

Comparison of the Effects of Remifentanil and Esmolol on Peroperative Hemodynamics and Postoperative Pain in Septum Deviation



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Abstract

Introduction: The aim of this study was to compare the effects of remifentanil and esmolol infusion used for controlled hypotension on hemodynamics and postoperative pain in elective septoplasty cases.

Materials and methods: Forty ASA I - II patients aged 18-55 years were included in the study. The patients were divided into two groups as R (remifentanil) and group E (esmolol). ECG, noninvasive blood pressure and peripheral oxygen saturation were monitored. None of the patients were premedicated. After anesthesia induction, in Group R 0.25µg/kg/min remifentanil infusion was started following 1µg/kg loading dose of remifentanil. In Group E, 50µg/kg/min esmolol infusion was given after 500µg/kg/min loading dose. Doses were gradually increased until the targeted 65-75mmHg OAB was reached. Blood pressure, Heart Rate (HR) and oxygen saturation (SpO₂) values were recorded during the operation and postoperatively. Modified Aldrete Scoring was used in the evaluation of recovery. Postoperative pain was evaluated using the visual analog scale (VAS). Side effects were recorded.

Results: There was no statistically significant difference between the groups in terms of their effects on heart rate, blood pressure, SpO₂ values, Aldrete scores and the presence of postoperative nausea and vomiting. VAS values were significantly lower in group R than group E.

Conclusion: Esmolol is a good alternative to remifentanil in the management of hypotensive anesthesia. However, remifentanil was better in pain management.

Keywords: Controlled hypotension; Remifentanil; Esmolol

Introduction

The aim of ideal anesthesia is to provide surgical comfort and hemodynamic stability without damaging the physiology of the organism, and to achieve a balanced and safe recovery in a short time.

Hypotensive anesthesia is preferred in surgeries in narrow areas such as septoplasty. For this purpose, controlled hypotension is applied. Controlled hypotension is a method that aims to consciously and reversibly reduce the Mean Arterial Pressure (MAP) up to 50-65mmHg. It was first introduced by Cushing in 1917 [1].

Controlled hypotension provides better surgical field of view reducing the amount of bleeding. Bleeding control is easier under controlled hypotension. Therefore the trauma to the tissues is minimized. Surgical procedure can be done in short time, better and easily. Although it is difficult to rate the blood loss, it is accepted that blood loss can be reduced by 50% with controlled hypotension. Remifentanil, which is frequently used for controlled

hypotension, is a narcotic analgesic, one of the agents with short-acting, rapid onset and easily titrated. Recently, esmolol, a short-acting, cardio-selective beta-blocking agent that has a rapid effect, has also been used for this purpose. In our study, we compared the effects of esmolol, a cardioselective beta-blocker and remifentanil, an opioid analgesic on hemodynamics and postoperative pain, in a group of patients with controlled hypotension in elective septoplasty procedures.

Material and Methods

An institutional ethical committee approval and informed consent were obtained for this prospective study. A total of 40 ASA I - II patients aged 18-55 years were included in the study. For the standardization of the group, the patients have Mean Arterial Pressure (MAP) below 50mmHg and heart rate below 50 beats/min, who has been used antihypertensive and anticoagulant drug who has coronary artery disease, morbid obese, pregnant and patients in lactation, who has drug abuse, liver and kidney

