Impact of Different Regional Anesthesia Techniques on Postoperative Cognitive Functions in Geriatrics Undergoing Cataract Surgery

Katarakt Cerrahisi Uygulanan Geriatrik Hastalarda Farklı Rejyonel Anestezi Tekniklerinin Postoperatif Bilişsel Fonksiyonlar Üzerine Etkisi

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ABSTRACT

Introduction: Postoperative cognitive dysfunction (POCD) has become a major concern for anesthesiologists and surgeons, particularly in elderly who already have limited cognitive status. General anesthesia is a well known risk factor for this entity. However, there is insufficient data regarding the association between regional anesthesia and POCD. This study aimed to investigate the impact of different regional anesthesia techniques on the development of POCD in elderly patients undergoing cataract surgery.

Methods: The patients above 65 years who underwent cataract surgery were enrolled in this study. All patients were assigned to one of two anesthesia groups; topical anesthesia group (n=16) and retrobulbar blockade group (n=25). Cognitive status was assessed preoperatively and postoperatively (1st hour, 1st day, and 1st week), using Blessed Orientation-Memory-Concentration (BOMC) test.

Results: The groups were similar in terms of age, gender, American Society of Anesthesiologist score, educational status, and baseline hemodynamic values (p>0.05). Postoperative lower BOMC scores were found in both groups at all 3 times when compared to preoperative scores however differences were not statistically significant. There were no differences in all BOMC scores between the groups (p>0.05).

Conclusion: Both topical and retrobulbar blockade anesthesia had no significant effect on the development of POCD in geriatric patients undergoing cataract surgery.

Key words: Cataract surgery, geriatrics, postoperative cognitive dysfunction, regional anesthesia, topical anesthesia.

ÖZET

Giriş: Postoperatif bilişsel işlev bozukluğu (POBİB), özellikle sınırlı bilişsel kapasiteye sahip geriatrik hastaların yönetiminde, anestezistler ve cerrahlar için önemli bir endişe haline gelmiştir. Genel anestezi, bu antite için bilinen bir risk faktörüdür. Bununla birlikte, rejyonel anestezi ile POBİB arasındaki ilişki hakkında yeterli veri yoktur. Bu çalışma, katarakt ameliyatı geçiren yaşlı hastalarda farklı rejyonel anestezi tekniklerinin POBİB gelişimine etkisini araştırmayı amaçladı.

Yöntemler: Bu çalışmaya katarakt ameliyatı geçiren 65 yaş üstü hastalar alındı. Tüm hastalar iki anestezi grubundan birine atandı; topikal (n=16) ve retrobulbar (n=25). Bilişsel durum preoperatif ve postoperatif (1. saat, 1. gün ve 1. hafta) Blessed Orientation-Memory-Concentration (BOMC) testi ile değerlendirildi.

Bulgular: İki anestezi grubu yaş, cinsiyet, American Society of Anesthesiologist skoru, eğitim durumu ve başlangıç hemodinamik değerleri açısından benzerdi (p>0,05). Tüm gruplarda anestezi sonrası BOMC skorları preoperatif BOMC skorlarına göre azalmıştı. Gruplar arasında tüm zamanlardaki BOMC puanlarında da farklılık yoktu (p>0,05).

Sonuç: Katarakt cerrahisi uygulanan geriatrik hastalarda hem topikal hem de lokal anestezinin POBİB gelişimi üzerinde anlamlı bir etkisi yoktu.

Anahtar Kelimeler: Geriatrik, katarakt cerrahisi, postoperatif bilişsel fonksiyon bozukluğu, rejyonel anestezi, topikal anestezi.

INTRODUCTION

Postoperative cognitive dysfunction (POCD) is a clinical phenomenon characterized by various neuropsychological disorders such as impairment in memory and orientation, declined psychomotor dexterity, and reduced social integration (1, 2). This entity is observed approximately in one forth of the surgical patients, the majority of whom are elderly (3).

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Although POCD usually limits itself within the first days or weeks after surgery, morbidity and mortality associated with this phenomenon is more common in the geriatric population (4). Prolonged hospitalization and increased health costs are also other negative consequences related to POCD (5).

Although general anesthesia, especially inhalation agents, is generally considered to be more associated with the occurence of POCD among all types of anesthesia, various local anesthetic drugs, such as lidocaine, have been recently shown to lead cognitive dysfunction due to their neurotoxic effects (6-9). The haemodynamic effects of the anesthesia technique may also have negative results on cognitive function in the elderly who have already limited cognitive capacity (4, 7, 10). Therefore, POCD has become one of the major concerns for anesthesiologists and surgeons.

