Translation and validation of the Tibetan confusion assessment method for the intensive care unit

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Abstract
Background: At present, there is no available delirium translated assessment method for 3.3 million Tibetans. This study aimed to provide a method for delirium assessment for Tibetan patients speaking this language by validating a translation of the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU).

Methods: The study was conducted between July 2018 and November 2018. Patients were screened for delirium by a neurologist using the Diagnostic and Statistical Manual of Mental Disorders IV (DSM-IV). Patients were subsequently screened by two nurses using Tibetan translations of the CAM-ICU. With DSM-IV criterion as the reference standard, the sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated to assess the validity of the CAM-ICU criterion. Interrater reliability was determined by comparing the CAM-ICU ratings of nurse 1 vs. nurse 2 using the k coefficient.

Results: Ninety-six patients were assessed independently by two nurses and one neurologist. According to DSM-IV standard, 42 out of 96 (43.8%) patients developed delirium. The sensitivities of Tibetan CAM-ICU were 90.5% for nurse 1 and 92.9% for nurse 2, respectively. Their specificities were 85.2% and 90.7%, respectively. The PPV were 82.6% for nurse 1 and 88.6% for nurse 2. Their NPV were 92.0% and 94.2%, respectively. The Tibetan CAM-ICU was done with good interrater reliability between nurse 1 and nurse 2 (κ = 0.91, P < 0.001).

Conclusion: The Tibetan CAM-ICU shows good validity and might be incorporated into clinical practice in Tibetan Intensive Care Units.

Keywords: Delirium; Tibet; CAM-ICU; Validation

Introduction
Delirium is a disturbance in consciousness and is characterized by acute confusion, inattention, disorganized thinking, and altered level of consciousness.[11] According to recent studies,[2-4] delirium is a common complication seen in intensive care unit (ICU) patients, with an incidence ranging from 16% to 87%, and up to 80% in elderly and mechanically ventilated patients. Delirium not only prolongs the length of ICU as well as total hospital stay, but also increases health care costs and the risk of long-term cognitive impairment.[15-19] Moreover, the mortality rate of patients with delirium is higher than patients without delirium.[9] Therefore, the Society of Critical Care Medicine (SCCM) guidelines[10] have recommended routine screening and assessment for the presence of delirium in ICU inpatients.

Several methods, such as Confusion Assessment Method for the Intensive Care Unit (CAM-ICU), the Intensive Care Delirium Screening Checklist (ICDSC) and so on, have been developed and validated to diagnose delirium in ICU patients.[11] Of all these methods, CAM-ICU is considered the most frequently employed tools for the purpose of delirium screening.[12] CAM-ICU was developed by Ely et al., and it can be used to assess patients with speech impairment due to endotracheal intubation or tracheotomy. CAM-ICU is a simple, reliable, and valid tool for assessing ICU delirium, and has high specificity (98%–100%) and sensitivity (93%–100%).[12] It can be used by non-psychiatrists with minimal training and takes only few minutes to complete.[13] Due to these advantages, CAM-ICU has been translated into over 40 languages, but a Tibetan version of the CAM-ICU is not yet available. Thus, assessment of delirium cannot be turned to be a routine clinical practice in Tibet, where approximately 3.31 million people speak Tibetan. Therefore, in this study,...
we attempted to translate and validate the CAM-ICU for practical use in the Tibetan ICU setting.

**Methods**

**Ethical approval**

The study was conducted in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of Peking Union Medical College Hospital, Chinese Academy of Medical Sciences (No. JS-1170).

**Patients**

The study population included adult ICU patients who are admitted to the Tibet Autonomous Region People’s Hospital, with an 800-bed university-affiliated teaching hospital in Tibet, and 18 adult ICU beds. Otherwise, they should meet the inclusion criteria of 18 years or older, hospitalized in ICU for more than 24 h, and could understand the Tibetan language. The exclusion criteria were as follows: patients (1) with preexisting psychosis or neurologic disease; (2) who are comatose or moribund at the time of screening; (3) diagnosed with delirium before assessment and have been prescribed antipsychotics; (4) with a history of vision or hearing impairment; and (5) who refused informed consent. Data collection was conducted between July 2018 and November 2018.

