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Comparison of intravenous remifentanil and dexmedetomidine infusions' effects on intraocular pressure and hemodynamy in dacryosystorinostomy operations

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ABSTRACT

Aim: To compare the effects of intravenous infusion of remifentanil and dexmedetomidine on intraocular pressure (IOP) and hemodynamics of patients who underwent dacryocystorhinostomy (DCR) operation.

Methods: Ninety consecutive patients aged between 20 and 65 who had lacrimal duct stenosis or occlusion scheduled for elective DCR operation were included in the study. Patients were divided into 3 groups as control (Group C), remifentanil infusion (Group R) and dexmedetomidine infusion (Group D). Peroperative intraocular pressures and hemodynamics were evaluated.

Results: According to intraocular pressure levels; although the IOP decreased at the drug loading dose, induction, preextubation and postextubation, it was statistically significantly higher in Group C than in Group R and Group D (p<0,001). Concominantly, IOP was higher in Group R than in Group D during the time periods listed above. Although IOP measurements at the 1st and 5th minutes of intubation decreased compared to the preoperative value, they were higher than those in Group C, Group R, and Group D; 16.43±1.48 mmHg and 15.62±1.43 mmHg respectively (p < 0.001). However, in these periods there was no statistically significant difference between Group R and Group D. In the postoperative period, the IOP measurements of Group D were significantly lower than those of Group C and Group R, 16.81±1.65 mmHg, 18.21±1.98 mmHg, 18.17±1.29 mmHg, respectively (p< 0.002). Blood pressure and heart rate values decreased more in Group R and Group D compared to Group C during the operation (p < 0.001).

Conclusions: Remifentanil and dexmedetomidine are agents that can be used in intravenous infusions for controlled hypotension in eye surgeries where low IOP is desired. Intraoperative hemodynamic effects are similar. However, considering that it decreases IOP values more in the intraoperative period and lowers IOP values in the postoperative period compared to remifentanil, we believe that dexmedetomidine can be preferred primarily.

Key words: Intraocular pressure, hemodynamics, remifentanil, dexmedetomidine, dacryocystorhinostomy.

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Introduction

Although most of the ophthalmic routine surgeries can be performed under local anesthesia, general anesthesia is principally preferred in orbital surgical procedures [1]. Anesthetic approach can cause good or unsuccessful surgical outcome. General anaesthesia (GA) is considered as the gold standard for DCR surgery. Since the introduction of the procedure at the beginning of the last century until very recently, most surgeons prefer to perform the surgery under GA. This form of anaesthesia offers an excellent operative condition which completely eliminates the surgical pain especially during periosteal elevation and creation of the osteotomy [2]. Balancing the intraocular pressure, inhibiting the oculocardiac reflexes, controlling the intraocular gas diffusion and preventing the possible systemic effects of ophthalmic drugs are the focus of attention of the anesthesiologist in eye surgery [3]. Understanding and regulating the mechanisms of these potential problems may positively affect the surgical results. Anesthetic management significantly influences the pressure changes in the eye throughout the perioperative period. The anesthetic procedures chosen must place a strong emphasis on safeguarding retinal perfusion, reducing the danger of ischemic stroke, and minimizing the possibility of expulsive bleeding [4]. Laryngoscopy, tracheal intubation and subsequent extubation are often associated with an increase in arterial blood pressure (BP), heart rate (HR), arrhythmias, and raised intracranial and intraocular pressure [5]. Comfortable induction, deep anesthesia during intubation and adequate muscle relaxation should be ensured. The increase in IOP in response to laryngoscopy and intubation can be reduced to some extent by intravenous administration of lidocaine before induction or opioids in induction [6]. When the anesthetic used increases the IOP; this effect can lead to complications such as iris, lens, vitreous protrusion from the incision site and complications that can lead to loss of the eye, especially in surgeries in which the anterior chamber is opened. Therefore, the main principle should be to be careful in the selection of anesthesia techniques and drugs that do not increase IOP, but on the contrary, decrease it when necessary in eye surgeries. In operations such as dacryocystorhinostomy, a small amount of blood can cover the entire working area of the surgeon. Controlled hypotension is commonly used in operations to decrease intraoperative bleeding and to improve visualization of the operative field. Intravenous remifentanil and dexmedetomidine are two frequently used intravenous infusion agents in operations requiring controlled hypotension. [7]. Both drugs have common effects such as suppressing sudden hemodynamic response changes, providing intraoperative analgesia and deepening anesthesia [8]. Our hypothesis is that dexmedetomidine, which has a longer half-life, will have a longer effect on IOP than remifentanyl. In this clinical study, the primary objective is compare the effects of intravenous infusions of remifentanil or dexmedetomidine on intraocular pressure and the secondary aim is hemodynamic responses in patients undergoing dacryocystorhinostomy operation under general anesthesia.

Materials and methods

Settings and Participants: This was a prospective, controlled, randomized study conducted between 01.04.2010 and 30.12.2010, consecutive 90 patients aged 20-65 years who applied to the Ophthalmology Clinic of İstanbul Kartal Lütfi Kırdar Training and Research

Hospital scheduled for DCR operation were included in the study. Physical examination of the patients included in the clinical study was performed the day before the surgery and laboratory findings were evaluated. They were asked not to take food by mouth within 6-8 hours before surgery. Writing informed constent was taken from the patients who were informed about the study. The clinical trial randomized, before trhe surgery, by the sealed envelope technique based on computer-generated random numbers into three groups with 30 patients. The participants were randomized into the Control group (Group C; n=30), Remifentanil Group (Group R; n=30), Dexmedetomidine Group (Group D; n=30). Higher than ASA II Score, difficult intubation, morbidly obese, uncontrollable hypertension, cardiac arrhythmia, liver failure, renal failure, allergy to opioid and alpha-blocker drugs, using alpha 2 receptor agonist and antagonist drugs, psychiatric disorder, communication restriction, eye disease other than refractive error and dacryostenosis, and previous eye surgery were accepted as exclusion criteria.

