



Validation and Translation of the 3D-CAM to Turkish in Surgical Intensive Care Patients

¹ Sinem Sarı^{1,2}, ¹ Pelin Dilsiz³, ¹ Tuna Eker⁴, ¹ Samet Şahin⁵, ¹ Meltem Derya Şahin⁶, ¹ Bilge Doğan⁷,
¹ Pakize Özçiftçi⁸, ¹ Halil Özcan⁹, ¹ Ayşenur Dostbil¹⁰, ¹ Mehmet Sinan İyisoy¹¹, ¹ Oğuz Turan¹², ¹ Fatma Taşkın⁶,
¹ Didar Kıyşılık¹, ¹ Meryem Kazaylek¹³, ¹ İlker İnce¹⁴, ¹ Alparslan Turan¹⁵

¹Aydın Adnan Menderes University Faculty of Medicine, Department of Anaesthesiology and Reanimation, Aydın, Türkiye

²Outcomes Research Consortium, Houston, Texas, USA

³Soma State Hospital, Clinic of Anaesthesiology and Reanimation, Manisa, Türkiye

⁴Soma State Hospital, Clinic of Psychiatry, Manisa, Türkiye

⁵Muğla Sıtkı Koçman University Faculty of Medicine, Department of General Surgery, Muğla, Türkiye

⁶Muğla Sıtkı Koçman University Faculty of Medicine, Department of Psychiatry, Muğla, Türkiye

⁷Aydın Adnan Menderes University Faculty of Medicine, Department of Psychiatry, Aydın, Türkiye

⁸Aydın Adnan Menderes University Faculty of Medicine, Department of Intensive Care Unit, Aydın, Türkiye

⁹Atatürk University Faculty of Medicine, Department of Psychiatry, Erzurum, Türkiye

¹⁰Atatürk University Faculty of Medicine, Department of Anaesthesiology and Reanimation, Erzurum, Türkiye

¹¹Necmettin Erbakan University Faculty of Medicine, Department of Medical Education and Informatics, Konya, Türkiye

¹²Northeast Ohio Medical University, Ohio, United States

¹³Bayburt State Hospital, Clinic of Psychiatry, Bayburt, Türkiye

¹⁴The Pennsylvania State University, Penn State College of Medicine, Department of Anaesthesiology and Perioperative Medicine, Pennsylvania, United States

¹⁵Center of Outcome Research, University of Texas, Houston, USA

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Abstract

Objective: Delirium is a common condition that can significantly worsen a patient's clinical status. Timely and accurate detection of this often-overlooked condition is essential for effective prevention and treatment. This study aims to validate the Turkish version of the 3-Minute Diagnostic Interview for Confusion Assessment-defined Delirium (3D-CAM-TR), which has been culturally adapted for surgical intensive care patients.

Methods: This study was conducted in surgical intensive care units and wards at three academic hospitals, including 133 surgical intensive care patients. The 3D-CAM was culturally adapted and translated into Turkish. The 3D-CAM-TR was administered by trained clinicians from the first to the third postoperative day. During this period, delirium diagnosis was made by experienced psychiatrists using the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) criteria as the reference standard. All assessors were blinded to each other's assessment results. The 3D-CAM delirium diagnosis was compared with the reference standard in all patients.

Results: A total of 133 adult patients were assessed over three consecutive days, findings in 399 paired assessments. Compared to the DSM-5-based reference standard, the sensitivity and specificity of the 3D-CAM-TR assessment were found to be 95% and 97%, respectively, for rater 1, and 93% and 99%, respectively, for rater 2, with good inter-rater reliability (Kappa coefficient=0.898, confidence interval=0.84, 0.96).

Conclusion: Our results indicate that the 3D-CAM-TR is a dependable and precise instrument for assessing delirium in postoperative intensive care patients.

Keywords: 3D-CAM, Delirium, Intensive Care, Turkish Version, Validation

Main Points

- The sensitivity of the Turkish version of the 3-Minute Diagnostic Interview for Confusion Assessment-defined Delirium (3D-CAM-TR) assessment was found to be 95% for rater 1 and 93% for rater 2.
- The specificity of the 3D-CAM-TR assessment were found to be 97% for rater 1, and 99% for rater 2.
- Assessment was have good inter-rater reliability.

