Duran *et al. BMC Anesthesiology* (2024) 24:350
https://doi.org/10.1186/s12871-024-02735-y

BMC Anesthesiology

RESEARCH

Open Access

The effect of two different modes of anaesthesia maintenance on postoperative delirium in elderly patient with low preoperative mini-cog score

Harun Tolga Duran[1*], Mehmet Kızılkaya[1], Aslı Aydinli[1], Sadık Osmantevfik[1], Serkan Taştan[1], Osman Özgür Kılınç[1] and Yavuz Pirhan[2]

Abstract

Background Postoperative delirium is a common distressing symptom experienced following laparoscopic cholecystectomy. The study aimed to investigate the influence of a low preoperative Mini-Cog testing score and 2 different anesthesia methods: total intravenous anaesthesia (TIVA) versus sevoflurane, on postoperative delirium in elderly patients undergoing laparoscopic cholecystectomy.

Methods A total of 84 patients over 60 years old who underwent laparoscopic cholecystectomy between March 1and – October 1 2023 were included in the study. Patients with a Mini-Cog score of 0–2 were considered to have low and possibly impaired neurocognitive function. We invastigated the effects of preoperative Mini-Cog score and the two anesthesia methods used on the incidence of postoperative delirium.

Results The proportion of patients with low Mini-Cog score in the preoperative period was 17.9%. Sevoflurane and TIVA was used in 41 and 43 patients respectively. The incidence of postoperative delirium in patients with low preoperative Mini-Cog scores was 66.7% at postoperative 0 h and 33.3% at the 1st hours. Postoperative delirium was found to be statistically higher in patients with low Mini-cog scores than in those with negatively-screened for Mini-cog scores (p: 0.01–0.035). In patients using sevoflurane, the incidence of postoperative delirium was 26.8% and 24.4% at the 0 and 1st hours, respectively. This was found to be statistically higher than in patients receiving TIVA (p: 0.036 – 0.010).

Conclusion Low Mini-Cog score was an indicator of a higher risk of early postoperative delirium. Sevoflurane is more likely to cause postoperative delirium than TIVA.

Trial registration The study was registered on ClinicalTrials.gov (Identifier: NCT06597812) .

Keywords Postoperative delirium, Mini-cog, Anaesthesia

*Correspondence:
Harun Tolga Duran
Htd0561@gmail.com

[1]Department of Anesthesiology and Reanimation, Amasya University Sabuncuoglu Serefettin Training and Research Hospital, No, Amasya 55100, Turkey
[2]Department of General Surgery, Amasya University Sabuncuoglu Serefettin Training and Research Hospital, No, Amasya 55100, Turkey

Background

Delirium as a neurocognitive dysfunction following anaesthesia, is frequently seen especially in elderly patients. Many factors are reported to contribute to the development of neurocognitive dysfunctions in combination with advanced age. In patients with neurocognitive dysfunctions like delirium, prolonged hospital stays, increased costs related to patient hospitalization, and increased mortality can occur [1]. Some institutions such as the American Society of Geriatrics, emphasize the importance of performing screening tests for postoperative neurocognitive dysfunction, especially in patients who are high-risk [2]. There are many tests used to screen for neurocognitive dysfunction, but problems are encountered during measurement due to the test administrator's clinical inexperince. The Mini-Cog neurocognitive function test is used as a screening test with a high success rate. Scores of 0–2 are classified as low and scores 3–5 are classified as negative-screened for neurocognitive dysfunction [3]. Reliability and validity analyses were made [4, 5]. This test that can also be used at the onset of the dementia. It is frequently used to identify patients with mild and severe dementia, and it is thought to be effective in showing the rate rehospitalization rate and a predictive indicator of mortality rate [6].

Delirium is a cognitive dysfunction characterized by inattention, loss of consciousness, and fluctuating course of cognitive dysfunction [7]. The type of surgery performed and the anaesthesia method applied can also cause some problems that might promote the development of delirium [8, 9].

In our study, we investigated the effects of preoperative Mini-cog score and two different anaesthesia methods on the incidence of postoperative delirium in elderly patients undergoing laparoscopic cholecystectomy. For this purpose, the effect of low Mini-Cog scores in the preoperative period on the incidence of delirium in the early postoperative period in elderly patients was investigated. The effect of the two different anesthesia methods used on the incidence of delirium in the early postoperative period constitutes the important hypotheses of our study. This hypothesis has two parts. The first part was the idea of how the preoperative cognitive screening test affects the early postoperative delirium incidence in patients with low screening test scores. The second part was the effect of using two different anaesthesia methods on the incidence of early postoperative delirium in patient groups with low cognitive screening test and those classified as negative-screened for neurocognitive dysfunction. There are limited literature on the screening methods performed on the day of surgery and the two different anaesthesia methods used.

