Original Article

Diagnostic Accuracy of CAM-ICU and NEECHAM Tools Compared With DSM-IV Criteria in Diagnosing Delirium After Coronary Artery Bypass Surgery

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ABSTRACT

Background: Early diagnosis of patients in the ICU can significantly contribute to improved quality of care. This study aims to compare the diagnostic accuracy of Confusion Assessment Method for the ICU (CAM-ICU) and Nursing Evaluation and Education of Cognitive Health Assessment Model **(**NEECHAM) Confusion Scale tools with DSM-IV diagnostic criteria for patients who have undergone coronary artery bypass surgery (CABG).

Methods: In this cross-sectional study, 280 patients were examined. Delirium assessments were conducted a day after surgery. The evaluation process involved the following steps: An intensive care specialist assessed the patients' delirium status according to the DSM-IV criteria (as the reference standard). Subsequently, the researcher evaluated the same patients using the NEECHAM tool. Finally, the researcher assessed the patients using the CAM-ICU tool. Thereafter, sensitivity, specificity, positive and negative predictive values, and Kappa agreement coefficient were measured to compare the diagnostic accuracy of both CAM-ICU and NEECHAM tools with DSM-IV.

Results: The frequency of delirium varied depending on the diagnostic tool used: DSM-IV: 12%; CAM-ICU: 2.9%; and NEECHAM: 3.9%. The sensitivity and specificity values for each tool were as follows:
CAM-ICU: sensitivity: 25% (95% CI, 11.5% to 43.4%) and specificity: 98.5%.
NEECHAM: sensitivity: 34.4%, 95% CI, 18.6% to 53.2%) and specificity: 98.5%.
Both CAM-ICU and NEECHAM demonstrated a positive predictive value of 100%. The negative predictive values were 91.1% for CAM-ICU and 92.1% for NEECHAM. The Kappa coefficient was calculated to be 0.73.

Conclusions: There was no significant difference between the diagnostic accuracy of NEECHAM and the CAM-ICU tools in detecting delirium. Both tools demonstrated low sensitivity but high specificity in diagnosing delirium following CABG. ***(Iranian Heart Journal 2025; 26(1): 93-101)***

KEYWORDS: Delirium, CAM-ICU tool, NEECHAM tool, ICU, Coronary artery bypass surgery

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The prevalence of coronary artery disease (CAD) is on the rise globally. In the United States alone, it is estimated that around 500,000 coronary artery bypass graft (CABG) surgeries are conducted each year. [1] CABG is among the most common cardiac surgeries and often requires the use of cardiopulmonary bypass (CPB) during the procedure. [2] The complications associated with CPB include pulmonary dysfunction, [3] acute kidney injury, [4] coagulation disorders, [5] arrhythmias, and neurocognitive changes. [6]

Delirium is recognized as one of the most prevalent cognitive complications experienced by patients in the ICU following cardiac surgery. [7] This condition is characterized by an acute decline in consciousness, attention, and memory, as well as disturbances in the sleep-wake cycle. [8] Post-cardiac surgery delirium has been reported in 8% to 50% of patients, indicating a significant concern for this patient population. [9] Several studies have found an association between the duration of CPB and postoperative delirium. [10] Studies have shown that patients undergoing cardiac surgery face a higher risk of developing postoperative delirium than those undergoing non-cardiac surgeries. [11, 12]

To reduce the risk of delirium after cardiac surgery and improve outcomes, modifiable risk factors should be managed carefully[13]. Several tools are employed to assess delirium, with the Confusion Assessment Method for the ICU (CAM-ICU) and the Nursing Evaluation and Education of Cognitive Health Assessment Model (NEECHAM) Confusion Scale being 2 commonly employed instruments for evaluating delirium in critically ill patients and ICU settings. [14] The CAM-ICU questionnaire encompasses 4 primary domains: 1) acute change in mental status, 2) inattention, 3) disorganized thinking, and 4) altered level of consciousness. [15] Notable advantages of the CAM-ICU are its applicability in patients undergoing mechanical ventilation [16] and its ease of use in clinical environments, requiring minimal training and facilitating rapid implementation in the daily routines of ICU nurses. [17] Nonetheless, one notable limitation of the CAM-ICU is the decreased sensitivity observed when the tool is administered by bedside staff as opposed to researchers. This finding underscores the importance of proper training and education for healthcare professionals utilizing the CAM-ICU. [18]

