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Comparative study between Dexmedetomidine, magnesium sulfate and propofol in controlled hypotensive anesthesia during endoscopic sinus surgery

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Abstract
Background: The use of controlled hypotension has been shown to enhance the operational field visibility and reduce many surgical factors such as total blood loss, surgery duration and the occurrence of ecchymosis and postoperative edema. The objective of this research was to assess and evaluate the effectiveness of propofol, magnesium sulfate, and Dexmedetomidine in inducing controlled hypotensive anesthesia for Functional Endoscopic Sinus Surgery (FESS).
Methods: The use of controlled the current research had a prospective randomized double-blind design and included a sample of sixty individuals aged between twenty-one and fifty years, including both genders. The participants were having FESS. The participants were classified into three distinct groups. In the first group, participants were administered Dexmedetomidine intravenously at a loading dosage of 0.5 micrograms per kilogram, followed by a maintenance dose ranging from 0.2 to 0.4 mcg/kg/hour. The second group got an intravenous dose of forty mcg\kg of magnesium sulfate, with a maintenance dose ranging from ten to fifteen mcg/kg/hour. Lastly, the third group received an intravenous dose of two hundred mg per twenty ml of propofol, with a maintenance dose ranging from two to four mcg/kg/hour. These administrations were carried out continuously during the surgical procedure.
Results: The research observed a substantial decline in the visibility and bleeding score within group one compared to group two. However, there was no important variance in the visibility and bleeding score between group one and group three. Additionally, the research found a significant elevate in the visibility and bleeding score within group two compared to group three. The bradycardia incidence and the need for atropine were higher in patients receiving propofol and Dexmedetomidine. There was no bradycardia or atropine needed with group two. Side effects as nausea, shivering, and vomiting were less with propofol and Dexmedetomidine than with group two.
Conclusions: The efficacy of Dexmedetomidine is better than $MgSO_4$ and propofol and for controlled hypotension during FESS.

Keywords: Dexmedetomidine, magnesium sulfate, propofol, functional endoscopic sinus surgery

Introduction
The use of controlled hypotension has been demonstrated to enhance the visibility of the operational field and reduce many surgical parameters, including the time of the procedure, total blood loss, and incidence of postoperative edema and ecchymosis [1]. The occurrence of bleeding during surgery has a negative impact on the quality of the surgical field, leading to compromised circumstances and a higher risk of complications. [2, 3].
Functional endoscopic sinus surgery (FESS) often utilizes several medications, such as magnesium sulfate and Dexmedetomidine, to induce controlled hypotension. [4]. Additional drugs, such as high concentrations of strong inhaled anesthetics (such as isoflurane), vasodilators (specifically sodium nitroprusside and nitroglycerine (NTG) and β-adrenergic antagonists (propranolol and esmolol), have been used. Several disadvantages are associated with these medications, including reflex tachycardia, tachyphylaxis and rebound hypertension similar to NTG. Additionally, sodium nitroprusside may lead to cyanide poisoning, whereas esmolol can lead to myocardial depression [5, 6]. Administration of inhalational anesthetics high dosages has been demonstrated to result in an extension of the patient's release from the hospital and extended period of recovery and [7].

Several research have examined the various medicines' efficacy in causing controlled hypotension during surgical procedures. However, there is a limited amount of research that has explicitly evaluated these agents in the endoscopic sinus surgery field. The comparable clinical features of Dexmedetomidine, propofol and magnesium sulfate, in addition to their ability to induce a significant reduction in Heart rate (HR) after Dexmedetomidine administration and maintain stable hemodynamic response during anesthesia, influenced the current investigation undertaking. The aim of this study is to develop a pharmacological alternative that exhibits enhanced efficacy and a reduced incidence of adverse effects. The objective of this research is to evaluate and assess the effectiveness of Dexmedetomidine, propofol and magnesium sulfate and in inducing controlled hypotensive anesthesia for FESS.

