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Effects of combining nicardipine and remifentanil on surgical visual field and hemodynamic parameters in functional endoscopic sinus surgery

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Abstract

Aim: This study examined the impact of using a Nicardipine/Remifentanil combination inducing controlled hypotension (CH) in Functional Endoscopic Sinus Surgery (FESS). The goal was to minimize bleeding and enhance the visibility of the endoscopic field. The study focused on surgical field visibility, asccess, its hemodynamic consequences, and the impact on postoperative paraöeters such as nausea, vomiting, and pain.

Materials and Methods: Our study included 73 patients whose age ranging between 18 and 65 years. The patients were randomly assigned to two groups. Group R (Remifentanil) (n=36) patients, and Group RN (Remifentanil/Nicardipine combination) (n=37) patients. Following intubation, In Group R, patients were administered an intravenous (IV) infusion of Remifentanil at a rate of 0.05–2.0 µg/kg/min, while Group RN received Remifentanil at 0.025–1 µg/kg/min, Nicardipine at 0.5–3.5 µg/kg/min. Target mean arterial pressure (MAP) was set at 50–65 mmHg. After the surgical procedure began, bleeding volume, suction requirements, and surgical field visibility were assessed at 15-minute intervals using the Boezaart scale. Duration of stay in the Post-Anesthesia Care Unit (PACU), incidence of nausea, vomiting, and pain assessment with the Numeric Rating Scale (NRS) were evaluated.

Results: PACU length of stay was considerably shorter in Group RN compared to Group R (p=0.003). Pain scoring was greater in Group R (p=0.001). Nausea and vomiting scores were less in group RN (p=0.037). SAP and MAP were considerably lower in group RN (p=0.018 and p=0.023). HR values şin all time intervals were greater in group RN (p= <0.001). Boezaart score was lower in group RN during in all intervals (p= <0.001).

Conclusion: The Remifentanil/Nicardipine combination provides better surgical field access and visibility byb inducing controlled hypotension (CH) in FESS. This combination is preferable over Remifentanil alone. It effectively maintains CH and shows greater success in reducing postoperative pain, nausea, and vomiting scores.

Introduction

Functional endoscopic sinus surgery (FESS) is a procedure used to cure conditions that cause obstruction in the sinuses by hindering drainage [1]. The most common indication for FESS is chronic rhino-sinusitis. Other indications for FESS include nasal polyposis, cerebrospinal fluid leak, fungal infections, foreign bodies, mucoceles, periorbital abscesses, orbital decompression, post-traumatic evaluations, dacryocystorhinostomy, epistaxis, and resection of various tumors [2].

One of the most common issues during this surgery is bleeding [3]. Disruption of the endoscopic view due to hemorrhage can lead to additional complications because the sinuses are anatomically close to structures like the skull base and orbital cavity [4]. Even minimal bleeding can threaten the successful completion of the surgery, increase the risk of complications, and prolong the surgical duration [5].

One method used to reduce hemorrhage under general anesthesia is controlled hypotension (CH), which consists of intentionally reducing the blood pressure of the patients below the baseline levels. Diverse pharmacological substances are utilized to induce controlled hypotension, ei-

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ther individually or in combination.

The primary objective of this study was to evaluate the impact of controlled hypotension induced by remifentanil alone versus a remifentanil/nicardipine combination on visibility and accessibility of the endoscopic surgical field and hemodynamic stability. The secondary objective was to assess their effects on postoperative nausea, vomiting, and pain.

Materials and Methods

Protocol

Our study was conducted in the operating room of the Otorhinolaryngology Department at our institution. The study was approved by the institutional review board (protocol code 2023/05) and adhered strictly to the principles of the Declaration of Helsinki. Written and verbal informed consent was obtained preoperatively. Supervised by the Department of Anesthesia and Reanimation in accordance with operating room standards, the study was primarily conducted by two anesthesiologists. The otolaryngologists confirmed the findings and changes in the intraoperative surgical field.