disease and those with severe anemia were excluded from the study. The patients were randomly divided into two groups as R (Remifentanyl) and Group E (Esmolol). Patients without premedication were taken to the operating room. ECG in standard D2 derivation, heart rate, non-invasive Systolic Arterial Pressure (SAP), Diastolic Arterial Pressure (DAP), Mean Arterial Pressure (MAP) and Peripheral Oxygen Saturation (SpO₂) were monitored. The values were used as follow-up parameters. Following a 3-minute preoxygenation with 100% oxygen, anesthesia induction was achieved with 5-7mg/kg thiopental sodium (Pental sodium 1g, İ.E Ulagay), 1µg/kg fentanyl (Fentanyl-citrate, Abbott, USA). Esmeron (Rocuronium, Organon, Netherlands) 0.5mg/kg was given intravenously and endotracheal intubation was performed. Anesthesia was maintained with 4-6% desflurane and 50% N₂O-50% O₂. A standard dose of lidocaine (with adrenaline) infiltration was performed on the surgical site by the surgical team. Loading dose was given after intubation and all parameters were recorded. Then a remifentanyl infusion at 0.25µg/kg was started. The infusion rate was increased by 0.025µg/kg/min every 5 minutes to reach the targeted MAP (65-75mmHg). After esmolol (Brevibloc) 500µg/kg/min loading dose in Group E, 50µg/kg/min esmolol infusion was started, it was gradually increased and targeted MAP value was reached. During the initial surgical incision, and during the operation at 5, 15, 30, 45min, and at every 15min, follow-up parameters were recorded. The heart rate ≤ 50 beats/min was accepted as bradycardia and the infusion rate was decreased. Even if the MAP was allowed to decrease to

60mmHg, the infusion rate of the drug was halved if it lasts longer than 60 seconds. If there is no improvement in 5 minutes, the drug was discontinued. When the heart rate was 45 beats/min, 0.01mg/kg atropine was administered intravenously. The dose was repeated when necessary. Changes in ECG were recorded. All hypotensive and anesthetic agents were discontinued during insertion of nasal tampons and metochlorpropamide 10 mg was given intravenously. When spontaneous respiration started, the effect of the muscle relaxant was reversed using IV 0.06mg/kg neostigmine and 0.02mg/kg atropine. Follow-up parameters of patients were recorded postoperatively. Postoperative pain scoring was performed using the Visual Analogue Scale (VAS) at 0, 5, 10, and 30 minutes. Side effects such as nausea, vomiting, agitation, bradycardia, cough, tremors, reflex tachycardia and rebound hypertension were recorded. Patients were evaluated according to Modified Aldrete recovery score at 0, 10, and 30 minutes at the end of anesthesia. Patients who reached 9 and above were sent to their clinics.

Statistical analysis

For multiple comparisons of descriptive statistics (arithmetic mean and standard errors) and group averages, SPSS V17 packet program was used for Duncan test calculations, and MS Office Excell program was used for plotting graphs. Significance levels were shown as P<0.05 for α = 0.05 and P <0.01 for α = 0.05. P> 0.05 indicates that the differences were not statistically significant.

Results

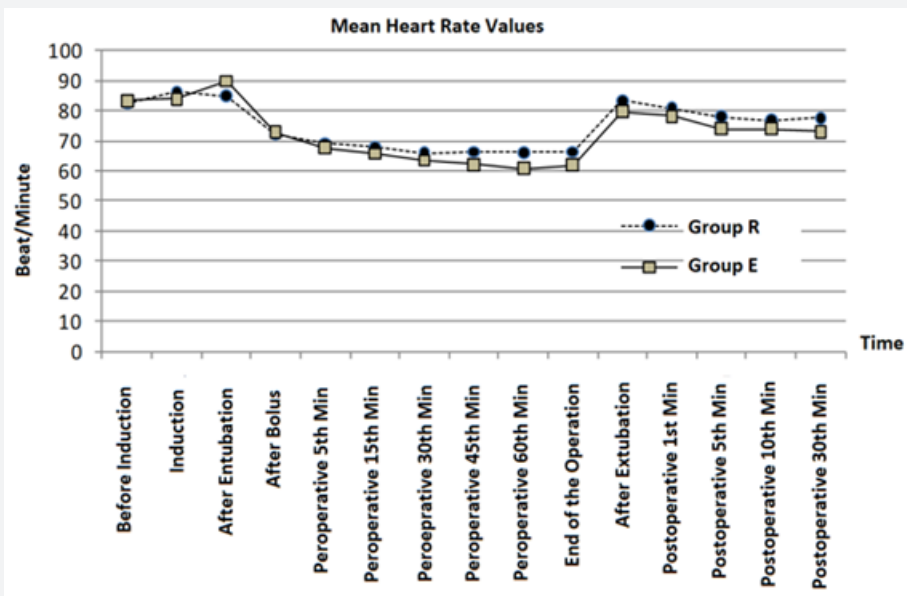


Figure 1: Average Heart Rate Values Change in Time in R and E Groups.