Ethical consideration: The present study was approved by İstanbul Kartal Dr. Lütfi Kırdar Training and Research Hospital local ethical board in accordance with the Declaration of Helsinki (No and date: 04/2010). The study was designed prospectively.

Interventions: Vascular access was established with a 20 G intravenous cannula from the right or left upper extremities of the patients. There was no preoperative sedative medication used. An infusion of 0.9% NaCl was started through the cannula at a rate of 5 ml/min. Standard DII lead ECG, automatic noninvasive blood pressure and peripheral oxygen saturation monitoring were applied to the patients who were taken to the operating room. For BIS monitoring, "BIS Monitor Aspect A2000 TM USA" was utilized. Intraocular pressures of the patients were measured on the non-operated side of the eye with a Schiotz tonometer. Local anesthetic 2% procaine drops were applied 2-3 minutes before the intraocular pressure measurements. After the measurements, 0.03% ofloxacin eye drops were administered as a postoperative prophylactic.

In the prospective randomized study, the patients were divided into 3 groups with 30 patients in each group. Group C: Control group: Patients received isotonic sodium chloride infusion throughout the operation, starting from the preoperative period. No drug loading or intravenous drug infusion was applied to the control group, except for intravenous isotonic infusion. Group R: Remifentanil group: In the preoperative period, 1 μg/kg remifentanil intravenous loading dose was given to the patients for 10 minutes. Intravenous infusion of 0.1-0.3 μg/kg/min remifentanil was administered, with the BIS titrated to 40-60% at each stage of the operation. Five minutes before the procedure was to end, the infusion was stopped. Group D: Dexmedetomidine group: In the preoperative period, 1 μg/kg dexmedetomidine intravenous loading dose was given to the patients for 10 minutes. Intravenous infusion of 0.2-0.7 μg/kg/min dexmedetomidine was administered with the BIS titrated to 40-60% at each stage of the operation. Five minutes before the procedure was to end the infusion was stopped.

Patients in all three groups; before preoperative drug administration, 10th minute of drug loading dose, after anesthesia induction, 1th minute after intubation, 5th minute after intubation, before extubation, after extubation, in the postoperative recovery room IOP was measured. Simultaneously, heart rates, noninvasively arterial blood pressures (systolic

arterial pressure, diastolic arterial pressure and mean arterial pressures), oxygen saturation values were recorded.

The heart rate, noninvasive blood pressure, and peripheral oxygen saturation of the patients were routinely measured and recorded every 5 minutes during the operation. All patients received intravenous administration of 1.5 µg/kg fentanyl, 5 mg/kg thiopental sodium, 0.6 mg/kg rocuronium at induction were intubated and operated under general anesthesia. After intubation, general anesthesia was maintained with 1% sevoflurane and a mixture of 3/3 liters of oxygen and nitrous oxide. For the prevention of postoperative nausea 10 mg metoclopramide and for postoperative analgesia 100 mg tramadol intravenously was administered. Intravenous infusion was stopped 5 minutes before the end of the operation. Inhalation of volatile anesthetic agents was terminated and spontaneous respiration started. The patient was extubated by intravenous administration of 0.02 mg/kg neostigmine and 0.007 mg/kg atropine. In the postoperative recovery room, the patients were monitored and the measurements were recorded. Peripheral oxygen level falling below 90% in perioperative patients, oxygen desaturation, heart rate falling below 45 per minute and this situation persisting for 20 seconds, bradycardia, mean arterial pressures greater than 20% of the baseline value decrease was considered as hypotension. It was planned to be treated with intravenous 0.01 mg/kg atropine when bradycardia developed and intravenous 10 mg ephedrine when hypotension developed.

Data Analysis: Statistical analysis was performed using the NCSS (Number Cruncher Statistical System) 2007&PASS 2008 Statistical Software (Utah, USA) application for analyzing the study's findings. While evaluating the study data, in addition to descriptive statistical methods (Mean, Standard deviation), the Oneway Anova test was used for the comparison of the parameters showing normal distribution between groups in the comparison of quantitative data and the Tukey HSD test was used to determine the group that caused the difference. The Kruskal Wallis test in the intergroup comparisons of the parameters that do not show normal distribution and the results that cause the difference. Mann Whitney U test was used to determine the group. Paired Samples t-test was used for within-group comparisons of normally distributed parameters. Chi-square test was used to compare qualitative data. Significance was evaluated at the $p<0.05$ level.

Results

This clinical study was conducted on a total of 90 participants, 73 (81.1%) female and 17 (18.9%) male, between 01.04.2010 and 30.12.2010. The ages of the cases ranged from 20 to 65 years, with a mean of 47.97±12.41 years. There was no statistically significant difference between the groups in terms of age, gender, ASA scores and operation sites ($p>0.05$). Clinical and demographic characteristics are seen in Table 1.

There was no statistically significant difference between preoperative IOP measurements according to the groups ($p>0.05$) (Table 2). Compared to the preoperative measurement in Group C, there were significant decreases in IOP in Group C, except for Group C's postextubation and postoperative IOP measurements. With the exception of the dexmedetomidine group (16, 81±1, 65 mmHg), postoperative IOP in the control (18, 17±1,29 mmHg) and remifentanil (18,21±1,98 mmHg) groups returned to baseline values. After the Group R preoperative IOP measurement, there were significant decreases in IOP

measurements at each level, except for the postoperative IOP measurement. When the IOP measurements of Group R were compared with those of Group D, there was no significant difference between the 1st and 5th minutes of intubation. Postoperatively, Group R was significantly higher than Group D in IOP measurement. Group D which decreased at each level according to the preoperative measurement,unlike the other 2 groups, had a significantly lower postoperative IOP (Table 2, Figure.1).