Inclusion criteria

Patients between the ages of 18 and 65 years, categorized as American Society of Anesthesiologists (ASA) I-II, and scheduled for FESS without any additional procedures in the same session were included in the present study for analyses.

Exclusion criteria

Patients were excluded if their records were incomplete, informed consent was not obtained, they were under 18 or over 65 years old, or had a body mass index >30 kg/m^2, ASA score of 3 or higher, pregnancy, diabetes, significant hepatic or renal insufficiency, cerebral and/or aortic or mitral stenosis, or cardiac insufficiency. Additionally, patients with a history of chronic medication use were reviewed, and those taking cimetidine were also excluded.

Randomization and blinding

In total, 73 patients enrolled in our study and were randomly divided into two groups: Group R (Remifentanil) with 36 patients and Group RN (Remifentanil/Nicardipine combination) with 37 patients. To prevent selection bias, the assignment of drugs to the groups was not based on any specific order (e.g., remifentanil was not consistently given to the first 35 patients). Instead, drugs were administered randomly until a sufficient number of patients were enrolled, and the groups were formed by chance. This randomization process was performed using MedCalc statistical software, version 16 (medcalc.com.tr) for Windows. Each morning, the drugs were prepared by an anesthesia technician who was unaware of the group assignments. Similarly, the anesthesia and patient management were carried out by another anesthesiologist who had no knowledge of the group allocations. The anesthesiologist who managed the anesthesia and administered the medication was different from the anesthesiologist who managed the study. Additionally, the surgeon performing the endoscopic sinus surgery was not informed about which drug was administered. Based on this setup, our study was designed to be both randomized and double-blind.

Preoperative procedures

In the patients included in the study, vascular access was routinely provided with a 20 G intravenous (IV) line inserted in the ante-cubital vein. Premedication was administered with 0.05 mg/kg midazolam 30 minutes before surgery. ECG, noninvasive blood pressure monitoring, SpO_2, and $EtCO_2$ surveillance were performed on all patients admitted to the operating room.

Anesthesia management

All patients were preoxygenated for 3 minutes. Anesthesia induction was performed by intravenous infusion of propofol 2 mg/kg iv, fentanyl 1-2 µg/kg iv, rocuronium 0.5 mg/kg. Once the patients were unconscious and jaw relaxation was adequately established, endotracheal intubation was performed by the anesthesiologist who was blinded to the study group. The cuff of the intubation tubes was inflated to no more than 25 cm H_2O. The patient's head was elevated approximately 15-30 degrees by adjusting their position appropriately. Sevoflurane was administered at 1 MAC in a 50% O_2/air mixture to sustain anesthesia. Intraoperatively, respiratory rate and ventilation were maintained to provide a tidal volume of 6-8 mL/kg and an $EtCO_2$ value of 35-45 mm Hg in both groups. Following intubation in Group R: Remifentanil: 0.05-2.0 µg/kg/min, Group RN: Remifentanil 0.025-1 µg/kg/min, Nicardipine: 0.5-3.5 µg/kg/min iv infusion was started. In both groups, the goal MAP was set at 50-65 mmHg and drug dosages were raised till the goal MAP was reached. A HR below 45 beats/min for more than 120 seconds was considered as bradycardia and remifentanil dose was decreased. If the response was not adequate, atropine 0.5 mg IV was administered. When the mean arterial pressure (MAP) exceeded 65 mm Hg for more than 5 minutes, nicardipine and remifentanil infusions were titrated and increased in both groups. Upon completion of the surgical procedure, neuromuscular blockade was reversed using intravenous injection of atropine at a dose of 0.02 mg/kg and neostigmine at a dose of 0.04 mg/kg. Patients who responded to stimulation by opening their eyes, exhibited regular spontaneous breathing with a respiratory rate of 12–20 breaths per minute, and maintained oxygen saturation levels above 95% were extubated and transferred to the recovery room. Those who achieved a Modified Aldrete score of 9 were subsequently moved to the otolaryngology unit. In the recovery room, trained technicians monitored the patient and recorded the data.