The values obtained from the study were examined, it was determined that there was no statistically significant difference between the drug groups in terms of their effects on heart rate (Figure 1). Heart rate was higher and statistically significant at 45 and 60 minutes of operation and at postoperative 30 minute in

Group R compared to Group E (P<0.05). SAP, DAP and MAP values were not different after induction between groups. A significant decrease occurred following the bolus dose, and continued at the same level until the end of operation. There was no statistically significant difference between R and E groups regards to SAP,

DAP and OAP values throughout the operation ($p>0.05$), (Figure 2-4). There was no statistically significant difference between the groups in terms of their effects on SpO_2 (Figure 5). VAS values of Group R and Group E were compared, and found that it was low and statistically significant at all time periods except after extubation. The VAS values were measured as 2,390 in group R and 3,330 in group E (Figure 6). VAS value of Group R at the

postoperative 1st, 5th, 10th and 30th minutes were lower than Group E and the difference was statistically significant ($p<0.05$). There was no statistically significant difference between the groups according to the presence of postoperative nausea and vomiting ($p=0.231>0.05$) (Table 1), in atropine requirement ($p=0.337>0.05$) (Table 2) and in Aldrete Scores (Table 3).

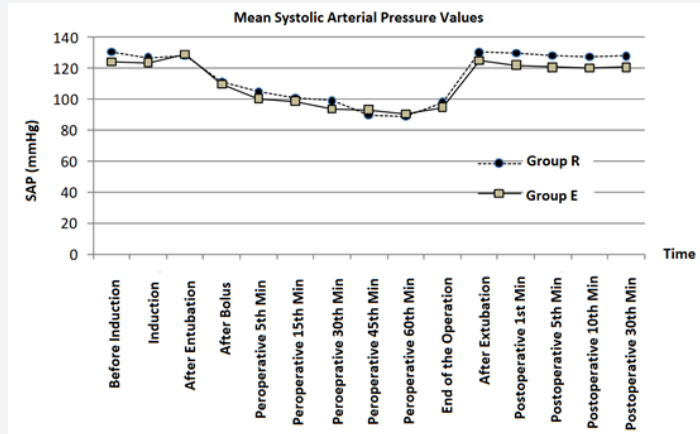


Figure 2: Variation of Systolic Arterial Pressure Values by Time in R and E Groups.

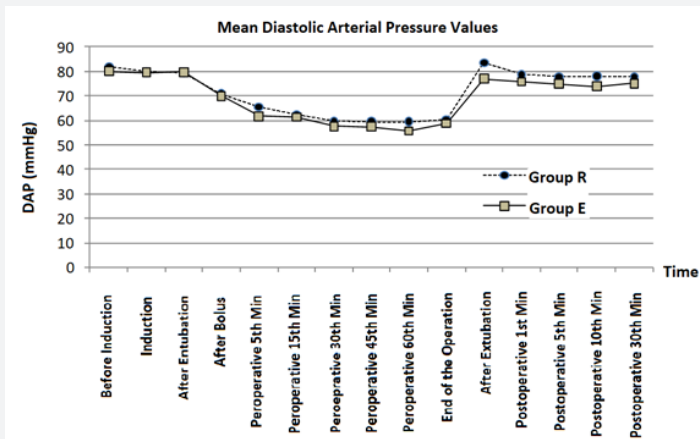


Figure 3: Variation of Diastolic Arterial Pressure Values by Time in R and E Groups.