**Translation and back-translation**

After permission from E. Wesley Ely, the CAM-ICU was translated into Tibetan by the authors-doctors of critical care medicine who are native Tibetan speakers and proficient in English. Each of them carried out their translation independently and then discussed. The final Tibetan version was submitted to a professional translator for back-translation to English without any information about the original version. The back-translated version was sent to the original author E. Wesley Ely for approval and acceptance of the Tibetan version (see the Tibetan version of the CAM-ICU [Tibetan CAM-ICU] at www.icudelirium.org).

**Validation of delirium assessment and interrater reliability**

Two study nurses independently conducted delirium assessment in the enrolled patients using Tibetan CAM-ICU. For reference standard evaluation, a neurologist with more than 10 years experiences independently assessed the delirium using a complete clinical examination of each patient and the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) criteria. All assessments were done between 10:00 AM and 1:00 PM to avoid any bias that arise due to changes in patients’ condition.

To validate the Tibetan version, we compared the Tibetan CAM-ICU users to the neurologist ratings of delirium using the DSM-IV criteria as the reference standard. For interrater reliability, we compared the Tibetan CAM-ICU ratings between the two nurses by the \( \kappa \) coefficient.

Before conducting the study, two nurses in the research received formal training, which included the instructions given by the researcher, where the definition and cases of delirium features were explicated and discussed, and the training courses were held.

**Statistical analysis**

Continuous variables were described as mean ± standard deviation (SD) and were compared by using a *t* test. Categorical data were analyzed as proportions and compared by using Fisher exact test or Chi-squared test. With DSM-IV criterion as the reference standard, the sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated to assess the validity of the CAM-ICU criterion. Interrater reliability was determined by comparing the CAM-ICU ratings of nurse 1 vs. nurse 2 using the \( \kappa \) coefficient. Statistical analysis was conducted using SPSS 20.0 (SPSS Inc., Chicago, IL, USA) software for Windows. Two-tailed tests of significance were employed, and the significance was assumed at \( P < 0.05 \).

**Results**

**Patient characteristics**

A total of 268 consecutive patients were admitted to the ICU during the study period, and the patient enrollment and the flow details are presented in Figure 1. One hundred and seventy-two patients were excluded from the study due to previous exclusion criteria. The remaining 96 patients were enrolled and subsequently evaluated by the DSM-IV reference standard expert and the two study nurses were included in the study population.

The baseline characteristics of the patients are shown in Table 1. Most of the patients (55.2%) were male, with a median age of 53 years. The most common cause of ICU admission (22.9%) was respiratory failure. The APACHE (Acute Physiology and Chronic Health Evaluation) II at admission was 15 ± 6. According to the DSM-IV reference standard, 42 out of 96 (43.8%) enrolled patients developed delirium during the period of evaluation.

**Interrater reliability of the Tibetan CAM-ICU**

The interrater reliability was defined as the agreement of CAM-ICU results between the two study nurses. Ninety-six paired comparisons were conducted in the included patients. The kappa values of each feature were 0.78, 0.84, 0.77, and 0.80, respectively [Table 2]. The Tibetan CAM-ICU demonstrated good interrater reliability by synthetically considering all four indexes between nurse 1 and 2 (\( \kappa = 0.91; P < 0.001 \)).

**Validity of the Tibetan CAM-ICU**

The neurology expert and the two study nurses completed the 96 paired evaluations in the patients. According to the DSM-IV reference raters, 42 patients were found to be
delirious and 54 patients were non-delirious. Nurse 1 found that 46 patients had delirium, whereas nurse 2 found that 44 patients had delirium [Table 3]. Compared with the reference raters, the sensitivities of the two study nurses in using the Tibetan CAM-ICU for evaluation were 90.5% and 92.9%, and their specificities were 85.2% and 90.7%, respectively. The PPVs were 82.6% for nurse 1 and 88.6% for nurse 2, and their NPVs were 92.0% and 94.2%, respectively [Table 4].

**Discussion**

With the help of the national aid medical team of Tibet, this novel study translated and validated the CAM-ICU for use in the Tibetan ICU settings. Our study results showed that the Tibetan CAM-ICU had high sensitivity (90.5% for nurse 1 and 92.9% for nurse 2) and specificity (85.2% for nurse 1 and 90.7% for nurse 2) against the DSM-IV reference raters.