Method

Study design

This was a prospective observational study conducted at Amasya University Hospital from March 1, 2023 to October 1, 2023. The study was registered on ClinicalTrials.gov (Identifier: NCT06597812). We used the CONSORT checklist when writing our report and conducted adherence with the guidelines outlined in the "STROBE" guidelines. Amasya University training and research hospital is a city hospital with 500 patient's bedspace. There are 12 anesthesiologists and 5 general surgeons who perform laparoscopic cholecystectomy and procedure is performed under general anesthesia in the operating room.

Patient and data collection

The patients were preoperatively assessed for American Society of Anesthesiologists (ASA) risk by an anesthetist and age, sex and comorbidities were recorded. The Mini-cog test was applied as a cognitive screening test by the anesthesiologist in the preoperative period and the test score was recorded. Three-word memory test, clock drawing, and visual function test was performed to evaluate the patient's cognitive functions. In this test, patients were asked to memorize three words such as umbrella, sunshine, and chair at the beginning of the test. The patients were asked to draw a clock, place the numbers in the correct places and draw the time as 11:10. They were then asked to recall the three words given earlier. The clock drawing was evaluated over 2 points and 1 point was given for each word that was successfully recalled. The Mini-Cog scores were evaluated; a score between 0 and 2 points was considered as low cognitive function and 3–5 points -was considered as negative-screened for cognitive function [9]. In the preoperative period, it was observed that there was no acute-onset fluctuation in cognitive status, inattention, disorganized thinking and no change in the level of consciousness in all patients, and it was not defined as delirium.

Inclusion criteria

There was a correlation between the incidence of delirium after the age of 60 [10]. Therefore, patients over the age of 60 who underwent planned laparoscopic cholecystectomy between March 1, 2023 and October 1, 2023 were included in the study.

Exclusion criteria

Patients' age < 60 years, patients undergoing emergency cholecystectomy or did not have preoperative Mini-Cog assessment, with a history of cerebrovaskuler insult that was thought to have an effect on postoperative delirium, patients with difficulty in cooperation, patients with hemodynamic instability(arterial blood pressure above 160/90 mmHg and below 90/60 mmHg and patients with pulse rate below 50/min and above 100/min), patients with previously diagnosed dementia, and those who had surgical procedures lasting more than 2 h were excluded from the study.

Protocol

Voluntary participants were included in the study after written informed consent was obtained. All patients were taken to the operation room after 6 h of fasting. For premedication, midazolam 1 mg and pantoprazole 40 mg were administered intravenously. Routine electrocardiogram, pulse oximetry and blood pressure monitoring were performed. Age, sex, heart rate, systolic and diastolic blood pressures, Mini-Cog score, and comorbidities were recorded in the preoperative period. Depending on the anesthesia maintenance protocol, total intravenous anesthesia (TIVA) or sevoflurane anesthesia, patients were divided into group T (TIVA) and group S (sevoflurane). The patient groups were selected by randomization method with a computer program. The TIVA protocol included; Propofol 2 mg/kg, fentanyl 2 µg/kg and rocuronium 0.6 mg/kg were administered intravenously for induction of anaesthesia, and induction was achieved with propofol 0.1–0.2 mg/kg/min and remifentanil 0.1–0.2 mg/kg/min. The sevoflurane protocol included; Propofol 2 mg/kg, fentanyl 2 µg/kg and rocuronium 0.6 mg/kg were administered intravenously for induction of anaesthesia, and induction was achieved with sevoflurane 2%. In all patients, fresh gas flow was adjusted to 3 L/min as 50% O_2-Air. After anaesthesia preparation was completed, the abdomen was entered with a 10 no trocar and routine cholecystectomy was completed with intraabdominal pressure of 12–14 mmHg with 10 L/min Co_2 insufflation. Sugammadex 200 mg was used to terminate the effect of muscle relaxants following laparoscopic cholecystetcomy and analgesia was provided with meperidine 50 mg and paracetamol 500 mg intravenously in the postoperative period.