Patients and Methods

This research included a prospective randomized double-blind design and included a sample of sixty patients who had elective FESS. The patients were categorized according to the American Society of Anesthesiologists (ASA) class one, two, and were between the ages of twenty-one and fifty years. Both males and females were included in the research. This research was carried out from May 2021 to April 2022 following the permission from the institutional ethical committee of Tanta University Hospital, Informed permission was obtained from every patient. The exclusion criteria encompassed individuals with a documented history of drug allergies to Dexmedetomidine, propofol and magnesium sulphate, as well as those with bleeding and coagulation disorders, renal, hepatic, cerebrovascular disease, coronary artery diseases, cardiovascular dysfunction, anemia, severe lung disease, hypothyroidism, airway problems such as cognitive disorders and morbid obesity. All patients have a comprehensive evaluation, which includes obtaining a detailed medical history, conducting a thorough physical examination, and doing normal laboratory investigations such as complete blood count (CBC), coagulation profile, kidney function tests, liver function tests and lipid profile. Additionally, chest x-ray, EKG, and echocardiography (ECG) are also included in the diagnostic workup. The process of group allocation was conducted using the sealed opaque envelope approach. The administration of all medications was performed by a single anesthesiologist, while the collection of measures was carried out by a separate anesthesiologist who was unaware of the research groups and had no further participation in the research.

Patients were divided into three groups

In the Dexmedetomidine group (Group one), patients were administered a loading intravenous (IV) dose of 0.5mcg/kg of Dexmedetomidine (Precedex, 200 mcg/2mL) diluted in fifty mL of 0.9% saline solution. This loading dose was infused intravenously over attend minutes period. Subsequently, a continuous IV infusion of Dexmedetomidine was administered using a syringe pump (INJECTOMAT AGILIA 22719323 FRANCE) at a dose range of 0.2-0.4 mcg/kg/hour throughout the duration of the surgery.

In the Group II (Magnesium sulphate group), patients were administered a loading intravenous (I.V) dose of fourty mg/kg of $MgSO_4$ ($MgSO_4$ ten% onegm/ten ml), which was diluted in fifty mL of 0.9% saline and infused intravenously over a period of ten minutes. This was followed by a continuous I.V infusion using a syringe pump (Injectomat Agilia 22719323 France) at a dose range of ten-fifteen mg/kg/hour throughout the surgery duration.

In Group II (Propofol group), patients were administered intravenous infusion of propofol (two hundred mg/twenty ml) using a syringe pump (Injectomat Agilia 22719323 France) at a dosage of two-four mg/kg/hour throughout the surgical procedure duration.

Hemodynamic measurements: specifically, HR and mean arterial pressure (MAP), were documented at a baseline of fifteen minutes after intubation. This baseline measurement was taken to exclude any influence from the propofol administration during the induction phase. Subsequently, measurements were taken at ten-minute intervals following the infusion of Dexmedetomidine, propofol or magnesium sulfate. These measurements were continued every fifteen minutes until the surgical procedure concluded. Additionally, HR and MAP were recorded at fifteen, thirty, and sixty minutes after extubating during the patient's stay PACU. The measurement of serum cortisol levels occurred before the anesthesia initiation, at a time point of 10 minutes after the surgical procedure starting, and again at a time point of 30 minutes subsequent to the removal of the endotracheal tube. The research documented the isoflurane inhalation consumption in ml per hr., as well as the total dosages of atracurium taken. The research recorded the patients quantity who were administered intraoperative fentanyl, ephedrine, NTG or atropine, as well as the cumulative dosage needed within each respective group.

Surgical field: was evaluated by the surgeon in terms of visibility and bleeding by using a six-option Likert-scale (zero = no bleeding, one = minor bleeding but no aspiration needed, two = minor bleeding but aspiration needed, 3 = frequent aspiration needed and minor bleeding and, four = visible only with aspiration and moderate bleeding and, five = continuous aspiration required and severe bleeding and) [8]. The surgeon satisfaction assessment with the field of operating was conducted at the surgical procedure conclusion, using a Likert scale composting of four options: (one= bad, two = moderate, three = good, four = excellent) [8].

