COMPARISON OF GENERAL AND SPINAL ANESTHESIA IN TERMS OF POSTOPERATIVE COGNITIVE DECLINE USING THE MMSE AND MOCA AFTER MINOR ELECTIVE SURGERY IN ELDERLY PATIENTS

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Abstract

Introduction and aim Postoperative cognitive dysfunction is an important complication associated with increased morbidity, mortality, and reduced quality of life. Generally studies have focused on major surgery, while there is little evidence of the incidence of cognitive dysfunction in minor surgery. We aimed to compare general and spinal anesthesia in terms of cognitive decline in elderly patients after elective minor surgery using the Mini-mental state examination and Montreal cognitive assessment. Material and methods This observational study was conducted June 2014 to March 2015 at Ankara Numune Education and Research Hospital. The Mini-mental state examination and Montreal cognitive assessment scores were evaluated before and one day after the operation. Results The postoperative Mini-mental state examination scores of patients (26.23±2.77) were significantly lower than the preoperative scores (27.17±1.93) only in the general anesthesia group (p =0.003), while the postoperative Montreal cognitive assessment scores (22.87±3.88 for general and 23.13±4.08 for spinal anesthesia) were lower than the preoperative scores (24.32±3.19 for general and 24.35±2.84 for spinal anesthesia) in both the general and spinal anesthesia groups (p =0.000 and 0.019, respectively). The Postoperative cognitive dysfunction incidence was 32.9% using the Montreal cognitive assessment and was not significantly different between anesthesia methods. Conclusion Early Postoperative cognitive dysfunction is an important problem after elective minor surgeries, even with spinal anesthesia, in elderly patients. The Montreal cognitive assessment is an alternative tool that can be applied in a short time for screening cognitive functions in elderly patients. The cognitive screening of elderly patients perioperatively may be beneficial.

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anesthesia in terms of cognitive decline in elderly patients after elective minor surgery using the Mini-mental state examination and Montreal cognitive assessment.

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The Postoperative cognitive dysfunction incidence was 32.9% using the Montreal cognitive assessment and was not significantly different between anesthesia methods.

Conclusion

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KEYWORDS: MMSE; Mini Mental State Examination; Montreal Cognitive Assessment; Postoperative Cognitive Dysfunction; ; Anesthesia; Spinal

INTRODUCTION

Currently similar to the world demographic structure, the population of Turkey is rapidly aging, and in 2023, it is estimated that the number of people over 65 will rise to 8.87 million (10.2% of the total population)[1]. Therefore, it can be predicted that anesthesiologists will have to deal more with elderly patients in the near future. Anesthesiologists encounter many problems in elderly patients, who have reduced efficacy of physiological functions. Postoperative pulmonary, cardiovascular, and renal complications are more likely to occur and adversely affect outcome in elderly patients[2]. In addition, postoperative cognitive dysfunction (POCD) is another frequent complication associated with increased morbidity, mortality, and reduced quality of life[2,3].

Most POCD studies have focused on cardiac or non-cardiac major surgery, and the incidence or severity of POCD may vary depending on the type of surgery, cognitive assessment time, POCD definition, and neuropsychological testing tools[4-8] . Cognitive decline is usually noticed by the patient's family and can also be detected by comparison of preoperative and postoperative neuropsychological testing. Despite the importance of POCD, for elderly patients undergoing elective surgical procedures, evaluation of cognition is often overlooked[9]. There are few studies of POCD in minor surgical procedures and outpatient cases in elderly patients, although the minor surgeries accounts for a large proportion of the surgical burden[10-12] . Certain negative features of the hospital environment, such as noise and preoperative anxiety, may impair cognitive functions in elderly patients, even in minor and outpatient surgeries[10,11] .

The Mini Mental State Examination (MMSE) is a widely used cognitive assessment tool to detect POCD in multiple cognitive domains, including orientation, registration, attention and calculation, immediate recall, language, short-term memory, and construct ability. The time required for examination is 5–15 minutes, but it has high specificity and low sensitivity to detect mild cognitive impairment[13-15] . On the other hand, the Montreal Cognitive Assessment (MoCA) is a new cognitive screening tool for multiple cognitive domains, including short-term memory, visuospatial skills, executive function, attention, concentration and working

memory, language, and orientation. The MoCA has high sensitivity and specificity to detect patients with mild cognitive impairment performing in the normal range on the MMSE[15-17].

In this prospective blinded observational study, we aimed to compare general and spinal anesthesia in terms of early postoperative cognitive decline and to determine the burden of this decline in elderly patients after elective minor surgery (inguinal herniorrhaphy). Our hypothesis was that the MoCA can detect more elderly patients with cognitive decline, even in the neuraxial anesthesia group.

METHODS

This prospective observer blind cohort study was conducted at Ankara Numune Education and Research Hospital between June 2014 and March 2015 after obtaining approval from the Institutional Ethics Committee (dated on 06/18/2014 and numbered E-14-216) and written informed consent from the patients. The inclusion criteria were fluency in Turkish, age [?] 65, ASA I–III, and being scheduled for elective inguinal herniorrhaphy. The exclusion criteria were an MMSE score < 24 in preoperative examination, suffering from diseases of the central nervous system, use of antidepressant or antipsychotic medication, alcohol or drug abuse, and being illiterate.