The patients whose muscle strength allowed spontaneous breathing after surgery and whose breathing was regular were extubated. The patients who continued spontaneous breathing without support and who could lift their heads without support were taken to the postoperative care unit. Systolic blood pressure, diastolic blood pressure and heart rate values were recorded in the postoperative care unit and this was regarded as the 0 h. A neurological examination was performed by the same anesthesiologist at the 0, 1st and 2nd hours, and a delirium incidence was performed and recorded. Patients with modified Aldrete score ≥ 9 were discharged from the post-anesthesia care unit.

Study definitions

Postoperative delirium was defined as a new deterioration or fluctuation in cognitive status. Acute-onset fluctuation in cognitive status, inattention, disorganized thinking and altered level of consciousness were defined as delirium [8]. A bedside clinical assessment of the patient was performed to determine the level of attention and arousal and the presence of other cognitive deficits, psychotic features, or other mental status abnormalities. The presence of an acute change in the postoperative period in a functionally independent patient in the preoperative period supports this clinical situation.

Delirium investigation was planned in the early postoperative period by same anesthesiologist. Admission to the postoperative care unit was accepted as the 0 h and the presence of delirium was examined in the following hours. Neurological examination was performed to show whether there was delirium at the 0-, 1st, and 2nd hours. Postoperative delirium incidences, heart rate, systolic blood pressure, diastolic blood pressure, and comorbidity characteristics were statistically compared in patients with and without low preoperative Mini-Cog scores.

In addition, two different anesthesia methods were used in these patients. Preoperative Mini-Cog scores, heart rate, systolic blood pressure, diastolic blood pressure, comorbidity features and delirium incidence at the 0-, 1st, and 2nd hours postoperatively were compared statistically in group S and T patients.

Primary outcome

The primary outcome was to determine the effect of preoperative Mini-Cog score and the two different anesthesia methods on the incidence of delirium in the early postoperative period in elderly patients undergoing laparoscopic cholecystectomy.

Secondary outcome

The secondary outcome was to determine the effects of two different anesthesia methods on the incidence of postoperative delirium in patients with normal preoperative Mini-Cog scores.

Ethics considerations

The study was conducted in Amasya Sabuncuoğlu Şerefettin Training and Research Hospital. Ethics committee approval numbered 2023/11 was obtained from Amasya Sabuncuoğlu Şerefettin Training and Research Hospital Clinical Research Ethics Committee.

Sample size

The sample size was calculated with the G power 3.1.9.4 program using the study of Fiamarya [11]. The effect size was calculated was 38 per group (accepting type I error of 0.05 and a power of 0.80). The total number of patients was calculated as 76. In order to prevent possible missing data, 84 patients were included in the study.

Statistical analysis

The study data were evaluated using "-SPSS (Statistical Package for Social Sciences) 22.0 (SPSS Inc, Chicago, IL)" software. Descriptive statistics were presented as mean ± standard deviation median (max, min), frequency distribution and percentage. The Pearson Chi-Square Test and Fisher's Exact Test were used in the evaluation of categorical variables. The conformity of the variables to normal distribution was analyzed using visual (histogram and probability graphs) and analytical methods (Kolmogorov-Smirnov Test/Shapiro Wilk Test). The Mann-Whitney U Test was applied for statistical significance between two independent groups for the variables that were found not to conform to normal distribution. For the variables found to fit the normal distribution, the Student's T test was used for statistical significance between two independent groups and the paired Sample T test was used between two dependent groups. The confidence interval was accepted as 95%. A statistical significance level was accepted as $p<0.05$.

Results

The data of a total of 84 patients were analysed. While 82.1% ($n=69$) of the patients had normal Mini-Cog scores, the remaining 17.9% ($n=15$) had low Mını-Cog scores.

Anaesthesia maintenance was achieved with TIVA in 51.2% ($n=43$) of the patients and with sevoflurane in the remaining 48.8% ($n=41$).

Age, gender, comorbidities and low cognitive status in group S and group T patints had no observable statistical difference between the functional statuses. It was observed that the incidence of delirium in the postoperative 0 -and 1st hours was statistically higher in group S patients compared to group T patients (p: 0.036-P:0.010). The patients with low preoperative Mini-cog scores were distributed as 19.5% ($n=8$) in group S patients and 16.3% ($n=7$) in group T patients (Table 1).