The NEECHAM Confusion Scale is a nursing-focused delirium screening tool validated for use in the ICU and consists of 9 items divided among 3 subscales: information processing, behavior, and physiological condition. [19] A key benefit of NEECHAM is its ability to identify at-risk groups and mild delirium, allowing for proactive measures compared with the binary CAM-ICU scale. [20] Nevertheless, the sensitivity and specificity of NEECHAM in diagnosing delirium are lower than those of the DSM criteria, as reported in several studies. [21, 22] Early detection of delirium symptoms is vital for identifying and addressing the underlying cause promptly, emphasizing the significance of selecting an optimal delirium assessment tool. [23] To ensure effective screening, these tools should meet certain criteria, including standardization, ease of use and learning, and reliability per established reference standards. [24] Implementing appropriate screening tools after open-heart surgery can lead to better prognosis, earlier intervention, and effective patient management. [25]

Given the inconsistent results from previous studies comparing the diagnostic accuracy of the CAM-ICU and NEECHAM tools in patients following CABG, the primary objective of this study was to conduct a comparative analysis of these 2 tools against the DSM-IV criteria for diagnosing delirium in ICU patients post-CABG.

METHODS

The current cross-sectional study focuses on comparing the diagnostic accuracy of the CAM-ICU and NEECHAM tools with the DSM-IV diagnostic criteria for identifying delirium in patients following CABG. This investigation took place within the cardiac surgery ICUs of a tertiary referral hospital, providing a specialized and relevant clinical setting for the research. Participants for this study were recruited from the patient population admitted to the center between August 2022 and May 2023. Inclusion was determined based on specific criteria, and any patients who did not meet these criteria were excluded from the study.

The following inclusion criteria were established for participant selection: age ≥ 18 years, undergoing CPB surgery, fluency in the Persian language, Glasgow Coma Scale (GCS) scores > 10, Richmond Agitation-Sedation Scale (RASS) scores ≥ 3, absence of tracheal intubation, and no impairment in speech, hearing, cognition, and memory. Patients were excluded from the study if they met any of the following criteria: unwillingness to participate, presence of deep sedation (RASS = −4 or −5), occurrence of stroke, cardiac arrest, or cardiopulmonary resuscitation during or after surgery, cardiogenic shock, development of coma, and death.

Prior to enrollment, all participants provided informed written consent. Relevant data collected from each participant included demographic characteristics, comorbidities, and perioperative clinical parameters. Delirium assessments were performed on the second postoperative day, provided that the patient had been extubated. If the patient was still sedated or had not yet undergone extubation, the assessment was postponed until the third postoperative day.

The evaluation process began by assessing patients' consciousness levels using RASS. Subsequently, a critical care specialist, unaware of the study objectives, evaluated patients for delirium based on the DSM-IV diagnostic criteria, which served as the reference standard. These assessments were documented independently to ensure unbiased results. Next, a blinded investigator assessed the patients' consciousness using RASS and then completed the NEECHAM and CAM-ICU questionnaires sequentially without calculating the results.

Data analysis was performed using STATA software, version 14. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were reported as frequency (percentage). To evaluate the diagnostic accuracy of the CAM-ICU and NEECHAM tools against the DSM-IV criteria, the following measures were calculated along with their corresponding 95% confidence intervals (Cis): sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and Kappa agreement coefficient.

RESULTS

The study enrolled 280 participants who underwent elective CABG. Of these participants, 130 (46.4%) were men, and 150 (53.6%) were women. 28.6% of the participants reported a history of addiction (Table 1).

Table 1: Demographic and Clinical Characteristics of the Studied Patients

Variables	Frequency (%) or Mean ± SD
Sex (female)	130 (46.4%)
Age, y	57.9±12.3
Height, cm	165.9±8.4
Weight, kg	74.1±13.3
Body mass index	27.0±4.5
Marital status (married)	270 (96.4%)
Diabetes mellitus	82(29.3%)
Smoking	73 (26.1%)
Opium addiction	60 (21.4%)
Cardiopulmonary bypass time, min	112.4±55.2
Blood product transfusion, units	4.98±2.84
Intubation time, d	1.09±0.43

Two patients were excluded from the analysis due to re-exploration in the operating room for controlling excessive bleeding, resulting in a final study sample of 278 patients. Sensitivity and specificity percentages were calculated based on the frequencies obtained from these participants. The analysis revealed that the sensitivity of the diagnostic tool was 25% (95% CI, 11.5% to 43.4%), and the specificity was 100% (95% CI, 98.5% to 100%). The overall sensitivity and specificity of the test were found to be 62% (95% CI, 55% to 70%). These results are presented visually in Table 2.