In the three experimental cohorts, our objective was to attain a MAP within the range of sixty-sixty-five mmHg. The isoflurane concentration was modified to maintain the calibration was performed within the range of 1%-1.2% and the bispectral index (BIS) values within the desired range of 40-60. In the event that the HR rises to more than 20% over the baseline value and MAP above the target threshold and, despite satisfactory BIS outcomes, the one mcg/kg administration of fentanyl intravenously is used as a therapeutic measure to address insufficient analgesia. In the case that MAP exceeded the level of target, the hypotensive infusion rate medication was raised. If there was no discernible response, a gradual intravenous NTG administration at a dosage of fifty µg was provided and repeated as necessary. If bradycardia occurred (HR less than sixty beat/minute) and/or MAP decreased lower than the level of desired, the infused hypotensive rate drug declined. In the case of an absence of response, an intravenous injection of atropine at a dosage of and/or ephedrine at a

dosage of five mg 0.6 mg was provided. This administration was repeated as necessary until HR and MAP were appropriately regulated within the predetermined parameters. All patients receiving medical operations were transported to the PACU. The moment at which spontaneous breathing started, the time of extubating, and the length of the surgical procedure were documented. The postoperative evaluation recuperation was conducted using the modified Aldrete score as a means of ascertaining the readiness of patients for release from the PACU. A patient may be released from the PACU if they have achieved a score of nine.

The evaluation of postoperative sedation included the use of the Ramsay sedation score at two, four, and six hours after the surgical procedure. All observed negative outcomes, such as bradycardia, shivering, nausea, and vomiting, were duly documented and managed accordingly. The symptoms of nausea and vomiting were managed with the administration of an intravenous injection containing eight mg of ondansetron. The treatment for shivering was the use of the administration of oxygen and warming techniques**.** The first finding is surgical field quality (visibility and bleeding). The second finding are postoperative recovery, nausea, vomiting, shivering, sedation, and bradycardia.

Sample size calculation

The estimation sample size estimation was conducted using G. power 3.1.9.2. The determination of the sample size was conducted taking into account the following factors: The research's statistical significance level is set at 0.05 α error, with a confidence level of ninety-five%. The power of the study is not specified. However, a prior study reported an anticipated excellent visual field rate of 89.3%, which serves as the major outcome measure. In order to address the student attrition issue, two more instances were included inside each experimental group. Consequently, a total of twenty participants were recruited for each group.

Statistical analysis

Statistical analysis was done by SPSS v27 (IBM©, Chicago, IL, USA). Histograms and Shapiro-Wilks test were used to assess the distribution of data normality. We used the one-way analysis of variance (ANOVA) followed by a post hoc Tukey test to examine quantitative parametric data provided as mean and SD. Quantitative non-parametric data were presented as interquartile range (IQR) and median and were analyzed by Kruskal-Wallis test with Mann Whitney-test to compare each group. The qualitative variables were represented in terms of and percentage (%) frequency and were subjected to analysis using the Chi-square test. A two-tailed P-value less than 0.05 was deemed to be statistically significant.

Results

This study included the evaluation of a total of ninety-three people to determine their eligibility. Out of these participants, twenty-four patients were found to not satisfy the predetermined criteria, while an additional nine patients declined to participate in the study. The remaining sixty patients were divided randomly into three groups of similar size, with each group consisting of twenty patients. The patients who were assigned to certain groups were thereafter monitored and subjected to statistical analysis (Figure one).

