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FEATURES OF COGNITIVE STATUS OF OPHTHALMIC PATIENTS AS A PREDICTOR OF POSTOPERATIVE COGNITIVE DYSFUNCTIONS

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ABSTRACT

The influence of the chosen method of anesthesia on cognitive functions in the postoperative period is investigated in the article. Cognitive status analysis was performed using neuropsychological testing: Frontal Assessment Battery (FAB), short-term mental status assessment scale (Mini-Mental State Examination - MMSE). The evaluation was performed in 3 stages: on the eve of surgery, 7 days after it and on the 21st day of the postoperative period. Patients were divided into two groups: group k - patients received general anesthesia with narcotic analgesics and benzodiazepines in premedication for 40 minutes, maintenance of anesthesia - sevoflurano - oxygen mixture on a low gas stream. minutes before surgery. Estimation of the depth of analgesia was monitored using ANI (Analgesia Nociception Index, index of analgesia with nociceptive effect), evaluation of the depth of sedation - by BIS (Bispectral index, Bispectral index). Patients in both groups were statistically comparable by gender and age. Given the comparative analysis of changes in neuropsychological testing on the FAB scale, the average in the group using dexmedetomidine increased by 13.3% relative to baseline. After a comparative analysis of neuropsychological testing on the MMSE scale, the indicators in the group using dexmedetomid while in the group with the "classical" method of anesthesia, they did not change significantly. Based on the data obtained, it can be argued that the use of dexmedetomidine, as a component of multimodal analgesia, has a positive effect on the state of cognitive functions in the post-anesthetic period.

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Introduction. The term "postoperative cognitive dysfunction" (POKD) was proposed in 2001 by L.S. Rasmussen to characterize postoperative cognitive deficit and identify cognitive impairments that may develop in the early and persist in the late postoperative period, clinical manifestations of which are memory impairment and other higher cortical functions (ie thinking, speech, etc.), and confirmed by neuropsychological testing in the form of a decrease in results compared to baseline by at least 10%, which causes problems with learning, reduced mental capacity and mood [1]. The anesthesiologist in ophthalmic surgery is initially faced with reduced cognitive function. This can be explained by both visual impairment and previous painful manipulations, prolonged and ineffective treatment [2]. Factors that increase the risk of developing PKD include the following anamnestic factors [3]: age over 60 years; alcoholism; smoking; decreased vision and hearing; hypertension;

previous cognitive impairment and mental disorders; APOE gene polymorphism. At the same time, the frequency of PKD significantly increases in the elderly with cognitive impairment. The iatrogenic factors in the development of PKD [4,5] include the following: use of opioids and benzodiazepines; prolonged and deep sedation; unusual situation; social isolation and loneliness; invasive methods of therapy and monitoring; immobilization; prolonged mechanical ventilation.

In our study, we observed the severity of PKD depending on the type of anesthesia in patients with initial cognitive deficits as a consequence of decreased vision [6]. The ability of the body to adapt to change in this case, Y. Stern in 2002 described as a cognitive reserve: the ability of the brain to optimize or maximize its productivity through a differential set of neuronal responses, leading to the use of alternative cognitive strategies. Since neuronal reactions in the brain associated with cognitive reserve are a normal response to the complication of the cognitive task, it means that cognitive reserve is present in both healthy and in conditions of brain pathology and is manifested in the activation of the neural connection [7]. **Objective:** To analyze and evaluate the severity of PKD depending on the type of anesthesia in patients with initial cognitive deficits as a consequence of decreased vision.

Material and methods of research.

We monitored 77 patients who underwent surgery for end-to-end keratoplasty during 2017-2018. Among them were 45 men and 32 women aged 22 to 78 years. The study was conducted in three stages: on the eve of surgery; in 7 days after surgery; in 21 days after surgery. Assessment of cognitive status was performed using neuropsychological testing on the scale of frontal dysfunction (Frontal Assessment Battery, FAB), short scale of mental status assessment (Mini-Mental State Examination, MMSE) [8]. Interpretation of the results of neuropsychological testing was performed as follows. For MMSE scale: 28-30 points are considered normal; pre-dementia disorders - 24-27 points; mild dementia - 20-23 points. For the FAB scale: 16-18 points - the norm; 12-15 points - moderate frontal dysfunction; 11 and less points - signs of frontal dementia. Anesthesia - surgical risk of patients was assessed as 1-2 class on ASA. Group k (n = 45) consisted of patients who underwent anesthesia according to the following scheme: premedication 40 minutes before surgery - sibazone 10 mg, fentanyl 0.1 mg, and intravenous ondansetron 4 mg, dexamethasone 4 mg, ketorolac 30 mg; induction was performed with propofol 2–2.5 mg / kg fractionally until the clinical effect of fentanyl 0.005% 0.1 mg; relaxation on the background of atracurium besylate 0.3-0.6 mg / kg, tracheal intubation was performed; anesthesia support: oxygen-sevoflurane mixture FiO₂ 21–55%, sevoflurane 1.4–1.8 vol.% on exhalation (1–1.5 MAC) in low gas flow.