Utilizing the obtained frequencies, sensitivity and specificity percentages were calculated. The analysis demonstrated a sensitivity of 34.4% (95% CI, 18.6% to 53.2%) and a specificity of 100% (95% CI, 98.5% to 100%). Furthermore, the overall sensitivity and specificity of the test were found to be 65% (95% CI, 59% to 75%). Table 3 presents these results visually, offering a clear representation of the diagnostic performance in terms of sensitivity and specificity.

The analysis demonstrated that both diagnostic tools had a PPV of 100%. Conversely, the NPV was found to be 91.1% for CAM-ICU and 92.1% for NEECHAM. Additionally, the Kappa coefficient, which measures the agreement between the tools and the reference standard, was determined to be 0.73.

Table 2: Diagnosis of Delirium Using the CAM-ICU Tool Compared With DSM-IV

		Delirium Assessed Using the CAM-ICU Tool		
		positive	negative	Total
Delirium Assessed using DSM-IV	positive	8	24	32
	negative	0	246	246
Total		8	270	278

Table 3: Diagnosis of Delirium Using the NEECHAM Tool Compared With DSM-IV

		Delirium Assessed Using the NEECHAM Tool		
		positive	negative	Total
Delirium Assessed using DSM-IV	positive	11	21	32
	negative	0	246	246
Total		11	267	278

DISCUSSION

The present study aimed to compare the diagnostic accuracy of CAM-ICU and NEECHAM tools against the DSM-IV diagnostic criteria as the reference standard for diagnosing delirium following CABG. The findings demonstrated that the total sensitivity and specificity indices for both tools were similar, with values of 62% and 67%, respectively. Although there was no significant difference in these indices, the PPV and NPV results for both tools were acceptable when compared with the DSM-IV criteria. Consequently, these tools can be considered valid for diagnosing delirium or ruling it out. Still, it is essential to acknowledge that the sensitivity of these tools is somewhat limited, while their convergence is satisfactory. Thus, neither tool can be considered superior to the other, and they may be used interchangeably in clinical settings. [24-28]

In the current study, the frequency of delirium was observed in 12% of participants based on the DSM-IV criteria. Nonetheless, the CAM-ICU tool identified delirium in 2.9% of participants, while the

NEECHAM tool detected delirium in 3.9% of participants. These results are comparable to a study conducted by Fathi et al, [29] which investigated the incidence of postoperative delirium in the ICU following CABG. Their findings demonstrated a 2.7% incidence rate of delirium as assessed by the CAM-ICU tool. In a study conducted by Serafim et al, [30] the prevalence of delirium in non-intubated ICU patients was examined, revealing a 2.9% prevalence rate when assessed using the CAM-ICU tool. The discrepancies in delirium incidence between the aforementioned studies and the current research can be attributed to several factors. These include differences in sample size, patient characteristics, type of admission (elective or emergency), average age of participants, research settings, and time points for delirium evaluation. These factors may influence the reported prevalence of delirium. In addition, other studies have indicated that the incidence of delirium can be influenced by factors such as disease severity, the specific assessment scale employed, and the reasons for hospitalization. In the present study, 3.9% of participants were identified as having delirium based on the NEECHAM tool. Sharafi et al, [31] who investigated the effect of using earplugs and eye masks during sleep on delirium in ICU patients, showed in their study that the incidence of delirium was 24.61% with the NEECHAM tool.

In the current study, approximately 12% of participants were identified as having delirium based on the DSM-IV criteria. These findings are comparable to a study conducted by Falk et al, [32] which examined the prevalence of delirium in cardiac patients. Their results indicated an overall delirium prevalence rate of 26%. Wu et al [33] reported that the overall prevalence of postoperative delirium in elderly patients in their study was 26.2%. Various factors may contribute to differences in delirium prevalence across studies, including the timing of delirium assessment, the age group of the studied population, patients' sex, and the type of surgery. Notably, many of the referenced studies focused on patients undergoing hip or orthopedic surgery, whereas the present study examined patients following cardiac surgery.