Table 1. Demographic and clinical characteristics of the participants.

Parameters		**Group C**	**Group R**	**Group D**	***p***
Age		49,87±12,31	45,53±11,41	48,52±13,46	***0,389***
Gender	Female	24 (%80)	26 (%86,7)	23 (%76,7)	***0,602***
	Male	6 (%20)	4 (%13,3)	7 (%23,3)	
ASA	I	10 (%33,3)	16 (%53,3)	12 (%40)	***0,279***
	II	20 (%66,7)	14 (%46,7)	18 (%60)	
Operation side	Right	15 (%50)	10 (%33,3)	19 (%63,3)	***0,066***
	Left	15 (%50)	20 (%66,7)	11 (%36,7)	

Table 2. Intraocular pressure evaluation by groups (mmHg).

IOP	**Group C**	**Group R**	**Group D**	***p***
Preoperative	18,09±1,49	18,44±1,91	17,72±1,98	*0,311*
After medication 10. minute	17,90±1,50	16,36±2,06	15,12±2,08	*0,001***
Induction	15,08±2,00	13,34±2,43	11,97±2,11	*0,001***
Intubation 1. minute	16,43±1,48	14,94±2,45	14,43±1,68	*0,001***
Intubation 5. minute	15,62±1,43	14,10±2,22	13,71±1,64	*0,001***
Preextubation	15,82±1,54	12,84±2,97	10,18±1,34	*0,001***
Postextubation	18,03±1,82	16,04±2,44	14,27±1,53	*0,001***
Postoperative	18,17±1,29	18,21±1,98	16,81±1,65	*0,002***

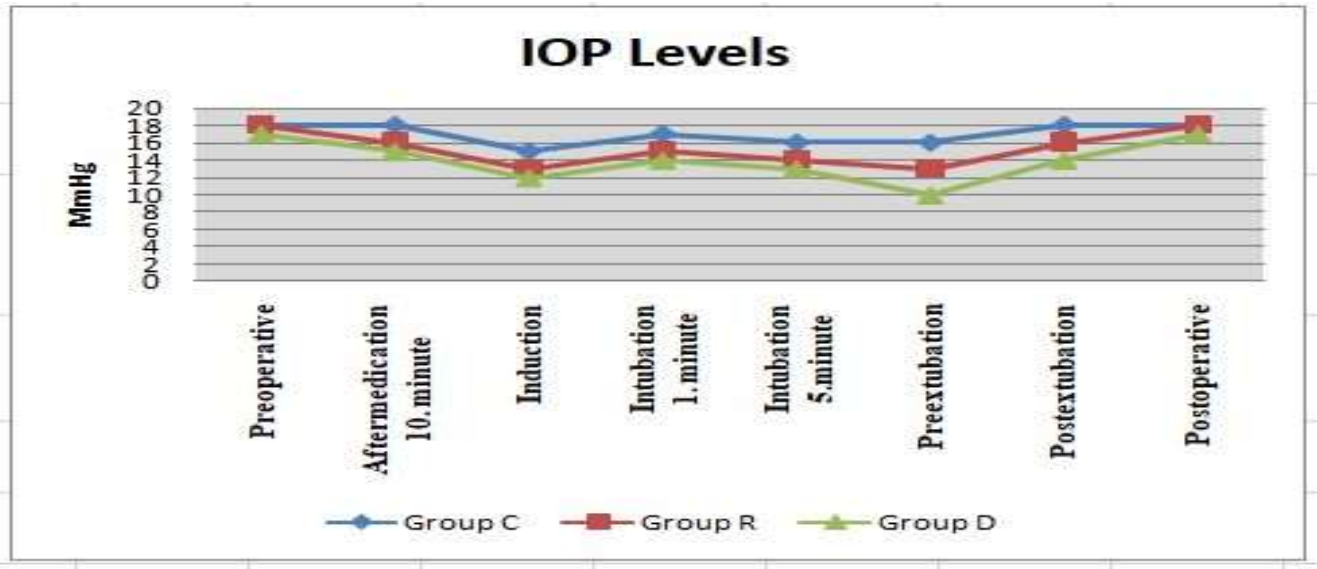

Figure 1. Intraocular pressure levels by groups (mmHg).

There is no statistically significant difference between preoperative HR measurements according to the groups (p>0.05) (Table 3). According to the preoperative HR measurements, there was a significant decrease in Group D in the postoperative period compared to Group C and Group R's preoperative HR measurement (p: 0,006). In the postoperative period, there was no significant difference between Group C and Group R according to the preoperative measurement (Table 3, Figure.2).

There is no statistically significant difference between preoperative SBP measurements according to the groups (p>0.05) (Table 4). Group R and group D SBP measurement was significantly less than Group C, but even though Group D SBP was measured lower in the postoperative period compared to other groups, it was not statistically significant (p:0.086) (Table 4, Figure.3).

There is no statistically significant difference between preoperative SBP measurements according to the groups (p>0.05) (Table 4). Group R and group D SBP measurement was significantly less than Group C, but eventhough Group D SBP was measured lower in the postoperative period compared to other groups, it was not statistically significant (p:0.086) (Table4, Figure.3).

Table 3. Heart rate evaluation by groups (beat/minute).