Theoretically, SCCM guidelines[10] recommend CAM-ICU and the Intensive Care Delirium Screening Checklist (ICDSC) as the most valid and reliable delirium monitoring tools in adult ICU patients. This was consistent with more than a dozen other original studies,[16-20] and our

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**Table 1: Baseline characteristics of the study population.**

| Characteristics | Values |
|-----------------|--------|
| Male            | 53 (55.2) |
| Age (years)     | 53 ± 18 |
| APACHE II       | 15 ± 6 |
| Cause of ICU admission |        |
| Sepsis          | 17 (17.7) |
| Respiratory failure | 22 (22.9) |
| Pancreatitis or cholecystitis | 11 (11.5) |
| Abdominal surgery | 13 (13.5) |
| Thoracic surgery | 15 (15.6) |
| Orthopedic surgery | 8 (8.3) |
| Others          | 10 (10.4) |
| Delirium using DSM-IV | 42 (43.8) |

Data are presented as n (%) or mean ± standard deviation. APACHE: Acute Physiology and Chronic Health Evaluation; ICU: Intensive Care Unit; DSM-IV: Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition.

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**Table 2: Interrater reliability of each part of the Tibetan CAM-ICU (n=96).**

| Parameters | Component of CAM-ICU | Kappa | P     |
|------------|-----------------------|-------|-------|
| Feature I  | Acute onset or fluctuating course | 0.78 | <0.001 |
| Feature II | Inattention            | 0.84 | <0.001 |
| Feature III| Altered level of consciousness | 0.77 | <0.001 |
| Feature IV | Disorganized Thinking  | 0.80 | <0.001 |

Feature I is an acute onset or fluctuating course. Feature II is inattention. Feature III is an altered level of consciousness. Feature IV is disorganized Thinking. Interrater reliability measures across 96 paired comparison showed kappa of 0.91 (P<0.001). CAM-ICU: Confusion Assessment Method for the Intensive Care Unit.
Table 3: Comparison of delirium assessment between nurse and the neurology expert (n = 96).

| Expert DSM-IV delirium rating | Study nurse 1 | Study nurse 2 |
|-------------------------------|--------------|--------------|
|                               | Yes | No | Total | Yes | No | Total |
| Yes                            | 38  | 4  | 42    | 39  | 3  | 42    |
| No                             | 8   | 46 | 54    | 5   | 49 | 54    |
| Total                          | 46  | 50 | 96    | 44  | 52 | 96    |

The neurology experts and two study nurses completed the evaluation in 96 patients. The neurology expert found that 42 patients were delirious and 54 patients were not delirious. Nurse 1 found that 46 patients had delirium, whereas nurse 2 found that 44 patients had delirium. DSM-IV: Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition.

Table 4: Validity of the Tibetan version of CAM-ICU (n = 96).

| Rater                | Study nurse 1 | Study nurse 2 |
|----------------------|--------------|--------------|
| Sensitivity          | 90.5 (76.5–96.9) | 92.9 (79.4–98.1) |
| Specificity          | 85.2 (72.3–92.9) | 90.7 (79.0–96.5) |
| PPV                  | 82.6 (68.0–91.7) | 88.6 (74.6–95.7) |
| NPV                  | 92.0 (79.9–97.4) | 94.2 (83.0–98.5) |
| Kappa                | 0.75 (P < 0.001) | 0.83 (P < 0.001) |

The neurology experts and two study nurses completed the evaluation in 96 patients. Data are presented as median (95% confidence interval). CAM-ICU: Confusion Assessment Method for the Intensive Care Unit; PPV: Positive predictive value; NPV: Negative predictive value.

Investigation showed that the Tibetan CAM-ICU had high sensitivity and specificity against the DSM-IV reference raters. Thus, our data demonstrated that the CAM-ICU was valid in the Tibetan population. In addition, we reviewed the misclassified CAM-ICU ratings by the study nurses (where there were eight false positives and four false negatives for nurse 1 and five false positives and three false negatives for nurse 2), and these discordant ratings might be due to: (a) unfamiliarity of the patients’ baseline mental status, (b) the use of analgesics and sedatives between the study nurses and the intake of DSM-IV ratings, and (c) the fluctuating nature of delirium.