In group S, systolic and diastolic blood pressure values were statistically similar (p: 0.405–0.507). In group T, the postoperative systolic blood pressure was higher than that in the preoperative period (p: 0.01). The diastolic blood pressure was similar (p: 0.422). The diastolic blood pressure was statistically higher in group S in the preoperative and postoperative periods (p: 0.026−0.010) (Table 2).

Statistically, the incidence of delirium at the 0 and 1st hours was higher in patients with low Mini-Cog scores(0 h 66.7%, 1st hour 33.3%)- than in patients with normal Mini-Cog scores(0 h 7,2%, 1st hour 10,1%) (p: 0.01–0.035). Hypertension was found to be statistically higher in patients with low cognitive dysfunction (P:0.023). It was observed that the incidence of delirium was statistically higher in the 0 and 1st hours of the postoperative period in patients with low Mini-Cog score (P: <0.001-P:0.0035). No statistical difference was observed between other variables (Table 3).

The delirium incidence at the 0 h in 66.6% ($n=10$) of 15 patients with low Mini-Cog scores in the preoperative 0 _hour. A total of 70% ($n=7$)- of these patients were in group S and 30% ($n=3$)- were in group T.

Table 1 Descriptive characteristics, preoperative Mini-cog score and incidence of postoperative delirium according to the anesthesia method

		Total ($n=84$)	**Group S($n=41$)**	**Group T ($n=43$)**	***p***
Age (years)		66.5 ±4.6 (60–79)	66.4 ±4.6 (60–77)	66.7 ±4.8 (60–79)	0.854 [a]
Sex					
	Male	40 (47.6)	19 (46.3)	21 (48.8)	0.819 [b]
	Female	44 (52.4)	22 (53.7)	22 (51.2)	
Hypertension		34 (40.5)	16 (39.0)	18 (52.9)	0.791 [b]
Diabetes mellitus		23 (27.4)	10 (24.4)	13 (30.2)	0.548 [b]
Heart disease		14 (16.7)	8 (19.5)	6 (14.0)	0.494 [b]
Mini-Cog score (Preoperative)		4.1 ±1.2 (1–5)	4.0 ±1.3 (1–5)	4.2 ±1.2 (1–5)	0.749 –
Mini-Cog score (Preoperative)					
	Low	15 (17.9)	8 (19.5)	7 (16.3)	0.699 [b]
	Normal	69 (82.1)	33 (80.5)	36 (83.7)	
Incidence of postoperative delirium					
	0.hour	15 (17.9)	11 (26.8)	4 (9.3)	**0.036b *–**
	1. hour	12 (14.3)	10 (24.4)	2 (4.7)	**0.010b *–**
	2 .hours	4 (4.8)	3 (7.3)	1 (2.3)	0.354c –

Continuous variables are presented as "mean ±standard deviation (minimum-maximum)", categorical variables are presented as "number (column percentage)"; [a] Mann-Whitney U Test; [b] Pearson Chi-Square Test; [c] Fisher's Exact Test; *$p<0.05$

Table 2 Comparison of hemodynamic parameters according anaesthesia method

	Total ($n = 84$)	Group S ($n = 41$)	Group T ($n = 43$)	p^a
SBP (mmHg)				
Preoperative	138.0 ±19.4 (100–191)	141.9 ±21.3 (103–191)	134.2 ±16.8 (100–169)	0.068
Postoperative	144.4 ±18.7 (102–186)	144.9 ±17.1 (112–180)	144.0 ±20.4 (102–186)	0.823
p^b	***0.004****	*0.405*	***0.001****	
DBP (mmHg)				
Preoperative	73.9 ±11.7 (55–104)	76.8 ±12.0 (58–104)	71.1 ±10.6 (55–103)	**0.026***
Postoperative	75.3 ±11.4 (54–112)	78.3 ±12.4 (61–112)	72.4 ±10.0 (54–99)	**0.015***
p^b	*0.313*	*0.507*	*0.422*	
HR (beats/ min)				
Preoperative	78.5 ±12.4 (51–102)	79.2 ±13.2 (51–102)	77.8 ±11.7 (57–100)	0.594
Postoperative	76.5 ±13.3 (50–112)	77.4 ±13.6 (53–112)	75.7 ±13.1 (50–104)	0.568
p^b	*0.294*	*0.473*	*0.452*	

Variables are presented as "mean ±standard deviation (minimum-maximum)", categorical variables are presented as "number (column percentage)"; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; HR : Heart rate; [a] Student's T Test; [b] Paired Sample T Test; *$p < 0.05$