HR	Group C	Group R	Group D	*p*
Preoperative	83,53±8,98	83,40±10,20	80,30±6,97	*0,280*
After medication 10. minute	84,06±9,61	77,46±8,87	73,53±7,16	*0,001***
Induction	78,57±8,44	74,26±11,79	66,10±5,40	*0,001***
Intubation 1. minute	83,60±11,0	75,76±11,53	72,67±6,97	*0,001***
Intubation 5. minute	79,20±11,90	70,50±9,46	69,40±6,27	*0,001***
Preextubation	68,26±7,38	67,67±10,45	58,60±5,58	*0,001***
Postextubation	75,73±8,68	76,40±10,73	73,03±6,21	*0,292*
Postoperative	79,20±7,41	82,73±9,31	76,13±6,41	*0,006***

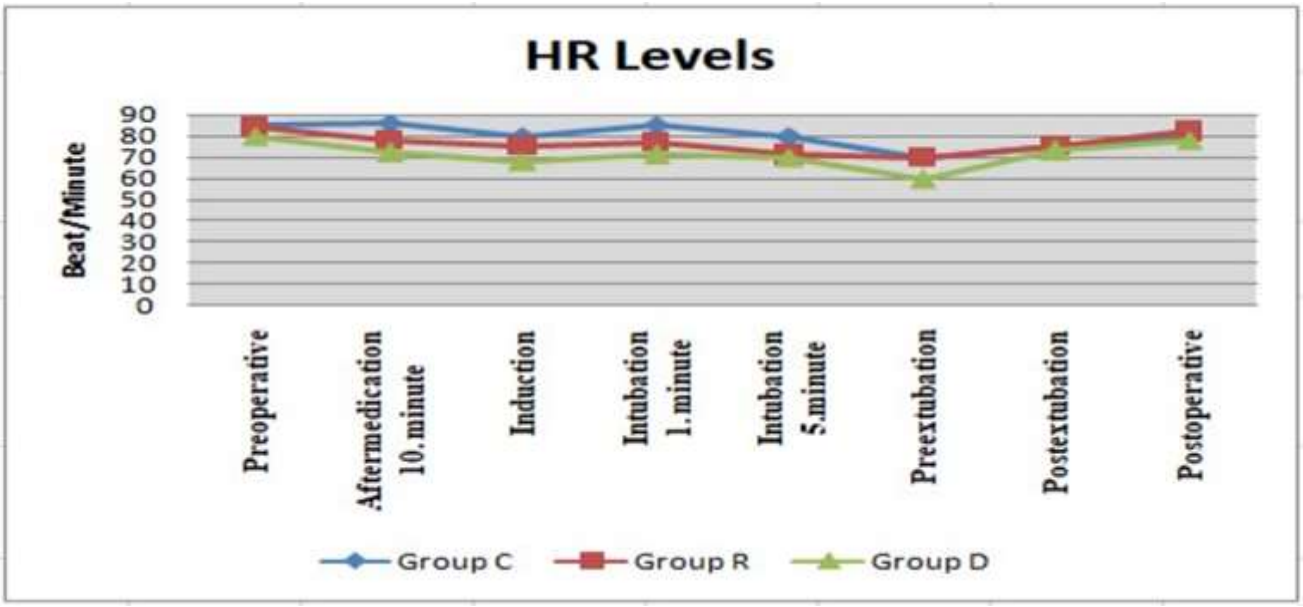

Figure 2. Heart rate levels by groups (beat/minute).

Table 4. Systolic blood pressure evaluation by groups (mmHg).

SBP	Group C	Group R	Group D	*p*
Preoperative	140,70±9,62	137,70±12,33	137,97±13,95	*0,571*
After medication 10. minute	140,0±10,0	126,50±12,16	125,83±13,73	*0,001***
Induction	112,23±12,59	101,83±23,14	101,33±11,45	*0,019**
Intubation 1. minute	128,33±12,56	113,23±14,25	119,40±10,20	*0,001***
Intubation 5. minute	114,63±13,59	101,50±23,11	112,56±11,11	*0,007***
Preextubation	111,46±25,03	99,27±14,11	90,86±11,79	*0,001***
Postextubation	136,73±14,06	128,26±13,58	122,97±12,71	*0,001***
Postoperative	138,10±12,19	134,97±12,56	131,16±11,11	*0,086*

