

Comparison of the effects of dexmedetomidine and remifentanyl on emergence agitation after sevoflurane anesthesia in adults undergoing septoplasty operation: a randomized double-blind trial

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Abstract. – **OBJECTIVES:** Sevoflurane is an ideal agent for anesthesia since its respiratory irritant effect is minimal during mask induction. Emergence agitation (EA) is a common problem after anesthesia with sevoflurane. In this study it was aimed to compare the effects of dexmedetomidine and remifentanyl on emergence agitation after sevoflurane anesthesia in adults undergoing septoplasty operation.

PATIENTS AND METHODS: This prospective, randomized, double-blind study was conducted in Yenimahalle State Hospital after obtaining local Ethics Committee approval and patient's written informed consent. The patients were randomized into dexmedetomidine and remifentanyl groups. Hemodynamic parameters including heart rate, Mean arterial pressure, and sPO₂ were recorded. The patients were followed for 1 hour at the recovery room. Categorical data was analyzed using χ^2 test. Hemodynamic data was evaluated using unpaired *t* test for intergroup and paired *t*-test for within group comparisons. Data not normally distributed was compared using Mann Whitney U test. *p* < 0.05 was considered statistically significant.

RESULTS: Demographic data were similar in both groups (*p* > 0.05). Riker score was similar in both groups. VAS score was also not significantly different between both groups at the recovery room.

CONCLUSIONS: Our study demonstrated that Dexmedetomidine and Remifentanyl had equal effectiveness in reducing emergence agitation in patients undergoing septoplasty under Sevoflurane anesthesia.

Key Words:

Emergence agitation, Anesthesia, Dexmedetomidine, Remifentanyl.

Introduction

Sevoflurane is an ideal agent for anesthesia since its respiratory irritant effect is minimal during mask induction¹⁻³. Emergence agitation (EA) is a common problem after anesthesia with sevoflurane. Different terms including "agitation", "delirium", and 'excitation' have been used in different studies to describe the abnormal recovery patterns associated with this clinical condition^{4,5}. However, the rate of emergence agitation after general anesthesia with sevoflurane ranges between 20% and 80% depending on the definition of emergence agitation and the monitorization time after emergence from anesthesia^{2,5-9}.

Remifentanyl is a very rapid micron receptor agonist hydrolyzed by nonspecific plasma esterases. Its rapid elimination is independent of hepatic and renal functions, and its half life is 4 minutes (3-10 minutes) which is independent of infusion duration. It has no cumulative effect. Use of remifentanyl for analgesia in critical patients is made attractive by its properties of having rapid onset and offset of action, controllable cardiovascular effects, titrability, and a metabolite which has a shorter and lower effect than itself^{10,11}.

Dexmedetomidine, a selective α_2 receptor agonist, is an analgesic and sympatholytic with titrating sedation effect that lacks major respiratory depression¹²⁻¹⁴. Decreased opioid requirements and stress response to surgery ensuring a stable hemodynamic state is a beneficial property of the agent¹⁵⁻¹⁷. It has been reported that dexmedetomidine reduces emergence agitation^{18,19}.

In this study it was aimed to compare the effects of dexmedetomidine and remifentanyl on emergence agitation after sevoflurane anesthesia in adults undergoing septoplasty operation.

Patients and Methods

This prospective, randomized, double-blind study was conducted in 60 patients aged 18 to 65 years with an ASA (American Society of Anaesthesiology) risk group of I-II undergoing septoplasty operation in Yenimahalle State Hospital after obtaining local Ethics Committee approval and patient's written informed consent. Patients with the following characteristics were excluded: kidney, liver, and cardiovascular disease including atrioventricular block; history of allergy to study drugs; use of sedatives, narcotics, alcohol, and anticoagulant drugs; history of hematologic or neuromuscular diseases; morbid obesity and pregnancy.

No premedication was done in patients. All patients were infused Ringer's lactate solution at a rate of 5 ml/kg/h during perioperative period. In the operation room a second 22 G intravenous route was established. Systolic blood pressure, diastolic blood pressure, peripheral oxygen saturation (SpO₂) and electrocardiogram (EKG) were monitored and recorded. The patients were randomized into dexmedetomidine (Group D) and remifentanyl (Group R) groups. An anesthesiologist who was not a member of the study team prepared the study drug. A loading dose of 1 µg/kg of remifentanyl and dexmedetomidine was given to Group R (n = 30) and Group D (n = 30) in 100 ml 0.9% saline in 10 minutes. Neuromuscular stimulation was monitored by acceleromyography (TOF-Guard®; Biometer, Odense, Denmark) of right adductor pollicis muscle in all patients. Anesthesia induction was achieved by infusion of propofol 2 mg/kg following placement of superficial electrodes and probes on the ulnar nerve at wrist. After initial autocalibration of a single muscle twitch to 100% level by applying a supramaximal stimulation (60 mA), rocuronium 0.6 mg/kg was given and the patient was intubated when T1 reached 0%. Maintenance anesthesia was achieved by 50% oxygen+ 50% air and 5% sevoflurane. The ventilator settings were adjusted so as to achieve an end-tidal carbon dioxide level of 35-40 mmHg.