Outcome measures

SAP, DAP, MAP, HR values were recorded every fifteen minutes at T0; before induction, T8; during extubation, T9; at 10 minutes in the post-anesthesia care unit (PACU). $EtCO_2$ values were recorded every fifteen minutes after induction until extubation.

The amount of bleeding, need for assistance with suction, and surgical field visibility were evaluated every fifteen

minutes by a surgeon blinded to the study group. The evaluation of the surgical site was performed by using a 6-point scale (Boezaart scale) with the lowest bleeding score being zero and the highest score being 5 (Table 1) [6].

Table 1. Boezaart Scale [6].

Score	Bleeding	Definition
0 points	No bleeding	
1 points	Minimal Bleeding	Aspiration is not necessary.
2 points	Bleeding Less	Occasional aspiration required, surgical field open.
3 points	Bleeding Less	Aspiration is necessary, the need for aspiration in the surgicalfield happens again after a few seconds.
4 points	Moderate Bleeding	Frequentaspirationrequired, bleedingimmediately after aspiratorremoval, surgicalfield not open.
5 points	Severe Bleeding	Continuousaspiration is necessary. Surgery is not possibledue to severe loss of vision in the surgicalfield.

Time of anesthesia, time to reach the target MAP, duration of operation, extubation time, recovery time, PACU stay, total fluid given, pain and episodes of nausea/vomiting were recorded. A comparison was conducted across the two groups.

Anesthesia time; the time from induction of anesthesia until extubation, whereas surgical time is measured from the initial surgical incision to the conclusion of the procedure. Extubation time was described as the time from the completion of operation and discontinuation of anesthetic drugs until extubation, and verbal response (recovery) time was defined as response to basic verbal instruction given after extubation. Duration of stay in the PACU was described as the time from when the patient was taken to the recovery room until the patient was sent to the relevant service.

Pain scores were evaluated 10 minutes after arrival in the PACU. Pain was assessed by a blinded anesthesiologist according to a numerical rating scale (NRS) (0-10 rating (0-1: mild, 2-4: moderate, 5-7: medium, 8-10: severe). (NRS) $\geq$5 cases were given 15 mg/kg i.v. paracetamol as a rescue analgesic and pain control was achieved.

In the PACU, nausea and vomiting were evaluated using a 4-point scale (0 = no nausea, 1 = moderate nausea, 2 = severe nausea, 3 = retching/vomiting). Patients with severe nausea were treated with ondansetron 50 µg/kg IV as an antiemetic.

In this study, we examined the demographic data of the patients, general symptoms such as nausea and vomiting as well as pain, the duration of anesthesia, surgery, recovery, and the stay in the PACU. We also analyzed the time it took to reach MAP and compared the values of SAP, DAP, MAP, HR, SpO_2, and $EtCO_2$ between the groups, considering their distribution across defined intervals. Additionally, we evaluated the distribution of Boezaart scoring between the groups according to these time intervals.

Statistical analysis

One of the primary outcome measures of this thesis research is the PACU Length of Stay (minutes) variable. According to the findings of the experimental power analysis, with a type I error (α) of 0.05, a total sample size of 73, an effect size of 0.87789, and a two-tailed alternative hypothesis (H1), the observed statistical power (1-β) for the independent two-sample t-test is calculated as 0.99.

All analyses were conducted using IBM SPSS Statistics 26.0 for Windows (New York, USA). The Shapiro-Wilk test, histogram distribution, and skewness-kurtosis parameters were applied for normality analysis. Descriptive statistics were presented as mean $\pm$ standard deviation for normally distributed variables, median (min-max) for non-normally distributed variables, and frequency and percentage for nominal variables. In statistical analyses, categorical comparisons were made using Yates' corrected chi-square test. For quantitative variables, an independent samples t-test was used for comparisons between two independent groups. For analyses involving repeated measurements over time, the General Linear Model - Repeated Measures Analysis (Greenhouse-Geisser Test) was used. For dependent quantitative variables in multiple comparisons, the Bonferroni corrected dependent samples t-test was used for repeated measures analysis of variance. In the applied statistical analyses, $p < 0.05$ was considered statistically significant.