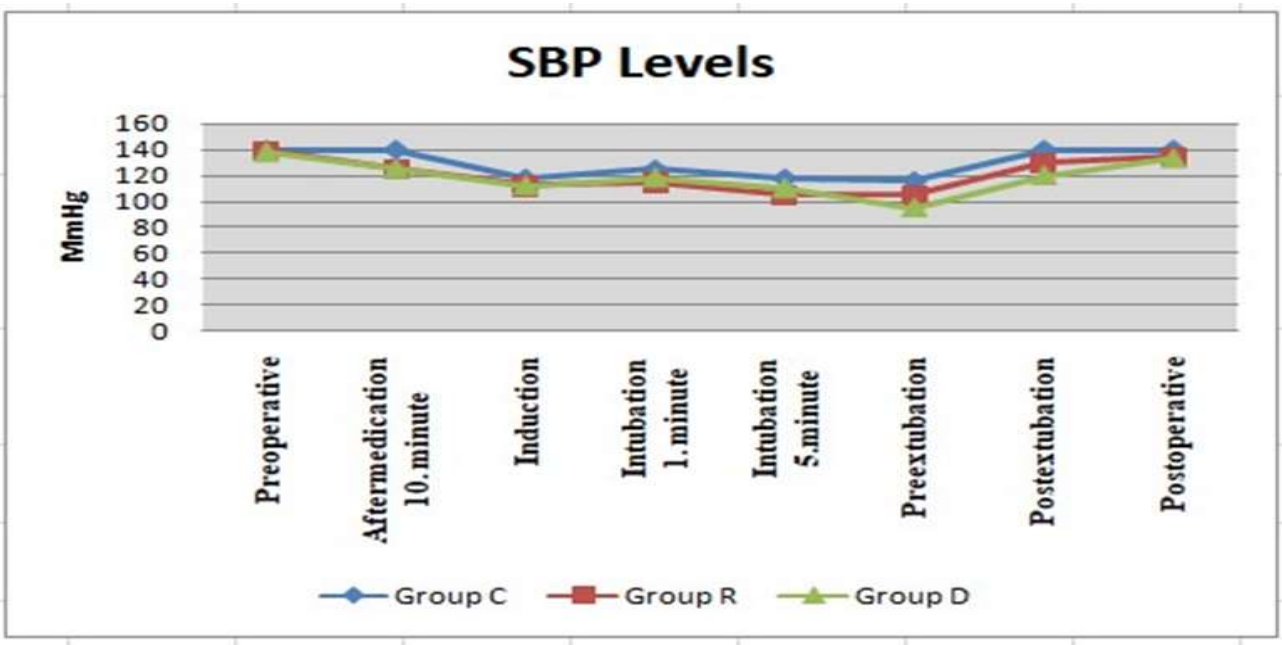

Figure 3. Systolic blood pressure levels by groups (mmHg).

Table 5. Diastolic blood pressure evaluation by groups (mmHg).

DBP (mmHg)	Group C	Group R	Group D	p
Preoperative	81,53±11,51	74,46±12,31	79,60±12,33	0,069
After medication 10. minute	80,13±9,24	70,26±9,46	70,63±10,67	0,001**
Induction	68,90±8,33	60,87±11,77	61,56±11,29	0,007**
Intubation 1. minute	78,23±9,99	64,33±10,89	66,90±10,13	0,001**
Intubation 5. minute	70,46±9,74	60,10±14,97	63,87±10,63	0,005**
Preextubation	68,67±11,71	61,23±10,23	55,50±8,33	0,001**
Postextubation	81,93±11,22	76,90±11,75	66,30±12,51	0,001**
Postoperative	79,06±10,23	75,97±10,77	72,0±10,24	0,036**

There was no statistically significant difference between preoperative DBP measurements according to the groups (p>0.05) (Table5).

Group D DBP measurement was statistically significantly lower than Group C at all levels. Until the post-extubation period, Group D DBP

measurement was not statistically different from Group R DBP measurement. While Group D DBP was statistically significantly lower than Group R after extubation (*p*:0,001), there was no statistically significant difference between Group D and Group R in postoperative DBP measurements (*p:*0,036) (Table 5, Figure.4).

There was no statistically significant difference between preoperative MAP measurements according to the groups (*p*>0.05) (Table 6). Group R and Group D MAP measurements were statistically significantly lower at each level compared to Group C. Although Group D MAP was higher than Group R in the postextubation period between the groups, there was no statistically significant difference between Group D and Group R MAP values in the postoperative period (*p*:0.005). According to preoperative MAP measurements, there was a statistically significant decrease in Group D in the postextubation and postoperative periods (Table 6, Figure.5).

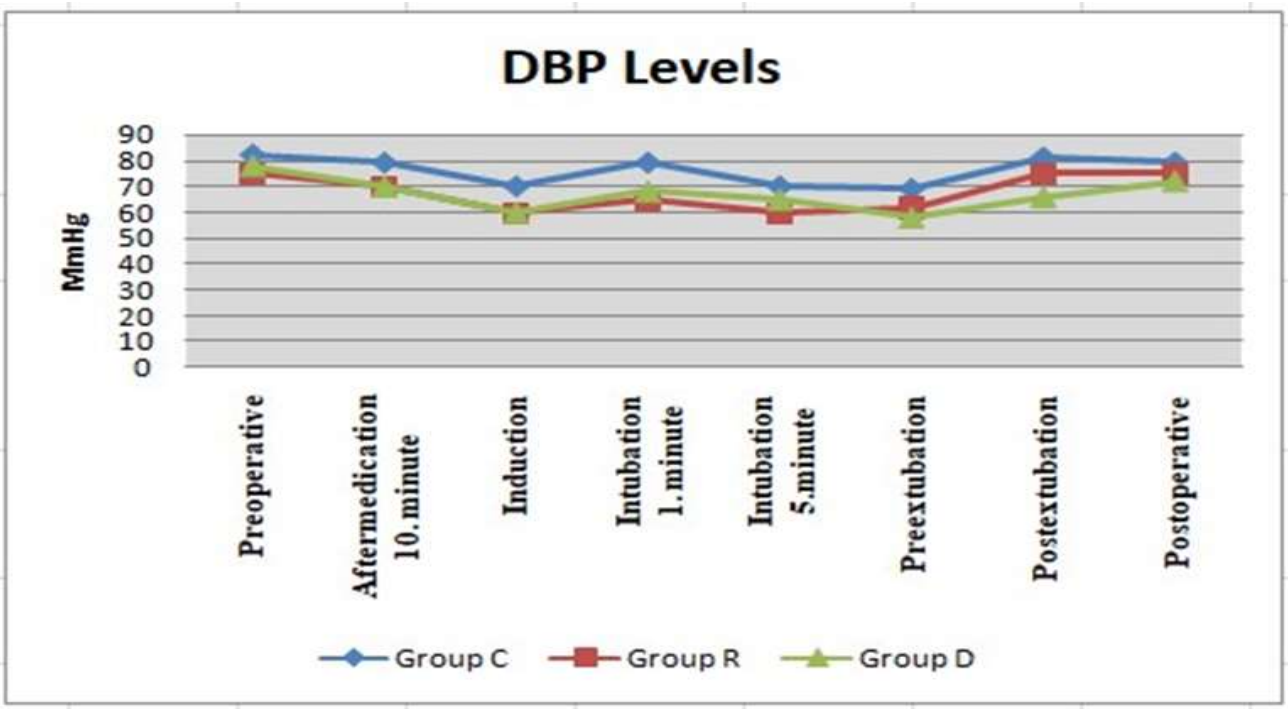

Figure.4. Diastolic blood pressure levels by groups (mmHg).