In the present study, the CAM-ICU tool demonstrated a sensitivity of 25% and a specificity of 98.5%, with an overall test sensitivity and specificity of 62%. These findings differ from those reported in a study conducted by Karci et al, [34] where the CAM-ICU scale showed a sensitivity of 100% and a specificity of 98.3% when compared with the DSM-IV criteria. The observed difference in sensitivity and specificity between the studies may be attributed to variations in the type of patients included and the average age of participants. In the current study, the NEECHAM tool demonstrated a sensitivity of 34.4% and a specificity of 98.5%. An earlier study found that the NEECHAM tool demonstrated a sensitivity of 97.2% and a specificity of 82.8% in diagnosing delirium. [35] These results contrast with those reported by Karci et al, [34] where the NEECHAM scale exhibited a sensitivity of 88.9% and a specificity of 97.5% when compared with the DSM-IV criteria. The discrepancies in sensitivity and specificity across studies may be attributable to several factors, including differences in the patient populations studied, variations in the average age of participants, research settings, and the timing of delirium assessments.

In the present study, the CAM-ICU tool demonstrated a sensitivity of 25% and a specificity of 98.5%, yielding an overall test sensitivity and specificity of 62%. Meanwhile, the NEECHAM tool showed a sensitivity of 34.4% and a specificity of 98.5%, resulting in a combined sensitivity and specificity of 67%. These findings

suggest that there is no significant difference between the 2 tools in diagnosing delirium following CABG. Locihová et al [36] conducted a study comparing the CAM-ICU and NEECHAM tools for assessing delirium in non-intubated ICU patients. Their findings indicated that the incidence of delirium detection differed between the 2 tools, with the NEECHAM scale identifying patients at risk of delirium earlier due to its self-classification model. As a result, they concluded that the NEECHAM scale was a more reliable delirium assessment tool. Nevertheless, these findings are not consistent with the results of the present study, which demonstrated no significant difference between the 2 tools in diagnosing delirium following CABG. In a study conducted by Van et al, [37] it was concluded that the NEECHAM scale outperformed the CAM-ICU scale in identifying delirium. The authors attributed this superiority to the NEECHAM scale's ability to differentiate between various levels of delirium, a feature not present in the CAM-ICU scale. However, these findings are not in agreement with the results of the present study, which found no significant difference between the 2 tools in diagnosing delirium following CABG. Karci et al [34] compared the CAM-ICU and NEECHAM tools in the ICU and showed that the former was a sensitive and specific screening test and could be applied more swiftly than the latter in the ICU.

The discrepancies between the aforementioned studies and the present study can be attributed to a variety of factors. These include differences in the patient populations, such as the type of patients studied, the severity of their illness, and the reasons for their hospitalization. Additionally, variations in the average age of participants, the research settings, and the timing of delirium evaluations may have contributed to the divergent findings.

Chen et al [37] conducted a study demonstrating the superiority of the CAM-ICU tool in diagnosing delirium among patients receiving mechanical ventilation. One possible reason for the divergent findings in the present study may be the differences in the inclusion criteria. The current study included patients without endotracheal tubes who had a level of consciousness higher than 10, whereas the study by Chen and colleagues focused on intubated patients. Their findings emphasized the CAM-ICU tool's effectiveness in diagnosing delirium specifically within the context of mechanical ventilation.

Moreover, preoperative risk factors such as age, lower functional status, and weaker cognitive function are associated with the severity of postoperative delirium in patients. Specifically, preoperative cognitive status has been shown to have a negative relationship with the occurrence of delirium following surgery. [33] Guenther et al [25] suggested that a combination of factors, including age, the Charlson equivalence index, the MMSE score, and the length of CPB, could be utilized to predict postoperative delirium in cardiac surgery patients, potentially affecting the incidence of delirium. Additionally, the time of evaluation plays a significant role in diagnosing delirium, as assessing symptoms only once a day may be insufficient due to fluctuations in symptoms throughout the day. [32]

CONCLUSIONS

This study's objective was to compare the diagnostic accuracy of CAM-ICU and NEECHAM tools with the DSM-IV diagnostic criteria for diagnosing delirium following CABG. The results demonstrated no significant difference between the 2 tools in diagnosing delirium in this context, suggesting that each tool possesses equal

value and validity. Consequently, either tool can be effectively utilized to diagnose delirium after CABG.

Early diagnosis of delirium is vital for critically ill patients in the ICU, as delirium can lead to decreased performance, longer hospital stays, increased morbidity and mortality rates, poor prognosis, and higher healthcare costs. Identifying risk factors and investigating preventive measures can help reduce morbidity, mortality, and healthcare costs, playing a significant role in improving patient outcomes.

One challenge in delirium diagnosis is the lack of knowledge among caregivers regarding the use of standardized tools. Based on the results of this study, employing the CAM-ICU and NEECHAM tools can aid in addressing this issue and improving delirium diagnosis.