Clinically, delirium is common in ICU patients but unrecognized by medical and nurse ICU teams if the validated delirium-screening tools were not used. The CAM-ICU had great psychometric properties, and was translated into many different languages. Therefore, we hope that the translation of CAM-ICU will allow for a larger implementation of this tool in the Tibetan ICU inpatients. Moreover, for the second feature of CAM-ICU worksheet, the experts used the Vigilance A form of the attention examination (including repetition of letters and asking the patient to squeeze on every “A”). Considering that most of the Tibetan population is not so familiar with Latin alphabets, we have adapted the attention test by using numbers instead.

Politically, the Tibetan version of CAM-ICU is a vital reflection of the achievements of the national aid medical team for Tibet. Department of critical care medicine of Peking Union Medical College Hospital (PUMCH) counterpart aids the Department of critical care medicine of Tibet Autonomous Region People’s Hospital (TARPH). With the help of professors from PUMCH, the local medical team of TARPH translated CAM-ICU into Tibetan and made it available on the international website for the first time (https://www.icudelirium.org/medical-professionals/resource-language-translations). This has been set as an example for the professional development of critical care medicine in the Tibet autonomous region.

However, the present study has some limitations. Firstly, more than half of the patients were excluded due to preexisting psychosis or neurologic disease. We do not have exact detailed clinical information of these patients even though we screened all patients who are admitted to ICU. Whether there are valid and reliable instruments to monitor delirium in neuro-critically ill patients and whether delirium is related to relevant clinical outcomes in this population are still unknown. These questions should be clarified in future research. Secondly, Ely et al., who originally studied the CAM-ICU, interviewed the patients’ family members to estimate their baseline mental status. However, we just presumed the patients’ baseline mental status from the previous medical records because the nurses in our study could not accomplish such family interviews. Thirdly, we used DSM-IV but not DSM-V criteria as the reference standard evaluation in this study. Although studies indicated that DSM-IV and DSM-V have no significant difference in diagnosing delirium, DSM-V was supposed to be more restrictive in defining in terms of its cognitive features. Further study could be required to explore the diagnostic relevance of different application of these criteria.

In conclusion, this study provides evidence to support that the Tibetan version of CAM-ICU monitoring is valid, reliable, and feasible in Tibetan ICU patients. We hope that the availability of such worksheet will facilitate the implementation of delirium screening in Tibetan-speaking ICU inpatients and eventually improve the outcome of patients.

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Conflicts of interest
None.

References
1. Kofis K, Marra A, Ely EW. ICU delirium – a diagnostic and therapeutic challenge in the intensive care unit. Anaesthesiol Intensive Ther 2018;50:128–140. doi: 10.5603/AIT.2018.0011.
Ely EW, Margolin R, Francis J, May L, Truman B, Dittus R, et al. Evaluation of delirium in critically ill patients: validation of the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU). Crit Care Med 2001;29:1370–1379. doi: 10.1097/00003246-200107000-00012.

Ely EW, Shintani A, Truman B, Speroff T, Gordon SM, Harrell FE, et al. Delirium as a predictor of mortality in mechanically ventilated patients in the intensive care unit. JAMA 2004;291:1753–1762. doi: 10.1001/jama.291.14.1753.

Krewulak KD, Stelfox HT, Leigh JP, Ely EW, Fiset KM. Incidence and prevalence of delirium subtypes in an adult ICU: a systematic review and meta-analysis. Crit Care Med 2018;46:2029–2035. doi: 10.1097/CCM.0000000000003402.

Lin SM, Liu CY, Wang CH, Lin HC, Huang CD, Huang PY, et al. The impact of delirium on the survival of mechanically ventilated patients. Crit Care Med 2004;32:2254–2259. doi: 10.1097/01.ccm.0000145587.16421.db.

Salluh JI, Soares M, Teles JM, Ceraso D, Raimondi N, Nava VS, et al. Delirium epidemiology in critical care (DECCA): an international study. Crit Care 2010;14:R210. doi: 10.1186/cc9333.

Girard TD, Jackson JC, Pandharipande PP, Pun BT, Thompson JL, Shintani AK, et al. Delirium as a predictor of long-term cognitive impairment in survivors of critical illness. Crit Care Med 2010;38:1513–1520. doi: 10.1097/CCM.0b013e3181e78be1.

