Journal of Critical Care (2010) **25**, 144–151

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Journal of Critical Care

Validity and Reliability of the CAM-ICU Flowsheet to diagnose delirium in surgical ICU patients☆

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Keywords:
Delirium;
Confusion;
Critical care medicine;
Richmond Agitation Sedation Scale

Abstract

Purpose: Delirium occurs frequently in critical care but often remains undiagnosed because delirium monitoring is often dismissed as being too time-consuming. This study determined the validity and reliability of the "CAM-ICU Flowsheet," a practical, time-sparing algorithm to assess the 4 delirium criteria in intubated patients.

Materials and Methods: With permission from our institution's ethics committee, patients of a 31-bed surgical intensive care unit department were screened for delirium (1) by a psychiatrist as the reference rater using the 4 delirium criteria of the *Diagnostic and Statistical Manual of Mental Diseases, Fourth Edition (DSM-IV)*, and (2) by 2 physician investigators using a German translation of the CAM-ICU Flowsheet.

Results: Fifty-four surgical ICU patients underwent the complete protocol assessment with paired observations; 46% were diagnosed with delirium by the reference rater (n = 25), 9% had hyperactive delirium (n = 5), and 37% were hypoactive (n = 20). The CAM-ICU Flowsheet investigators had sensitivities of 88% (95% confidence interval, 69%-98%) and 92% (74%-99%), specificities of 100% (85%-100%), very high interrater reliability (κ, 0.96; 0.87-1.00), and needed 50 seconds (interquartile range, 40-120 seconds) in patients with delirium vs 45 seconds (interquartile range, 40–75 seconds) in those without delirium to complete assessments.

Conclusions: The CAM-ICU Flowsheet has high sensitivity, high specificity, and very high interrater reliability. False-negative ratings can occur infrequently and mostly reflect the fluctuating course of delirium. The CAM-ICU Flowsheet is a valid, reliable, and quickly performed bedside delirium instrument.

☆ UG, JP, LK, TM, HW, and CP received departmental funding. EWE has received research grants and honoraria from NIHRO1AG027472, Hospira, Pfizer, Eli Lilly, and GlaxoSmithKline; a research grant from Aspect Medical Systems; and is an advisor for Healthways.

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0883-9441/$ – see front matter
doi:10.1016/j.jcrc.2009.08.005

1. Introduction

Delirium is the most frequent psychiatric diagnosis in the intensive care unit (ICU) [1-4]. According to the *Diagnostic and Statistical Manual of Mental Diseases, Fourth Edition* (*DSM-IV*) [5], delirium is defined as an acute or fluctuating course of mental status change, combined with inattention, and either an altered level of consciousness or disorganized thinking. The incidence of delirium in ICU is reported to range between 28% and 92% depending on severity of illness and composition of ventilated vs nonventilated populations [6-9]. The onset of delirium predicts longer length of stay in hospital [4,10], prolonged ICU length of stay [6], and increased treatment costs [11]. After discharge from hospital, patients who had delirium at some time during their hospital stay had increased rates of cognitive deficits [12,13], and mortality was significantly increased up to 12 months after discharge [14,15].

Although guidelines for the use of sedatives and analgesics recommend delirium monitoring routinely [16,17], it is only rarely done because delirium monitoring is often considered too complicated and time-consuming [18-22]. Nursing staff plays the key role in delirium detection and monitoring, as they are constantly present at the bedside; validated instruments should make it possible for all members of the ICU team to quickly determine brain organ dysfunction. Hence, a delirium monitoring tool should be uncomplicated, standardized, easy to teach, valid against a reference standard, and reliably reproduced among different assessors [23].

Mere clinical judgment, regardless if by nurses or physicians, leaves a considerable amount of patients with delirium unrecognized [2,24]. Delirium can be subdivided by assessing motoric symptoms: (1) hyperactive or "agitated" delirium with positive symptoms; (2) hypoactive or "quiet" delirium with negative symptoms; and (3) mixed type, if both subtypes appear alternately over time. It is mostly hypoactive delirium that remains undiagnosed [25,26]. This is of utmost importance, as hypoactive delirium is the most common subtype and particularly associated with a prolonged in-hospital length of stay and higher incidence of decubitus ulcers [27].

The "CAM-ICU Flowsheet," derived from the Confusion Assessment Method for Intensive Care Units (CAM-ICU) [8,9,28,29], provides an algorithm by which to assess the 4 delirium criteria of the *DSM-IV* in a standardized fashion in intubated patients. It allows for truncation of assessments, if appropriate, to save time, which might impair the validity of this tool. This study was performed to determine the validity and reliability of the German translation of the CAM-ICU Flowsheet.

2. Materials and methods

The CAM-ICU Flowsheet [30] (Fig. 1) was developed from the CAM-ICU [28,29]. It is important to note that the CAM-ICU Flowsheet switches the original numbering of features 3 and 4 for simplicity because most ICU patients with delirium are positive in the order of the flow sheet, thus allowing the CAM-ICU Flowsheet to be completed in just 3 features and only needing to include the fourth feature in a minority of patients. The German CAM-ICU Flowsheet was translated according to the Principles of Good Practice for the Translation and Cultural Adaptation Process for Patient-Reported Outcomes Measures into German language [31,32]. This included the "forward translation" of the original English CAM-ICU Flowsheet, the revision by a geriatric psychiatrist, and the back-translation into English by 2 physicians who were unaware of the original. The merged back-translations were returned to the authors of the original for harmonization and approval. The resulting version was then tested together with experienced nursing staff in our ICU, final amendments made, again reviewed by the original authors, and used in this investigation. The German version is available online at www.icudelirium.org.

The institution's ethics committee approved this study and waived informed consent. In 5 sessions from May through August 2008, every patient eligible for assessment in our 31-bed ICU was screened for enrollment by a psychiatric consultant who served as the reference rater. Patients already scheduled for transfer to non-ICU wards were not screened for enrollment. Patients were excluded if they were in a coma or experiencing acute stroke, were non-German speaking, or unwilling to participate. Once enrolled, the reference rater's assessment consisted of a semistructured interview based on the *DSM-IV* diagnostic criteria for delirium, and, if applicable, tasks of the Mini-Mental State Examination [33]. Further information was obtained from the patients' files, day charts, nurses' notes, and visiting relatives to exclude previous cognitive impairment or dementia. Patients' demographics, Therapeutic Intervention Scoring System [34], Sepsis-related Organ Failure Assessment [35], and Simplified Acute Physiology Score II [36] were calculated from patients' files on the day of assessment.

The same patients were assessed with the German CAM-ICU Flowsheet by an intensivist (UG) and a trained medical student (LK); both were unaware of the reference rater's judgment. The CAM-ICU Flowsheet tests the following features in a standardized fashion: (1) acute onset or fluctuating course of a change from mental status baseline, (2) inattention, (3) altered level of consciousness, and (4) disorganized thinking. A patient is considered positive for delirium if he or she is positive for features 1, 2, and 3; or 1, 2, and 4. All 3 investigators (the 2 CAM-ICU Flowsheet raters and the psychiatric reference rater) saw patients within 4 hours time without any knowledge of the judgment of others. Time consumption of a CAM-ICU Flowsheet rater was measured during one assessment session of 14 patients.

2.1. Motoric subtypes of delirium

Delirium subtypes were classified into a motoric subtype grouping according to the Richmond Agitation