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**THE STATE OF THE HEMOSTASIS SYSTEM DURING ENDOPROSTHETICS OF
THE JOINTS OF THE LOWER EXTREMITIES OPERATED ON UNDER
CONDITIONS OF GENERAL ANESTHESIA IN PEOPLE WITH HIGH
ANESTHETIC RISK**

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Endoprosthetics of the joints of the lower extremities is considered one of the most successful orthopedic procedures and more than a million such operations are performed every year in the world (4). It is predicted that by 2020, arthroplasty of the joints of the lower extremities will exceed more than one million per year in the United States alone (2). Historically, general anesthesia has been the gold standard in orthopedic surgery. At present, in research practice and in discussing the timely prevention of cardiovascular diseases, especially coronary heart disease, which occupies the first place among the causes of population death worldwide, it is necessary to take into account age-related changes that occur in the anatomical structures of the heart and the vessels supplying it. In the **References:** there is evidence of age-related changes in coronary vessels. According to (1), in people of the second period of middle age and the elderly, age-related changes in the vascular wall are noted. According to (5), there is a direct correlation between the degree of tortuosity of the coronary vessels and the age of the patient.

Vascular changes (including tortuosity) can lead to a deterioration in the hemodynamic conditions inside the vessels, and possibly to a change in the hydrodynamic parameters of the blood flow. An increase in the load on certain sections of the vascular wall can lead to chronic inflammation and the deposition of atherosclerotic plaques, which is the main link in the pathogenesis of IHD. This can contribute to rupture of the atherosclerotic plaque tire and blood clots due to turbulence in the bloodstream. One of the formidable problems of the postoperative period when performing orthopedic surgery is bleeding. Total blood loss can be significant, reaching 50-60% of the volume of circulating blood, with the development of a complex of negative processes that accompany massive blood loss, which exacerbates an already traumatic intervention (3.6).

Objective: to study the state of the hemostatic system in elderly and senile patients operated on under conditions of general anesthesia, to identify its side effects.

Material and research methods.

We analyzed the postoperative period in 50 patients. Patients were hospitalized in the trauma department of the multidisciplinary clinic TMA.

All patients underwent total joint replacement (39-THA and 11-TKA). Men - 22 (44%) 28 - women (56%). The age of patients in this group was in the range of 68-81 years, i.e. it is mainly elderly (78%) and senile age (22%) with a physical status of ASA 3 or higher. The right side of the lesion prevailed (54%) according to the Kettle index indicator, trophological status fell within the framework of normal elderly and senile age, which were operated on for degenerative-dystrophic and traumatic injuries of the joints of the lower extremities.

Induction in anesthesia was carried out with propofol at the rate of 1-2 mg / kg, fentanyl (2-3 mg / kg), midazolam (dormicum) (0.1-0.2 mg / kg), relaxant-pipecuronium bromide (arduan) (0.06 -0.08 mg / kg). After tracheal intubation, anesthesia was maintained by inhalation of 1.3-1.8 vol.% Isflurane and propofol infusion of 2.5-3.5 mg / kg / hour. Fentanyl was administered at times. The total amount was 4-5 µg / kg.

In the preoperative period, an infusion program was carried out in the range of 6-8 ml / kg (5% glucose solution and electrolyte solutions). In order to prevent thrombotic-embolic complications in all patients, 10-12 hours after admission, heparin (7,500 IU) was administered subcutaneously twice a day. In patients receiving anticoagulant therapy per os, the latter was canceled, before surgery, 5 mg of vitamin K (Vikasol) was administered intravenously, followed by a triple administration of heparin (7,500 IU) sc daily.

Anesthesia was monitored by us using the bispectral index (BIS) for a thorough titration of the anesthetic.

At values (BIS) exceeding 60 (tracheal intubation, traumatic stages of the operation), fentanyl infusion was increased to 0.5-0.7 µg / mg. All studies in the GA process were performed at (BIS) values up to 40-60 recommended for elderly patients.