Cataract surgery is one of the most frequently performed ophthalmic operations, particularly in older population. These patients have lower cardiorespiratory capacity and more concomitant chronic diseases compared to younger patients. Therefore, there is an increasing trend towards the use of regional anesthesia techniques rather than general anesthesia in this patient group. However, the impact of regional anesthesia on cognitive functions has not been clearly determined yet. In addition, there is no specific study compared the effect of different regional anesthesia techniques on cognitive functions of the elderly undergoing cataract surgery.

In this study, we aimed to investigate the impact of two frequently used anesthetic techniques, retrobulbar block and topical anesthesia, on the development of POCD in geriatric patients undergoing cataract surgery.

METHODS

General Data

After obtaining the local ethics committee approval (permit no/date: 2020/28), the patients who underwent elective cataract surgery at a tertiary care university hospital between September 2019 and March 2020 were enrolled in this prospective study. The written informed consents were obtained from each participant. Preoperative routine anesthetic assessments were employed for all patients. Patients' age, gender, and educational level, American Society of Anesthesiologist (ASA) physical status, procedural data, anesthetic techniques, and perioperative anesthesia-related complications were recorded.

Inclusion and Exclusion Criteria

The inclusion criteria were ASA physical status I-III, age above 65 years, and a sufficient level of education to be able to complete neuropsychological tests. Significant neurological and psychiatric disorder, serious hearing or visual impairment, psychiatric drug (benzodiazepine, antidepressant, and etc.) and alcohol use, and allergy to study medications were the exclusion criteria.

Anesthetic Techniques

The fasting times were set as at least eight hours before surgery. No premedication or sedoanalgesia was given to patients. Standard monitoring included five-lead electrocardiogram, noninvasive blood pressure, and pulse oximetry. Preanesthetic mean arterial pressure (MAP) and heart rate (HR) were noted. Patients were classified into two groups; topical anesthesia (Group T) and retrobulbar blockade (Group R).

Topical anesthesia was performed in supine position by the ophthalmic surgeon. Proparacaine hydrochloride (0.5%, single dose) was dropped into the conjunctival sac. Subsequently, 1% lidocaine (without an additive) was applied into the anterior chamber.

Retrobulbar blockade was performed by the ophthalmic surgeon. In supine position, the inferolateral point of the inferior orbital margin was palpated while the patient's nose was towards the ceiling of the operating room.

Table 1. Comparison of baseline characteristics between the two groups

	Group T (n= 16)	Group R (n= 25)	p
Age (y)	68 (18)	68 (20)	0.655
Gender			0.530
female	9 (56.3%)	11 (44%)	
male	7 (43.7%)	14 (56%)	
ASA status			0.977
ASA 1	1 (6.3%)	2 (8%)	
ASA 2	11 (68.7%)	17 (68%)	
ASA 3	4 (25%)	6 (24%)	
Educational status	13 (81.3%)	22 (88%)	0.890
elementary	1 (6.3%)	1 (4%)	
high school	2 (12.5%)	2 (8%)	
university			
History of surgery	4 (25%)	5 (20%)	0.092
Operation time (min)	25 (35)	30 (30)	0.064
MAP (baseline)	110 (58)	111 (55)	0.885
MAP (10th min)	104.5 (57)	113 (55)	0.217
MAP (15th min)	106 (62)	113 (55)	0.435
MAP (30th min)	99.5 (37)	111 (49)	0.166
HR (baseline)	81 (46)	76 (45)	0.179
HR (10th min)	78.5 (43)	73 (45)	0.404
HR (15th min)	79.5 (41)	71 (37)	0.702
HR (30th min)	80 (28)	72 (38)	0.259

Data are presented as median (interquantile range) for age, operation time, Mean arterial pressure (MAP), and heart rate (HR) values; n (%) for other variables. y: year, min: minute

Subsequently, a blunt 25 gauge needle was inserted into subcutaneous tissue at the junction of the middle and lateral third of the orbit in the lower eyelid. While the patient was looking supranasally and perpendicularly, the needle was inserted in 35 angle towards the apex of the muscle cone. After aspiration to prevent intravascular injection, 3-4 ml of local anesthetic (mixture of 2% lidocaine and 0.5% bupivacaine, in equal proportions) were injected. In order to provide proper distibution of local anesthetic, the injection site was patted for 2-5 minutes.

HR, MAP, peripheral oxygen saturation, and en-tidal carbondioxide were monitored continuously during the procedure. Intraoperative HR and MAP values were recorded at 10th, 15th, and 30th minutes. After the procedure, all patients were followed up in the recovery room for at least 30 minutes.