Table 6. Mean arterial pressure evaluation by groups (mmHg).

MAP (mmHg)	**Group C**	**Group R**	**Group D**	***p***
Preoperative	104,03±10,40	98,80±11,57	100,13±11,89	*0,182*
After medication 10. minute	103,53±10,38	92,80±11,68	90,30±11,74	*0,001***
Induction	85,16±10,18	77,60±14,11	75,53±10,57	*0,005***
Intubation 1. minute	95,90±12,02	83,50±11,18	84,26±8,64	*0,001***
Intubation 5. minute	86,56±10,51	78,63±11,59	78,93±7,98	*0,004***
Preextubation	85,60±12,57	76,66±11,49	67,63±7,86	*0,001***
Postextubation	102,13±11,37	76,70±13,19	85,50±8,92	*0,001***
Postoperative	101,57±11,23	97,83±10,54	92,43±9,88	*0,005***

Discussion

This study's objective is to assess and contrast the effects of intravenous remifentanil and dexmedetomidine infusions on IOP and hemodynamics compared to the control group. Anesthesia applied in ophthalmic surgery should keep the intraocular pressure under control before, during and after the operation. In ophthalmic operations, it should be preferred to use anesthesia techniques and devices that do not increase the intraocular pressure on the contrary reduce the intraocular pressure.

Antihypertensive agents and many drugs used in anesthesia also reduce blood pressure and therefore intraocular pressure. Both intravenous medications, remifentanil and dexmedetomidine can induce controlled hypotension, deepen anesthesia and offer analgesia. They also blunt the hemodynamic response to laryngoscopy [9]. It was determined that the intraocular pressures measured after laryngoscopy, intubation and post-intubation were significantly lower in the remifentanil group than in the control group, and as a result, remifentanil prevented the increase in intraocular pressure [10]. In our clinical study, a significant decrease was found in intraocular pressure measurements in the remifentanil group compared to the saline group. Heart rate and mean arterial pressure values were significantly decreased in the remifentanil group compared to the control group. Ng et al. dividing 45 patients who will undergo elective eye surgery into three groups, 10 ml of saline in the group 1, and 2 microgram/kg fentanyl group 2, and 1 microgram/kg remifentanil group 3, intravenously within 30 seconds [11].

Intraocular pressure, heart rate, mean arterial pressure, and oxygen saturations were recorded preoperatively, after laryngoscopy, after intubation, and at three-minute intervals in patients who were serially intubated with propofol and succinylcholine induction. They found that the measured parameters decreased significantly more in the remifentanil group compared to the other groups, and that remifentanil could be a suitable agent for use in open globe trauma. In our study, unlike Ng et al. the intraocular pressure values in dexmedetomidine, which we used, were found to be significantly more controlled and decreased compared to the remifentanil group. Eltzschig et al. reported that the use of sevofuran and remifentanil in patients who will undergo elective strabismus operation under general anesthesia prevents the increase in intraocular pressure in patients who use tracheal intubation or laryngeal mask [12]. In this study conducted in elective surgical operations other than eye surgery, it was concluded that the reducing effect of iv infusion remifentanil on intraocular pressure was equal to that of iv intermittent bolus fentanyl. Doruk et al. in their study comparing the effects of propofol and remifentanil on sedation, mobility and intraocular pressure in cataract operations performed under local anesthesia. Although remifentanil and propofol do not increase intraocular pressure at the administered doses, they provide adequate analgesia and sedation, but they concluded that remifentanil is a more appropriate option in sedation application due to less patient mobility. In this study, only 0.3 µg/kg loading dose of remifentanil was administered [13]. We think that the significant decrease in intraocular pressure of remifentanil in our study may be due to the fact that we continued the drug as an intravenous infusion during the operation. It has been reported that opioid agents such as remifentanil mostly reduce intraocular pressure by affecting the extraocular muscle tone and aqueous humor flow with their central depressive effects [14]. At the same time, we think that it prevents the

