Attention Screening Examination (ASE) are examined and difficulty focusing attention is evidenced by a score of less than 8 correct answers in each examination. Delirium is

considered positive when features a and b, with either feature c or d is present (7).

### *Linguistic validation*

The Persian CAM-ICU was translated according to the Principles of Good Practice for the Translation and Cultural Adaptation Process for Patient Reported Outcomes (PRO) Measures into Persian language (29). After obtaining the agreement of CAM-ICU developers, the English CAM-ICU was translated into Persian language by two professional English translators (forward-translation). The translated version was revised by a psychiatrist who was blind about the original version of the questionnaire, and then “back-translated” into English by a third qualified English translator, who was unaware of the original version. The back-translated version was then reviewed by two professional English translators for its consistency with the original version, based on which necessary modifications were made on the Persian version. The Persian version of the CAM-ICU is provided in Supplementary File 1.

### *Face and content validity*

To assess face and content validity, two focus group discussions (FGD) were conducted by the research team. The members of the FGD included the research team (two nurses, one general practitioner, and one psychiatrist), four psychiatrists and two open-heart ICU nurses. The objective of the first FGD was to ensure the content, wording and appearance of the scale makes it acceptable and comprehensible for the users in Iran. Minor disagreements about the wording were resolved through consensus between FGD members. Then, one trained nurse applied the Persian CAM-ICU to 10 ventilated patients, and in the second FGD session, shared her experience about CAM-

ICU application. Required modifications were made by the research team to improve the applicability of the Persian scale.

### *Concurrent validity and inter-rater reliability*

For the accuracy and validity studies, DSM-IV criteria applied by a psychiatrist were considered as the reference standard. CAM-ICU was applied independently by two evaluators, who were trained nurses. For each study participants, the evaluators classified the delirium status as “present” or “absent”. They also documented the duration of performing CAM-ICU assessment. The same patient underwent clinical assessment by a psychiatrist who used DSM-IV diagnostic criteria for delirium diagnosis and also classified patient’s delirium status as “present” or “absent”. The time interval between the two assessments should not take more than one hour. The nurses and the psychiatrist were blind to the classification results of the other raters. To evaluate concurrent validity, ratings of one evaluator were compared to the reference standard. To evaluate inter-rater reliability, pair assessments by the two evaluators were compared.

### *Construct validity*

CAM-ICU has four domains including: a) acute onset or fluctuating course, b) inattention, c) altered level of consciousness, and d) disorganized thinking, all of which requiring a yes/no answer. To evaluate the construct validity of the CAM-ICU, sensitivity and specificity of each constructs in detecting the targeted feature was evaluated given DSM-IV criteria applied by a psychiatrist as the reference standard, following the standard formula proposed for sensitivity and specificity (30-32).











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