Introduction

Postoperative delirium (PD) is a common complication in geriatric surgical patients. As defined by the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), delirium is a transient condition marked by disturbances in attention, awareness, and cognition, with symptoms that develop suddenly and fluctuate over time.¹ Delirium is associated with accelerated cognitive decline, although there is ongoing debate about whether it serves as a marker or a risk factor for subsequent persistent cognitive impairment.^{2,3}

The exact etiology of PD remains unclear. However, it is recognized as an acute disturbance in cognitive function and/or spatial-temporal perception, which can be diagnosed at the bedside using specific diagnostic tools. PD typically presents with an abrupt onset and a fluctuating course, and without systematic screening, it may be easily overlooked. The condition is characterized by three core features: altered consciousness, changes in cognitive abilities, and a rapid onset.⁴

The DSM-5 is used to establish the definitive diagnosis of delirium. Nevertheless, utilizing it correctly necessitates specialized psychiatric training and education. The most commonly used tool developed for use by non-psychiatric practitioners to help diagnose delirium is the Confusion Assessment Method (CAM). Other tools described include the CAM for intensive care units (CAM-ICU) and the CAM-defined 3 Minute Diagnostic Interview for Delirium (3D-CAM).¹

The 3D-CAM can be completed in an average of three minutes and has excellent diagnostic test properties with 95% sensitivity and 94% specificity compared to a reference standard based on a comprehensive clinical evaluation.⁵ The 3D-CAM is a concise interview that utilizes verbal responses complete the CAM diagnostic algorithm.⁶ By providing a short, repeatable method for detecting delirium, the 3D-CAM facilitates case finding among hospitalized frail elderly patients.

Although the 3D-CAM has been translated and validated into many languages, there is currently no Turkish translation or validation available. The aim of our study is to translate the 3D-CAM into Turkish and validate the Turkish version 3D-CAM (3D-CAM-TR) in surgical patients.

Methods

This study was conducted prospectively to translate and validate the reliability of the Turkish version of the 3D-CAM in surgical intensive care patients. The research protocol received approval from the Aydın Adnan Menderes University Faculty of Medicine, Non-Interventional Clinical Research Ethics Committee (date: 28.01.2021, approval no.: 2021/28). The study was registered with Clinical

Trials under the number NCT04853706. The multicenter study was carried out. All enrolled patients or their proxies provided written informed consent.

Translation and Back Translation

The forward translation process, which involves translating the original version into the target language, was carried out independently by two bilingual experts: a specialist doctor of Turkish descent who has lived in the United States for an extended period (AT), and a medical student, also of Turkish descent, who was born and raised in the United States (OT). Both translators independently translated all items of the 3D-CAM, including response options and instructions, into Turkish. The initial translation was then reviewed by Dr. Edward R. Marcantonio, the original developer and validator of the 3D-CAM. After incorporating the revisions he suggested, the translation received his formal approval.

To identify potential conceptual inaccuracies, a back-translation process was employed, whereby the translated text was retranslated from the target language back into the source language. Any back-translations that deviated from the intended meaning were revised in the Turkish version, back-translated again, and subjected to further review. This iterative process continued until the principal developer gave final approval for the reverse translation (Figure 1).

Participants

To be eligible for participation, individuals met the following inclusion criteria: (a) be at least 18 years of age and (b) have an American Society of Anesthesiologists (ASA) classification. Physical status 1-3. (c) admitted to the postoperative critical care unit and are expected to stay in the hospital for more than 48 hours. Additionally, patients with a Mini-Mental State Examination (MMSE) score of 20 or higher are included, while those with dementia are excluded.

Exclusion criteria: (a) Patients who declined to participate, (b) Patients with significant visual or auditory impairment/disability or the presence of endotracheal intubation that may impede communication, (c) The presence of a significant psychiatric condition, such as bipolar disorder, major depression, schizophrenia, Alzheimer's disease, dementia, or parkinsonism, and (d) profound sedation or unconsciousness. ASA physical status IV or V refers to patients who have severe systemic disease posing a continuous threat to life (IV) or patients who are not expected to survive without the surgery (V). (e) Patients receiving surgical procedures with a duration of less than one hour.