Results

Of the 73 patients who underwent functional endoscopic sinus surgery, 65 were operated for chronic sinusitis. The remaining 6 patients were operated for dacryocystorhinostomy and 2 for cerebrospinal fluid leakage.

When the demographic information of the groups was compared, no significant difference was observed between gender, body mass index, and ASA values (Table 2). Mean age was significantly different among groups (p=0.026). No significant difference between the time to reach the target MAP, mean surgical time, time under anesthesia,

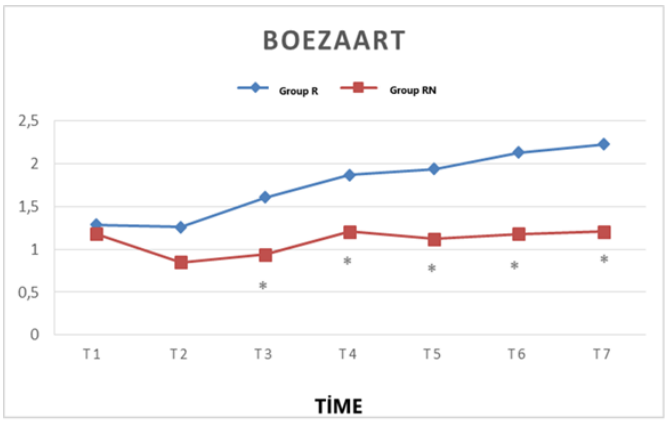

Figure 1. Distribution of Boezaart scoring between the groups in defined intervals.

extubation, and recovery times. PACU stay was considerably shorter in Group RN than Group R (p=0.003). No difference in the total amount of fluid infusion among the groups.

There was a significant difference in the distribution of SAP (p=0.018) and MAP (p=0.023) values in both groups in all intervals, while no difference was detected in the DAP value. SAP and MAP showed a lower course in Group RN (Table 3 and Table 4). There was no difference in the distribution of HR in the two groups in all intervals and it was greater in Group RN (p= <0.001) (Table 5). As a result of the analysis conducted to examine the interaction between interval measurements and the study groups, SAP, MAP, and HR were comparable among the independent variables analyzed. This indicated that there was no interaction between time measurements and groups. The distribution of SpO_2 and $EtCO_2$ values did not significantly change among the groups in any interval.

The Boezaart scores were significantly lower in the Group RN (p= <0.001) (Figure 1). The NRS for evaluation of the intensity of pain was lower in the Group RN (p=0.001).

Table 2. Demographic data, clinical, and operative chartacteristics of the study groups.

Variables	Group R	Group RN	p
Age (year)	41.53 ± 13.94	34.38 ± 11.29	**0.026***
Tall (cm)	169.28 ± 10.58	170.24 ± 9.33	0.618*
Weight (kg)	72.53 ± 14.61	68.54 ± 13.09	0.291*
BMI (kg/m^2)	25.42 ± 5.92	23.48 ± 3.45	0.111*
Gender n(%)			
Male	19 (52.8)	16 (43.2)	0.415**
Female	17 (47.2)	21 (56.8)	
ASA			
1	15 (41.7)	18 (48.6)	0.549**
2	21 (58.3)	19 (51.4)	
Anesthesia Duration (minutes)	141.33 ± 47.12	157.81 ± 48.47	0.108*
Surgical Duration (minutes)	124.28 ± 46.53	142.30 ± 47.61	0.077*
ExtubationTime (minutes)	8.72 ± 3.20	8.38 ± 3.65	0.575*
Recovery Time (minutes)	14.47 ± 4.57	14.57 ± 5.06	0.942*
PACU Duration of Stay (minutes)	17.64 ± 9.44	11.78 ± 0.03	**0.003***
Time to reach MAP (minutes)	28.14 ± 17.53	25.19 ± 12.38	0.595*
Total Fluid Infusion (ml)	1148.61 ± 348.77	1129.73 ± 349.49	0.977*
Remifentanil Infusion Dose (mcg)	710.01 ± 597.24	360.55 ± 240.94	**0.023***
Nicardipine Infusion Dose (mg)	-	2.79 ± 2.57	-

BMI: Body Mass Index; ASA: American Society of Anesthesiologists; MAP: mean arterial pressure; PACU:Postanesthetic Care Unit; *: Independent sample t-test; **: Chi-square test with Yates' correction.