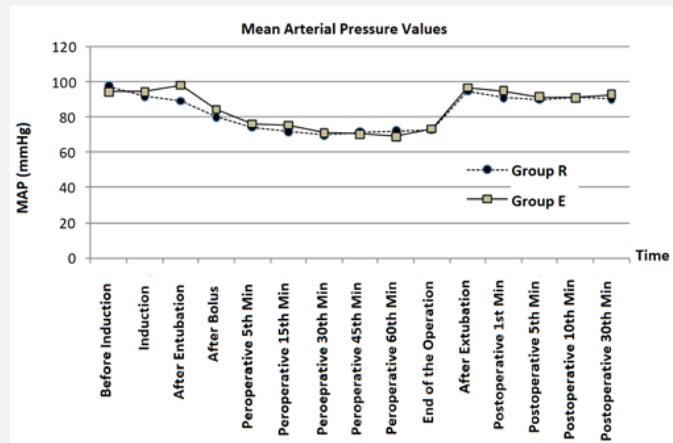


Figure 4: Variation of Mean Arterial Pressure Values by Time in R and E Groups.

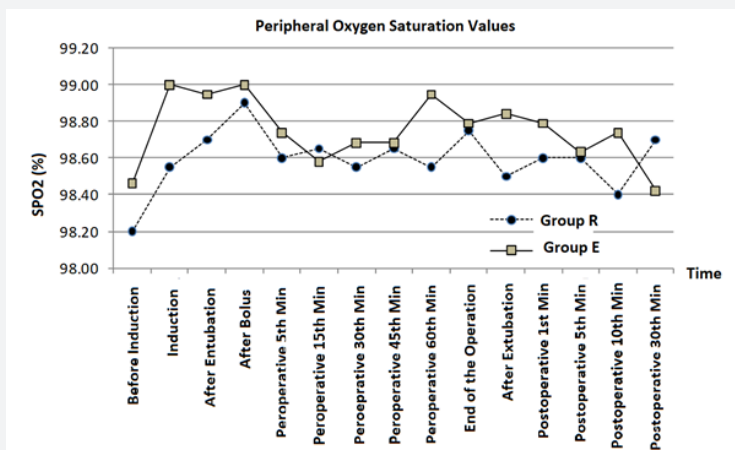


Figure 5: Change of Peripheral Oxygen Saturation Values in Time in R and E Groups.

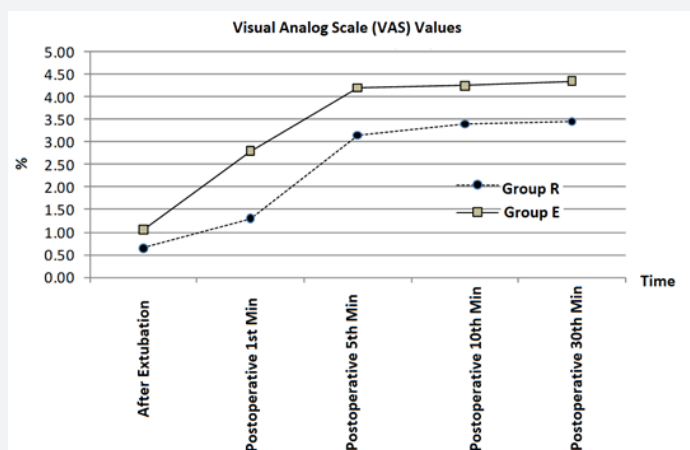


Figure 6: Change of VAS Values by Time in R and E Groups.

Table 1: Comparison of the groups according to the presence of postoperative nausea and vomiting.

		Group R		Group E		p
		n	%	n	%	
Nausea and Vomiting	Present	3	15	1	5	0.231
	Absent	17	85	19	95	

Table 2: Comparison of the groups according to atropine requirement.

