OPHTALMOLOGY

PREOPERATIVE MANAGEMENT OF OPHTHALMIC PATIENTS TAKING ORAL ANTICOAGULANTS

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ABSTRACT

Surgical treatment is often accompanied by such complication as bleeding, and ophthalmic surgery is not an exception. The bleeding risk depends on many factors, the most significant are age, arterial hypertension, hepatic and renal impairment, prior stroke or treatment with oral anticoagulants.

The aim. *To evaluate the structure of patients taking novel oral anticoagulants (NOACs) with an assessment of activated partial thromboplastin time before ophthalmosurgical treatment.*

Materials and methods. *54 patients taking oral anticoagulants were included in the study. A retrospective analysis of medical histories of patients who had surgery for ocular pathology was carried out. The patients were divided into two groups: group 1 – 28 patients whose activated partial thromboplastin time (APTT) did not exceed 45 seconds; group 2 – 26 patients with APTT more than 45 seconds. The criterion for the numerical expression of APTT is the safety of performing regional anesthesia against the background of taking anticoagulant drugs. Statistical processing was performed using the Mann – Whitney test ($p < 0.05$).*

Results. *A comparative analysis of the results showed that the patients of the group 2 had higher rates of APTT. At the same time, they were less likely to have acute cerebrovascular accident (11.5 % compared to 21 % of patients in the group 1) and prior acute myocardial infarction (19 % and 28 %, respectively). Among all the patients, women and slightly older patients prevailed.*

Conclusion. *Patients with atrial fibrillation make up the majority of patients undergoing ophthalmosurgical treatment and taking NOACs. Surgical treatment method was phacoemulsification with intraocular lens implantation. Studying APTT before the surgery allowed us to identify a category of patients with high APTT, to prescribe the withdrawal of the drug before the surgery in order to create optimal conditions for surgical treatment.*

Key words: *vitrectomy, posterior segment eye disease, novel oral anticoagulants, activated partial thromboplastin time, hemorrhagic complications, hypocoagulation effect*

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ОПЫТ ПРЕДОПЕРАЦИОННОГО ВЕДЕНИЯ ОФТАЛЬМОЛОГИЧЕСКИХ БОЛЬНЫХ, ПРИНИМАЮЩИХ ПЕРОРАЛЬНЫЕ АНТИКОАГУЛЯНТЫ

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РЕЗЮМЕ

Хирургическая помощь пациентам зачастую сопровождается таким осложнением, как кровотечение; не является исключением и офтальмологическая хирургия. Вероятность кровотечений зависит от многих факторов, наиболее значимыми из которых являются наличие артериальной гипертонии, нарушение функции печени и почек, перенесённый инсульт, лечение пероральными антикоагулянтами.

Цель работы. *Оценить структуру пациентов, принимающих новые оральные антикоагулянты (НОАК), с оценкой активированного частичного тромбопластинового времени перед офтальмохирургическим лечением.*

Материалы и методы. *В исследование были включены 54 пациента, принимающие пероральные антикоагулянты. Был проведён ретроспективный анализ историй болезни пациентов, прооперированных по поводу глазной патологии. Пациенты были разделены на две группы: 1-я группа – 28 пациентов, у которых активированное частичное тромбопластиновое время (АЧТВ) не превышало 45 с; 2-я группа – 26 пациентов, у которых АЧТВ было больше 45 с, согласно рекомендациям безопасности выполнения регионарной анестезии на фоне приёма антикоагулянтных препаратов. Статистическая обработка выполнялась с использованием критерия Манна – Уитни ($p < 0,05$).*

Результаты. *Сравнительный анализ полученных результатов продемонстрировал, что у пациентов второй группы реже выявлялись острое нарушение мозгового кровообращения (11,5 % по сравнению с 21 % больных первой группы) и острый инфаркт миокарда в анамнезе (19 % и 28 % соответственно). Преобладали лица женского пола и незначительно больший возраст больных.*