Enrollment and Baseline Data Collection

The assessment of eligibility and obtaining patient consent were conducted during the preoperative consultation. Demographic and historical medical information, including medication use, was obtained during this appointment.

3D-CAM DEĞERLENDİRMESİ [CAM Copyright 2003, Hospital Elder Life Program, LLC. Not to be reproduced without permission] Version 5.2				CAM Özelliği			
(KODLAMA BİLGİSİ: "Bilmiyorum" cevabı veya hiçbir cevap alınamaması ya da mantıkla bağdaşmayan cevaplar "YANLIŞ" kategorisinde kabul edilmelidir. "Yanlış" veya "Evet" olarak işaretlenen cevaplar için lütfen en sağ sütundaki kareleri de işaretleyerek hangi delirium kriterinin mevcut olduğunu belirtiniz.)				1	2	3	4
HASTAYA OKUYUN (Size düşünme ve hafızanızla ilgili bazı sorular soracağım) ...							
1. Şu an hangi yılda olduğumuzu söylemişsiniz?	<input type="checkbox"/> Doğru	<input type="checkbox"/> Kabul Etmedi	<input type="checkbox"/> Yanlış, Bilmiyor, Cevap yok, Anlamsız cevap	→	→		
2. Bugün günlerden ne?	<input type="checkbox"/> Doğru	<input type="checkbox"/> Kabul Etmedi	<input type="checkbox"/> Yanlış, Bilmiyor, Cevap yok, Anlamsız cevap	→	→		
3. Bulduğumuz yer neresi? (Mesela: Ev mi, Okul mu ?)	<input type="checkbox"/> Doğru	<input type="checkbox"/> Kabul Etmedi	<input type="checkbox"/> Yanlış, Bilmiyor, Cevap yok, Anlamsız cevap	→	→		
4. Şimdi size baki rakamlar söyleyeceğim. Bunları bana tersi sıralamada geri soylemenizi istiyorum. Mesela, 5, 2, .. dersem, size 2, 5 diyerek geri tekrar edeceksiniz. Başlayalım mı? Rakamlar: 8, 2, 5. (Cevap: 5,2,8)	<input type="checkbox"/> Doğru	<input type="checkbox"/> Kabul Etmedi	<input type="checkbox"/> Yanlış, Bilmiyor, Cevap yok, Anlamsız cevap	→			
5. Bir kere daha tekrar edelim rakamları. Yeni sıralama 3,1,9,4 (Cevap: 4,9,1,3)	<input type="checkbox"/> Doğru	<input type="checkbox"/> Kabul Etmedi	<input type="checkbox"/> Yanlış, Bilmiyor, Cevap yok, Anlamsız cevap	→			
6. Bana haftanın günlerini Cumartesi'den başlayarak geriye doğru saymışınız? (Cumartesi, Cuma, Perşembe...)(Bu sıralama esnasında iki defayı asmamak üzere "Cuma'dan önce hangi gün var" şeklinde hastaya yardım edebilirsiniz)	<input type="checkbox"/> Doğru	<input type="checkbox"/> Kabul Etmedi	<input type="checkbox"/> Yanlış, Bilmiyor, Cevap yok, Anlamsız cevap	→			
7. Bana yılın aylarını Aralık'tan başlayarak geriye doğru sıralar mısınız? (Aralık, Kasım, Ekim, Eylül...) Bu sıralama esnasında iki defayı asmamak şartıyla, "Ekim'den önce hangi ay geliyor" şeklinde hastaya yardım edebilirsiniz)	<input type="checkbox"/> Doğru	<input type="checkbox"/> Kabul Etmedi	<input type="checkbox"/> Yanlış, Bilmiyor, Cevap yok, Anlamsız cevap	→			
8. Dun, gunun herhangi bir zamaninda, kafanizin karisik (veya bulanik) oldugunu dusundunuz mu?	<input type="checkbox"/> Doğru	<input type="checkbox"/> Kabul Etmedi	<input type="checkbox"/> Yanlış, Bilmiyor, Cevap yok, Anlamsız cevap				
9. Dun, gunun herhangi bir zamaninda, hastanede olmadiginizi dusundugunuz oldu mu?	<input type="checkbox"/> Doğru	<input type="checkbox"/> Kabul Etmedi	<input type="checkbox"/> Yanlış, Bilmiyor, Cevap yok, Anlamsız cevap				
10. Dun, gunun herhangi bir zamaninda, normalde etrafınızda olmayan seyler gordunuz mu?	<input type="checkbox"/> Doğru	<input type="checkbox"/> Kabul Etmedi	<input type="checkbox"/> Yanlış, Bilmiyor, Cevap yok, Anlamsız cevap				
GOZLEMCİ DEĞERLENDİRMESİ: (Bu kısım, hastaya yukarıdaki 10 soru sorulduktan ve değerlendirme yapıldıktan sonra tamamlanmalıdır.)							
11. Soru degerlendirmesi esnasinda hasta uykulu, uyusuk veya komatoz belirdi mi?	<input type="checkbox"/> Hayır	<input type="checkbox"/> Değerlendirilemedi	<input type="checkbox"/> Evet	→	→	→	