increase in intraocular pressure by preventing sudden increase in central venous pressure by creating deep sedation. In a study comparing alfentanil and remifentanil, it was reported that remifentanil lowered diastolic blood pressure and heart rate more, but the intraocular pressure lowering effects of both drugs were similar [15]. Hanna et al. [16] observed that remifentanil induction provided adequate intubation conditions, prevented the increase in intraocular pressure, and suppressed the hemodynamic response to laryngoscopy and intubation. Dexmedetomidine, on the other hand, is a α2 adrenoreceptor agonist, which is mostly used for sedation in intensive care units due to its sedative, anxiolytic and analgesic properties [17]. Remifentanil is a synthetic opioid with sedative and analgesic properties, and because of its ultra-short-acting effect, its effect on respiratory depression is rare in the recovery of general anesthesia. There was no respiratory depression at postoperative anesthesia care unit in either drug group [18]. In our study, we applied a loading dose of 1 μg/kg for 10 minutes. We administered 0.2-0.7 μg/kg/hour maintenance infusion after giving intravenously bolus. Muttu et al. concluded in their study that dexmedetomidine provides a suitable surgical environment with effective conscious sedation in cataract surgeries performed under local anesthesia [19]. A placebo-controlled randomized clinical research was carried out by Virkkila et al. to evaluate the effects on intraocular pressure (IOP) and hemodynamics during cataract procedures performed under regional anesthesia between intramuscular dexmedetomidine (1 μg/kg) and intramuscular midazolam (20 μg/kg). It has been suggested that dexmedetomidine is the agent that moderately reduces intraocular pressure, heart rate and blood pressure values, and can be used as a premedication agent in patients who will undergo cataract surgery [20]. According to Akyol et al. 1 μg/kg dexmedetomidine for 5 minutes in 30 patients who will undergo cataract surgery and reported that the intraocular pressure decreased by 21% compared to the control value [21]. Mahmoud et al. investigated the safety and effects of dexmedetomidine sedation on intraocular pressure during local anesthesia in ophthalmic surgery. In the study, it was concluded that dexmedetomidine is a sedative agent that can be used safely in eye surgery, reducing intraocular pressure [22]. Jaakola et al. examined the changes in intraocular pressure and hemodynamic parameters during laryngoscopy and tracheal intubation in ophthalmic surgery with dexmedetomidine in their study. After administration of dexmedetomidine, it was observed that intraocular pressure decreased by 27-43% and plasma noradrenaline level by 57-68% compared to the placebo group. It was also reported that systolic and diastolic arterial pressures were significantly lower in the dexmedetomidine group in measurements made within 10 minutes after intubation. As a result, it was concluded that dexmedetomidine reduces intraocular pressure and improves sympathoadrenal responses with laryngoscopy and intubation [23].

In a study comparing the early effects of midazolam and dexmedetomidine on intraocular pressure, it was reported that both drugs had sufficient sedative and anxiolytic effects and reduced intraocular pressure, but this decrease was more pronounced (17-44%) in dexmedetomidine [24]. In a study comparing the effects of dexmedetomidine and esmolol on IOP and hemodynamy; it was concluded that iv single dose 0.5 μg/kg dexmedetomidine administration before induction was more effective in preventing hemodynamic and

intraocular pressure responses to tracheal intubation [25]. Mowafi et al. in their study on 40 patients who did not have any eye disease and would be operated under general anesthesia; the patients were randomly divided into two groups and 0.6 μg/kg dexmedetomidine and saline were administered intravenously applied throughout for 10 minutes. It was concluded that heart rate fluctuated less in the dexmedetomidine group, mean arterial pressure values increased more after intubation in the control group, and dexmedetomidine premedication could be beneficial in the surgery of open globe injuries [26]. Lee et al. conducted a study on the combination of isoflurane anesthesia and dexmedetomidine infusion in patients undergoing vitreoretinal surgery under general anesthesia. Infusions were also terminated 30 minutes before the operation. Significant difference in heart rate and mean blood pressure values between dexmedetomidine and control groups not detected. It has been reported that dexmedetomidine reduces excitatory responses during extubation and significantly reduces intraocular pressure compared to placebo [27]. The reason why the findings of Lee et al. are different from our findings. We think that it may be due to the fact that the drug was given approximately 0.4 μg/kg of intravenous dexmedetomidine loading dose iv and the drug was discontinued 30 minutes before the operation. However, in our study, after a loading dose of 1 μg/kg intravenous dexmedetomidine, 0.2-0.7 μg/kg/hour dexmedetomidine iv infusion is continued until 5 minutes before the end of surgery. We think that the significant difference in intraoperative hemodynamic values between the groups is related to the duration of intravenous infusion. Kalyoncu et al. compared the effects of propofol and dexmedetomidine sedation on intraocular pressure in patients undergoing regional anesthesia and non-ophthalmic surgery. It has been concluded that dexmedetomidine may be preferred primarily because of the similar sedation levels and hemodynamic effects as well as lowering the intraocular pressure more [28].

We have frequently encountered studies in the literature comparing the effects of remifentanil or dexmedetomidine with different drugs or control groups on hemodynamic or intraocular pressure. However, we could not find a study that included the control group and compared the effects of these two agents on intraocular pressure. In our study, we observed that both drugs decreased the intraocular pressure statistically significantly compared to the values in the control group. However, the decrease in the dexmedetomidine group was statistically significantly higher than in the remifentanil group. The reason for this difference may be that dexmedetomidine decreases the plasma noradrenaline level. However, since plasma noradrenaline levels were not evaluated in our study, it cannot reveal the reason for this difference. Dexmedetomidine reduced IOP more profoundly and for a longer period postoperatively than remifentanil. The shorter half-life of remifentanil than dexmedetomidine may explain dexmedetomidine longer duration of action

In conclusion, at hemodynamic values that are comparable, both drugs lower intraocular pressure; however, dexmedetomidine has a stronger effect and its effects last longer than those of remifentanil. We believe that dexmedetomidine would be th e better option, particularly when maintaining l ow intraocular pressure for an extended period of time is necessary.

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References

[1]Kumar CM, Eke T, Dodds C, et al. Local anaesthesia for ophthalmic surgery—new guidelines from the Royal College of Anaesthetists and the Royal College of Ophthalmologists. Eye (Lond). 2012;26:897–8.

[2]Riad W, Chaudhry IA. Anaesthesia for dacryocystorhinostomy. Current Anaesthesia & Critical Care. 2010; 21: 180–183.

[3]Young S, Basavaraju A. General anaesthesia for ophthalmic surgery. Anaesth Intensive Care Med. 2019;20:716–720.

[4]Kelly DJ, Farrell SM. Physiology and role of intraocular pressure in contemporary anesthesia. Anesth Analg. 2018;126:1551–62.

[5]Wang YM, Chung KC, Lu HF, et al. Lidocaine: The optimal timing of intravenous administration in attenuation of increase of intraocular pressure during tracheal intubation. Acta Anaesthesiol Sin. 2003;41:71-5.