Заключение. *Основную долю пациентов, находящихся на офтальмохирургическом лечении и принимающих НОАК, составили больные с фибрилляцией предсердий, в качестве метода хирургического лечения выбрана факоэмульсификация катаракты с имплантацией интраокулярной линзы. Исследование АЧТВ перед операцией позволило выявить категорию пациентов с высоким АЧТВ, назначить отмену препарата перед операцией для создания оптимальных условий для хирургического лечения.*

Ключевые слова: *витрэктомия, заболевания заднего отрезка глаза, новые оральные антикоагулянты, активированное частичное тромбопластиновое время, геморрагические осложнения, гипокоагуляционный эффект*

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RELEVANCE

The majority of patients in ophthalmology clinics who undergo surgery for cataracts, glaucoma, and other eye diseases are elderly and senile. As it is known, with age the specific weight of patients having concomitant cardiovascular pathology increases, which is represented mostly by arterial hypertension (AH) and coronary heart disease (CHD). One of the clinical manifestations of CHD is atrial fibrillation (AF). AF in turn determines a certain risk of cardioembolic complications. This risk is assessed using the CHA_2DS_2-VASc score, which takes into account such indicators as gender, age of the patient, presence of comorbidities (AH, diabetes mellitus (DM), vascular disease, history of acute cerebrovascular accidents (ACVA), signs of heart failure) [1]. Each of the above signs corresponds to a certain score, and the summation of these figures reflects the risk of thromboembolic complications (events). If the total score is 1 or more, the prescription of direct oral anticoagulants (DOACs) should be considered. However, taking anticoagulants is accompanied by the risk of hemorrhagic complications [2]. Bleeding probability depends on many factors, the most significant of which (age, presence of AH, hepatic and renal dysfunction, prior stroke or bleeding) are taken into account in the HAS-BLED score [1]. All these points should be taken into account when providing surgical care to patients, including those with ophthalmologic pathology.

It should be kept in mind that any surgical intervention itself carries the risk of complications, both cardiovascular and localized. Surgical risk assessment (i.e., the incidence rate of cardiovascular complications during and after surgical intervention) depends primarily on the possible volume of the upcoming surgery. According to the National Guidelines [3], ophthalmic surgery is categorized as low-risk surgery, that is, the risk of myocardial infarction (MI) or death from cardiac causes within 30 days after surgery is less than 1 %. That is, large-scale cardiac risk assessment is of no practical use in small-volume surgeries [4]. However, the possibility of non-systemic hemorrhagic complications should not be neglected, especially in patients taking new oral anticoagulants (NOACs), including when performing regional anesthesia [5, 6]. In ophthalmology, this is especially relevant in surgeries requiring regional anesthesia in the form of retrobulbar and pterygopalatine blockades, which can be accompanied by major complications, even though ultrasound navigation levels out technical difficulties and the possibility of damage to anatomical structures [7].

THE AIM OF THE WORK

To evaluate the structure of patients taking novel oral anticoagulants with an assessment of activated partial thromboplastin time before ophthalmosurgical treatment.

MATERIALS AND METHODS

A retrospective analysis of medical histories included data from 54 patients receiving NOACs operated for ocular pathology (Table 1). Patients receiving dual antithrombotic therapy (i. e. NOACs and antiaggregants together), as well as those with severe liver disease, hematologic pathology, and end stage renal disease were excluded from the study.

Based on clinical guidelines on the perioperative management of patients receiving long-term antithrombotic therapy [8, 9], the patients were divided into two groups. Group 1 included patients whose activated partial thromboplastin time (APTT) did not exceed 45 s; group 2 was made up of those who`s APTT was greater than 45 s (Table 2). The criterion for the numerical expression of APTT is the safety of performing regional anesthesia against the background of taking anticoagulant drugs.

Statistical analysis was performed using the Mann – Whitney test. Statistical significance level < 0.05.

