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Sensitivity and specificity of the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU) and the Intensive Care Delirium Screening Checklist (ICDSC) for detecting post-cardiac surgery delirium: A single-center study in Japan

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ABSTRACT

Objective: To compare the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU) and the Intensive Care Delirium Screening Checklist (ICDSC) for detecting post-cardiac surgery delirium.
Background: These tools have not been tested in a specialized cardio-surgical ICU.
Methods: Sensitivities and specificities of each tool were assessed in a cardio-surgical ICU in Japan by two trained nurses independently. Results were compared with delirium diagnosed by psychiatrists using the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, Text Revision.
Results: There were 110 daily, paired assessments in 31 patients. The CAM-ICU showed 38% sensitivity and 100% specificity for both nurses. All 20 false-negative cases resulted from high scores in the auditory attention screening in CAM-ICU. The ICDSC showed 97% and 94% sensitivity, and 97% and 91% specificity for the two nurses (cutoff $\geq$4).
Conclusion: In a Japanese cardio-surgical ICU, the ICDSC had a higher sensitivity than the CAM-ICU.

Introduction

The incidence of postoperative delirium has been reported to range from 13% to 42%.[1] However, the incidence of post-cardiac surgery delirium appears to be much higher, ranging from 26% to 52% as estimated using rigorous methodology.[2] Furthermore, post-cardiac surgery delirium has been reported to be associated with significant adverse outcomes, such as increased morbidity,[3] decreased functional status,[4] cognitive decline,[5] and increased long-term mortality.[6] Recently, a guideline to predict delirium after cardiac surgery has been developed to assess baseline vulnerability including four items: prior stroke/transient ischemic attack, Geriatric Depression Scale >4, abnormal albumin, and Mini-Mental State Examination (MMSE) score.[4] In addition, perioperative insults, for example, inadequate choice of sedative, depth of sedation,

Abbreviations: ASE, Attention Screening Examination; AUC, Area under the curve; CAM-ICU, Confusion Assessment Method for the Intensive Care Unit; CI, confidence interval; CASUS, Cardiac Surgery Score; DSM-IV-TR, Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, Text Revision; ICDSC, Intensive Care Delirium Screening Checklist; NPV, negative predictive value; PPV, positive predictive value; RASS, Richmond Agitation Sedation Scale; ROC, Receiver operating characteristic.

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or inadequate blood pressure control (leading to inadequate cerebral perfusion) have been widely implicated in increasing the risk of delirium in this population.[2] However, delirium often remains underdiagnosed in the intensive care unit (ICU).[7]

Among various methods developed to detect delirium in an ICU setting, the Confusion Assessment Method for the ICU (CAM-ICU)[8] and the Intensive Care Delirium Screening Checklist (ICDSC)[9] have been most frequently employed. Recently, both of these instruments have been recommended by the Society of Critical Care Medicine Pain, Agitation, and Delirium (PAD) guidelines for delirium screening based on high-quality evidence.[10] The CAM-ICU is a valid, brief screening tool to detect delirium in both mechanically ventilated and non-mechanically ventilated patients in the ICU setting,[11] and it can be easily and quickly used by non-psychiatric clinicians after minimal training. The ICDSC, based on the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, Text Revision (DSM-IV-TR) criteria, is also a valid tool for detecting delirium and has the potential advantage of allowing diagnosis of subsyndromal delirium.

The CAM-ICU has been translated into several languages worldwide, for example, German,[12] Swedish,[13] Italian,[14] Greek,[15] Dutch,[16] Czech,[17] Chinese (traditional [Taiwanese][11] and simplified [mainland][18]), Thai,[19] and Korean.[20] The ICDSC has also been translated into a number of languages, including Turkish[21] and Portuguese,[22] and has been reported to have sufficient reliability and validity in these versions. The CAM-ICU and the ICDSC were translated into Japanese in 2002 and in 2011, respectively. The reliabilities and validities of the Japanese versions were tested with good results,[23,24] although the assessment of delirium in the validation study of the ICDSC was only based on a retrospective chart review by nurses.[23]

The validity of the CAM-ICU has been tested in different ICU settings, for example, for medical,[8,25] medical/surgical,[26,27] surgical conditions,[12,23,28] and stroke.[17] Most validation studies of the ICDSC have been conducted in medical[21,29] or mixed[9,22,26] ICUs. To our knowledge, no validation studies of either tool have been conducted in specialized cardio-surgery ICU populations. Therefore, we intended to address this knowledge gap by conducting this study.