12. Soru degerlendirmesi esnasinda hasta sıradan uyarılara aşırı güçlü tepkiler verdi mi?	<input type="checkbox"/> Hayır	<input type="checkbox"/> Değerlendirilemedi	<input type="checkbox"/> Evet	→	→	→	
13. Soru degerlendirmesi esnasinda hastanın dusunme sinisi karisik veya mantiksiz gozuktu mu? (Mesela bu gorusme esnasinda sorulan sorudan alakasiz olarak bir baska konu ile ilgili konusmaya basladi mi?)	<input type="checkbox"/> Hayır	<input type="checkbox"/> Değerlendirilemedi	<input type="checkbox"/> Evet	→	→		
14. Hastanın diyalogu karisik veya uygunsuz bir sekilde ayrıntılı mıydı? (Yani, sorulan soruya uygunsuz kelimelerle veya tamamen alakasiz cevaplar verdi mi?)	<input type="checkbox"/> Hayır	<input type="checkbox"/> Değerlendirilemedi	<input type="checkbox"/> Evet	→	→		
15. Hastanın konusma sekli cok olagan disı bir sekilde kisitli, kısa veya aralikli miydi? (Mesela sadece evet veya hayir seklinde cevap vermek gibi.)	<input type="checkbox"/> Hayır	<input type="checkbox"/> Değerlendirilemedi	<input type="checkbox"/> Evet	→	→		
16. Hasta soru degerlendirmesi esnasinda sorulan soruyu takip edemiyor gibi gozuktu mu?	<input type="checkbox"/> Hayır	<input type="checkbox"/> Değerlendirilemedi	<input type="checkbox"/> Evet	→			
17. Hasta, soru degerlendirmesi esnasinda, etraftaki herhangi bir uyarandan duruma uygunsuz bir sekilde etkilendi ve dikkati dagildi mi?	<input type="checkbox"/> Hayır	<input type="checkbox"/> Değerlendirilemedi	<input type="checkbox"/> Evet	→			
18. Soru degerlendirmesi esnasinda, hastanın bilinc duzeyi degisken gozuktu mu? (Mesela, soruya cevap vermeye baslayip, sonuna dogru uykuya daldi mi?)	<input type="checkbox"/> Hayır	<input type="checkbox"/> Değerlendirilemedi	<input type="checkbox"/> Evet				
19. Soru degerlendirmesi esnasinda hastanın dikkati degisken gozuktumu? (Örneğin, hastanın odaklanma ve dikkatini verme yeteneği görüşmenin farklı bölümleri arasında değişti mi?)	<input type="checkbox"/> Hayır	<input type="checkbox"/> Değerlendirilemedi	<input type="checkbox"/> Evet				
20. Soru degerlendirmesi esnasinda hastanın konusma veya dusunmesinde dalgalanmalar gozlemlendi mi? (Mesela, cok yavas konusup sonra hizlanmasi gibi)	<input type="checkbox"/> Hayır	<input type="checkbox"/> Değerlendirilemedi	<input type="checkbox"/> Evet				
OPSİYONEL SORULAR (Sayfanın sağ alt kosesindeki Delirium kriter 1-4 olarak numaralandırılmış kutulara bakın. Eger Delirium 1. kriter kutusu bos ise ve de 2. kriter pozitif olup 3 veya 4. kriter kutusu da pozitif ise, bu soruları sorabilirsiniz. (Yani delirium kriterlerinden 2+3 pozitif veya 2+4 pozitif ise bu ek soruları sorabilirsiniz)							
21. Hastanın bir aile bireyine, hastanın yakın bir arkadaşına veya hastayı bilen bir saglik calisanına ulasabilir ve hastanın dusunme sinisinde (hafiza ve dusunmesinde) herhangi bir akut degisiklik gozlediniz mi diye sorunuz.	<input type="checkbox"/> Hayır	<input type="checkbox"/> Değerlendirilemedi	<input type="checkbox"/> Evet				
22. Hastanın hastanedeki 2.gunu veya sonrasini donemdeyseniz, hastanın daha onceki 3D-Cam degerlendirmelerine bakarak, eldeki "yeni pozitif" semptomlar isiginda akut bir degisiklik olup olmadigina karar veriniz.	<input type="checkbox"/> Hayır	<input type="checkbox"/> Değerlendirilemedi	<input type="checkbox"/> Evet				
CAM Özeti: Eger sutunun yukaridaki kutularda isaret var ise, 1-4 kutusuna isaret koyunuz.				1	2	3	4
Delirium tanisi icin pozitif kriter 1, pozitif kriter 2, ve ek olarak 3 veya 4 kriterlerinden birisinin pozitif olması gerekmektedir. -----var-----yok							

