Comparative characteristics of various options for local anesthesia in patients with high intraocular pressure

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ABSTRACT

The purpose of the study is a comparative study of the analgesic effect of various local anesthetics in ophthalmic surgery and their effect on intraocular pressure, intraocular hydrodynamics and relaxation of the ocular muscles.

Keywords: Local Anesthesia, Intraocular Pressure

Advances in cataract and glaucoma surgery allow the use of local anesthesia of the eyeball as an independent method of anesthesia or in combination with sedatives (2,7). A large number of abdominal operations existing in ophthalmology, in which local anesthetics are used during the intervention to eliminate pain, has given new impetus to the study of the effectiveness and duration of retrobulbar anesthesia, its effect on intraocular pressure (IOP) (5,7,9,12).

Regional anesthesia can have the most complete analgesic effect due to the suppression of nociceptive impulses and the creation of an autonomic blockade. The main criterion for choosing drugs for local anesthesia in surgical ophthalmology is the rapid onset of an anesthetic effect, myoplegia and a decrease in IOP.

The requirements for local anesthetics in ophthalmology are different. For anesthesia during eye surgery, higher concentrations of drugs are required, causing long-term and profound loss of sensitivity in the tissues of the eyeball. To relieve pain after abdominal operations (antiglaucomatous , extracapsular cataract extraction with intraocular lens implantation), it is sufficient to use minimal concentrations of anesthetic solution that do not have a toxic effect on the corneal epithelium and cause shallow, superficial anesthesia (11,12).

However, to date, the activity of various drugs during superficial anesthesia of the eyeball has not been sufficiently studied. The information available in the available literature is contradictory, which is explained by the use of different research methods. Currently, the most widespread are: 2-4% lidocaine (xylocaine , A stra , Sweden). 0.5-0.75% bupivacaine (marcaine , A stra , Sweden). Longocaine (bupivacaine hydrochloride, Yuria Pharm , Ukraine).

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Materials and methods

The studies were carried out on the basis of 2 clinics of the Tashkent Medical Academy. 42 (42 eyes) patients of both sexes with concomitant pathology of the circulatory system aged from 60 to 80 years (average age 68.2 ± 3.2 years) were examined. There were 23 (63%) men, 19 (37%) women. The patients were operated on for glaucoma with high intraocular pressure. The patients underwent antiglaucomatous operations. All patients received intramuscular premedication (diphenhydramine 0.1 mg/kg, diazepam 0.25 mg/kg or droperidol 0.125 mg/kg and non-narcotic analgesics) 30 minutes before surgery.

Depending on the local anesthetic used for retrobulbar blockade, patients were divided into three subgroups of 14 (14 eyes) each. The first subgroup (control) consisted of patients who received 8-10 ml of 2% lidocaine as a local anesthetic . Patients of the second subgroup used 2-5 ml of 0.5% bupivacaine as a local anesthetic . For patients of the third subgroup, 2-5 ml of 0.5% longocaine solution was used for conduction anesthesia .

Maklakov tonometer with a load of 10 g) and tonography (according to Nesterov) were performed before and 10 minutes after retrobulbar anesthesia. The activity of local anesthetics during regional anesthesia of the eyeball was assessed by the presence of ptosis, lack of movement of the eyeball in all directions, and decreased sensitivity of the eyeball.

The following indicators were studied:

- speed of onset of anesthesia,
- duration of complete anesthesia,
- total duration of anesthesia,
- depth of anesthesia.

The first determination of the sensitivity of the eyeball was carried out after 2 minutes, then after 5, 8, 10 minutes and subsequently every 5 minutes during anesthesia.

The absence of a blink reflex and movement of the eyeball, and a decrease in intraocular pressure were conventionally taken as complete anesthesia of the eyeball. The duration of complete anesthesia of the eyeball was determined from the moment of lack of sensitivity, which was measured by the length of time from the moment the sensitivity of the eyeball decreased until its threshold values returned. The depth of anesthesia of the eyeball characterized the degree of decrease in sensitivity and decrease in intraocular pressure. Statistical processing of the obtained results was carried out using generally accepted statistical methods, which included assessment of the arithmetic mean (M), the average error of the arithmetic mean (m), and the standard deviation (s). Student 's t test was used to assess intergroup differences .