[6]Jain S, Khan RM. Effect of peri-operative intravenous infusion of lignocaine on haemodynamic responses to intubation, extubation and post-operative analgesia. Indian J Anaesth. 2015;59(6):342-7.

[7]Lee J, Kim Y, Park C, et al. Comparison between dexmedetomidine and remifentanil for controlled hypotension and recovery in endoscopic sinus surgery. Annals of Otology, Rhinology and Laryngology. 2013; 122: 421–6.

[8]Grape S, Kirkham KR, Frauenknecht J, et al. Intra-operative analgesia with remifentanil vs. dexmedetomidine: a systematic review and meta-analysis with trial sequential analysis. Anaesthesia. 2019; 74:793–800.

[9]Lee JH, Kim H, Kim HT, et al. Comparison of Dexmedetomidine and remifentanil for attenuation of hemodynamic responses to laryngoscopy and tracheal intubation. Korean J Anesthesiol. 2012;63:124–9.

[10] Alexander R, Hill R, Lipham WJ, et al. Remifentanil prevents an increase in intraocular pressure after succinylcholine and tracheal intubation. Br J Anaesth. 1998;81:606-7

[11] Ng HP, Chen FG, Yeong SM, et al. Effect of remifentanilcompared with fentanylon intraocular pressure after succinylcholine and tracheal intubation. Br J Anaesth. 2000;85:785-7.

[12] Eltzschig HK, Darsow R, Schroeder TH, et al. Effect of tracheal intubation or laryngeal mask airway insertion on intraocular pressure using balanced anesthesia with sevoflurane and remifentanil. J Clin Anesth. 2001;13:264-7.

[13] Doruk N, Atıcı A, Yıldırım Ö, et al. Retrobulber blok öncesi uygulanan propofol ve remifentanilin sedasyon, hareketlilik ve göz içi basıncı üzerine etkilerinin karşılaştırılması. Türk Anest Rean Der Dergisi. 2005;33:121-6.

[14] Montazeri K, Dehghan A, Akbari S. Increase in intraocular pressure is less with propofol and remifentanil than isoflurane with remifentanil during cataract surgery: a randomized controlled trial. Adv Biomed Res. 2015; 4:55.

[15] Güneş Y, Özcan AA, Ünlügenç H, et al. Jinekolojik laparoskopik girişimlerde propofol-alfentanil ve propofol-remifentanilin göz içi basıncına etkileri. Artemis. 2004;5(1):55-8.

[16] Hanna SF, Ahmad F, Pappas AL, et al. The effect of propofol/remifentanil rapid-induction technique without muscle relaxants on intraocular pressure. J Clin Anesth. 2010;22(6):437-42.

[17] Venn RM, Bradshaw CJ, Spencer R, et al. Preliminary UK experience of dexmedetomidine, a novel agent for postoperative sedation in the intensive care unit. Anesthesia. 1999;54:136-42

[18] Shahbaz R, Arain MD, Thomas J, Ebert MD. The efficacy, side effects and recovery characteristics of dexmedetomidine versus propofol when used for intraoperative sedation. Anesth Analg. 2002;95(2):461-6.

[19] Muttu S, Liu EH, Ang SB, et al. Comparison of deksmedetomidine and midazolam sedation for cataract surgery under topical anesthesia. J Cataract Refract Surg. 2005;31:1845-6.

[20] Virkkila M, Ali-Melkkila T, Kanto J, et al. Dexmedetomidine as intramuscular premedication for day-case cataract surgery. A comperative study of dexmedetomidine, midazolam and placebo. Anaesthesia. 1994;49:853-8.

[21] Akyol R. Katarakt cerrahisinde bilinçli sedasyon için uygulanan midazolam ve deksmedetomidinin karşılaştırılması. (Uzmanlık tezi). Şanlıurfa: Harran Üniversitesi; 2006.

[22] Mahmoud IM. Abdalla, Fatıma AL Mansouri, Bener A. Deksmedetomidine during lokal anesthesia. J Anaesth. 2006;20:54-6.

[23] Jaakola ML, Ali-Melkkila T, Kanto J, et al. Dexmedetomidine reduces intraocular pressure, intubation responses and anaesthetic requirements in patients undergoing ophthalmic surgery. Br J Anaesth. 1992;68:570-5

[24] Şenoğlu N, Ezberci M, Öksüz H, Özdemir G. Katarakt cerrahisinde premedikasyonda uygulanan midazolam ve deksmedetomidinin göz içi basıncı üzerine erken dönem etkileri. Anestezi Dergisi. 2006;14:249-52.

[25] Yavaşçaoğlu B, Kaya FN, Baykara M, et al. A comparison of esmolol and dexmedetomidine for attenuation of intraocular pressure and haemodynamic responses to laryncoscopy and tracheal intubation. Eur J. Anaesthesiol. 2008;25:517-19.

[26] Mowafi HA, Aldossary N, Ismail SA, et al. Effect of dexmedetomidine premedication on the intraocular pressure changes after succinylcholine and intubation. Br J Anaesth. 2008;100:485-89.

[27] Lee YYS, Wong SM, Hung CT. Dexmedetomidine infusion as a suplement to isoflurane anaesthesia for vitreoretinal surgery. Br J Anaesth. 2007;98:477-83.

[28] Kalyoncu A, Korfalı G, Yavaşçaoğlu B, et al. Propofol ve deksmedetomidin sedasyonunun göz içi basıncı üzerine olan etkilerinin karşılaştırılması. Uludağ Üniversitesi Tıp Fakültesi Dergisi. 2008;34(2):65-70.