TABLE 1

TYPES OF SURGICAL INTERVENTION PERFORMED IN PATIENTS TAKING ORAL ANTICOAGULANTS

Intraocular surgical procedures (*n* = 39)				Laser surgeries (*n* = 15)			
Phaco + IOL	AGO	Vitreoretinal surgeries	Administration of angiogenesis inhibitors	PC discission	Laser iridectomy	Retinal laser photocoagulation	SLP
22	5	7	5	7	4	1	3

Note. Phaco + IOL – phacoemulsification with intraocular lens implantation; AGS – antiglaucomatous surgery; PC discission – posterior capsule discission (performed for secondary cataract); SLP – scatter laser photocoagulation (performed in the proliferative stage of diabetic retinopathy).

RESULTS AND DISCUSSION

The patients included in the study underwent both intraocular surgical interventions and laser surgeries of different types, as presented in Table 1.

Patients were taking oral anticoagulants such as rivaroxaban, apixaban, and dabigatran.

Rivaroxaban was prescribed in 43 % of cases (23 patients), of which 11 patients took the drug at a dose of 20 mg/day, 7 patients at 15 mg/day, 4 patients at 10 mg/day, and one patient at 5 mg/day. Apixaban was given to two patients (4 % of cases) at a dose of 5 mg twice daily. Dabigatran was prescribed in 54 % of cases (29 patients), of which 16 patients received the drug at a dose of 110 mg twice a day, 13 patients – 150 mg twice a day. All patients were analyzed on admission and the APTT was analyzed (laboratory normal value – 25–35 s). Distribution of the patients is summarized in Table 2.

TABLE 2

DISTRIBUTION OF THE PATIENTS DEPENDING ON THE APTT VALUES AND THE ORAL ANTICOAGULANT USED

Parameter, *n* (%)	APTT ≤ 45 s (*n* = 28)	APTT > 45 s (*n* = 26)
Male, *n* (%)	20 (72 %)	11 (42 %)
Female, *n* (%)	8 (28 %)	15 (58 %)
Age, years	74 (56–93)	77 (63–87)
AF, *n* (%)	26 (92 %)	25 (96 %)
AH, *n* (%)	26 (92 %)	26 (100 %)
DM, *n* (%)	7 (25 %)	10 (38 %)
PICS, *n* (%)	8 (28 %)	5 (19 %)
ACVA, *n* (%)	6 (21 %)	3 (11.5 %)
Dabigatran, *n* (%)	12 (43 %)	17 (65 %)
Apixaban, *n* (%)	1 (3 %)	1 (4 %)
Rivaroxaban, *n* (%)	15 (54 %)	8 (31 %)

Note. PICS – postinfarction cardiosclerosis.

Group 1 included 28 patients. Of these, there were 20 (72 %) males and 8 (28 %) females; mean age, 73 ± 0.1 years (56–93 years). Cataract surgery was performed in 39 % of cases (11 patients), vitreoretinal surgery in 21 % of cases (6 patients), antiglaucomatous surgery in 1 patient, and intravitreal injection of drugs in 1 patient. Laser surgical intervention was performed in 29 % of cases (8 patients): laser iridectomy – in 12 %, laser photocoagulation of the retina for its rupture – in 12 %, discission of the posterior capsule (performed for secondary cataract) – in 38 %, laser photocoagulation of the retina in diabetic retinopathy – in 38 %.

Evaluation of somatic status showed that in the majority of cases (93 % – 26 patients) DOACs were prescribed for AF. The remaining patients showed no signs of AF; the indication for NOAC prescription was previously performed prosthesis of the iliac/femoral segments for obliterating atherosclerosis of the lower limb arteries and pulmonary embolism.

8 patients had a history of acute myocardial infarction (AMI), 3 patients underwent coronary artery stenting, 1 patient underwent coronary artery bypass graft surgery, and 4 patients underwent pacemaker implantation. 6 patients had a history of acute cerebrovascular accidents. 1 patient with AF underwent thrombectomy of the left radial artery.

Arterial hypertension was detected in 25 of 28 patients in this group, diabetes mellitus – in 6 patients.

The APTT had a variation from 32 to 46.8 seconds; the mean was 39.6 ± 0.05 seconds. When rivaroxaban was administered, the average APTT was 39.9 ± 0.19 s, when apixaban was administered, it was 41 ± 0 s, and when dabigatran was administered, it was 39.1 ± 0.29 s.