Results and discussion. The total duration of anesthesia of the eyeball under the influence of 2.0% lidocaine was 30-45 minutes, 0.5% bupivacaine - from 120 to 180 minutes, 0.5% longocaine - from 120 to 180 minutes (Table No. 1). Complete anesthesia of the eyeball was significantly shorter than the total duration of anesthesia and began within 2 minutes after administration of 0.5% bupivacaine and 0.5 % longocaine

The duration of complete anesthesia of the eyeball under the influence of 0.5% bupivacaine and longocaine was significantly shorter than when using 2% lidocaine . For anesthesia with 2% lidocaine, it is necessary to use the drug in an amount of 8-10 ml. The use of such amounts of the drug often led to the development of conjunctival chemosis and retrobulbar edema. The incidence of chemosis and retrobulbar edema during anesthesia with 2% lidocaine solution was observed in 4 (12.5%) patients. No such complications were observed during anesthesia with solutions of bupivicaine and longocaine . The total duration of anesthesia of the eyeball under the influence of bupivacaine and Longocaine (0.5%) was on average 3 times longer than with 2% lidocaine .

Table No. 1

Comparative characteristics of the local anesthetics studied

A drug	Solution concentration %	Speed of onset of anesthesia, min	Duration of complete anesthesia, (min)	Total duration of anesthesia (min)
Lidocaine	2.0	5-8	8.8 ± 0.9	30.1 ± 1.4
Bupivacaine	0.5	2-5	3.2 ± 0.5 *	120.6 ± 1.8 *
Longocaine	0.5	2-4	3.3 ± 0.5 *	120.9 ± 2.0 *

Note: * – differences compared to the control group (lidocaine) (P<0.05)

As it turned out, 0.5% bupivacaine and longocaine had pronounced anesthetic properties. These drugs caused good relaxation and led to a significant decrease in IOP, a decrease in true ophthalmotonus , due to a pronounced decrease in the production of aqueous humor. The hypotensive effect of these drugs, noted when measuring intraocular pressure with a Maklakov tonometer , is confirmed by tonography data according to Nesterov: in patients of the second and third subgroups during surgery, the true intraocular pressure significantly decreased mainly due to a decrease in the minute volume of aqueous humor (33%) and a simultaneous increase ease of churn rate (21.9%). When using 2% lidocaine, a slight decrease in IOP was noted (Table No. 2).

Thus, 0.5% bupivacaine and 0.5% longocaine, in addition to a quick and long-term anesthetic effect, also have hypotensive properties, which is important for abdominal operations in ophthalmology.

Table No. 2

Comparative characteristics of the effect of the studied anesthetics on IOP, hydrodynamics of the eye before and after anesthesia in patients with glaucoma

IOP and tonometry indicator	Norm	Group examination					
		I		II		III	
		Before	**After**	**Before**	**After**	**Before**	**After**
Tonometric pressure mmHg . (PT)	17-26	38.9±1.5	37.2±1.4	37.1±1.2	28.0±1.5	36.3±2.0	29.0±1.4 *
True IOP mmHg . (Po) _	9-21	36.3±1.57	34.8±2.1	35.1±1.7	22.9±1.8	35.7±0.72	24.4±2.8 *
Outflow ease coefficient mm ^{3} /min / mmHg	0.18-0.45	0.09±0.01	0.18±0.01	0.08±0.01	0.21±0.02	0.10±0.01	0.22±0.02
Minute volume of aqueous moisture mm ^{3} /min	1.6-4.0	4.46±0.08	4.49±0.03	4.48±0.09	3.50±0.09	4.55±0.08	3.17±0.07 *

Note: * – differences compared to the control group (P<0.05)

The study showed that when administered retrobulbarly, the drugs differ significantly in their anesthetic effect on the eyeball. Most authors indicate that anesthesia of the eyeball under the influence of 2% lidocaine lasts 30-45 minutes. In this case, the duration of deep (complete) anesthesia of the eyeball is taken into account; a less pronounced degree of sensitivity reduction is not taken into account, i.e. period of restoration of its threshold values. This is important to consider when eliminating only the pain sensitivity of the eyeball, which has a low threshold and is blocked by minimal concentrations of painkillers . Deep anesthesia of the eyeball turns off, in addition to pain, tactile, temperature and pressor sensitivity.
of bupivacaine (Marcaine , A stra , Sweden) can be used . 0.5% solution of longocaine (bupivacaine hydrochloride, Yuria Pharm , Ukraine) - drugs with pronounced anesthetic properties .

Conclusions:

1. A study of the local anesthetic activity of drugs used in ophthalmic surgery showed that the most effective is a 0.5% solution of bupivacaine and a 0.5% solution of longocaine , which cause deep anesthesia of the eyeball with a long-lasting effect.
2. Bupivacaine (0.5 %) and Longocaine (0.5%) during anesthesia lowers IOP by reducing the secretion of aqueous humor, improving the coefficient of ease of outflow of aqueous humor, which helps prevent complications from the eye during surgery and in the postoperative period.
3. Lidocaine (2%) when administered retrobulbarly causes complete anesthesia of the eyeball with a short duration of action and has side effects such as chemosis of the conjunctiva and retrobulbar edema. The drug does not cause proper myoplegia and its hypotensive effect is insignificant.

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