		Group R		Group E		p
		n	%	n	%	
Atropine Requirement	Present	5	25	3	15	0.337
	Absent	15	75	17	85	

Table 3: Comparison of the groups according to Aldrete Scores.

	Group R	Group E	P
Aldrete 0 minutes	8,70±0,163	8,80±0,138	0.192
Aldrete 5. minutes	9,00±0,162	9,00±0,145	0.537
Aldrete 10 minutes	9,85±0,082	9,90±0,069	0.351
Mean±SD	9,183±0,102	9,233±0,093	0.339

*p<0.05 is significant.

Discussion

The aim of general anesthesia; to provide adequate depth hypnosis, analgesia and appropriate surgical environment. Controlled hypotension is one of the applications used to provide better surgical field of vision by reducing the amount of bleeding. Various methods and drugs can be used to create controlled hypotension. The main targets of the drug selection are safety of the drug, rapid onset and termination of the effect, non-toxicity, rapid elimination and minimal effect on the blood flow to the vital organs. Remifentanyl is a short-acting, fast-acting, easily titrated opioid analgesic. The hypotensive side effect is used for controlled hypotension.

In controlled hypotension, sympatholitics are also frequently used. Esmolol is a short-acting, rapid onset cardioselective β-adrenergic receptor blocker. In addition its analgesic effect is an advantage to other sympatholitics. In our study, we compared the effects of the μ-opioid receptor agonist remifentanyl and esmolol on hemodynamics and postoperative pain in elective septoplasty interventions. Sang Jun et al. [2] divided patients into two groups, esmolol and remifentanyl administered to one group, saline and remifentanyl were given to the other group in laparoscopic

appendectomy patients. Perioperative nausea and vomiting, pain score, antiemetic and analgesic requirement were evaluated.

Esmolol supplementation has been shown to increase the analgesic effect of remifentanyl and decrease postoperative nausea and vomiting. In saline group postoperative nausea, vomiting, pain and mean arterial pressure values were significantly higher during intubation and extubation. It was observed that these patients needed more antiemetic and analgesic within the first 24 hours [2].

Shukkla et al. [3] investigated the effects of perioperative esmolol on anesthesia and on postoperative pain in 60 ASA 1-2 patients undergoing lower abdominal surgery. Esmolol was given 15 minutes before and 15 minutes after the induction [3]. In the esmolol group, hemodynamia was more stable, postoperative pain score was lower, the use of morphine with PCA was less ($p < 0.05$) when compared to the saline group. Gökçe et al. [4] divided the ASA 1 group 40 patients into two groups for controlled hypotension. One group received remifentanyl-propofol combination and the other group received esmolol infusion in addition to remifentanyl-propofol combination. The consumption of remifentanyl was significantly lower in the esmolol group. It was reported that there was no difference between the groups in terms of recovery times [4].

Aydin et al used remifentanyl and esmolol in 36 adult patients who underwent tympanoplasty for controlled hypotension. In the remifentanyl group, the target was achieved much faster and the HR, OAB values were lower than the esmolol group. In the Esmolol group, hemorrhage decreased in the first 20 minutes, but at first 60 minutes the bleeding scores were high. Remifentanyl was accepted as a good, stable and reliable hypotensive agent in anesthesia [5]. Collard et al. [6] studied 90 patients who underwent laparoscopic cholecystectomy in three groups. In the control group fentanyl was given intermittently, in the second group esmolol infusion 5-15mcg/kg/min was given and in the third group remifentanyl infusion 0.1-0.5mcg/kg/min was given. The amount of fentanyl given for postoperative analgesia was significantly lower in the esmolol group compared to the other two groups ($p < 0.001$). The frequency of nausea was significantly lower in the esmolol group ($p < 0.01$) [6].