The maintenance doses of remifentanyl and dexmedetomidine were 0.25-1 µg/kg/min and 0.4-1 µg/kg/h, respectively. The doses of the

drugs were adjusted so as to attain a mean arterial pressure (MAP) of 60 ± 5 mmHg. When MAP dropped below 50 mmHg ephedrine 5 mg was administered. When the former increased above 70 mmHg Nitroglycerine with 0.1 mg increments was given. Atropine 0.01 mg/kg was administered when HR (heart rate) dropped below 50/bpm. All drug administrations were recorded. Hemodynamic parameters including HR, MAP, and sPO₂ were recorded before, during, and after intubation. Skin temperature over adductor pollicis muscle was maintained above 32°C while body temperature was kept between 36 and 37°C. When T1 height reached 25% of the control value rocuronium 0.15 mg/kg was administered to maintain a T1 height below 10%. When the skin closure started at the end of the operation remifentanyl and dexmedetomidine infusions were stopped and no additional anesthetic agent was administered. When T1 responses reached 25% of the control value atropine 0.02 mg/kg and neostigmine 0.04 mg/kg were administered to antagonize neuromuscular block. The patients were extubated as soon as T4/T1 ratio became 90%. The patients were followed for 1 hour at the recovery room. Emergence agitation was recorded with Riker score at 0, 5, 15, and 30 minutes. The pain status of the patients was assessed with Visual Analog Scale (VAS) at 0, 15, and 30 minutes. Side effects of the drugs were recorded.

Statistical Analysis

Data analysis has been done using SPSS Version 11.0 (SOSS Inc., Chicago, IL, USA). Power analysis was based on the results of a previous study²⁰. According to the results of the power analysis, at $\alpha = 0.05$, $\beta = 0.05$ (power = 95%) each group should have contained at least 18 patients. Demographic and hemodynamic data as well as Riker and VAS scores were compared between the 2 groups.

Categorical data was analyzed using Chi square test. Hemodynamic data was evaluated using unpaired *t* test for intergroup and paired *t*-test for within group comparisons. Data not normally distributed was compared using Mann Whitney U test. A *p* value less than 0.05 was considered statistically significant.

Results

The study included a total of 60 patients. The demographic and clinical characteristics of pa-

Table I. Characteristics of patients.

	Group R	Group D	p
Sex (M/F)	18/12	16/14	$\chi^2 = 0.68, p = 0.79$
Age	33.03 ± 12.4	31.47 ± 10.9	T = 0.52, p = 0.60
Duration of operation	65.05 ± 51.6	64.67 ± 31.7	T = 0.29, p = 0.97
Duration of anesthesia	77.82 ± 49.3	76.90 ± 34.6	T = 0.07, p = 0.97
Duration of the agent	78.45 ± 45.7	79.57 ± 39.6	T = -0.27, p = 0.78
MAP before induction	97.41 ± 10.7	95.69 ± 12.4	T = -0.50, p = 0.61
HR before induction	83.87 ± 14.6	88.43 ± 17.3	T = -0.94, p = 0.34
sPO ₂ before induction	94.33 ± 1.3	99.06 ± 1.0	T = -90, p = 0.37
MAP after induction	84.71 ± 11.1	87.37 ± 10.3	T = -0.83, p = 0.40
HR after induction	115.47 ± 17.2	85.81 ± 12.6	T = 0.80, p = 0.42
sPO ₂ after induction	99.32 ± 0.6	99.00 ± 1.6	T = 0.84, p = 0.40
MAP after intubation	92.58 ± 13.6	102.21 ± 20.0	T = -1.93, p = 0.06
HR after intubation	88.48 ± 14.9	90.43 ± 13.4	T = -0.45, p = 0.65
sPO ₂ after intubation	98.91 ± 2.0	99.76 ± 0.7	T = -1.62, p = 0.11
Side effect	10	12	$\chi^2 = 0.33, p = 0.56$
Min 0 Riker	3.53-1.4	3.21-1.5	Z = -0.91, p = 0.35
Min 5 Riker	3.70-0.9	3.67-0.8	Z = -0.23, p = 0.81
Min 15 Riker	4.0-0.5	3.93-0.4	Z = -0.95, p = 0.34
Min 30 Riker	3.97-0.2	3.97-0.3	Z = -0.01, p = 0.98
Min 5 Pain	2.17-1.9	2.33-1.7	Z = -0.58, p = 0.56
Min 15 Pain	1.83-0.7	1.53-1.4	Z = -1.45, p = 0.14
Min 30 Pain	1.53-1.0	1.40-1.1	Z = -0.52, p = 0.60

HR = Heart ratio, MAP = Mean arterial pressure, sPO₂ = Arterial Oxygen saturation, Min = minute.

tients by the groups were summarized on Table I. Demographic data were similar in both groups ($p > 0.05$). Mean arterial pressure readings before and after induction, and after intubation were also similar in both groups (Table I). Rate of side effects was also similar (Table I). Riker score at 0, 5, 15, and 30 minutes was similar in both groups (Table I, Figure 1). VAS score was also not significantly different between both groups at 5, 15, and 30 minutes at the recovery room (Table I, Figure 2).