A direct comparison of the diagnostic accuracy of the CAM-ICU and ICDSC has been performed in only two studies with inconsistent results. A higher sensitivity of the CAM-ICU than the ICDSC (64% vs. 43%) and a higher specificity of the ICDSC than the CAM-ICU (95% vs. 88%) have been reported in a mixed ICU population in the Netherlands.[26] In contrast, a higher sensitivity of the ICDSC than the CAM-ICU (96% vs. 73%) and a higher specificity of the CAM-ICU than the ICDSC (96% vs. 72%) have been demonstrated in a mixed ICU in Brazil.[22]

The aim of the present study was to compare the sensitivity and specificity of the CAM-ICU and the ICDSC for detecting post-cardiac surgery delirium in Japanese ICU patients.

Methods

Subjects and procedure

The study population was recruited from patients over 20 years of age who were admitted to the Department of Cardiovascular Surgery, Tokyo Women's Medical University Hospital for elective cardiac surgery between November 2013 and January 2014. Patients were approached by the research group nurses (N.H., T.Y., C.M., or H.I.) and were asked to participate voluntarily in this study before undergoing surgery. Exclusion criteria were as follows: a poor command of the Japanese language; a history of severe neuropsychiatric diseases, for example, dementia, mental retardation, psychosis, alcohol or substance abuse, or other neurologic illness; significant visual or auditory disturbance; or lack of consent. To determine whether patients had dementia or delirium before surgery, we used the Hasegawa Dementia Scale-Revised,[30] which is similar to the Mini-Mental State Examination. The cutoff score was <20 out of a total score of 30. In addition, after enrollment, patients who developed intra- or post-operative acute stroke were excluded.

After surgery, all patients were independently evaluated in the ICU by two nurses: an experienced nurse specializing in consultation-liaison psychiatry (nurse 1: N.Y.); and an experienced nurse specializing in intensive care (nurse 2: M.K.) using both the CAM-ICU and the ICDSC. For reference, one of four expert consultation-liaison psychiatrists with more than 8 years clinical experience (K.N., K.Y., E.S., Y.U.) diagnosed whether a patient had delirium using the DSM-IV-TR criteria.[31] The assessments by all three evaluators (nurse 1, nurse 2, and psychiatrist) were carried out independently in blinded fashion within a maximum time interval of 2 h between 8 am and 7 pm. With reference to the original validation study of the CAM-ICU,[25] each enrolled patient was reassessed by the three evaluators on later days. The evaluations were carried out only when all three evaluators were simultaneously present at the hospital. Every morning on evaluation days, they coordinated their schedules to conduct all evaluations (each lasting a maximum of 2 h) between 8 am and 7 pm.

We determined the timing of the first delirium evaluation in reference to the series of postoperative routine monitoring evaluations performed using the Richmond Agitation Sedation Scale (RASS)[32] score in our ICU. As soon as a score ≥ -3 was recorded for a particular patient, we started the evaluation. The evaluations were carried out on continuous days for the same patient, but if a psychiatrist in the evaluation team diagnosed the patient as not having delirium, all further evaluations were discontinued.

Prior to the study, the two nurses studied the Japanese version of the CAM-ICU training manual.[33] They also watched live patient demonstrations of the CAM-ICU application, and conducted the evaluation using this tool in both simulated and actual patients. They also received a 1-h lecture on delirium and the ICDSC from an expert psychiatrist (K.N.) using DSM-IV-TR criteria.

This study was approved by the ethics committee of Tokyo Women's Medical University. Before surgery, all participants provided written informed consent for participation in the study.

Delirium assessment

The first step in assessing delirium in the CAM-ICU procedure[8] was to evaluate the level of consciousness (arousal) using the RASS,[32] a 10-point scale ranging from −5 (no response to voice or physical stimulation) to +4 (overtly combative, violent, immediate danger to staff). In case of coma or stupor (RASS −5 or −4) the assessment of delirium was abandoned, and it was performed again on the following day. In the case of RASS ≥ -3, assessments using the two tools were conducted. Diagnosis of delirium with the CAM-ICU included a change or fluctuating course of mental status (Feature 1), accompanied by inattention (Feature 2), and either an altered level of consciousness (Feature 3) or disorganized thinking (Feature 4).[8] For determination of Feature 2, the Attention Screening Examination (ASE) was used, and included auditory and visual versions. The former was attempted first, and if the test could not be completed, the latter was performed. The original version employed an alphabet test for the auditory ASE (Directions: Say to the patient, "*I am going to read a series of 10 letters. Whenever you hear the letter 'A,' indicate by squeezing my hand.*" Read letters from the following list in a normal tone 3 s apart: SAVEAHAART or CASABLANCA or ABADBADAAY), while the Japanese version employed a number test instead (recognition of '1' in 6153191124)