Limitations

This study has several limitations that should be considered when interpreting the results. Firstly, delirium assessments were conducted only on the first day after CABG. Evaluating delirium over a longer duration may reveal different patterns of postoperative delirium incidence. Additionally, the study focused solely on patients undergoing CABG, and patients who received heart valve or aortic arch surgeries might experience different postoperative delirium patterns.

REFERENCES

1. Orobtsova M, Gorelik S, Belousova O, Avdeeva I, Krupenkina LJAoRI. Prevention of Cognitive Frailty in Patients of Older Age Groups after Open-Heart Surgery under Cardiopulmonary Bypass. 2022; 77(3):1113-23.
2. Ailawadi G, Zacour RKJSC. Cardiopulmonary bypass/extracorporeal membrane oxygenation/left heart bypass: indications, techniques, and complications. 2009; 89(4):781-96.
3. Almashrafi A, Elmontsri M, Aylin PJBhsr. Systematic review of factors influencing length of stay in ICU after adult cardiac surgery. 2016; 16(1):1-12.
4. Lannemyr L, Bragadottir G, Krumbholz V, Redfors B, Sellgren J, Ricksten S-EJA. Effects of cardiopulmonary bypass on renal perfusion, filtration, and oxygenation in patients undergoing cardiac surgery. 2017; 126(2):205-13.
5. Evora PRB, Bottura C, Arcêncio L, Albuquerque AAS, Évora PM, Rodrigues AJJACB. Key points for curbing cardiopulmonary bypass inflammation. 2016; 31:45-52.
6. Azarfarin R, Ashouri N, Totonchi Z, Bakhshandeh H, Yaghoubi AJRicm. Factors influencing prolonged ICU stay after open heart surgery. 2014; 3(4).
7. Mangusan RF, Hooper V, Denslow SA, Travis LJAJocc. Outcomes associated with postoperative delirium after cardiac surgery. 2015; 24(2):156-63.
8. Patel M, Onwochei DN, Desai NJBJoA. Influence of perioperative dexmedetomidine on the incidence of postoperative delirium in adult patients undergoing cardiac surgery. 2022.
9. Ince I, Chiu A, Sagir A, Chahar P, Lin J, Douglas A, et al. Association of pain with atrial fibrillation and delirium after cardiac surgery: a DECADE sub-study. 2021; 35(10):3021-6.
10. Ordóñez-Velasco LM, Hernández-Leiva EJAoca. Factors associated with delirium after cardiac surgery: A prospective cohort study. 2021; 24(2):183.
11. Jin Z, Hu J, Ma DJBjoa. Postoperative delirium: perioperative assessment, risk reduction, and management. 2020; 125(4):492-504.
12. O'Neal JB, Shaw ADJPM. Predicting, preventing, and identifying delirium after cardiac surgery. 2016; 5:1-8.
13. Hollinger A, Siegemund M, Goettel N, Steiner LAJJoc, anesthesia v. Postoperative

delirium in cardiac surgery: an unavoidable menace? 2015; 29(6):1677-87.

14. Van Rompaey B, Schuurmans MJ, Shortridge-Baggett LM, Truijen S, Elseviers M, Bossaert LJCC. A comparison of the CAM-ICU and the NEECHAM Confusion Scale in intensive care delirium assessment: an observational study in non-intubated patients. 2008; 12(1):1-7.

15. 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). 2001; 286(21):2703-10.

16. Balková M, Tomagová MJCEJoN, Midwifery. Use of measurement tools for screening of postoperative delirium in nursing practice. 2018; 9(3):897-904.

17. Ho MH, Montgomery A, Traynor V, Chang CC, Kuo KN, Chang HC, Chen KHJWoEBN. Diagnostic performance of delirium assessment tools in critically ill patients: a systematic review and meta-analysis. 2020; 17(4):301-10.

18. Poikajärvi S, Salanterä S, Katajisto J, Junttila KJBn. Validation of Finnish Neecham confusion scale and nursing delirium screening scale using confusion assessment method algorithm as a comparison scale. 2017; 16(1):1-10.

19. Csokasy JJANR. Assessment of acute confusion: use of the NEECHAM Confusion Scale. 1999; 12(1):51-5.

20. Smit L, van der Jagt MJNJoCC. Delirium in the ICU–A structured review of promising diagnostic and therapeutic approaches: Next steps in ICU delirium. 2020; 28(3):126-33.