In group d (n = 32), patients received premedication for 40 minutes intravenously: ondansetron 4 mg, dexamethasone 4 mg, ketorolac 30 mg and infusion of dexmedetomidine 0.3 mg / kg. Induction: propofol 2–2.5 mg / kg fractionally until clinical effect, fentanyl 0.005% 0.1 mg. Relaxation and maintenance of anesthesia were performed as in group k. The depth of anesthesia and the level of analgesia were monitored according to BIS- (Bispectral index, Bispectral index) and ANI - (Analgesia Nociception Index, monitoring index of nociceptive action) monitoring. In both groups, the indicators did not differ significantly and were within the optimal values [9].

Statistical processing of the study results was performed using the license package Statistica v.6.1 (StatsoftInc., USA) (№ AGAR909E415822FA). The analysis of quantitative data was performed taking into account the distribution law according to the criteria of Liliefors and Shapiro-Wilk. In cases of normal law, the arithmetic mean (M), its standard error (m), Student's criterion for independent samples (t) were used, in other cases the median (Me), interquartile range (25%; 75%), Mann-Whitney criteria were used. (U) and Wilcoxon (W). The probability of differences in relative indicators was estimated by the Pearson Chi-square criterion (χ^2). Differences at p < 0.05 (5%) were considered significant [10].

Results and discussion.

To assess the impact of anamnestic data on the development of cognitive deficits in the postoperative period, it is necessary to consider the distribution of patients by age groups in the clinic KP "DOKOL" for the period from 2017 to 2018. As can be seen, patients older than 60 years account for 32.4% of the total number of patients.

At the beginning of the study, both clinical groups were statistically comparable (p > 0.05) in terms of age and sex characteristics, baseline hemodynamics and cognitive functions (Table 1).

Table 1. General characteristics of patients in the control and main groups at the beginning of the study

Indicator		Group k (n=45)	Group d (n=32)
Gender, abs./%	male	26/ 57,8	19/ 59,4
	female	19/ 42,2	13/ 40,6
Age, years, M±m		49,9±2,4	48,8±2,5
SBP, mm Hg, M±m		136,4±3,5	126,5±2,7
DBP, mm Hg, M±m		79,7±1,8	74,4±1,7
MMSE, point, Me (25%; 75%)		24 (23; 25)	24 (23; 25)
FAB, point, Me (25%; 75%)		14 (13; 15)	15 (13; 16)

Note. $p > 0.05$ for all comparisons between the χ^2 , Student and Mann-Whitney groups for unrelated samples.

The fact of visual impairment in this study is not in doubt, as this is the main complaint when admitted to the hospital for surgery for end-to-end keratoplasty.

When analyzing the depth of anesthesia and analgesia during surgery, no significant differences were observed ($p > 0.05$), while the number of narcotic analgesics used was significantly lower in the group using dexmedetomidine (Table 2).

Table 2. Comparison of the average number of used narcotic analgesics, BIS and ANI during surgery in the study groups, M ± m

Group	The amount of narcotic analgesic, ml	Indicator ANI, C.U.	BIS indicator, C.U.
K (n ₁ = 45)	5,26±0,26*	60,6±4,8	36,4±1,3
D (n ₂ = 32)	4,52±0,26*	56,2±3,2	35,4±1,1

Note. * - $p < 0.05$ between groups, in other cases $p > 0.05$ (t-test)

When testing on the eve of surgery, the distribution of the score of cognitive function did not differ significantly by study groups ($p > 0.05$), and the indicators mostly met the criteria before dementia on the MMSE scale (57.8% and 68.7%, respectively, in groups k and d) tapomeric frontal dysfunction on the FAB scale (75.5% and 62.5%) (Fig. 1).

