Study the Effects of Ataralgesia on the State of the Cardiovascular System and Ocular Tonus in Operative Ophthalmology.

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ABSTRACT

Ataralgesia is one of the types of combined pain relief and consists of the use of an ataractic and an analgesic. To date, there is limited data in the literature on the possibility of using ataralgesia during ophthalmic surgery. The effect of this method on intraocular pressure also remains unclear. The study of ataralgesia in elderly patients and with concomitant somatic diseases is of certain value.

Keywords: Droperidol, fentanyl, seduxen, UI, SI, HR,

Research Aim

The aim of the study is to investigate the state of peripheral and central hemodynamics and ophthalmotonus when using ataralgesia in ophthalmic surgery in patients with acquired cataract.

Research objectives

1. Study the peripheral and central hemodynamics of patients with acquired cataracts who are preparing for surgical intervention.
2. Investigate the effect of surgical aggression on blood circulation when using droperidol, fentanyl, and seduxen.
3. Investigate the effect of ataractics on ophthalmic tone.

Material and Methods of Research

Clinical material was collected in the ophthalmology department of a multi-profile clinic of the Tashkent Medical Academy during the period from 2020 to 2021. The study was conducted on 25 operated patients with a diagnosis of cataract (acquired). For ataralgesia, we used a combination of 3 drugs: droperidol, fentanyl and seduxen, i.e. groups of neuroleptics, analgesics and ataractisants. The applied method is a peculiar sum of methods of neuroleptanalgesia and ataralgia, and this combination allowed achieving a pronounced effect with significantly smaller doses of all drugs, which is probably explained by the potentiating effect.

In addition to routine clinical and biochemical studies to evaluate the effectiveness of anesthesia, and in the perioperative period, we used a multifunctional "reanimation-surgical" monitor YM 300 (LLC "Company YUTAS" Ukraine), designed for continuous monitoring of the patient's vital functions, displaying them on the screen, signaling the deviations of controlled parameters. (Figure 1)

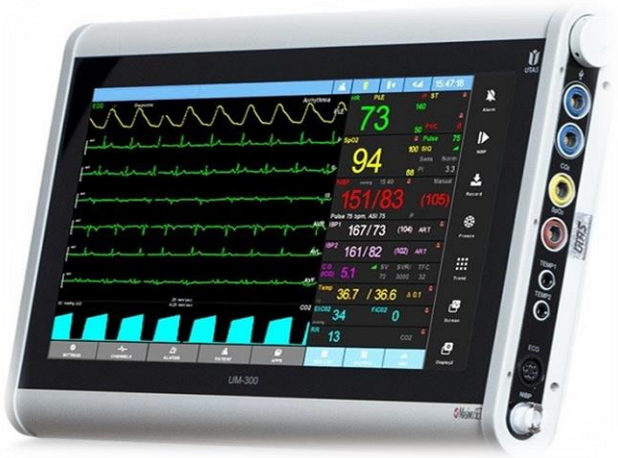

Fig.1. Polyfunctional "reanimation-surgical" monitor YUM 300.

In our research, we used the following capabilities of the monitor:

1. Registration and monitoring of ECG;
2. Measurement (monitoring) of heart rate (HR) with the possibility of selecting the source (ECG, SpO2);
3. Registration and automatic recording of arrhythmias;
4. Measurement (monitoring) of capillary blood oxygen saturation level (pulse oximetry);
5. Non-invasive constant monitoring of central hemodynamics parameters by impedance cardiography (ICU module): stroke volume index (SVI), cardiac output index (COI), HR;
6. We studied the following indices of peripheral hemodynamics: systolic (SBP), diastolic (DBP), pulse pressure (PP), and mean arterial pressure (MAP).

Statistical data processing was carried out using Microsoft Excel and SPSS 25000 (JBM) software. Data with normal distribution (after checking with the Kolmogorov-Smirnov test and assessing the equality of variances with the Levine criterion) were presented as mean (M) with standard deviation and evaluated using the Student's t-test for non-parametric data or the Mann-Whitney test. To determine the statistical significance of nominal data differences, Fisher's criteria were applied. Differences were considered significant at $p<0.05$.

Results of the Study and Their Discussion

The influence of drugs on intraocular pressure plays a significant, and sometimes determining role in anesthesia procedures in ophthalmic surgery. It is important to consider the fact that intraocular pressure is closely related to systemic hemodynamics. With this information, it becomes possible to have a differentiated approach to selecting the anesthesia method in ophthalmic surgery for elderly patients.

Among the group of sedatives, midazolam, which is a derivative of benzodiazepines, is the most widely used. This drug, when administered intravenously, induces a sleep that is close to physiological, with some muscle relaxation. The sedative, tranquilizing, and relaxing effects are determined by its influence on the limbic system, hippocampus, and amygdala. As an analgesic, we used fentanyl. Fentanyl, a derivative of piperidine, is several times more effective than morphine in terms of analgesic effect, but its respiratory depressive effect is significantly weak.