Table 3. Comparison of SAP between groups in defined intervals.

	SAP		
	Group R (Mean ± SD)	Group RN (Mean ± SD)	p
Time			**0.018** *
T0	134.84 ± 16.44	123.12 ± 15.69	**0.003** *
T1	112.35 ± 16.68	104.79 ± 11.78	**0.015** *
T2	97.81 ± 14.34	99.88 ± 16.98 6	0.922
T3	91.65 ± 19.54	90.64 ± 17.20	0.634
T4	89.87 ± 14.80	87.73 ± 10.29	0.724
T5	87.39 ± 12.54	86.45 ± 8.12	0.852
T6	89.06 ± 11.61	87.76 ± 8.96	0.787
T7	90.16 ± 10.88	87.24 ± 9.09	0.248
T8	112.13 ± 13.09	113.42 ± 11.88	0.434
T9	130.35 ± 27.80	116.12 ± 20.3	**0.032** *

SD: Standard deviation; SAP:systolic arterial pressure; Pre-induction (T0), 15 minutes after induction (T1), 30 minutes after induction (T2), 45 minutes after induction (T3), 60 minutes after induction (T4), 75 minutes after induction (T5), 90 minutes after induction (T6), 105 minutes after induction (T7), during extubation (T8), 10 min in PACU (T9). *Meaningful difference among the groups (p<0.05).

Table 4. Distribution of MAP value between groups in defined intervals.

	MAP		
	Group R (Mean ± SD)	Group RN (Mean ± SD)	p
Time			**0.023** *
T0	104.87 ± 13.52	93.61 ± 12.28	**<0.001** *
T1	87.42 ± 16.14	78.15 ± 0.77	**0.002** *
T2	74.84 ± 11.68	74.45 ± 13.28	0.525
T3	70.87 ± 12.35	63.76 ± 9.58	**0.011** *
T4	67.16 ± 13.98	62.18 ± 9.58	0.100
T5	65.97 ± 12.12	62.39 ± 8.36	0.126
T6	67.35 ± 11.31	62.85 ± 7.13	0.083
T7	68.00 ± 8.89	62.42 ± 6.45	**0.005** *
T8	82.94 ± 14.53	85.03 ± 12.31	0.398
T9	105.19 ± 24.70	91.45 ± 18.55	**0.012** *

SD: Standard deviation; MAP: Mean arterial pressure; Pre-induction (T0), 15 minutes after induction (T1) ,30 minutes after induction (T2), 45 minutes after induction (T3), 60 minutes after induction (T4), 75 minutes after induction (T5), 90 minutes after induction (T6), 105 minutes after induction (T7), during extubation (T8), 10 min in PACU (T9). *Meaningful difference among the groups (p<0.05).

The episodes of nausea and vomiting are lower and less intense in the Group RN (p=0.037).

Discussion

In our study, SAP and MAP were significantly lower in Group RN, while HR was statistically significantly lower in Group R. Bradycardia occurred in 3 cases in Group R, whereas no bradycardia developed in Group RN. The MAP was maintained between 50-65 mm Hg in both groups to ensure appropriate surgical conditions without endangering patients in terms of end-organ ischemia, but a more stable success was observed in Group RN. The time to reach MAP did not indicate a statistically notable difference among the groups.

Table 5. Distribution of HR values between groups in defined intervals.