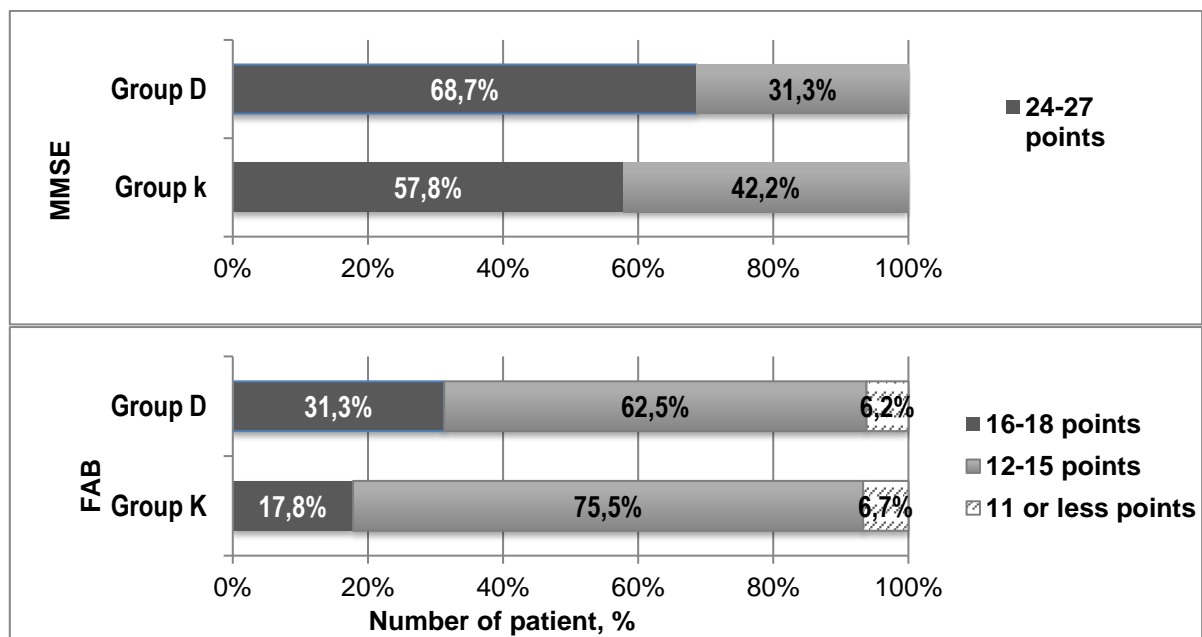


Fig. 1. The initial state of cognitive functions on the MMSE and FAB scales: $p > 0.05$ for all comparisons between groups by the criterion χ^2

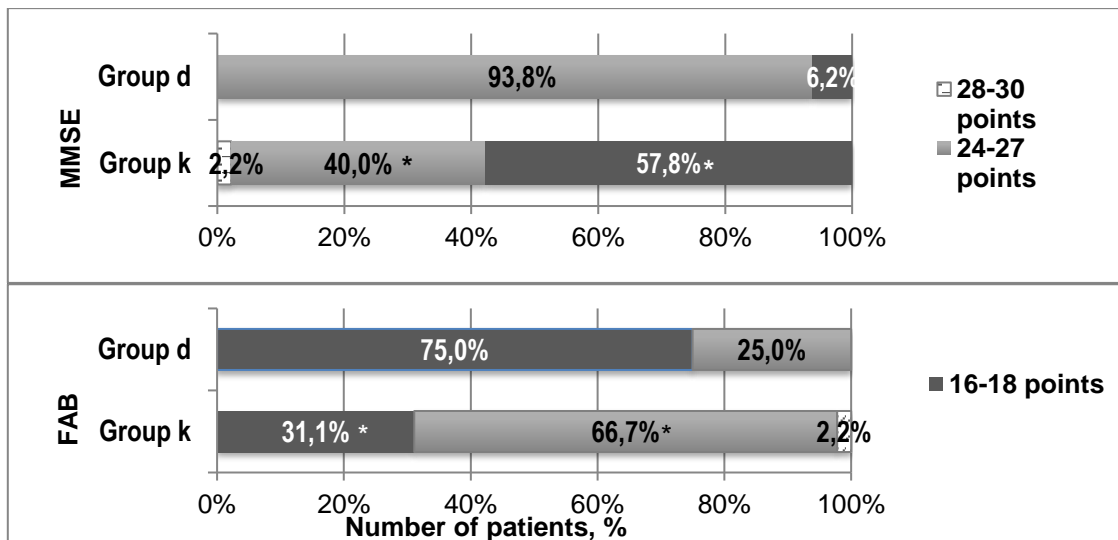


Fig. 2. The state of cognitive functions on the scales MMSE and FAB on the 21st day of the postoperative period: * - $p < 0,001$ compared with the indicators in group d (by criterion χ^2)