21. Kallenbach T, Amado LJSAJoA, Analgesia. Assessment of delirium in the intensive care unit. 2017; 23(3):4-10.

22. R, Alizadehasl A. Prevalence and intensity of hyperglycemia in non-diabetic patients undergoing coronary artery bypass graft surgery with and without cardiopulmonary bypass. Saudi Medical Journal, 2008, 29(9): 1294–1298.

23. Karci O, Serin S, Sungurtekin HJA, Analgesia. Abstract PR125: A Comparison Between Confusion Assessment Method in Intensive Care Unit (Cam-Icu) And Neelon-Champagne (Neecham) Confusion Scale. 2016; 123(3S):166.

24. Gemert van LA, Schuurmans MJJBn. The Neecham Confusion Scale and the Delirium Observation Screening Scale: capacity to discriminate and ease of use in clinical practice. 2007; 6:1-6.

25. Guenther U, Popp J, Koecher L, Muders T, Wrigge H, Ely EW, Putensen CJJocc. Validity and reliability of the CAM-ICU Flowsheet to diagnose delirium in surgical ICU patients. 2010; 25(1):144-51.

26. Mirinejad M, Azarfarin R, Asl AA. Cisatracurium in cardiac surgery - Continuous infusion vs. bolus administration. Middle East Journal of Anesthesiology, 2007, 19(3): 563–572.

27. Yaghoubi A, Safaie N, Azarfarin R, Alizadehasl A, Golzari SE. Evaluation of cardiovascular diseases and their risk factors in hospitalized patients in East Azerbaijan province, Northwest Iran: A review of 18323 cases. Journal of Tehran University Heart Center, 2013, 8(2): 101–105.

28. Greaves D, Psaltis PJ, Davis DH, Ross TJ, Ghezzi ES, Lampit A, et al. Risk factors for delirium and cognitive decline following coronary artery bypass grafting surgery: a systematic review and meta-analysis. 2020; 9(22):e017275.

29. M Fathi, S Amini, G Soltani, Z Abbasi. The relationship between STS risk score and post-operative delerium in ICU in of pump coronary artery bypass graft surgery. medical journal of MUMS 2021 63(6): 2004-2010.
DOI:10.22038/MJMS.2021.17605

30. Serafim, R. B., Dutra, M.F., Saddy, F., Tura, B., De Castro, J. E. C., Villarinho, L. C., Da Gloria Santos, M., Bozza, F. A. Delirium in postoperative nonventilated intensive care patients: risk factors and outcomes. Annals of intensive care 2012 2, 1-6.

31. Sharafi S, Hajiabadi F, Malekzadeh J, Bahrami M. The effect of using earplugs and

eye mask during sleep on delirium in intensive care unit patients. J Crit Care Nurs 2019 8(3): 125-132.

32. Falk, A., Kåhlin, J., Nymark. C., Hultgren, R., Stenman, M. Depression as a predictor of postoperative delirium after cardiac surgery: a systematic review and meta-analysis. Interactive cardiovascular and thoracic surgery 2021 32: 371–379.

33. Wu, Y., Shi, Z., Wang, M., Zhu, Y., Li, C., Li, G., Marcantoni, E. R., Xie, Z. & Shen, Y. J. P. O. Different MMSE score is associated with postoperative delirium in young-old and old-old Adults. PloS one 2015 10(10): e0139879.

34. Karci, O., Serin, S., Sungurtekin, H. J. A. & ANALGESIA 2016. Abstract PR125: A Comparison between Confusion Assessment Method in Intensive Care Unit (Cam-Icu) And Neelon-Champagne (Neecham) Confusion Scale. Anesthesia & Analgesia 2016 123(3S): 166. DOI: 10.1213/01.ane.0000492530.87208.a8

35. Delvin JW, Fong JJ, Fraser GL. Riker RR J. Delirium assessment in the critically ill. Intensive care medicine 2007 33(6):929-940.

36. Locihová H, Pelikánová J. Comparing the Confusion Assessment Method for the Intensive Care Unit and Neelon and Champagne Confusion Scale for assessing delirium in non-intubated intensive care patients. Journal of nursing and social sciences related to health and illness 2022 DOI: 10.32725/kont.2022.006.

37. Chen TJ, Chung YW, Chang HCR, Chen PY, Wu CR, Hsieh SH. Chiu H. Diagnostic accuracy of the CAM-ICU and ICDSC in detecting intensive care unit delirium: a bivariate meta-analysis. International journal of nursing studies 2021 113: 103782.