Induction was carried out by intravenous administration of droperidol, at a rate of 0.2 mg per 1 kg of patient's weight, but no more than 5 ml, fentanyl, at a rate of 0.05 mg-1 ml, midazolam, at a rate of 0.4 mg but no more than 30 mg, i.e. 3 ml. 45-60 seconds after the administration of midazolam, patients fell asleep and were given standard pain relief. Most patients did not react to injections. Ataralgesia was maintained with repeated intravenous administration of fentanyl and midazolam. Fentanyl was administered every 20-25 minutes at doses of 0.025-0.05 mg (0.5-1.0 ml), which did not inhibit the respiratory center. Midazolam was administered every 15-20 minutes in doses of 5-10 mg (0.5-1.0 ml). It

should be noted that in patients over 70, the amount of administered drugs was halved, and they were administered again as necessary, depending on the anesthesia clinic.

The Condition of Peripheral Hemodynamics and Ophthalmotonus During the Use of Ataralgia

Three to four minutes after the administration of the drugs, the arterial pressure decreased on average from 142.7+2.4 to 110.0+2.8 mmHg practically in all patients and remained stable until the end of the operation. Sometimes an increase of 20-25 mmHg was observed in the most traumatic moments of the operation, but arterial pressure decreased upon the administration of 0.5 ml of fentanyl. In two patients over 75 years old, arterial pressure dropped to 70 mmHg 15-20 minutes after the beginning of anesthesia due to hypovolemia. After intravenous infusion of volumetric solutions, arterial pressure increased to 90-100 mmHg.

Table №1

Peripheral hemodynamics and ophthalmotonus condition when using ataralgesia (n=25)

Parameters measured	Unit of measurement	Before anesthesia	After induction	During operation	After operation
SBP	mmHg	21,8±0,71	17,3±0,61***	-	-
DBP	mmHg	142,7±4,6	110,0±3,7***	110,1±3,5	114,2±3,7***
MBP	mmHg	93,7±3,0	69,6±2,3***	68,8±3,0^	70,3±2,4***
PP	mmHg	49,0±1,6	40,4±1,4***	45,8±1,8***	47,2±1,6^^
MAP	mmHg	110,3±3,6	83,0±2,8***	85,9±3,0***	84,9±3,0***
SpO2	%	94,4±0,75	94,4±0,78	94,8±0,68	95,7±0,46

Note: * reliable compared to indicators before the operation (*-P<0.05; ***-P<0.001)

Breathing was spontaneous in all patients during anesthesia. After seduxen was administered, a reduction in breathing frequency to 12-14 cycles per minute was noted. However, the depth of breathing increased. Rarely, after seduxen administration, there was a brief pause in breathing associated with the sinking of the lower jaw. As a result of intubation or the extraction of the lower jaw, spontaneous breathing was restored. In no case did we have to resort to assisted ventilation.

As noted above, one of the central issues of this work was to determine the effect of ataralgesia on intraocular pressure. The maximum decrease was recorded at the 25th minute and the pressure remained unchanged thereafter. It decreased in patients on average by 4.5 mmHg, which is 20.7% of the initial level.

Analgesia during the operation was sufficient, but arterial pressure remained at the initial level or tended to increase, which is highly undesirable in patients with arterial hypertension. To reduce arterial pressure as one of the components of ataralgesia, we used droperidol. This drug proved to be very effective. Five minutes after administration of the drug, arterial pressure decreased on average by 22.9% from the initial level and remained stable for another 3-4 hours after the end of the operation.

Central hemodynamics condition when using ataralgia

The following changes in central hemodynamics were noted after the introduction of anesthesia. After the induction of anesthesia, the cardiac output and stroke volume decreased by 16.2% and 17.8%, respectively. This indicator remained at the same level during and after the operation. The initial tone of resistive vessels according to the scale for evaluating systemic tonic states was within moderate stressful changes. The heart rate during the operation was stable and averaged 76.2 ± 2.3 beats per minute. After the introduction of anesthesia, it decreased by 2.5%. During and after the operation, the tonus of arterioles decreased by 4.6% from the initial value, i.e. it was within normal values. Overall, almost all of the studied indicators remained

stable without significant shifts towards increase or decrease during and after ataralgia, indicating a stable course of anesthesia. The decrease in the tone of resistive vessels indicates decentralization of blood circulation and improvement of microcirculation.

Table №2

Central hemodynamic state under the use of ataralgia (n=25)

Measured Indicators	Normal Values	Research Stages			
		Stage I	Stage II	Stage III	Stage IV
		Before anesthesia	After induction of anesthesia	During surgery	After surgery
Heart rate, beats per minute	60-80	76,4±3,2	75,6±2,9	76,2±3,1	77,0±3,3
Stroke volume, ml/m2	42-47	36,4±1,5	30,5±1,3*	30,0±1,2*	29,9±1,1*
Cardiac index, L/min/m2	3,1	2,8±0,12	2,3±0,10*	2,3±0,09*	2,3±0,11*
Respiratory rate, breaths per minute	16-20	20,3±0,55	18,3±0,50	20,8±0,40	20,3±0,50

Note: *-reliably compared to the indicators before anesthesia (*-P<0.01)

Rarely after the introduction of seduxen, a short-term breathing delay associated with the sinking of the lower jaw occurred. As a result of intubation or lowering of the lower jaw, spontaneous breathing was restored. In no case did we have to resort to auxiliary lung ventilation.

Conclusions

Thus, ataralgesia with the use of Seduxen, Fentanyl, and Droperidol is an effective way of pain relief during intraocular surgeries, which contributes to the reduction of blood pressure and intraocular pressure, creating favorable conditions for performing the operation. Ataralgesia is particularly indicated for patients with increased surgical risk (concomitant cardiovascular diseases).

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