In cases of the development of arterial hypotension, it was assessed as: "moderate", when the systolic blood pressure decreased to 20% of the initial level, "pronounced" - a decrease in systolic BP was more than 30% of the initial, and the mean BP (MBP) became less than 100 mmHg. In such cases, vasopressors (ephedrine, dopamine) were used, as well as fluid infusion until restoration of the MBP.

In cases of the development of bradycardia, defined as a decrease in heart rate <50 per minute, atropine 0.5 mg was administered intravenously.

Indicators of systemic and central hemodynamics, BIS, SpO₂ and pressor consumption were monitored every 5-10 minutes during the operation and up to 120 minutes after it. Surgical blood loss was compensated for by the infusion of crystalloid and colloid and, if necessary, blood products.

Surgical blood loss during hip and knee arthroplasty was determined by the gravimetric method. During the operation, changes in systemic BP, DBP, MBP, heart rate, SpO₂ were observed. Stages of registration of these indicators: before, during anesthesia, 30, 60, 120 minutes after the operation is completed.

Clinical and biochemical blood tests (erythrocytes, Hb, Ht, lymphocytes, total protein, electrolytes, glucose, transaminases, nitrogenous slags, bilirubin) were performed before the operation and 1.5.10 days after the operation. Before surgery and on day 10, coagulogram data were analyzed with a focus on: fibrinogen, prothrombin time, platelets, APTT. To assess the functional state of the components of the hemostatic system and fibrinolysis, the hemocoagulography method was used with the help of the blood rheology analyzer of the portable ARP Mednord (Tomsk). At the same time, duplex scanning of the deep veins of the lower extremities was performed on both sides. Research stages: 1) upon admission to the operating room, 2) after tracheal intubation, 3) joint implantation, 4) end of operation and anesthesia.

Results and discussion

Table No. 1 Indicators of a general blood test in patients operated on in conditions of GA before and after surgery.

Indicators	GA (n = 50)	
	Before operation	After operation
Red blood cells, 10 ¹² /l	4,19 ± 0,31	4,11 ± 0,42
Hemoglobin, g/l	13,2 ± 0,4	12,8 ± 0,5
White blood cells, 10 ⁹ /l	5,32 ± 0,64	5,79 ± 0,71
Neutrophils, 10 ⁹ /l	3,23 ± 0,41	3,69 ± 0,39
Lymphocytes, 10 ⁹ /l	1,62 ± 0,27	1,44 ± 0,31

From the data presented, it can be noted that initially all peripheral blood parameters were practically within the physiological values. But, given the age of patients in this group, we can talk about some initial hemoconcentration, as evidenced by high rates of red blood cells and Hb. Despite the fact that during the operation 21 patients (42%) underwent transfusion of 200 ml of erythrocyte mass, because blood loss exceeded 500 ml and averaged 625 ml, by the end of the operation these parameters were lower than the initial ones by 2.1 and 2.3 % ($p > 0.05$). As for the indicators of white blood, by the end of the operation there was a slight tendency to increase them within 8.8% - 12.5% except for lymphocytes. However, due to the relatively high scatter of numbers (m), the marked increase in white blood cells and neutrophils was not statistically significant. At the end of the operation, the number of lymphocytes decreased relative to the initial data by 11.2%, which was also a trend ($p > 0.05$).

Table No. 2 Indicators of hemostasis in patients operated on in conditions of GA (n = 50) before and after surgery

Indicators	GA (n = 50)	
	Before operation	After operation
Fibrinogen, g/l	3,84 ± 0,32	3,61 ± 0,27
Platelets, 10 ⁹ /l	162,3 ± 4,7	176,4 ± 3,9
Prothrombin time, sec	11,8 ± 0,5	11,4 ± 0,4
APTT, sec	28,9 ± 0,3	30,9 ± 0,2

Initial indicators of blood coagulation in this group of patients also did not go beyond physiological values. There was only a tendency towards a decrease in fibrinogen levels by the end of operations by 6.4% ($p > 0.05$) and an extension of APTT by 6.9% ($p < 0.05$).