Ely EW, Gautam S, Margolin R, Francis J, May L, Speroff T, et al. The impact of delirium in the intensive care unit on hospital length of stay. Intensive Care Med 2001;27:1892–1900. doi: 10.1007/s00134-001-1132-2.

Lima DP, Ochiai ME, Lima AB, Curiazi JA, Farfel JM, Filho WJ. Delirium in hospitalized elderly patients and post-discharge mortality. Clinics 2010;65:251–255. doi: 10.1590/S1807-59322010000300003.

Jaccob J, Fraser GL, Courin DB, Kerer RR, Fontaine D, Wittbrodt ET, et al. Clinical practice guidelines for the sustained use of sedatives and analgesics in the critically ill adult. Crit Care Med 2002;30:119–141. doi: 10.1097/00003246-200201000-00020.

Luetz A, Heymann A, Radtke FM, Chenitir C, Neuhaus U, Nachtigall et al. Delirium recognition and sedation practices in critically ill patients: a survey on the attitudes of 1015 Brazilian critical care physicians. J Crit Care 2009;24:536–562. doi: 10.1016/j.jcrc.2009.08.005.

Ely EW, Inouye SK, Bernard GR, Gordon S, Francis J, May L, et al. Delirium in mechanically ventilated patients: validity and reliability of the confusion assessment method for the intensive care unit (CAM-ICU). JAMA 2001;286:2703–2710. doi: 10.1001/jama.286.21.2703.

Beaton DE, Bombardier C, Guillemin F, Ferraz MB. Guidelines for the process of cross-cultural adaptation of self-report measures. Spine 2000;25:3186–3191. doi: 10.1097/00003776-200012150-00004.

Wild D, Grove A, Martin M, Eremenco S, McElroy S, Verjee-Lorenz A, et al. Principles of good practice for the translation and cultural adaptation process for Patient-Reported Outcomes (PRO) measures: report of the ISPOR Task Force for translation and cultural adaptation. Value Health 2003;6:94–104. doi: 10.1111/j.1524-4733.2005.04054.x.

Barr J, Fraser GL, Puntillo K, Ely EW, Gelinas C, Dasta JF, et al. Clinical practice guidelines for the management of pain, agitation, and delirium in adult patients in the intensive care unit. Crit Care Med 2013;41:278–280. doi: 10.1097/CCM.0b013e3182783b72.

Guenther U, Popp J, Koehler L, Muders T, Wrigge H, Ely EW, et al. Validity and reliability of the CAM-ICU flowsheet to diagnose delirium in surgical ICU patients. J Crit Care 2010;25:144–151. doi: 10.1016/j.jcrc.2009.08.005.

Heo EY, Lee BJ, Hahn BJ, Song EH, Lee HA, Yoo CG, et al. Translation and validation of the Korean Confusion Assessment Method for the intensive care unit. BMC Psychiatry 2011;11:94–97. doi: 10.1186/1471-244X-11-94.

Toro AC, Escobar LM, Franco JG, Diaz-Gomez JL, Munoz JF, Molina F, et al. Spanish version of the CAM-ICU (Confusion Assessment Method for the intensive care unit): Pilot study of validation. Med Intensiva 2010;34:14–21. doi: 10.1016/j.medici.2009.07.002.

Gusmão-Flores D, Salluh JI, Dal-Pizzol F, Ritter C, Tomasi CD, Lima MA, et al. The validity and reliability of the Portuguese versions of three tools used to diagnose delirium in critically ill patients. Clinics 2011;66:1917–1922. doi: 10.1590/S1807-59322011000100011.

Adams D, Rooney S, Meagher D, Mulligan O, McCarthy G. A comparison of delirium diagnosis in elderly medical inpatients using the CAM, DRS-R98, DSM-IV and DSM-5 criteria. Int Psychogeriatr 2015;27:883–889. doi: 10.1017/S1041610214002853.

Meagher DJ, Morandi A, Inouye SK, Ely W, Adams D, MacLullich AJ, et al. Concordance between DSM-IV and DSM-5 criteria for delirium diagnosis in a pooled database of 768 prospectively evaluated patients using the delirium rating scale-revised-98. BMC Med 2014;12:164–173. doi: 10.1186/s12916-014-0164-8.

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