Table 3 Descriptive characteristics and the incidence of postoperative delirium according to preoperative Mini-cog score

		Total ($n = 84$)	Low ($n = 15$)	Normal ($n = 69$)	p
Age (years)		66.5 ±4.6 (60–79)	71.5 ±3.9 (63–78)	65.4 ±4.1 (60–79)	<0.001a*
Sex					
	Male	40 (47.6)	8 (53.3)	32 (46.4)	0.625 [b]
	Female	44 (52.4)	7 (46.7)	37 (53.6)	
Hypertension		19 (40.5)	10 (66.7)	24 (34.8)	**0.023b** *–
Diabetes mellitus		23 (27.4)	5 (33.3)	18 (26.1)	0.542c –
Heart disease		14 (16.7)	4 (26.7)	10 (14.5)	0.264c –
Mini-Cog Score		4.1 ±1.2 (1–5)	1.7 ±0.5 (1–2)	4.6 ±0.5 (4–5)	<0.001a*
Incidence of Postoperative Delirium					
	0.hour	15 (17.9)	10 (66.7)	5 (7.2)	<0.001c*
	1.hour	12 (14.3)	5 (33.3)	7 (10.1)	**0.035c***_
	2 .hours	4 (4.8)	2 (13.3)	2 (2.9)	0.145c –

Continuous variables are presented as "mean ±standard deviation (minimum-maximum)", categorical variables are presented as "number (column percentage)"; [a] Mann-Whitney U Test; [b] Pearson Chi-Square Test; [c] Fisher's Exact Test; *$p < 0.05$

The delirium incidence at 1st hour in 41.6% ($n = 5$) of 12 patients with low Mini-cog scores in the preoperative 0th hour. A total of 80% ($n = 4$) of these patients were in group S and 30% ($n = 1$) were in group T.

No statistical difference was observed between preoperative and postoperative systolic blood pressure, diastolic blood pressure and heart rate in patients with low Mini-Cog scores (p: 0.258-0.963-0.487). The systolic blood pressure was statistically higher in the postoperative period compared to the preoperative period in patients with normal Mini-Cog scores, (p: 0.009). The diastolic blood pressure and heart rate were statistically similar (p: 0.219 – 0.106) (Table 4).

Of the patients with normal Mini-Cog scores in the preoperative period ($n = 69$), there were 33 patients in group S and 36 in group T. There was no statistically significant difference between the groups in terms of the incidence of postoperative delirium at the 0, 1st -, and 2nd -hours in group S and group T patients (p: 0.186-0.702-1.000) (Table 5).

Discussion

A high rate of cognitive dysfunction is observed in elderly patients who are planned to undergo surgery [12]. The incidence in people over 60 years of age is in the range of 3–18%. One of the leading causes of unfavorable postoperative outcomes is perioperative neurofunctional disorders [13]. Similarly in our study, cognitive dysfunction was observed with a postoperative rate of 17.9%. In addition, when the independent variables of the delirium incidence in the early postoperative period were analyzed, age and low Mini-Cog scores were found to be effective (Table 3). The Mini-Cog test can be used as a simple and easy-to-administer cognitive function screening test and it can be administered quickly and easily compared with other cognitive function tests such as the mini mental test [3]. In some studies, delirium incidence in the postoperative period is frequently observed in geriatric patients. The incidence of postoperative delirium in patients undergoing laparoscopic cholecystectomy varies between 10 and 40% [14–16]. In our study, this rate was 17.9%. When patients with low Mini-Cog test score

Table 4 Comparison of hemodynamic variables according to the preoperative Mini-cog score

	Total ($n=84$)	Low ($n=15$)	Normal ($n=69$)	p^a
SBP (mmHg)				
Preoperative	138.0 ±19.4 (100–191)	139.2 ±22.0 (100–171)	137.7 ±18.9 (103–191)	0.789
Postoperative	144.4 ±18.7 (102–186)	144.7 ±24.0 (102–180)	144.4 ±17.6 (104–186)	0.957
p^b	***0.004****	*0.258*	***0.009****	
DBP (mmHg)				
Preoperative	73.9 ±11.7 (55–104)	75.5 ±12.3 (55–104)	73.6 ±11.6 (55–103)	0.568
Postoperative	75.3 ±11.4 (54–112)	75.3 ±11.8 (60–104)	75.3 ±11.4 (54–112)	0.994
p^b	*0.313*	*0.963*	*0.219*	
HR (beats/min)				
Preoperative	78.5 ±12.4 (51–102)	78.7 ±14.5 (52–99)	78.4 ±12.0 (51–102)	0.930
Postoperative	76.5 ±13.3 (50–112)	82.4 ±13.6 (60–104)	75.3 ±13.0 (50–112)	0.059
p^b	*0.294*	*0.487*	*0.106*	