Chia et al. [7] administered 0.05mg/kg esmolol infusion following 0.5mg/kg esmolol bolus in ASA 1-2 group 97 patients undergoing hysterectomy prior to anesthesia induction, and the other group received normal saline at the same loading and infusion doses. In the esmolol group, inhalation anesthetic and fentanyl consumption decreased [7]. Degoute et al. [8] administered remifentanyl 1µg/kg to the first group of 40 ASA I children who had middle ear surgery, and sodium nitroprusside 0.25µg/kg/min and alfentanil 25µg/kg were given to the second group at the induction of anesthesia for controlled hypotension. In the maintenance of anesthesia remifentanyl infusion was administered 0.2-0.5µg/kg/minutes in the first group, and the

second group received 0.25µg/kg/minutes sodium nitroprusside infusion and 0.5µg/kg/min alfentanil infusion. Middle ear blood flow measured with laser doppler and it has been concluded that the combination of remifentanyl and sevoflurane provides better surgical field by reducing middle ear blood flow and no additional hypotensive agent was required [8]. Similarly, in our study, remifentanyl and esmolol were used for controlled hypotension, it was provided in both groups, and no additional hypotensive agent was needed. In another study; esmolol, remifentanyl and nitroprusside were compared to provide controlled hypotension in tympanoplasty by Degoute et al. [9]. The targeted 80mmHg pressure was achieved fastest with esmolol. In all three groups, the bleeding in the surgical area was found to decrease by 80% and no postoperative complication was observed. In the esmolol group, middle ear blood flow decreased more than remifentanyl and sodium nitroprusside groups [9].

Coloma et al. [10] investigated the use of esmolol as an alternative to remifentanyl in 53 patients who underwent laparoscopic tubal ligation. Esmolol and remifentanyl infusions were found to be equivalent in maintaining hemodynamic stability [10]. Lim et al. [11] compared 500µg/kg/min esmolol bolus, and 100µg/kg/min esmolol infusion and 200µg/kg/min esmolol infusion and placebo in patients undergoing intracranial surgery. Similar results were obtained in intraoperative sleep depth, postoperative recovery, need for additional analgesic and home discharge time. Systolic blood pressure and heart rate increased after extubation in all three groups. In the placebo group, 92% of patients had severe hypertension and tachycardia during and after extubation. It was concluded that hemodynamic response was more easily controlled with esmolol infusion and it was beneficial for patient safety and prophylactic esmolol infusion did not affect extubation time. There was no statistically significant difference between low-dose esmolol infusion and mid-dose esmolol infusion [11]. Watts et al. [12] conducted a meta-analysis in which investigated the effect of the perioperative percutaneous esmolol on postoperative early pain. It has been concluded that esmolol does not affect the time of awakening, decreases pain intensity, opioid consumption and postoperative nausea and vomiting [12]. Härkänen et al. performed a meta-analysis of 701 patients to evaluate the effects of beta adrenergic antagonists on perioperative pain. They stated that esmolol reduced the need for additional analgesic by 32-50%, prolonged the first analgesic time and reduced the amount of pain and analgesic consumption [13]. Thiruvankatarajan et al. [14] performed a meta-analysis comparing the effects of perioperative opioid and esmolol on nausea, vomiting, recovery time and analgesia. They stated that esmolol decreases postoperative nausea and vomiting, there is no difference between agents in terms of recovery time, early postoperative pain scores, opioid requirement and cumulative analgesic consumption [14]. The results of this study were compared with other results in the literature. The majority of studies have shown that esmolol provides better perioperative analgesia, lowers the incidence of nausea and vomiting, and

suppresses hemodynamic response better. In this study, it was found that there was no difference between the remifentanyl and esmolol groups in terms of the incidence of nausea and vomiting however, postoperative analgesia was better in remifentanyl group. There was no difference between the two groups in terms of postoperative recovery. As a result, esmolol is a good and a safe alternative to remifentanyl to provide controlled hypotension during anesthesia management. Remifentanyl, however, provides better postoperative analgesia.

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