

# Does Topical Anesthesia Increase Patient's Serum Cortisol Level?

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## Abstract

**Background:** To evaluate in an objective manner the intraoperative anxiety level of patients undergoing phacoemulsification under topical anesthesia.

**Methods:** This prospective study included patients undergoing phacoemulsification under topical or peribulbar anesthesia. Medical sedation was not used. Blood samples were obtained before, during and at the completion of the surgery, and serum cortisol levels were assessed. Significance of differences was evaluated using unpaired t-test and one-way analysis of variance (ANOVA).

**Results:** The arterial blood pressure and pulse rates remained near baseline in both groups. The preoperative, intraoperative and postoperative levels were not statistically significant in both groups ( $p=0.069$  and  $p=0.227$ ). Plasma cortisol levels on every particular measurement remained within the normal range in every individual. There was also not any statistically significant difference for the changes between pre-, intra-, and postoperative plasma cortisol levels.

**Conclusions:** In both anesthesia methods, insignificant rises in plasma cortisol levels might occur during phacoemulsification. In view of the fact that topical anesthesia does not increase the patient's anxiety to measurable levels, our results suggest that it is at least as comfortable as peribulbar anesthesia.

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## INTRODUCTION

Topical anesthesia has become increasingly popular since its introduction by Fichman.<sup>1</sup> It was shown to be preferred by 56% of cataract surgeons in 2001 as opposed to 8% in 1995, 14% in 1996, 30 % in 1997, 45% in 1999, and 49% in 2000 in a yearly survey by Leaming in ASCRS members.<sup>2,3,4,5,6,7</sup> Another survey from Japan showed the increase in the preference for topical anesthesia as 26% in 1999, from 4% in 1993.<sup>8</sup>

The main advantage of topical anesthesia is the elimination of various local and systemic complications that have been reported with peribulbar and retrobulbar anesthesia, since it

does not involve any kind of injection.<sup>9,10,11,12</sup> It is especially suitable for surgical procedures like phacoemulsification. However, some surgeons may still be hesitant about using topical anesthesia fearing that the patient may feel pain or discomfort.

Stress from surgery or any kind of procedure may induce an increase in plasma cortisol level as a physiological response.<sup>13,14</sup> Based on that fact, we planned to evaluate the perioperative anxiety level experienced by patients undergoing phacoemulsification with topical anesthesia via an objective method.

## METHODS

Twenty-five patients, 18 male and 7 female, with cataracts were settled on to be suitable candidates for topical anesthesia, and were included in the study group. The mean age was  $55.1 \pm 10.5$  years (ranged between 37 and 72 years). Another 25 patients, 13 male and 12 female, who were

undergoing cataract surgery under peribulbar anesthesia throughout the same period made up the control group. The mean age of this group was  $63.3 \pm 9.2$  years (range from 47 to 79 years). Individuals with any kind of systemic, metabolic, or psychological disorder were excluded from the study. All patients received detailed information about the anesthetic procedure and the study, and signed the informed consent form.

Preservative free tetracaine 0.5% (AK-T-Caine PF, Akorn) drops were started 20 minutes before receiving topical anesthesia in every 3-4 minutes. We also applied cycloplegic, mydriatic and non-steroidal anti-inflammatory drops concurrently. Ocular compression was not performed.

Peribulbar anesthesia comprised a one-site (transdermal) injection of 5-8 ml of a 50:50 mixture of lidocaine 2% and lidocaine 2% with epinephrine, using a 27-gauge needle of 22 mm length. Mild digital massage allowed the anesthetic to diffuse into the tissues. Cycloplegic, mydriatic and non-steroidal anti-inflammatory drops were also applied.

None of the patients received any oral or intravenous sedation before or during surgery in either group. An intravenous line was opened in all patients. Oxygen saturation, arterial blood pressure, pulse rate and electrocardiogram were monitored during the surgical procedure with Horizon 1000 monitor (Mennen Medical Inc.). Patients were receiving oxygen at 8 liter per minute via the anesthetic circuit, in a way enabling to inhale from the environment, along with keeping oxygen saturation at 100%.

In both groups, temporal clear corneal incision was performed in all eyes. Following injection of viscoelastic material through the side-port incision, a continuous curvilinear capsulorhexis, hydrodissection, hydrodelineation, phacoemulsification and cortex aspiration were carried out. Foldable acrylic intraocular lenses (Acrysof MA60BA, Alcon) were implanted to all eyes. No sutures were used after acrylic intraocular lens implantation.