Evaluation of Cognitive Status

Cognitive status was evaluated by Blessed Orientation-Memory-Concentration test (BOMC), with scores ranging from 0 to 28 (11). Each wrong answer is one point whereas each correct answer is zero point, meaning that higher scores are associated with worse cognitive level. The BOMC is a short cognitive screening tool, available in the public domain, which can be completed in a few minutes. This diagnostic tool is consisted of three main items including orientation, concentration, and memory. Orientation is evaluated with patient report of the current year, month, and time of day. Concentration is assessed by having the patient count backward from twenty to one and say the months in reverse order. Memory is evaluated through delayed recall of a brief phrase. A Turkish version of BOMC test was used in the study (12). The patients were evaluated by BOMC test four times throughout the study; preoperative (baseline), postoperative 1st hour, 1st day, and 1st week.

Statistical Analysis

A priori power analysis (G power 3.01) showed that a sample size of 15 patients per group was required to achive a power of 90% with a significant level of 5% and moderate effect size (0.25) for evaluating the differences of BOMC scores between the groups. The Statistical Package for Social Science (SPSS 21.0 software, IL-Chicago-USA) standard version was used for data analysis. Descriptive analyses were presented as number/percentage for categorical variables, and median (interquantile range) for continuous variables.

Chi square, Fisher's exact test, and Mann Whitney U test were used to assess the differences between the patient groups. Significance level was accepted as p< 0.05.

RESULTS

A total of 41 patients with a mean age of 71 years old (65-85) were included in the study. There were 20 (48.8%) females and 21 (51.2%) males. All patients were operated on the diagnosis of elective cataract, and were classified into two groups according to the type of anesthesia; topical anesthesia group (Group T, n=16) and retrobulbar blockade group (Group R, n=25). In univariate analysis, both groups were similar in baseline characteristics including age, gender, ASA physical status, educational status, and history of surgery (p>0.05). The mean operation time and intraoperative hemodynamic values were also statistically similar between the two groups (p>0.05). The comparison of all baseline patient characteristics were presented in Table 1.

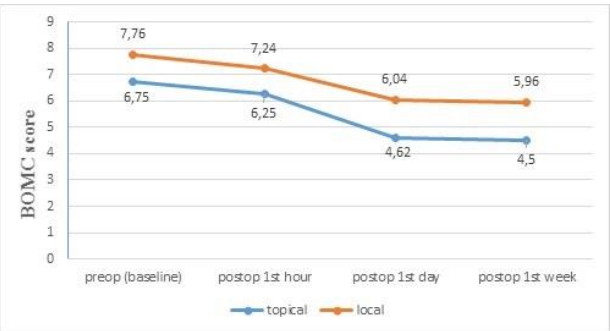

Figure 1. The graphical representation of the mean preoperative (baseline) and postoperative (1st hour, 1st day, and 1st week) BOMC scores in the two anesthesia groups.
In group T; preoperative BOMC score vs postoperative 1st hour BOMC score (p=0.426), preoperative BOMC score vs postoperative 1st day BOMC score (p=0.017), preoperative BOMC score vs postoperative 1st week BOMC score (p=0.005).
In group R; preoperative BOMC score vs postoperative 1st hour BOMC score (p=0.433), preoperative BOMC score vs postoperative 1st day BOMC score (p=0.007), preoperative BOMC score vs postoperative 1st week BOMC score (p=0.006).

All postoperative BOMC scores in both groups were decreased according to the baseline (preoperative) BOMC scores. In both groups, preoperative BOMC score and 1st postoperative hour BOMC score were statistically similar whereas there were significant differences between preoperative BOMC score and postoperative 1st day/1st week BOMC scores (p<0.05). A graphical representation of the mean preoperative and postoperative BOMC scores is presented in Figure 1.

The groups were then compared to each other in terms of BOMC scores at different postoperative times. There were no differences in BOMC scores between the groups (p>0.05) (Table 2).

Table 2. Comparison of BOMC scores between the two groups

	Group T (n= 16)	Group R (n= 25)	p
BOMC (baseline)	6 (16)	8 (23)	0.682
BOMC (1st hour)	5 (16)	6 (21)	0.741
BOMC (1st day)	2 (16)	4 (21)	0.552
BOMC (1st week)	2 (16)	4 (21)	0.435

Abb. BOMC; Blessed Orientation-Memory-Concentration
Data are presented as median (interquantile range) for all variables.

The number of patients who had increased postoperative BOMC score in comparison to baseline BOMC score were also calculated. Six (24%) patients in group R and three (18.8%) patients in group T had increased BOMC scores at 1st postop. hour, in comparison to the baseline BOMC scores (p=0.692) (Table 3).