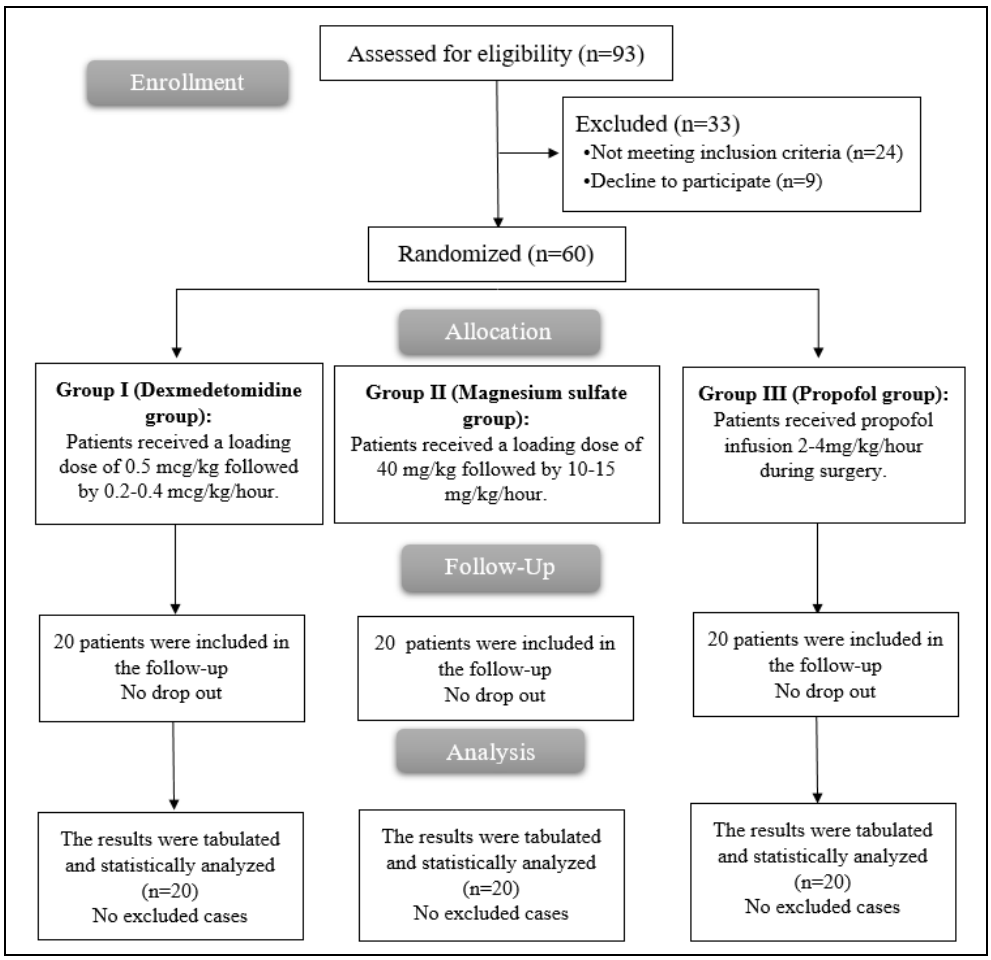


Fig 1: Consort the enrolled patients flowchart

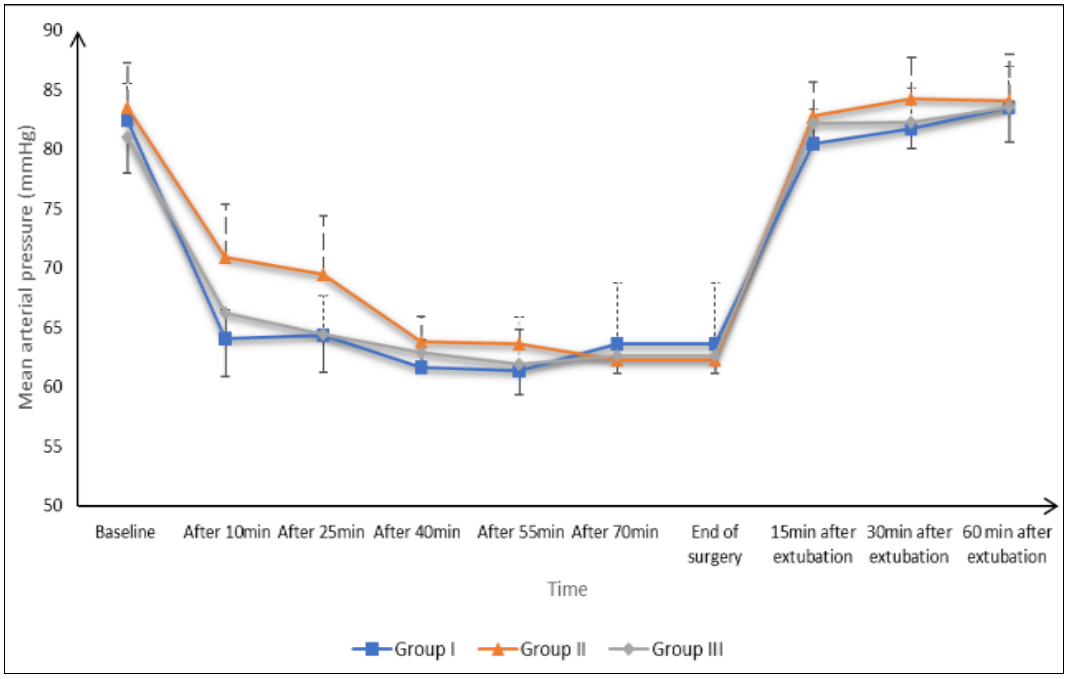
There were no important variances between three groups regarding age, physical status gender and weight. (Table one).

Table 1: Comparison between the three studied groups according to demographic data

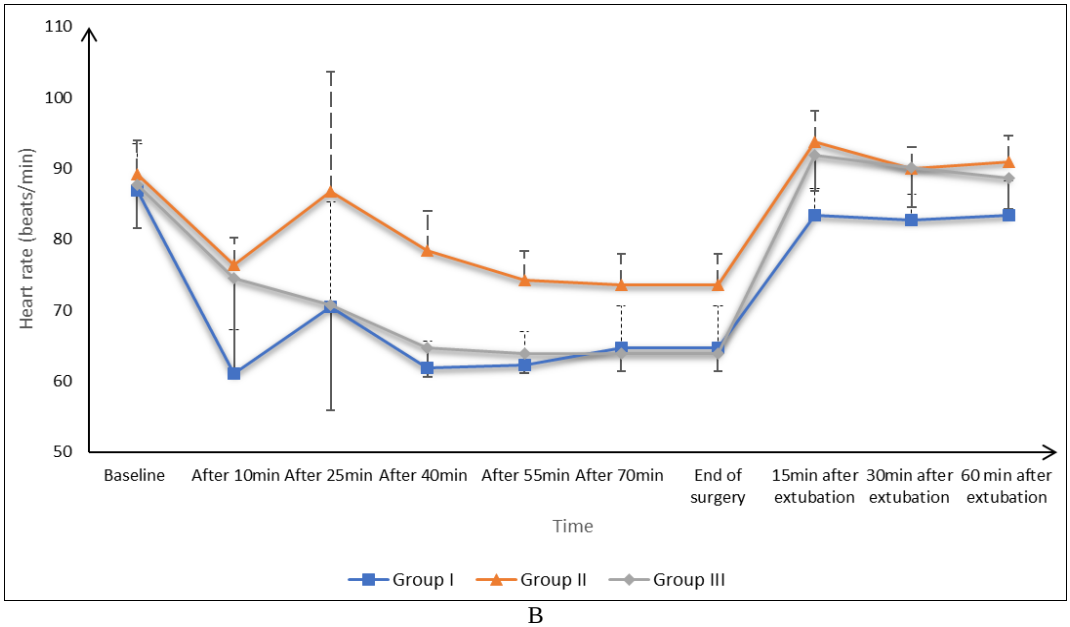
		Group one (N=Twenty)	Group two (N=Twenty)	Group three (N=Twenty)	P Value
Age (Years)		38.6±5.8	39.1±6.84	35.7±6.13	1.714
Gender	Male	11 (55%)	12 (60%)	14 (70%)	0.610
	Female	9 (45%)	8 (40%)	6 (30%)	
Weight (kg)		83.45±4.78	80.7±4.03	82.55±3.62	0.113
Physical status	ASA I	16 (80%)	18 (90%)	15 (75%)	0.459
	ASA II	4 (20%)	2 (10%)	5 (25%)	