Group 2 included 26 patients, of whom 11 (42 %) were males, 15 (58 %) were females. The age of the patients ranged from 63 to 87 years, with a mean of 76 ± 0.11 years. Intraocular surgery was performed for cataract in 42 % of cases (11 patients), antiglaucomatous surgery – in 12 % of cases (3 patients), intravitreal injection of angiogenesis inhibitors was performed in 15 % of cases (4 patients), vitreoretinal intervention – in 4 % of cases (1 patient). Laser intervention was required in 27 % of cases (7 patients).

Oral anticoagulants were prescribed for AF in the majority of patients (96 % of cases – 25 patients), as well as in the group 1. One patient without signs of AF had a history of deep vein thrombosis of the lower leg, post-thrombotic syndrome.

Arterial hypertension was detected in all patients. Five patients had a history of AMI, 1 patient underwent coronary artery bypass graft (CABG) surgery, 2 patients underwent coronary artery stenting, and 1 patient was implanted with an artificial pacemaker. A history of ACVA was revealed in 7 patients, and 1 patient had recurrent ACVA. Type 2 diabetes mellitus was recorded in 10 patients, of whom 1 patient was receiving insulin.

The range of the APTT values was from 47 to 114 s, with an average of 65.9 ± 0.1 s. When receiving rivaroxa-

TABLE 3

DISTRIBUTION OF APTT VALUES DEPENDING ON THE ORAL ANTICOAGULANT USED

Groups of patients depending on the APTT duration	APTT mean value, s	Rivaroxaban	Apixaban	Dabigatrian
APTT ≤ 45 s	36.9 ± 0.19	39.6 ± 0.19	41	39.1 ± 0.29
APTT > 45 s	65.96 ± 0.1	60 ± 1.07	47	69.7 ± 0.8
p (Mann – Whitney)	0.01	0.001		0.001

ban, the average APTT was 60 ± 1.07 s, apixaban – 47 ± 0 s, and dabigatran – 69.7 ± 0.8 s (Table 3).

Comparative analysis of the obtained results demonstrated that the patients of the group 2 had higher APTT values. At the same time, they had less frequent ACVA (11.5 % compared to 21 % of patients in the group 1) and a history of AMI (19 % and 28 %, respectively). The predominance of female patients and slightly higher age of patients can be noted. It is possible that better hemorheologic control, reflected by the elevated APTT values, contributed to the rarer occurrence of vascular accidents among these patients.

In addition, the medical histories of 20 patients who received oral anticoagulants and who had baseline APTT values greater than 60 s (62.25 ± 0.16 s) were analyzed separately. Patients received dabigatran in 60 % of cases (12 patients), rivaroxaban in 35 % of cases (7 patients), and apixaban was administered in 5 % of cases (1 patient). Taking into account the initial high values of APTT, anticoagulant withdrawal was carried out for a period of 2 to 5 days, on average for 3 days. On reexamination, the APTT values decreased to 37 ± 0.097 s.

DISCUSSION

Current oral anticoagulants include rivaroxaban, apixaban, and dabigatran. Rivaroxaban and apixaban are direct inhibitors of blood clotting factor Xa. Both drugs have a dose-dependent effect on prothrombin time, as well as dose-dependently increase in APTT. Dabigatran is a direct reversible thrombin inhibitor. The most informative parameters reflecting the anticoagulant activity are APTT (for apixaban and rivaroxaban) and thrombin time (for dabigatran).

