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Validation and comparison of CAM-ICU and ICDSC in mild and moderate traumatic brain injury patients

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Dear Editor,
Delirium is defined as an acute change or fluctuating mental status and inattention, and either disorganized thinking or altered level of consciousness and has been associated with significant increases in hospital length of stay, long-term

cognitive impairment, and mortality [1–3]. Guidelines recommend routine screening for delirium in ICU patients using a validated tool [4]. Traumatic brain injury (TBI) can induce focal or diffuse brain damage, which may predispose patients to neuropsychiatric complications including delirium as well as complexify its evaluation [5]. The aim of our study was to evaluate the validity and reliability of both the Confusion Assessment Method–Intensive Care Unit (CAM-ICU) and Intensive Care Delirium Screening Checklist (ICDSC) for delirium assessment in patients with mild [Glasgow Coma Scale (GCS 13–15)] or moderate (GCS 9–12) TBI.

A prospective observational study was conducted in two academic trauma centers. Patients of 18 years of age or older and admitted to ICU for more than 48 h were screened for inclusion if they had mild or moderate TBI. Exclusion criteria included severe TBI (GCS 3–8), Richmond Agitation Sedation Scale (RASS) score of –4 or –5 throughout the ICU stay, pre-existing cognitive impairment, inability to fluently communicate in English or French, and significant blindness or deafness that precluded adequate assessment. Written informed consent was obtained from all patients or their legal representative. Patients underwent evaluation with the CAM-ICU, ICDSC, and DSM-IV-TR criteria for delirium on days 3, 5, and 7 of ICU stay. Assessments were performed independently when RASS was superior to –3 and results were blinded. Trained pharmacy residents and ICU pharmacists performed delirium assessments with the CAM-ICU and

ICDSC while physicians (psychiatrists and intensivists) performed DSM-IV-TR. Criterion validity analyses were performed for each evaluation day separately (days 3, 5 and 7) and all together. Estimates of 95 % confidence intervals (CIs) for binary repeated data using generalized estimating equation (GEE) in conjunction with Huber-White estimator were performed. A total of 226 patients admitted to the ICU were screened and 61 patients were enrolled. The patients were mostly men (77 %) with a mean age of 56 ± 18 years, a median admission GCS of 14 (IQR 3), a mean APACHE II score of 11.5 ± 6.4 , and a mean Injury Severity Score (ISS) of 23.3 ± 9.4 . Seventeen patients (28 %) suffered an isolated head trauma and 44 (72 %) suffered polytrauma with head trauma. A total of 65.5 % of patients required mechanical ventilation during their ICU stay. According to the DSM-IV-TR, 28 patients were diagnosed with delirium (45.9 %). The overall sensitivity and specificity for CAM-ICU (62 and 74 %, respectively) and ICDSC (64 and 79 %, respectively) were similar and improved over time (Table 1). The overall inter-rater reliability for the CAM-ICU and ICDSC was 0.64 and 0.68 (kappa), respectively. Subgroup analyses suggested lower specificity for both tools in moderate TBI and patients more deeply sedated (eTables 2 and 3 in the Electronic Supplementary Material). In conclusion, the criterion validity and inter-rater reliability of the CAM-ICU and ICDSC were good. However, these clinical tools may perform suboptimally in patients with TBI. Further studies should aim at developing

Table 1 Criterion validity of the CAM-ICU and ICDS-C

| CAM-ICU | Day 3 (N = 61) | Day 5 (N = 25) | Day 7 (N = 12) | Overall (N = 98) |
|-------------------------------------|----------------|----------------|----------------|----------------------|
| Sensitivity | 58 % | 69 % | 88 % | 62 % (95 % CI 44–76) |
| Specificity (95 % CI) | 69 % | 67 % | 100 % | 74 % (95 % CI 59–85) |
| Positive predictive value (95 % CI) | 58 % | 69 % | 100 % | 63 % (95 % CI 45–78) |
| Negative predictive value (95 % CI) | 69 % | 67 % | 80 % | 70 % (95 % CI 55–82) |
| Overall accuracy (95 % CI) | 64 % | 68 % | 92 % | 69 % (95 % CI 57–78) |
| ICDS-C | Day 3 (N = 60) | Day 5 (N = 25) | Day 7 (N = 12) | Overall (N = 97) |
| Sensitivity (95 % CI) | 64 % | 54 % | 75 % | 64 % (95 % CI 49–77) |
| Specificity (95 % CI) | 80 % | 67 % | 75 % | 79 % (95 % CI 63–89) |
| Positive predictive value (95 % CI) | 70 % | 64 % | 86 % | 74 % (95 % CI 55–87) |
| Negative predictive value (95 % CI) | 76 % | 57 % | 60 % | 69 % (95 % CI 54–81) |
| Overall accuracy (95 % CI) | 73 % | 60 % | 75 % | 70 % (95 % CI 59–80) |

CAM-ICU Confusion Assessment Method–Intensive Care Unit, ICDS-C Intensive Care Delirium Screening Checklist

specific tools to discriminate between delirium and other acute cognitive dysfunction in critically ill TBI patients.

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Compliance with Ethical Standards

Conflicts of interest The authors have no conflict of interest to declare.

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