We obtained blood samples from all patients on 3 occasions: at the preoperative area before administering any anesthesia, during surgery and after the conclusion of surgery. These samples were sent to the endocrinology laboratory for the determination of the plasma cortisol levels. The laboratory had no knowledge about the patients, the type of anesthesia or the timing of blood samples.

The following day we questioned the patients about the pain perception. How they passed the intraoperative and

postoperative period, and whether they took any analgesics in the postoperative period were asked as well.

### STATISTICAL ANALYSIS

The data was entered into Statistical Package for Social Sciences (SPSS). General characteristics of the patients were compared with chi-square test. We assessed the significance of in the group and among the group differences of the serum cortisol levels using the parametric data for unpaired t-test and one-way analysis of variance (ANOVA). Probability index (p) greater than 5% was considered insignificant.

### RESULTS

The difference for the ages of the patients was statistically significant ( $t=2.375$ ,  $p=0.024$ ). All patients had normal outcome on electrocardiography with sinusoidal rhythm throughout surgery. Mean arterial blood pressure was 155 and 90 mmHg systolic and diastolic, respectively, in the topical group, and 160 and 90 mmHg in the peribulbar group. Mean pulse rate was 74 per minute in the topical group and 70 per minute in the peribulbar group. The difference between groups was statistically not significant for the blood pressure and pulse rates ( $\eta^2=0.029$ ,  $p=0.865$ ,  $\eta^2=0.058$ ,  $p=0.809$ , respectively)

Mean preoperative plasma cortisol levels were  $8.7 \pm 2.8$   $\mu\text{g}/100$  ml in the topical group and  $11.7 \pm 3.4$   $\mu\text{g}/100$  ml in the peribulbar group, and the difference was statistically significant ( $t=2.686$ ,  $p=0.012$ ).

Table and Figure 1 summarize the mean changes in plasma cortisol levels of the patients on three measurements. The differences between preoperative, intraoperative and postoperative levels were not statistically significant in both groups (one-way analysis of variance (ANOVA);  $p=0.069$  and  $p=0.227$ ). Plasma cortisol levels on every particular measurement remained within the normal range (5-25  $\mu\text{g}/100$  ml) in every individual.

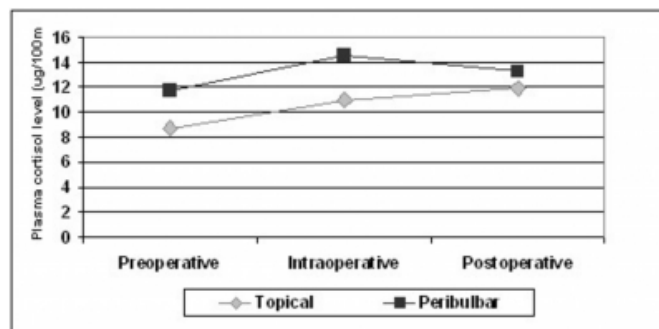
**Figure 1**

Table 1: The preoperative, intraoperative and postoperative plasma cortisol levels in patients undergoing phacoemulsification under topical or peribulbar anesthesia. Statistical significance was investigated using unpaired t-test between groups and ANOVA within groups. (\*p<0.05: statistically significant)

	Mean plasma cortisol level (% $\mu\text{g}$ )		unpaired t-test	
	Topical	Peribulbar	t	p
Preoperative	8.7 $\pm$ 2.8	11.7 $\pm$ 3.4	2.686	0.012*
Intraoperative	10.95 $\pm$ 4.4	14.5 $\pm$ 5.7	1.979	0.057
Postoperative	11.9 $\pm$ 4.1	13.2 $\pm$ 4.5	0.822	0.385
ANOVA	F	2.842	1.531	
	p	p= 0.069	p= 0.227	

**Figure 2**

Figure 1: Plasma cortisol levels in the patients undergoing small incision phacoemulsification under topical or peribulbar anesthesia: measurements were done before performing the anesthesia, during the operation and postoperatively



The difference between preoperative and intraoperative cortisol level in the topical and peribulbar anesthesia groups were calculated, and both groups compared. There was statistically insignificant difference between groups (t=0.326, p=0.746). The changes between the preoperative and postoperative cortisol levels were compared, and the difference was statistically insignificant (t=1.048, p=0.303). The variance of intraoperative and postoperative cortisol levels was also not significant when both groups were compared (t=1.668, p=0.106).

We also evaluated the results of the questionnaire: Neither of the patients in the topical anesthesia group took any analgesic nor had experienced any discomfort. However, four patients in the peribulbar group took a mild analgesic. This difference was statistically significant ( $\chi^2=4.348$ , p=0.037). Four patients in the peribulbar group had an ecchymosis at the injection site, seven had lid edema and mild ptosis, and five had chemosis and subconjunctival

hemorrhage in the early postoperative days.