The use of anticoagulant therapy has increased in patients seeking ophthalmic surgery over the past decade. The decision to discontinue anticoagulants prior to ophthalmic surgery is nuanced and ultimately depends on multiple factors, including the type of surgery, comorbidities, and the patient's risk profile. According to clinical guidelines [3, 9], NOAC therapy should not be interrupted for minor surgeries, which include, for example, cataract treatment. At the same time, at the stage of planning patients for surgery in order to prevent intraoperative hemorrhagic complications, it is necessary to take into account the initial state of the blood coagulation system [10]. To a greater extent, this applies to surgeries where retrobulbar anesthesia and pterygopalatine blockade are performed for the purpose of anesthesia, the most serious complications of which are retrobulbar hematoma and irreversible loss of vision [11]. Most ophthalmologic surgeries can be safely performed when anticoagulant therapy is within the therapeutic range. Certain difficulties may also arise during surgical interventions on the uvea in the treatment of glaucoma, vitreoretinal intervention performance. This is especially true for diabetic patients, as the newly formed vessels have imperfect angioarchitecture and are prone to rupture. The high risk of these complications dictates the necessity of short-term withdrawal of NOACs in case of high values of APTT with subsequent rechecking before surgical treatment.

The greatest hypocoagulant effect, according to our data, was found for dabigatran, which is consistent with the work of L. Ong-Tone et al. [12], where studied the risks of intraocular bleeding in patients taking anticoagulants.

CONCLUSIONS

The main share of patients undergoing ophthalmosurgical treatment and receiving NOACs were patients with atrial fibrillation, and phacoemulsification of cataract with intraocular lens implantation was used as a method

of surgical treatment. Studying APTT before the surgery allowed us to identify a category of patients with high APTT, to prescribe the withdrawal of the drug before the surgery in order to create optimal conditions for surgical treatment.

Conflict of interest

The authors of this article declare the absence of a conflict of interest.

REFERENCES

1. Protasov KV, Fedorishina OV. *Prevention of systemic embolism in patients with atrial fibrillation*. Irkutsk; 2014. (In Russ.).
2. Sinkov SV, Zabolotskikh IB. *Diagnosis and correction of disorders of the hemostasis system;* 2nd ed., revised and corrected. Moscow: Prakticheskaya meditsina; 2017. (In Russ.).
3. Prediction and prevention of cardiac complications of non-cardiac surgical interventions. *Cardiovascular Therapy and Prevention*. 2011; (6S3): 3-28. (In Russ.). doi: 10.15829/1728-8800-2011-6S3-3-28
4. Dzhioeva ON, Orlov DO, Reznik EV, Nikitin IG, Rodoman GV. Current principles of decreasing perioperative cardial complications in extracardiac surgical interventions. *Russian Medical Journal*. 2018; 6(1): 33-40. (In Russ.).
5. Horlocker TT, Wedel DJ, Rowlingson JC, Enneking FK. Executive summary: regional anesthesia in the patient receiving antithrombotic or thrombolytic therapy: American Society of Regional Anesthesia and Pain Medicine Evidence-Based guidelines (third edition). *Reg Anesth Pain Med*. 2010; 35(1): 102-105. doi: 10.1097/AAP.0b013e3181c15dd0
6. Vílchez JA, Gallego P, Lip GY. Safety of new oral anticoagulant drugs: A perspective. *Ther Adv Drug Saf*. 2014; 5(1): 8-20. doi: 10.1177/2042098613507945
7. Oleshchenko IG, Zabolotsky DV, Koriachkin VA, Pogorelchuk VV. Ensuring the effectiveness and safety of peripheral blockades. *Acta biomedica scientifica*. 2021; 6(6-1): 105-112. (In Russ.). doi: 10.29413/ABS.2021-6.6-1.12
8. Zabolotskikh IB, Shifman EM. *Clinical guidelines. Anesthesiology and reanimatology.* Moscow: GEOTAR-Media; 2016. (In Russ.).
9. Zabolotskikh IB, Kirov MYu, Afonchikov VS, Bulanov AYu, Grigoriev EV, Gritsan AI, et al. *Perioperative management of patients receiving long-term antithrombotic therapy. Clinical guidelines of the Federation of Anesthesiologists and Resuscitators of Russia.* Moscow; 2019. (In Russ.).
10. Tagariello G, Radossi P, Salviato R, Zardo M, De Valentin L, Basso M, et al. Clinical relevance of isolated prolongation of the activated partial thromboplastin time in a cohort of adults undergoing surgical procedures. *Blood Transfus*. 2017; 15(6): 557-561. doi: 10.2450/2016.0047-16
11. Li J, Halaszynski T. Neuraxial and peripheral nerve blocks in patients taking anticoagulant or thromboprophylactic drugs: challenges and solutions. *Local Reg Anesth*. 2015; 8: 21-32. doi: 10.2147/LRA.S55306
12. Ong-Tone L, Paluck EC, Hart-Mitchell RD. Perioperative use of warfarin and aspirin in cataract surgery by Canadian Society of Cataract and Refractive Surgery members: Survey. *J Cataract Refract Surg*. 2005; 31(5): 991-996. doi: 10.1016/j.jcrs.2004.09.058