Figure 1. Turkish Version of 3D-CAM.

The MMSE was performed. Patients with an MMSE score above 20 were included in the study. Patients excluded for any reason, including technical issues or contraindications, were recorded.

Delirium Assessment

3D-CAM Delirium Assessment

Before the study period, researchers from all centers participated in web-based instruction on the 3D-CAM. The assessment of delirium was conducted by two different clinicians utilizing the 3D-CAM tool each evening from 18:00 to 20:00 for a period of three days postoperatively. If the patient was transferred from the ICU to the ward, the assessment was conducted in the ward.

DSM-5 Delirium Assessment

An impartial psychiatrist researcher, who was blind to the 3D-CAM assessment results, assessed the patients based on DSM-5 criteria within a 3-minute timeframe following the 3D-CAM evaluation.

Statistical Analysis

Sample Calculation

A prior study found the incidence of delirium to be approximately 13%, with a sensitivity of 85% and specificity of 97%. We set the confidence interval (CI) width at 0.2 and determined that 377 assessments were needed.¹

Outcome Analysis

Mean and standard deviation were provided for numerical variables, and frequency and percentage statistics were provided for categorical variables. Cohen's kappa statistic was used to calculate inter-rater agreement, with a 95% CI provided (Additionally, McNemar test results were included). Analyses were performed using R 4.3.2 (R Core Team, 2024). A *P* value of <0.05 was considered significant.

Results

Between October 2021 and December 2024, 135 patients from this group who met the inclusion criteria and provided written informed consent were included in the study; 2 of these patients did not complete the study, and the analysis was completed with 133 patients (Figure 2). The mean age of the enrolled patients was 60.63 ± 15.55 years, and the MMSE score was 27.8 ± 2.60 . Socio-demographic and perioperative data are presented in Table 1.

A total of 399 paired assessments were conducted over a period of three consecutive days for each patient. Based on the psychiatrist's evaluation using the DSM-5, 19.55% (26 out of 133) of the patients encountered at least one episode of delirium.

When compared to the reference standard DSM-5

psychiatrist evaluation, the sensitivity and specificity of the 3D-CAM-TR assessment were 95% and 97% for rater 1, and 93% and 99% for rater 2, respectively (Table 2). The inter-rater reliability, expressed as the Kappa coefficient, was found to be 0.898 with a CI of 0.84 to 0.96.

A total of 274 paired assessments were conducted in the ICU, while 125 assessments were conducted in the ward, encompassing all enrolled patients. The sensitivity of the 3D-CAM-TR in the ICU was 92% for rater 1 and 94% for rater 2; the specificity was 96% for rater 1 and 99% for rater 2 (Table 3).