	HR		
	Group R (Mean ± SD)	Group RN (Mean ± SD)	p
Time			**<0.001** *
T0	104.87 ± 13.52	93.61 ± 12.28	0.757
T1	87.42 ± 16.14	78.15 ± 0.77	0.131
T2	74.84 ± 11.68	74.45 ± 13.28	0.268
T3	70.87 ± 12.35	63.76 ± 9.58	**<0.001** *
T4	67.16 ± 13.98	62.18 ± 9.58	**<0.001**
T5	65.97 ± 12.12	62.39 ± 8.36	**<0.001** *
T6	67.35 ± 11.31	62.85 ± 7.13	**<0.001**
T7	68.00 ± 8.89	62.42 ± 6.45	**<0.001** *
T8	82.94 ± 14.53	85.03 ± 12.31	**<0.001** *
T9	105.19 ± 24.70	91.45 ± 18.55	0.812

SD: Standard deviation; HR: HeartRate; Pre-induction (T0), 15 minutes after induction (T1) , 30 minutes after induction (T2) , 45 minutes after induction (T3), 60 minutes after induction (T4), 75 minutes after induction (T5), 90 minutes after induction (T6), 105 minutes after induction (T7) , during extubation (T8), 10 min in PACU (T9). *Meaningful difference among the groups (p<0.05).

Remifentanil is a powerful opioid with extremely short-acting properties. These attributes enable precise and rapid titration, making it highly suitable for managing various surgical procedures. However, in patients receiving remifentanil intraoperatively, there is a need for increased opioid consumption, which is associated with bradycardia, hypotension, and secondary hyperalgesia [7]. Nicardipine, a dihydropyridine class calcium channel antagonist, is an arteriolar smooth muscle-specific vasodilator with no notable effect on cardiac conduction and cardiac contractility. Its quick onset and termination of action allow for fast titration and regulation of blood pressure. Due to these favorable characteristics, it has been successfully used in the management of intraoperative hypertension [8,9].

A randomized controlled study by Shin et al. [10] compared the dynamics of heart rate variability during deliberate hypotension with nicardipine, remifentanil, and dexmedetomidine.

In the nicardipine group, there were significant increases above 100/min at certain time intervals, which may cause problems in patients with cardiovascular illnesses or reduced cardiac output. In the study by Won et al. [11] comparing the effects of nicardipine and remifentanil in thyroidectomy cases undergoing controlled hypotension (CH), heart rate was found to be significantly greater in the nicardipine group than in the remifentanil group. In a study using nicardipine as a controlled hypotension (CH) agent during spine surgery in twenty-four pediatric patients, tachycardia exceeding 100 beats per minute was observed in 6 patients and was managed with esmolol [12]. In our study, consistent with the literature, HR was higher in the remifentanil-nicardipine combination group compared to the remifentanil group. However, HR was not evaluated as tachycardia at any time point. This may be because, in our study, nicardipine, which was administered at high infusion doses such as a 100 mcg bolus or 5-10 mcg/kg/min in previous studies, was combined with remifentanil and titrated at a lower dose range of 0.5-3.5 mcg/kg/min.

Although not statistically significant, bradycardia occurred in 3 cases in Group R and none in Group RN. Therefore, we believe that the combination of nicardipine and remifentanil may be an advantageous alternative because it provides a good surgical field of view and protects against bradycardia caused by remifentanil due to the opposite effects of these two drugs on heart rate.

The Beozaart hemorrhage score was markedly lower in the RN group, which had lower MAP values and higher HR values throughout all time periods. When evaluating the results of our study alongside the literature, it is crucial to consider other parameters that may affect bleeding besides MAP and HR, such as the extent of the lesion and surgical conditions, and to observe the effects of anesthesia and controlled hypotension techniques on the quality of the surgical field accordingly.