ЛИТЕРАТУРА

1. Протасов К.В., Федоришина О.В. *Профилактика системных эмболий у больных фибрилляцией предсердий*. Иркутск: РИО ГБОУ ДПО ИГМАПО; 2014.
2. Синьков С.В., Заболотских И.Б. *Диагностика и коррекция расстройств системы гемостаза;* 2-е изд., перераб. и доп. М.: Практическая медицина; 2017.
3. Прогнозирование и профилактика кардиальных осложнений внесердечных хирургических вмешательств. *Кардиоваскулярная терапия и профилактика*. 2011; (6S3): 3-28. doi: 10.15829/1728-8800-2011-6S3-3-28
4. Джиоева О.Н., Орлов Д.О., Резник Е.В., Никитин И.Г., Родоман Г.В. Современные принципы снижения периоперационных кардиальных осложнений при внесердечных хирургических вмешательствах. *РМЖ*. 2018; 6(1): 33-40.
5. Horlocker TT, Wedel DJ, Rowlingson JC, Enneking FK. Executive summary: regional anesthesia in the patient receiving antithrombotic or thrombolytic therapy: American Society of Regional Anesthesia and Pain Medicine Evidence-Based guidelines (third edition). *Reg Anesth Pain Med*. 2010; 35(1): 102-105. doi: 10.1097/AAP.0b013e3181c15dd0
6. Vílchez JA, Gallego P, Lip GY. Safety of new oral anticoagulant drugs: A perspective. *Ther Adv Drug Saf*. 2014; 5(1): 8-20. doi: 10.1177/2042098613507945
7. Олещенко И.Г., Заболотский Д.В., Корячкин В.А., Погорельчук В.В. Обеспечение эффективности и безопасности периферических блокад. *Acta biomedica scientifica*. 2021; 6(6-1): 105-112. doi: 10.29413/ABS.2021-6.6-1.12
8. Заболотских И.Б., Шифман Е.М. *Клинические рекомендации. Анестезиология-реаниматология.* М.: ГЭОТАР-Медиа; 2016.
9. Заболотских И.Б., Киров М.Ю., Афончиков В.С., Буланов А.Ю., Григорьев Е.В., Грицан А.И., и др. *Периоперационное ведение больных, получающих длительную антитромботическую терапию. Клинические рекомендации Федерации анестезиологов-реаниматологов России.* М.; 2019.
10. Tagariello G, Radossi P, Salviato R, Zardo M, De Valentin L, Basso M, et al. Clinical relevance of isolated prolongation of the activated partial thromboplastin time in a cohort of adults undergoing surgical procedures. *Blood Transfus*. 2017; 15(6): 557-561. doi: 10.2450/2016.0047-16
11. Li J, Halaszynski T. Neuraxial and peripheral nerve blocks in patients taking anticoagulant or thromboprophylactic drugs: challenges and solutions. *Local Reg Anesth*. 2015; 8: 21-32. doi: 10.2147/LRA.S55306
12. Ong-Tone L, Paluck EC, Hart-Mitchell RD. Perioperative use of warfarin and aspirin in cataract surgery by Canadian Society of Cataract and Refractive Surgery members: Survey. *J Cataract Refract Surg*. 2005; 31(5): 991-996. doi: 10.1016/j.jcrs.2004.09.058

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