Discussion

Emergence agitation after sevoflurane anesthesia is common. Previous studies have investigated the assessment of emergence agitation. So far, subjective evaluation methods and various agitation rating methods has been used as a result of lack of widely recognized scales aimed at scoring emergence agitation and delirium²¹⁻²⁴. We utilized the agitation scale developed by Riker. In our study remifentanyl and dexmedetomidine had similar effects on emergence agitation.

The mechanism was possibly related to the sedative and analgesic effects of dexmedetomidine and remifentanyl. Demographic characteris-

tics of patients in both groups were similar (Table I). Previous studies have shown that remifentanyl reduces emergence agitation following sevoflurane anesthesia^{2,9-11}. Similarly, dexmedetomidine has also been reported to reduce emergence agitation^{12,15,24}. However, there are no studies in literature comparing the effects of both drugs. Our study compared the effects of both drugs on emergence agitation and found similar Riker score in both groups at 0, 5, 15, and

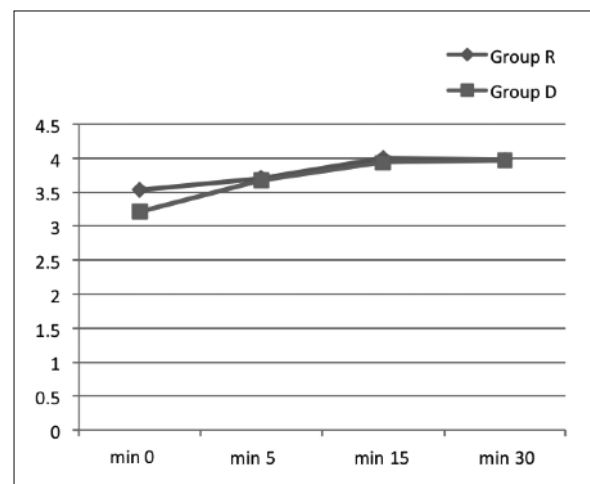


Figure 1. Comparison of group according to Riker score.

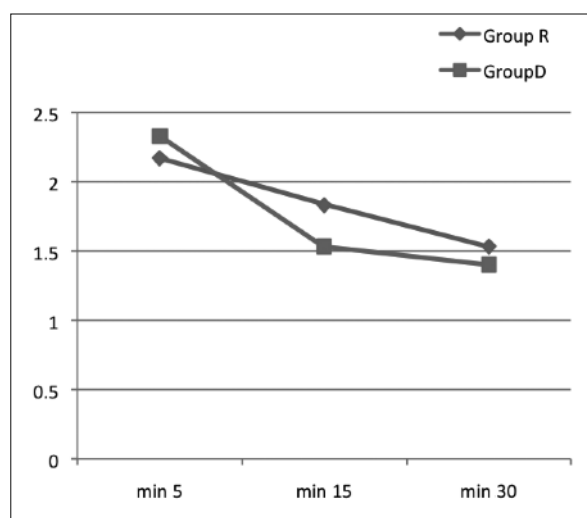


Figure 2. Comparison of group according to VAS score.

30 minutes. Both groups had similar operation, anesthesia, and infusion times.

Some previous reports investigated particularly on the effect of pain in postoperative agitation^{25,26}. A number of studies have reported that postoperative pain management is far from ideal²⁷⁻³². Until recently opioid drugs have been commonly used as analgesics against peri- and postoperative pain. Nevertheless, these drugs are not free of side effects including emesis, over-sedation, and possible risk of respiratory depression, limiting their use. According to previous works, a high ratio of emergence agitation is accompanied by a high visual analog scale (VAS) score, and emergence agitation ratio is reduced with decreased postoperative pain. This is in line with the hypothesis that insufficient postoperative pain control and sedation may have led to marked differences in emergence agitation found in other studies²⁹⁻³². Emergence agitation has also a decreased prevalence with more deeper sedation, a finding that suggests that emergence agitation is related with sedation depth. This finding is also in agreement with other researcher's reports³³⁻³⁶. Our study revealed that both groups had similarly low VAS scores.

Conclusions

Dexmedetomidine and remifentanyl had equal effectiveness in reducing emergence agitation in patients undergoing septoplasty under sevoflurane anesthesia.

Conflict of Interest

The Authors declare that there are no conflicts of interest.

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