Variables are presented as "mean ±standard deviation (minimum-maximum)", categorical variables are presented as "number (column percentage)"; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; HR : Heart rate; [a] Student's T Test; [b] Paired Sample T Test; *$p<0.05$

Table 5 Incidence of postoperative delirium according to the anesthesia method on preoperative normal Mini-cog score patients

	Total ($n=69$)	Group S ($n=33$)	Group T($n=36$)	P
Incidence of postoperative delirium				
0.hour	64(64)	4 (2,4)	1(2,6)	0.186c-
1. hour	62 (62)	4(3,3)	3(3,7)	0.702c-
2 .hours	67 (67)	1(1)	1(1)	1.000c-

[a] Mann-Whitney U Test; [b] Pearson Chi-Square Test; [c] Fisher's Exact Test; *$p<0.05$

in the preoperative period were compared with classified as negative-screened for patients, the probability of delirium incidence in the early postoperative period (0-1st hours) was statistically higher in the patient group with low Mini-Cog score (Table 3). When compared with the same patient groups, age, sex, comorbidities and hemodynamic findings were similar between the both groups. From this point of view, we believe that the Mini-Cog test is a valuable neurocognitive function test in the geriatric patient group as an indicator of delirium development in the early postoperative period.

Postoperative delirium is frequently seen in elderly patients and in the postoperative period. It causes an increase in both hospitalization time and complication rates. Anaesthesia maintenance with sevoflurane is a commonly used method and is preferred by most patients. Alternatively, anaesthesia maintenance can be achieved with TIVA because side effects such as postoperative nausea and vomiting are less. However, the effects of TIVA on cognitive functions in the postoperative period compared with sevoflurane are unclear. The effects of agents used in anaesthesia maintenance on postoperative delirium are not clear [17]. Jiang et al. [18] examined the delirium incidence following anaesthesia maintenance with sevoflurane or propofol-based TIVA in patients undergoing cardiopulmonary bypass surgery and similarly, no statistical difference was observed between the groups. In another study of 209 patients, the delirium incidence after anaesthesia maintenance with propofol and sevoflurane in elderly patients was investigated. As a result, it was statistically observed that the incidence and duration of delirium was more frequent in the propofol group than in the sevoflurane group [19]. Considering their different sedative and anti-inflammatory effects, propofol and sevoflurane could have different effects on postoperative delirium. There are many studies comparing the effects of propofol and sevoflurane on postoperative delirium; however, the results are inconsistent [20] .Some studies have reported that delirium incidence following sevoflurane use is up to 67% and appears to be more frequent in patients who rapidly recover from sevoflurane anaesthesia [21]. On the other hand, there are examples of studies in which delirium is observed more frequently because hemodynamic changes are more dramatic with propofol-based TIVA use [19]. In our study, when the patients who used sevoflurane or TIVA for anaesthesia maintenance were compared, the rate of delirium incidence in the early postoperative period was statistically higher in the sevoflurane group (Table 1). The diastolic blood pressure values were statistically lower in the TIVA group while other vital signs were similar between the groups.

Other results of our study suggest that the delirium incidence in the early postoperative period may be due to a slower awakening process between the groups. However, in our study, as can be seen in the Daignostic and Statistical Manualof Mental Disorders (DSM-5) diagnostic criteria [22], 'attention disorder and orientation difficulty are observed due to attention deficit. 'The disorder develops over a short period of time'. Therefore, we think that the patients defined as delirious in our study are related to the surgery and the anesthesia applied. We think that agitated patients may have a tendency to behave aggressively towards pain or environmental stimuli, unlike those with delirium.

In our study, we statistically compared the incidence of delirium in the early postoperative period in patients with normal Mini-Cog scores for cross-examination. The results show that the incidence of delirium at the 0-, 1st -, and 2nd postoperative hours was similar in group S and group T patients (Table 5). It was observed that both preoperative low Mini-cog score and the applied anaesthesia method were effective on the incidence of postoperative delirium (Tables 1, 2 and 3). However, it was observed that the anaesthesia method applied in patients with normal Mini-cog scores did not affect the incidence of postoperative delirium (Table 5). Therefore, it can be thought that the use of sevoflurane in patients with low Mini-cog scores increased the incidence of delirium in the early postoperative period.