The sensitivity of the 3D-CAM-TR in the ward was 100% for both rater 1 and rater 2; the specificity was 98% for rater 1 and 100% for rater 2 (Table 4).

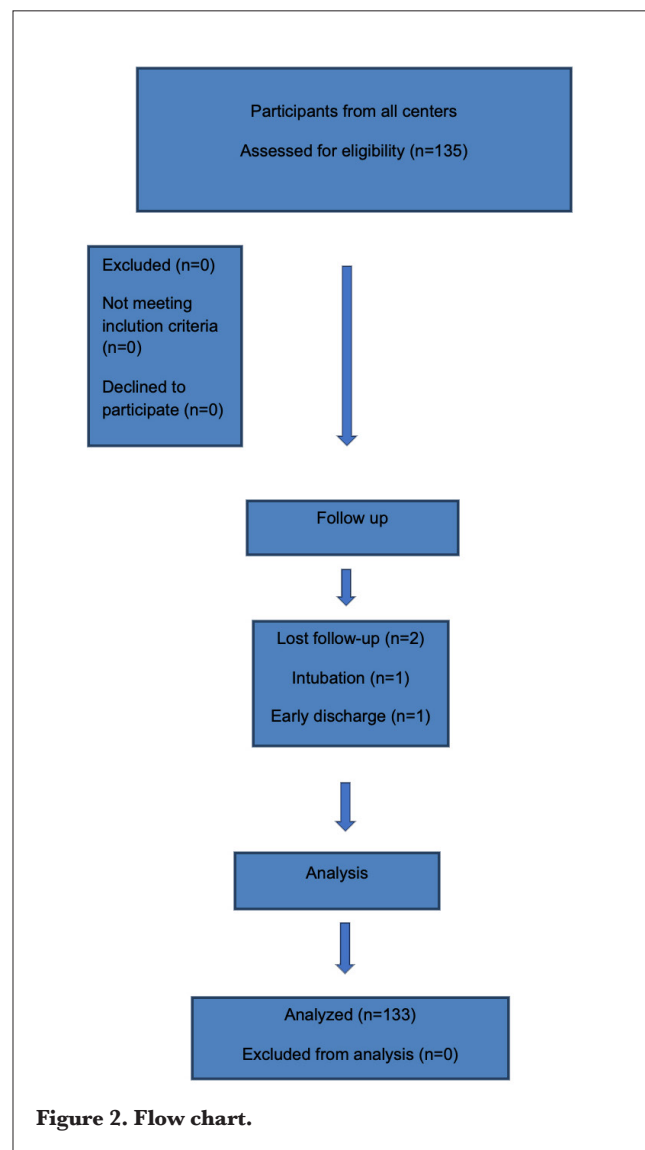


Figure 2. Flow chart.

Table 1. Socio-demographic and Perioperative Data	
Variable	n = 1331
Age, years	60.63±15.55
Gender	
Female	44.00 (33.08%)
Male	89.00 (66.92%)
Height, cm	168.92±9.10
Body weight, kg	68.49±13.37
Education level	
Secondary	87.00 (65.41%)
High school	32.00 (24.06%)
University	9.00 (6.77%)
Postgraduate	5.00 (3.76%)
Marital status	
Married	111.00 (83.46%)
Never married	10.00 (7.52%)
Divorced	3.00 (2.26%)
Widowed	9.00 (6.77%)
Illnesses	
Stroke	3 (1.4%)
Hypertension	57 (27.3%)
CAD	32 (15.3%)
Arrhythmia	7 (3.3%)
COPD	15 (7.2%)
DM	28 (13.4%)
Hyperlipidemia	5 (2.4%)
CRD	10 (4.8%)
Hyperthyroidism	1 (0.5%)
Hypothyroidism	1 (0.5%)
None	50 (23.9%)
ASA	
1	15.00 (11.28%)
2	75.00 (56.39%)
3	43.00 (32.33%)
MMSE, score	27.80±2.60
Data was presented as mean (standard deviation) or number (percentage) CAD, coroner artery disease; COPD, chronic obstructive pulmonary disease; DM, diabetes mellitus; CRD, chronic renal disease; ASA, American Society of Anesthesiologists; MMSE, mini-mental state examination	