Analysis of neuropsychological testing data on the 21st day of the postoperative period showed changes in both groups. As can be seen from Fig. 2, in group k there were patients with indicators above 27 points on the MMSE scale, however the overwhelming number of patients remained with existence of a mild dementia (57,8%). The average score did not change significantly compared to baseline ($p > 0.05$) and amounted to 23 (22; 25) points. Other dynamics of indicators in the post-anesthesia period was observed in the group with the use of dexmedetomidine. The number of patients with MMSE scores meeting the criteria for mild dementia decreased from 10 (31.3%) to 4 (12.5%), and the overall score increased from 24 (23; 25) points to 25 (25; 25) points, ie by 4.2% ($p < 0.001$ according to the W-test of Wilcoxon). Changes in frontal dysfunction according to the FAB test in the remote postoperative period were also more pronounced in group d. The majority of surveyed patients in this group (75.0%) received scores on testing above 16, which meets the criteria of the norm (Fig. 2). The average score increased from 15 (13; 16) points to 17 (15; 18) points ($p < 0.001$ according to the Wilcoxon W-test), ie by 13.3%. In the control group of patients using the standard method of analgesia during surgery in the vast majority of subjects, the score on the FAB test met the criteria of moderate frontal dysfunction (12-15 points) (Fig. 3) and averaged 14 (13; 16) points ($p > 0.05$ compared to baseline). As a result, when compared between the groups of scores on the state of cognitive functions on the scales MMSE and FAB before surgery ($p > 0.05$) after 21 days, the state of function was significantly better in patients of group d ($p < 0.01$) (Fig. 3).

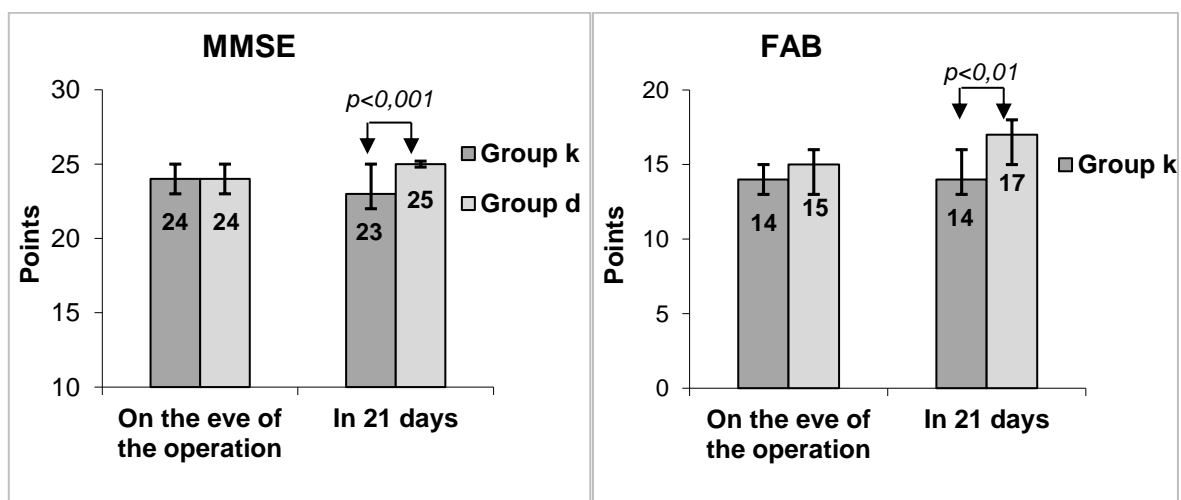


Fig.3. Dynamics of indicators of cognitive functions on MMSE and FAB scales in groups k and d: Me (25%; 75%); p - the level of statistical significance of the difference between the groups.

Conclusions. 1. Taking into account the data of the comparative analysis of changes in the indicators of neuropsychological testing on the FAB scale, the indicators in the group using dexmedetomidine increased by 13.3% relative to baseline.

2. After a comparative analysis of neuropsychological testing on the MMSE scale, the average in the group using dexmedetomidine increased by 4.2% relative to baseline, while in the group with the "classical" method of analgesia, the average scores did not change significantly.

3. Based on the data obtained, it can be assumed that the use of dexmedetomidine as a component of multimodal analgesia has a positive effect on the state of cognitive functions in the post-anesthesia period.

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