Limitations

This was a single-center, hospital-based study. Early hours were preferred for postoperative delirium examination. This situation can be confused with the time it takes to wake up from anesthesia. However, defining it in accordance with the DSM-5 diagnostic criteria is a suitable option for clinicians.

Conclusion

In our study, elderly laparoscopic surgery patients with a Mini-Cog score between 0 and 2 in the preoperative period were statistically more likely to delirium incidence in the postoperative period. As such, that the rate of early delirium incidence with low Mini-Cog score in the 0, and 1st hours of the postoperative period was higher in patients using sevoflurane compared with those patients using TIVA. It can be considered that low Mini-Cog test scores may predict the incidence of postoperative delirium in elderly patients undergoing elective cholecystectomy. We believe that the use of sevoflurane for maintenance of anesthesia in patients with low Mini-Cog test scores may cause an increase in the incidence of delirium compared to the use of TIVA.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12871-024-02735-y.

Supplementary Material 1

Supplementary Material 2

Acknowledgements

Not applicable.

Author contributions

HTD conducted the study, inputted and analysed the data, and wrote the manuscript. MK, SO, AA and YP conducted the study, collected the data, and performed follow-ups. ST. and AA, HTD designed the study. SO, OÖK Conducted the study, interpreted the data, and revised the manuscript. All the authors have read and approved the final version of the manuscript. All authors contributed equally to the manuscript and have read and approved the final version.

Funding

There is no financial support.

Data availability

The data that support the findings of this study are not openly available due to reasons of sensitivity and are available from the corresponding author upon reasonable request. Data are located in controlled access data storage at Amasya University.

Declarations

Ethics approval and consent to participate

This study was approved by MD Harun Tolga DURAN, the chairman of the Clinical Research Ethics Committee of Amasya university Hospital (2023/11]), and written informed consent was obtained from all participants.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Presentation

Not applicable.

Authors' information

Not applicable.

Received: 18 June 2024 / Accepted: 19 September 2024
Published online: 01 October 2024

References

1. Tiwary N, Treggiari MM, Yanez ND, Kirsch JR, Tekkali P, Taylor CC, Schenning KJ. Agreement between the Mini-cog in the preoperative clinic and on the day of surgery and association with postanesthesia care unit delirium: a cohort study of cognitive screening in older adults. Anesth Analgesia. 2021;132(4):1112–9.
2. American Geriatrics Society Expert Panel on Postoperative Delirium in Older Adults. Postoperative delirium in older adults: best practice statement from the American Geriatrics Society. J Am Coll Surg. 2015;220:136–e148131.
3. Borson S, Scanlan JM, Chen P, Ganguli M. The Mini-cog as a screen for dementia: validation in a population-based sample. J Am Geriatr Soc. 2003;51(10):1451–4.
4. Babacan Y, Özçelik E, Kolukisa M, Turan I, Gürsoy A, Kocaman E, G., Celebi A. (2016). Validity and reliability studies of modified Mini Mental State examination (MMSE-I) for Turkish illiterate patients with diagnosis of Alzheimer Disease. Turkish J Psychiatry, *27*(1).
5. Gedik G. Turkish validity and reabilityof Mini-Cog test for evulation of cognitive funcrion (2015) Yüksek Öğretim Kurulu Master thesis (P:82).
6. Shami A, Brennan M, Marie PS, Lindenauer PK, Stefan MS. The association of cognitive impairment as screened by the Mini-cog with long term post-hospitalization outcomes. Arch Gerontol Geriatr. 2019;85:103916.
7. Pereira JV, Sanjanwala RM, Mohammed MK, Le ML, Arora RC. Dexmedetomidine versus propofol sedation in reducing delirium among older adults in the ICU: a systematic review and meta-analysis. Eur J Anaesthesiology| EJA. 2020;37(2):121–31.
8. Yajima S, Nakanishi Y, Matsumoto S, Ookubo N, Tanabe K, Kataoka M, Masuda H. The Mini-cog: a simple screening tool for cognitive impairment useful in predicting the risk of delirium after major urological cancer surgery. Geriatr Gerontol Int. 2022;22(4):319–24.