## DISCUSSION

In the present study, we compared the changes in the plasma cortisol level in order to evaluate the objective response of the patient to the topical and peribulbar anesthesia during self-sealing phacoemulsification and foldable intraocular lens implantation procedures, in addition to the subjective replies of the patients. There was a significant difference for age between groups. This difference may be attributable to the decision of the patients for topical anesthesia. In our clinic practice, we observed that younger patients tend to require topical anesthesia compared to the elderly. For the topical anesthesia group we selected patients without hearing or speaking disabilities, without anxiety disorders, and with good cooperation. Thus, patients with younger ages underwent cataract surgery under topical anesthesia. However, we do not think this difference might have any effect on the results of plasma cortisol levels, since the range for normal does not differ with age considering the levels of cortisol.

In the last decade, topical anesthesia is developed from local anesthesia suitable for small incision phacoemulsification and other short lasting surgical procedures. Apart from eliminating many sight and life threatening complications, it has additional benefits like not interfering with visual function, immediate visual recovery, absence of ecchymosis and pain or conjunctival hyperemia and chemosis due to injection, unlimited ocular motility and absence of an increase in orbital volume.<sup>15</sup> Nielsen and Allerod evaluated patients preferences for anesthesia. They concluded that although with retrobulbar anesthesia less pain and discomfort was experienced, patients were preferring topical or subtenon anesthesia because of the inconvenience and pain of the retrobulbar injection.<sup>16</sup> However, topical anesthesia may not be suitable for every patient. Patient's tranquility and comfort during surgery increases the chances for uneventful surgery, as well as encouraging the patient for other procedures in the future, like operating on his/her other eye. Therefore, this study investigated increases in plasma cortisol levels that objectively reflect the discomfort of the patient during surgery as a physiological response to stressful conditions. The patients did not receive sedation before or during surgery, in order to assess the level of anxiety occurring in a patient under topical or peribulbar anesthesia alone. Results of the present study have shown that serum cortisol level did not increase significantly in patients undergoing surgery under topical anesthesia or

peribulbar anesthesia. The differences between groups were insignificant either.

Previous studies have assessed the degree of pain experienced by the patient during surgery in a subjective way by asking the patients' themselves by using a Visual Analog Scale.<sup>17,18,19,20,21,22</sup> Results of these studies show that most patients operated on under topical anesthesia do not feel a major amount of pain, similar to patients operated on peribulbar or retrobulbar anesthesia. However, these evaluations depend on the personal expression of the patient alone, who is capable of being affected by certain factors. Fichman has investigated changes in blood pressure, pulse rate and respiration rate of patients during surgery under topical anesthesia, and has found no major changes in these parameters.<sup>23</sup> Similarly, blood pressure, pulse rate and electrocardiography remained stable throughout surgery in our patients. Consequently, we propose that the patients did not experience such discomfort as would be reflected on these parameters. On the other hand, the main objective of our study was to determine the changes in plasma cortisol levels, which would show the stress experienced by the patients in a more direct and accurate manner. Pontiroli et al found that argon laser photocoagulation caused cortisol release in all patients with diabetic retinopathy.<sup>14</sup> We found no significant increases in our patients, which support the belief that topical anesthesia is right and proper for small incision cataract surgery.

Patients receiving topical anesthesia had significantly lower levels of plasma cortisol preoperatively. A possible explanation to this is that anesthetizing the eye with drops only was an option that is more attractive and that patients in the peribulbar group experienced fear at the idea of receiving an injection.

Topical anesthesia can be applied using different methods and substances.<sup>24,25,26,27</sup> However, they all have similar effects. Some surgeons add intraocular lidocaine 1% and/or apply sedation. The results of this study showed that tetracaine 0.5% drops alone, without any sedation or intraocular lidocaine 1%, are favorable.

In conclusion, in the present study insignificant rises in plasma cortisol levels occurred during surgery in patients under topical or peribulbar anesthesia, and the differences between the groups were insignificant. These findings suggest that topical anesthesia is at least as effective as peribulbar anesthesia in achieving patient satisfaction and in providing patient comfort. Patients and surgeons

convenience at most are the main goal of the cataract surgery. When additional benefits like uninterrupted visual function, absence of chemosis and ecchymosis, better cosmetic, simplicity and rapidity and avoidance of injection are considered, we believe that topical anesthesia is more advantageous than peribulbar injection in small incision phacoemulsification.

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