In a study by HJ Ahn et al. [13] comparing surgical conditions during propofol/remifentanil or sevoflurane/remifentanil anesthesia in FESS, heart rate and intraoperative blood loss were found to be lower with intravenous anesthesia than with balanced anesthesia, provided the patients had no cardiovascular illness and MAP was maintained within the same limit. Unlike previous studies, the size of the preoperative lesion was taken into account in this study, and patients were further classified according to the extent of the preoperative lesion using the Lund-Mackay score determined by computed tomography. We combined remifentanil with other agents. However, the best result we achieved was the hypotension induced by titrating the dose of the remifentanil-nicardipine combination, which resulted in low Boezaart scores. Although the primary aim of this combination was to reduce bleeding and clear the field of vision, it also provided hemodynamic advantages compared to other combinations. According to these studies, surgical conditions and indications seem to be more standardized in our cases. FESS is performed in a very limited area and the comorbidities of the patients are similar. In other words, there are no large lesions such as tumors. Therefore, it can be said that the hemorrhage score checked at certain intervals is a reliable evaluation [14].

While there was no notable difference between the two groups in terms of anesthesia, surgery, and recovery times, the length of stay in the PACU was significantly shorter in Group RN. NRS pain scores and nausea and vomiting scores in the PACU were significantly lower in Group RN. In a study comparing the clinical efficacy of remifentanil, nicardipine, and the remifentanil-nicardipine combination for controlled hypotension (CH) during arthroscopic shoulder surgery, no significant difference was found between the duration of anesthesia, operation time, and PACU stay [15]. In a randomized controlled study comparing the effect of remifentanil and nicardipine on surgical pleth index during thyroidectomy, anesthesia and recovery times were reported to be comparable among the study groups [11]. In our study, the markedly shorter length of stay in the PACU in Group RN was due to the need for rescue analgesics or antiemetics. The NRS pain score evaluated in the PACU was statistically significantly lower in Group RN, while the nausea/vomiting scores were statistically signif-

icantly greater in Group R.

In a study by Kim JY et al. [15] comparing the use of nicardipine, remifentanil, and nicardipine plus remifentanil for controlled hypotension (CH) in arthroscopic shoulder surgery cases, visual analog pain scores were evaluated in the PACU, and pain scores in Group R were found to be higher, confirming our study. In addition, in this study, although the need for antiemetics in the PACU in Group RN was found to be lower than in the other groups, the result was not notable. Although studies have shown that acute opioid tolerance develops at remifentanil infusion rates above 0.25 µg/kg/min, with reduced pain, pressure, cold or mechanical thresholds, a wider range of hyperalgesia, and an increase in postoperative opioid requirements at infusion rates exceeding 0.2 µg/kg/min, it is difficult to determine the optimal remifentanil dose range. Another study evaluated strategies such as gradual opioid reduction, opioid rotation, detoxification, multimodal analgesia, and the combination of adjuvants to mitigate or prevent opioid-induced hyperalgesia [16]. In our study, we concluded that the combination of remifentanil and nicardipine may be clinically advantageous in terms of preventing remifentanil-induced hyperalgesia.

Research has demonstrated that opioid-free anesthesia protocols reduce post-surgical opioid consumption and are associated with a lower risk of post-surgical nausea and vomiting [17-19]. In our study, postoperative nausea and vomiting values were notably greater in Group R compared to Group RN, consistent with the literature. In Group RN, the remifentanil infusion dose was halved to avoid these opioid-related side effects.

Conclusion

Although remifentanil is a widely used agent for controlled hypotension (CH), undesirable effects such as bradycardia, postoperative nausea/vomiting, and hyperalgesia—which increase with the consumption of excess doses alone—may significantly limit its use. The search for alternative drugs or drug combinations to overcome these limitations is ongoing. In this study, the combination of nicardipine and remifentanil was more successful in maintaining stable CH, preventing bradycardia, reducing bleeding, and improving endoscopic surgical field visibility in FESS cases. Additionally, postoperative nausea, vomiting, and pain scores were lower in the nicardipine/remifentanil group, suggesting that this combination may be an advantageous alternative in many ways. Further studies on drug combinations are needed to find the ideal controlled hypotension agents that will provide the desired level of surgical field clarity with minimal side effects.

Ethics Committee Approval

Ethical approval was obtained for this study from the Malatya Clinical Research Ethics Committee (Decision no: 2023/05).

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