9. Racine AM, Fong TG, Gou Y, Travison TG, Tommet D, Erickson K, Inouye SK. Clinical outcomes in older surgical patients with mild cognitive impairment. Alzheimer's Dement. 2018;14(5):590–600.
10. Jing GW, Xie Q, Tong J, Liu LZ, Jiang X, Si L. Early intervention of Perioperative Delirium in older patients (> 60 years) with hip fracture: a randomized controlled study. Orthop Surg. 2022;14(5):885–91. https://doi.org/10.1111/os.13244. Epub 2022 Apr 19.
11. Fiamanya S, Ma S, Yates DRA. The association between preoperative Mini-Cog© score and postoperative delirium (POD): a retrospective cohort study. Perioperative Med. 2022;11(1):1–7.
12. -Mini-Cog©. Mini-Cog. Mini-Cog: screening for cognitive impairment in older adults. [Internet]. [cited 2018 Feb 8]. https://mini-cog.com
13. Chen D, Chen J, Yang H, Liang X, Xie Y, Li S, Ding L, Li Q. Mini-cog to predict postoperative mortality in geriatric elective surgical patients under general anesthesia: a prospective cohort study. Minerva Anestesiol. 2019;85(11):1193–200.
14. Aoki Y, Kurita T, Nakajima M, Imai R, Suzuki Y, Makino H, Kinoshita H, Doi M, Nakajima Y. Association between remimazolam and postoperative delirium in older adults undergoing elective cardiovascular surgery: a prospective cohort study. J Anesth. 2023;37(1):13–22.
15. Ristescu AI, Pintilie G, Moscalu M, Rusu D, Grigoras I. Preoperative cognitive impairment and the prevalence of postoperative delirium in Elderly Cancer Patients-A prospective observational study. Diagnostics (Basel). 2021;11(2):275. https://doi.org/10.3390/diagnostics11020275. PMID: 33578953; PMCID: PMC7916677.
16. Park YM, Seo HI, Noh BG, Kim S, Hong SB, Lee NK, Kim DU, Han SY. Postoperative delirium after cholecystectomy in older patients: a retrospective study. Ann Hepatobiliary Pancreat Surg. 2023;27(3):301–6. https://doi.org/10.14701/ahbps.23-012. Epub 2023 Jun 20. PMID: 37336783; PMCID: PMC10472127.
17. Miller D, Lewis SR, Pritchard MW, Schofield-Robinson OJ, Shelton CL, Alderson P, Smith AF. Intravenous versus inhalational maintenance of anaesthesia for postoperative cognitive outcomes in elderly people undergoing non-cardiac surgery. Cochrane Database Syst Rev. 2018;8(8):CD012317.
18. Jiang JL, Zhang L, He LL, Yu H, Li XF, Dai SH, Yu H. Volatile Versus Total Intravenous Anesthesia on postoperative delirium in adult patients undergoing cardiac valve surgery: a Randomized Clinical Trial. Anesth Analg. 2023;136(1):60–9. https://doi.org/10.1213/ANE.0000000000006257.
19. - Mei X, Zheng HL, Li C, Ma X, Zheng H, Marcantonio E, Xie Z, Shen Y. The effects of Propofol and Sevoflurane on postoperative delirium in older patients: a Randomized Clinical Trial Study. J Alzheimers Dis. 2020;76(4):1627–36. https://doi.org/10.3233/JAD-200322.
20. Wang JH, Lv M, Zhang HX, Gao Y, Chen TT, Wan TT, Wang YL. Impact of propofol versus sevoflurane on the incidence of postoperative delirium in elderly patients after spine surgery: study protocol of a randomized controlled trial. Trials. 2022;23(1):720. https://doi.org/10.1186/s13063-022-06687-x.
21. - Yang X, Lin C, Chen S, Huang Y, Cheng Q, Yao Y. Remimazolam for the Prevention of Emergence Delirium in Children following Tonsillectomy and Adenoidectomy under Sevoflurane Anesthesia: a randomized controlled study. Drug Des Devel Ther. 2022;16:3413–20. https://doi.org/10.2147/DDDT.S381611.
22. Krueger RF, Hobbs KA. An overview of the DSM-5 Alternative Model of Personality disorders. Psychopathology. 2020;53(3–4):126–32. https://doi.org/10.1159/000508538. Epub 2020 Jul 9.

Publisher's note