Despite the fact that the vast majority of patients have suffered from hypertension for a long time, we did not note a special spread of blood pressure indicators upon admission, in all likelihood due to the systematic use of antihypertensive drugs. The level of blood pressure in them was within 160/90 - 125/70 mm. Hg, averaging 138.9 / 87, 7 mm Hg.

The table below shows the indicators of systemic hemodynamics and pulse oximetry in the implementation of GA.

Table No. 3 Indicators of systemic hemodynamics at the stages of GA (n = 50).

Indicators	Study Stages (GA)					
	Before operation	After operation	Joint implant	End of operation	In 30 minutes	In 60 minutes
Syst BP. (mm. Hg)	138,6±11,4	142,8±9,3	151,5±10,4	137,7±9,1	145,4 ± 9,2	150,3 ± 11,2
Diast BP (mm. Hg)	87,9 ± 5,0	90,1± 4,3	92,4 ± 3,7	89,4 ± 5,5	87,1 ± 3,9	90,6 ± 4,1
MBP (mm. Hg)	104,9±8,2	107,6 ± 6,8	112.0±7,1	105,5±7,0	106,5±6,5	110,5±7,0
HR (per minute)	76,3±4,4	80,2±3,0	89,3±2,1	84,0±3,2	87,2±4,3	88,4±3,1
CVP (cm H2O)	7,4±0,4	10,2±0,3	10,1±0,2	8,7±0,3	9,1±0,4	8,8±0,3
SPO ₂ (%)	92,4±1,0	93,6±0,9	92,9±1,2	93,7±0,7	92,4±0,5	92,1±0,5

Of the data presented in the table during GA, the studied circulatory parameters underwent changes, especially at the stages of tracheal intubation, joint implantation, and also, an hour after the operation, when

patients began to complain of pain in the area of the surgical wound. So for intubation and for the most traumatic stage of the operation - implantation of joints BP increased by 2.5% and 8.6%, and Diast BP - by 2.5% and 5.1%, respectively, although these changes indicated only a tendency to increase and are not statistically significant ($p > 0.05$). As for heart rate, according to averaged data, we did not observe bradycardia or bradyarrhythmia. It increased during the traumatic stage of the operation and 60 minutes after the operation by 17.0 and 15.8%, respectively. In both cases, $p < 0.05$.

The table below provides data on the magnitude, operational blood loss, and temporal parameters in patients operated on under conditions of GA.

Table No. 4 The volume of blood loss, ITT and temporal parameters in patients operated on in conditions of GA ($n = 50$).

Indicators	1 st patient group
	GA
THA blood loss volume, ml	518,6 \pm 67,6
TKA, ml	668,8 \pm 88,4
Total blood loss (ml)	593,7 \pm 78,0
The volume of ITT, ml	2588,4 \pm 120,6
Erythromass, ml	386,7 \pm 63,0
Time to surgery, min.	34,1 \pm 3,2
Operation time, min	132,7 \pm 6,1
Postoperative time, min.	44,9 \pm 10,2
Harness application time, min.	85,7 \pm 2,7
Extubation time, min	14,3 \pm 3,2
Cognitive function recovery time, min.	38,4 \pm 2,6

The data presented indicate that the total blood loss during joint replacement of the lower extremities is on average 7-8 ml / kg body weight (with THA-6.82 ml / kg, with TKA-8.8 ml / kg). The volume of infusion-transfusion therapy in the operating room is within 34-35 ml / kg body weight; The volume of red blood cells is 5.1 ml / kg. In GA, perioperative time intervals are quite long. The recovery time of cognitive functions was within 30-50 minutes after extubation, averaging 38.4 \pm 2.6 minutes.

Conclusions

1. Changes in the homeostasis system during arterial hypertension were revealed, manifested by activation of the fibrinolysis system and an increase in the level of antithrombin III, indicating latent hypercoagulation.

2. The use of NSAIDs in combination with narcotic analgesics makes it possible to obtain adequate analgesia, but due to the pronounced reotropic

effect due to the side effects of NSAIDs, the degree of postoperative bleeding also increases.

3. In elderly and senile patients, a physiological decrease in fibrinolytic activity develops, an increase in the level of the natural anticoagulant of protein C.

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