The MMSE and MoCA scores were evaluated in a quiet room and recorded by a blinded researcher during the preoperative visit at a desk and one day after the operation in quiet conditions in the sickbed. During the preoperative examination, we recorded the patient's age, gender, ASA score, BMI, comorbidities, information on previous anesthesia management, and routine intraoperative monitoring data (non-invasive blood pressure, heart rate, and pulse oximetry) from the patient's medical file. Postoperative complications and discharge times were also noted.

STATISTICAL ANALYSIS

Discrete data were expressed as numbers and percentages, while continuous variables were reported as mean and standard deviation when normally distributed, along with the median and minimum and maximum values. According to the suitability of the normal distribution of the data for the comparison of continuous variables, the t-test or Mann–Whitney U-test were used. To compare nominal data, the chi-square test or Fisher exact test were utilized. The Wilcoxon test served for the comparison of the MMSE and MoCA measurements before and after anesthesia in each anesthesia group. The analysis was performed with SPSS 11.5, and $p < 0.05$ was accepted as the statistical significance limit.

RESULTS

In the preoperative period, we evaluated 87 patients, among which 17 (19.5%) were excluded because of an MMSE < 24. The demographic characteristics of the patients are summarized in Table 1. The general and spinal anesthesia groups were similar in terms of mean age, BMI, distribution of gender, ASA scores, and comorbidity percentages ($p > 0.05$).

The intraoperative characteristics are summarized in Table 2. In the spinal anesthesia group, the duration of operation was significantly longer compared to the general anesthesia group ($p = 0.003$) . The intraoperative mean arterial pressure, SpO_2, heart rate levels, and postoperative length of hospital stay were similar between groups.

The postoperative MMSE scores were significantly lower than the preoperative scores only in the general anesthesia group ($p = 0.003$), while the postoperative MoCA scores were lower than the preoperative scores in both the general and spinal anesthesia groups ($p = 0.000$ and 0.019, respectively, as seen in Table 3). The intraclass correlation coefficient (ICC) between the MMSE and MoCA was found to be statistically significant ($p < 0.01$; Table 4).

According to the postoperative MoCA measurements, the incidence of POCD (MoCA < 21) [17] was similar between the general and spinal anesthesia groups (31.9% [n = 15] and 34,7% [n = 8], respectively, with $p = 0.810$) and the overall incidence was 32.9% (n = 23). The gender distribution was similar between POCD and normal patients (the F/M [n%] ratios were 6/17 [21.6%/73.9%] and 7/39 [15.2%/84.8%], respectively,

with p = 0.334). The mean age, duration of operation, and postoperative laboratory parameters were also similar between the POCD group (MoCA < 21) and normal group (MoCA [?] 21) (Table 5).

DISCUSSION

The present prospective observational study of 70 patients aged [?] 65 years undergoing elective inguinal hernia repair demonstrated a significant burden of early POCD. To our knowledge, the literature on POCD is generally concentrated on cardiovascular and orthopedic surgery, and there are only a few articles on minor surgeries, which constitute the majority of cases[5,6,10,11]. In a sample of 30 patients who underwent cystoscopy or hysteroscopy, Rohan et al. reported that POCD was present in 47% of patients who received propofol and 47% of patients who received sevoflurane[11]. In our observational study involving 70 patients, the incidence of early POCD was similar between the general and spinal anesthesia groups (31.9% and 34.7%, respectively, with p = 0.810), with an overall incidence of 32.9%.

Current evidence in the literature shows that there is no long-term cognitive impairment attributable to surgery and anesthesia[18,19] . However, considering that, in the early postoperative period, POCD may adversely affect quality of life and patient outcomes, it can be assumed that cognitive screening via neuropsychiatric tests is important both for elderly patients' outcomes and hospital costs[9] .

Although many neuropsychiatric tests with different advantages have been previously used for cognitive screening, it is unclear which of them is more effective in screening for POCD. In agreement with the current literature[15-17], our study showed that the MoCA test could detect cognitive decline in both the general and spinal anesthesia groups, while the MMSE test only in the general anesthesia group.

When we examined the demographic characteristics of the patients with and without POCD, the anesthesia method used, duration of operation, and laboratory results, we could not find any differences between the groups. Similar results have been obtained in the literature, where no variation was observed for different intraoperative anesthesia techniques in patients with POCD [20]. The reason for not being able to determine the factors causing POCD may be due to the limitations of our study, enumerated as follows.

First, the influence of characteristics such as anxiety and sociocultural levels, which may have affected the cognitive functions of the patients, was not investigated, as we focused on medical features such as laboratory results, comorbidities, and the anesthesia method used. However, preoperative anxiety and low educational attainment have been reported to be associated with an increased risk of decline in executive function[21] . Second, the pain levels of the patients were not determined. Postoperative pain is a modifiable factor that has been shown to be associated with delirium and cognitive decline[20].