Data are demonstrated as Average ± SD and number of (%), ASA: American Society of Anesthesiologists

There were significant differences in HR and MAP a across the three groups at six time points: ten minutes, twenty-five minutes, and fourty minutes during operation, at the surgery conclusion, fifteen min after extubating, and thirty min after extubating. The HR and MAP were found to be considerably lower in Group one compared to Group two at several time points, including ten min, twenty-five min, and forty minutes into the operation, as well as at the procedure completion, fifteen minutes following extubating, and thirty minutes after extubating. At the conclusion of the surgical procedure, it was observed that both HR and MAP were found to be considerably lower in Group one compared to Group three. The HR and MAP were found to be considerably elevated in Group two compared to Group three at both the ten-minute and twenty five-minute time points (Figure one).



A



B

Fig 2: (B) HR and (A) MAP of the three studied groups

There were no important variances showed in the serum cortisol levels before induction and thirty minutes after extubating, as well as in the use of atropine, ephedrine and fentanyl among the three groups. The blood cortisol level at ten minutes after surgical incision, as well as the intake of NTG, total isoflurane and atracurium exhibited significant variances across the three groups. Serum cortisol level, nitroglycerin consumption and total isoflurane consumption were significantly lower in Group one than Group two. Level of Serum cortisol was significantly lower in Group three at ten min after surgical incision. There was no significant difference seen in the serum cortisol level and Nitroglycerin intake between Group two and Group three. Consumption of atracurium was significantly elevated in Group one more than Group two and insignificantly variant among Group three and both Group one and Group two. Consumption of Total isoflurane insignificantly variant between Group one and Group three and significantly elevated in Group two than Group three (Table two).

Table 2: Comparison between the three studied groups according to serum cortisol level (mcg/dl), atropine consumption (mg), ephedrine consumption (mg), nitroglycerin consumption(mcg), fentanyl consumption (mcg), and isoflurane consumption (ml/hr.)

		Group one (N=Twenty)	Group two (N=Twenty)	Group three (N=Twenty)	P Value	Post Hoc
Serum cortisol level (mcg/dl)	Before induction	13.5±2.62	12±2.95	12.9±2.85	0.225	
	10 min after surgical incision	9.8±2.37	12±2.95	12.8±2.89	0.003*	P1 = 0.037* P2 = 0.003* P3 = 0.633
	30 min after Extubation	13.5±2.54	11.7±2.82	12.9±2.88	0.128	
Atropine use (mg)		3 (15%)	0 (0%)	1 (5%)	0.153	
Needs of Atropine (mg)		0.09±0.22	0±0	0.03±0.13	0.158	
Nitroglycerin use (mcg)		3 (15%)	10 (50%)	5 (25%)	0.045*	P1 = 0.018* P2 = 0.429 P3 = 0.102
Needs of Nitroglycerin (mcg)		7.5±18.32	32.5±37.26	17.5±33.54	0.042*	P1 = 0.034* P2 = 0.564 P3 = 0.280
Fentanyl use (mcg)		2 (10%)	7 (35%)	6 (30%)	0.155	
Needs of Fentanyl (mcg)		8.25±25.41	27±37.82	23.25±36.5	0.185	
Ephedrine use (mg)		2 (10%)	0 (0%)	3 (15%)	0.155	
Ephedrine needs (mg)		0.5±1.54	0±0	0.75±1.83	0.225	
Atracurium use (mg)		20 (100%)	20 (100%)	20 (100%)	----	
Needs of Atracurium (mg)		51.35±7.11	44.68±3.27	48.55±5.78	< 0.001*	P1 < 0.001* P2 = 0.263 P3 = 0.071
Consumption of Total isoflurane (ml/hr.)		14.55±0.83	17.45±0.83	14.6±0.88	< 0.001*	P1 < 0.001* P2 = 0.981 P3 < 0.001*