Table 3. Comparison of the number of patients who had increased postoperative BOMC score according to baseline BOMC score between the two groups

	Group T (n= 16)	Group R (n= 25)	p
BOMC increased at 1st hour	3 (18.8%)	6 (24%)	0.692
BOMC increased at 1st day	2 (12.5%)	3 (12%)	0.962
BOMC increased at 1st week	2 (12.5%)	3 (12%)	0.962

Abb. BOMC; Blessed Orientation-Memory-Concentration
Data are presented as count (percentage).

DISCUSSION

This study showed that both retrobulbar blockade and topical anesthesia had no significant negative effect on cognitive functions in geriatric patients undergoing cataract surgery. As known, regional anesthetic techniques are primarily preferred in older aged population due to the potential respiratory and cardiovasculary consequences related to general anesthesia. In addition, with the understanding the possible negative effects of inhalation agents on cognitive functions in recent years, this concern has also become one of the most important criteria in the choice of anesthesia type. This situation is also more important in geriatric patients due to their potentially limited cognitive capacity.

In recent years, significant number of studies reported the high incidence of POCD related to anesthetic drugs, particularly inhalation agents (4, 7, 13). Contrary, the impact of regional anesthesia techniques on cognitive functions has been less studied to date. Neverthless, local anesthetics, especially lidocaine, are known to be neurotoxic agents, which may potentially cause postoperative cognitive impairment. In the literature, there is insufficient data on the effect regional anesthesia methods on cognition in elderly patients undergoing cataract surgery (9, 14). The majority of published articles on this subject usually compared the incidence of POCD after general and regional anesthesia. Recently, a systematic review by Davis et al showed that only three out of sixteen studies found differences in postoperative cognitive function between general and regional anesthesia techniques (15). It should be stated here that various factors such as the absence of a standard definition of POCD, the variability of diagnostic tests used to measure cognitive deficits, and the heterogenity of study populations might be attributed to the variability of the results obtained from those studies. To us, elderlies should be considered as a special patient group due to the different physiological and psychological status. Older people have more limited cognitive capacity than youngers, and may be more severely affected by anesthetic agents. Additionally, a positive correlation between postoperative cognitive decline and long term cognitive impairment, such as increased susceptibility to brain injury or decreased reserve capacity, was previously reported (16, 17). Hence, clearly determination of the impact of regional anethesia on early cognitive functions is of great importance in this population.

In fact, whether local anesthetics caused a significant cognitive impairment is still controversial. Steinmetz et al reported that POCD associated with local anesthetics may result in decreased concentration, memory deficits, or executive dysfunctions (18). Similarly, Fathy et al demonstrated a mild cognitive impairment after use of lidocaine and bupivacaine in patients undergoing elective cataract surgery. However, the authors also reported that postoperative cognitive declined in their study can be attributed to the combined effect of surgery and local anesthesia (9).

To the best of our knowledge, there is only one study compared the effect of retrobulbar versus topical anesthesia on cognitive function in patients undergoing ophthalmic surgery (14). In that study, local anesthesia was found to cause a significant postoperative decline in neurocognitive functions compared to topical anesthesia. The authors explained their result by the fact that a larger amount of anesthetic drug was absorbed into the systemic circulation in local anesthesia compared with topical anesthesia. In our study, there was no significant decline in postoperative cognitive status in both retrobulbar and topical anesthesia groups. Contrarily, postoperative BOMC scores in both groups were decreased compared to preoperative BOMC values. In our opinion, this result was related to the increased familiarity of the patients with the questions. Even so, the present study is

important to show that regional anesthesia does not have a significant negative impact on cognitive functions. The number of patients with increased BOMC score at the postoperative 1st hour was higher in the local anesthesia group; however, this was not statistically significant. It should be stated here that there were some methodological differences between the two studies, including heterogenity of patient cohort and the tests used to assess the neurocognitive status (14). Our study was only conducted on geriatric patients, which allowed a more accurate assessment in this special group.

There are several limitations in the present study. First, the fact that the study was conducted in a single center may be considered as a limitation for generalization of the results. Second, a relatively small number of patient groups can make it difficult to interpret subgroup findings. However, considering that the present study is the first compared the impact of retrobulbar and topical anesthesia on POCD in geriatric patients undergoing cataract surgery, we hope that the results obtained from the present study may provide significant contribution to the current literature. The standard anesthesia protocols and homogeneity of the study population were the other strengths of the present work.

CONCLUSION

The results obtained from the present study showed that both retrobulbar and topical anesthesia had no significant negative effect on the development of POCD in geriatric patients undergoing cataract surgery.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Eskişehir Osmangazi University, Faculty of Medicine (2020/28).

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Conflict of Interest: No conflict of interest was declared by the authors.

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