CONCLUSION

Early POCD is a frequent and important problem after elective minor surgeries in elderly patients, even in the case of spinal anesthesia. Although the MMSE is a widely used neuropsychiatric screening tool, it may not be able to detect a significant number of cases. The MoCA is a suitable alternative that can be performed in a short time. The cognitive screening of elderly patients in the preoperative period is beneficial both medical and legally.

The authors declare no conflicts of interest.

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Table 1: Demographics of patients

Variable	General anesthesia (n = 47)	Spinal anesthesia (n = 23)	p value*

Variable	General anesthesia (n = 47)	Spinal anesthesia (n = 23)	p value*
Age (year), mean ± SD	69.72 ± 4.74	69.43 ± 4.16	0.809
BMI (kg/ m^2), mean ± SD	27.59 ± 2.98	27.0 ± 3.18	0.459
Gender, n(%)			
Female Male	8 (17.4) 38 (82.6)	5 (21.7) 18 (78.3)	0.663
ASA scores, n(%)			
I II III	1 (2.3) 41 (95.3) 1 (2.3)	1 (4.3) 19 (82.6) 3 (13)	0.128
Comorbidities, n(%)	16 (34) 3 (6.4) 7 (14.9)	10 (43.5) 5 (18) 7	0.443 0.104 0.202 1.000
Hypertension Diabetes mellitus Heart disease Renal disease	1 (2.1)	(30.4) 0 (0)	

* t-test/chi-squared test – Fisher's exact test

Table 2: Intraoperative characteristics of the groups

Variable	General anesthesia (n = 47)	General anesthesia (n = 47)	Spinal anesthesia (n = 23)	p value
Duration of operation (min) Mean ± SD Median (min−max)	Duration of operation (min) Mean ± SD Median (min−max)	54.89 ± 20.47 60 (30−90)	71.30 ± 18.96 75 (45−120)	**0.003***
Mean arterial pressure (mmHg) Mean ± SD Median (min−max)	Mean arterial pressure (mmHg) Mean ± SD Median (min−max)	98.72 ± 12.28 97 (81−145)	101.57 ± 10.69 102 (83−133)	0.234*
SpO_2 Mean ± SD Median (min−max)	SpO_2 Mean ± SD Median (min−max)	98.0 ± 1.45 98 (95−100)	97.65 ± 1.58 98 (94−100)	0.410*
Heart rate Mean ± SD Median (min−max)	Heart rate Mean ± SD Median (min−max)	82.96 ± 11.62 82 (60−104)	81.83 ± 11.71 78 (68−108)	0.460*
Length of hospital stay (days) Median (min−max)	Length of hospital stay (days) Median (min−max)	1 (0−16)	4 (0−10)	0.080**

* Mann-Whitney U-test ** t-test/chi-squared test – Fisher's exact test

Table 3: Comparison of preoperative and postoperative MMSE and MoCA scores in the general and neuraxial anesthesia groups

Variable	**Preoperative score**	**Postoperative score**	**p value***
MMSE in general anesthesia Mean ± SD Median (min−max)	27.17 ± 1.93 27 (24−30)	26.23 ± 2.77 27 (20−30)	**0.003**
MMSE in spinal anesthesia Mean ± SD Median (min−max)	26.96 ± 1.92 28 (24−30)	26.61 ± 2.74 27 (19−30)	0.531
MoCA in general anesthesia Mean ± SD Median (min−max)	24.32 ± 3.19 25 (18−30)	22.87 ± 3.88 22 (16−29)	**0.000**
MoCA in spinal anesthesia Mean ± SD Median (min−max)	24.35 ± 2.84 25 (20−30)	23.13 ± 4.08 23 (15−29)	**0.019**

*Wilcoxon test

Table 4: Correlation of the MMSE and MoCA according to the intraclass correlation coefficient (ICC)

	ICC	p value	95% confidence interval	95% confidence interval
MMSE & MoCA	0.789	0.000	Lower bound 0.682	Upper bound 0.864

Table 5: Comparison of patients with normal cognitive function and POCD according to age and laboratory parameters

Variable	Normal (Postoperative MoCA [?] 21)	Normal (Postoperative MoCA [?] 21)	POCD (Post
	Mean ± SD	**Median (min−max)**	**Mean ± SI**
Age (years)	69.02 ± 4.18	68 (65−82)	70.83 ± 5.05
Duration of operation (min)	61.28 ± 21.15	60 (30−120)	58.26 ± 21.9
Blood glucose(mg/dL)	93.51 ± 18.09	89 (65−148)	102.74 ± 25.
Urea (mg/dL)	39.52 ± 13.66	36.5(20−77)	41.14 ± 16.0
Creatinine (mg/dL)	1.12 ± 0.47	1.03 (0.63−3.12)	1.04 ± 0.21
Sodium (mEq/L)	138.36 ± 2.44	139 (130−143)	132.33 ± 29.
WBC (µl/ml)	8.04 ± 2.31	7.8 (4.5−14.80)	7.57 ± 2.26
Hgb (g/dL)	13.64 ± 1.78	14.1 (9.5−16.5)	13.57 ± 1.41

* t-test/Mann-Whitney U-test