Discussion

This study provides evidence that the Turkish version of 3D-CAM is a dependable instrument for evaluating delirium in patients, with an MMSE score of 20 and above, who are receiving intensive care after surgery. When compared to

the reference standard DSM-5 psychiatrist evaluation, the sensitivity and specificity of the 3D-CAM-TR assessment were 95% and 97% for rater 1, and 93% and 99% for rater 2, respectively. 3D-CAM-TR also yielded positive results when evaluated separately for patients in the ICU and the ward. A total of 274 paired assessments were conducted in the ICU, while 125 assessments were conducted in the ward, encompassing all enrolled patients. The sensitivity of the 3D-CAM-TR in the ICU was 92% for rater 1 and 94% for rater 2; the specificity was 96% for rater 1 and 99% for rater 2.

Delirium is frequently overlooked in clinical settings, and more than 28 diagnostic techniques have been created and implemented to aid in its screening.^{7,8} These tools have greatly enhanced the efficiency and precision of diagnosing delirium. Among these tools, CAM has been proposed as the most effective.^{7,8} Nevertheless, one disadvantage of CAM is that, despite extensive training, there may still be inconsistencies in the assessment criteria used by different assessors.⁷ Hence, the proficiency of the evaluator's interrogative abilities might greatly influence the outcomes of the evaluation. The 3D-CAM, a derivative of CAM, offers a concise and organized assessment technique to expedite and streamline the diagnostic procedure.⁵ The 3D-CAM's capacity to conduct evaluations within just three minutes is a notable benefit for clinical practice.

This study confirmed the efficacy and dependability of the 3D-CAM-TR in both the ICU (without the use of endotracheal intubation) and ward settings for surgical patients. Several diagnostic methods, such as CAM-ICU and the critical Care Delirium Screening Checklist, have been utilized to diagnose delirium in patients in ICUs.⁹ Nevertheless, the comparison between these tools and the 3D-CAM has only been conducted in a limited number of studies. A study was conducted with 101 elderly patients (aged 75 years or older) who were not in the ICU. The study found that the 3D-CAM method was more effective than the CAM-ICU method in identifying delirium.¹⁰

In a study similar to our study validating the 3D-CAM-CN, it was reported to be a reliable tool for diagnosing delirium in postoperative patients.¹ They highlighted the strengths of the study, including comprehensive pre-study preparation and strict criteria provided by a panel of psychiatrists. In our study, we planned to demonstrate the 3D-CAM application through online training. Subsequently, evaluators applied the 3D-CAM-TR without supervision. We believe that extended training periods reduce the efficiency of test administration, which is one of the test's advantages. We suggest that future research could explore evaluations after different levels of training and determine the optimal training duration.

Table 2. Raters' Concordance with the Reference Standard

	Reference Standard by DSM-5		Kappa	p ²
	Positive, n = 61 ¹	Negative, n = 338 ¹		
Rater 1			0.871	0.061
Positive	58 (95.1%)	11 (3.3%)		
Negative	3 (4.9%)	327 (96.7%)		
Rater 2			0.932	>0.9
Positive	57 (93.4%)	3 (0.9%)		
Negative	4 (6.6%)	335 (99.1%)		

¹n (%)
²McNemar's chi-squared test with continuity correction

Table 3. Raters' Concordance with the Reference Standard in the Intensive Care Unit

	Reference Standard by DSM-5 in ICU		Kappa	p ²
	Positive, n = 50 ¹	Negative, n = 224 ¹		
Rater 1			0.860 (0.78, 0.94)	0.15
Positive	47 (94.0%)	9 (4.0%)		
Negative	3 (6.0%)	215 (96.0%)		
Rater 2			0.914 (0.85, 0.98)	>0.9
Positive	46 (92.0%)	3 (1.3%)		
Negative	4 (8.0%)	221 (98.7%)		

¹n (%)
²McNemar's chi-squared test with continuity correction
ICU, intensive care unit.

Table 4. Raters' Concordance with the Reference Standard in the Ward

	Reference Standard by DSM-5 in ward		Kappa	p ²
	Positive, n = 11 ¹	Negative, n = 114 ¹		
Rater 1			0.908 (0.78, 1)	0.5
Positive	11 (100.0%)	2 (1.8%)		
Negative	0 (0.0%)	112 (98.2%)		
Rater 2			1.00 (1.1)	
Positive	11 (100.0%)	0 (0.0%)		
Negative	0 (0.0%)	114 (100.0%)		

¹n (%)
²McNemar's chi-squared test with continuity correction.

Study Limitations

Our study's strengths include a culturally appropriate translation and a sufficient sample size. However, there are also limitations. Types of delirium identified in the study were not recorded, so the reliability of the test among hypoactive, hyperactive, and mixed types could not be evaluated. The reliability of the test in patients with major cognitive impairment has been previously established. However, since we included only patients with an MMSE

score above 20 and no diagnosis of cognitive impairment, the reliability in the group with major cognitive impairment could not be assessed.

Conclusion

This study successfully linguistically validated the 3D-CAM for use in the Turkish population, enabling its application for assessing delirium in Turkish-speaking patients. The Turkish version of the questionnaire is now ready for use in post-

surgical patients who are not intubated and who do not have cognitive impairment.

Ethics

Ethics Committee Approval: The research protocol received approval from the Aydın Adnan Menderes University Faculty of Medicine, Non-Interventional Clinical Research Ethics Committee (date: 28.01.2021, approval no.: 2021/28).

Informed Consent: All enrolled patients or their proxies provided written informed consent.

Footnotes

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References

1. Mu DL, Ding PP, Zhou SZ, et al. Cross-cultural adaptation and validation of the 3D-CAM Chinese version in surgical ICU patients. *BMC Psychiatry*. 2020;20(1):133. [\[CrossRef\]](#)
2. Beloeil H, Laviolle B, Menard C, et al. POFA trial study protocol: a multicentre, double-blind, randomised, controlled clinical trial comparing opioid-free versus opioid anaesthesia on postoperative opioid-related adverse events after major or intermediate non-cardiac surgery. *BMJ Open*. 2018;8(6):e020873. [\[CrossRef\]](#)
3. Jackson JC, Gordon SM, Hart RP, Hopkins RO, Ely EW. The association between delirium and cognitive decline: a review of the empirical literature. *Neuropsychol Rev*. 2004;14(2):87-98. [\[CrossRef\]](#)
4. Bilotta F, Lauretta MP, Borozdina A, Mizikov VM, Rosa G. Postoperative delirium: risk factors, diagnosis and perioperative care. *Minerva Anesthesiol*. 2013;79(9):1066-1076. [\[CrossRef\]](#)
5. Marcantonio ER, Ngo LH, O'Connor M, et al. 3D-CAM: derivation and validation of a 3-minute diagnostic interview for CAM-defined delirium: a cross-sectional diagnostic test study. *Ann Intern Med*. 2014;161(8):554-561. [\[CrossRef\]](#)
6. Inouye SK, van Dyck CH, Alessi CA, Balkin S, Siegel AP, Horwitz RI. Clarifying confusion: the confusion assessment method. A new method for detection of delirium. *Ann Intern Med*. 1990;113(12):941-948. [\[CrossRef\]](#)
7. Wong CL, Holroyd-Leduc J, Simel DL, Straus SE. Does this patient have delirium?: value of bedside instruments. *JAMA*. 2010;304(7):779-786. [\[CrossRef\]](#)
8. van Velthuis EL, Zwakhalen SM, Warnier RM, Mulder WJ, Verhey FR, Kempen GI. Psychometric properties and feasibility of instruments for the detection of delirium in older hospitalized patients: a systematic review. *Int J Geriatr Psychiatry*. 2016;31(9):974-989. [\[CrossRef\]](#)
9. Bilotta F, Lauretta MP, Borozdina A, Mizikov VM, Rosa G. Postoperative delirium: risk factors, diagnosis and perioperative care. *Minerva Anesthesiol*. 2013;79(9):1066-1076. [\[CrossRef\]](#)
10. Kuczmarska A, Ngo LH, Guess J, et al. Detection of delirium in hospitalized older general medicine patients: a comparison of the 3D-CAM and CAM-ICU. *J Gen Intern Med*. 2016;31(3):297-303. [\[CrossRef\]](#)