Data are demonstrated as number of (%) and Average ± SD, P1: P Value among group one and Group two, P2: P Value among group one and Group three, P3: P Value among group two and Group three, * Significant $p<0.05$.

There were significant differences shown in the operation time, spontaneous breathing time after the cessation of anesthesia, Extubation time after the anesthesia cessation and postoperative sedation at the two-hour mark postoperatively between the three groups. There was no significant difference in postoperative sedation levels at six hours and four hours after surgery among the three groups. Surgery time was significantly declined in Group one less than Group three and Group two and higher than in Group three than Group two. Spontaneous breathing Time after stopping anesthesia was significantly declined in Group one than Group two and insignificantly variant among Group three and Group one. Spontaneous breathing Time after stopping anesthesia was significantly elevated in Group two than Group three. Extubating time after stopping anesthesia was significantly declined in Group one than Group two and Group three and elevated in Group two than Group three. Sedation of postoperative was significantly elevated in Group one than Group two and insignificantly different among Group three and both Group one and Group two at two hr. postoperatively (Table three).

Table 3: Comparison between the three studied groups according to time of surgery (min), Extubation time after stopping anesthesia (min) spontaneous breathing after stopping anesthesia (min) and postoperative sedation assessed by RSS

		Group one (N=Twenty)	Group two (N=Twenty)	Group three (N=Twenty)	P Value	Post Hoc
Surgery time (min)		66.3±11.23	105.6±7.83	78.25±12.3	< 0.001*	P1 < 0.001* P2 = 0.002* P3 < 0.001*
Spontaneous breathing after stopping anesthesia time (min)		5.3±1.03	9.16±1.21	6.1±0.97	< 0.001*	P1 < 0.001* P2 = 0.056 P3 < 0.001*
Extubation after stopping anesthesia time (min)		10.3±1.59	16.32±3.18	12.3±1.75	< 0.001*	P1 < 0.001* P2 = 0.018* P3 < 0.001*
Postoperative sedation RSS	2 hr.	3.2±0.67	2.6±0.76	3±0.73	0.029*	P1 = 0.029* P2 = 0.788 P3 = 0.127
	4 hr.	2.5±0.51	2.2±0.49	2.4±0.5	0.137	
	6 hr.	2.1±0.31	2±0.39	2.1±0.22	0.319	

Data are demonstrated as Average ± SD, P1: P Value among group one and Group two, P2: P Value among group one and group three, P3: P Value among group two and group three, * Significant $p<0.05$.

Field of Surgical visibility and bleeding score was significantly variant between the three groups. Field of Surgical visibility and bleeding score was significantly declined in Group one than Group two and insignificantly variant among Group three and Group one. Field of Surgical visibility and bleeding score was significantly elevated in Group two than Group three (Table four).

Table 4: Comparison between the three studied groups according to surgical field visibility and bleeding score

		Group one (N=Twenty)	Group two (N=Twenty)	Group three (N=Twenty)	P Value	Post Hoc
Surgical field visibility and bleeding score	≤ 2	15 (75%)	2 (10%)	14 (70%)	< 0.001*	P1 < 0.001* P2 = 0.723 P3 < 0.001*
	> 2	5 (25%)	18 (90%)	6 (30%)		
Surgical field visibility and bleeding score		1.4±1.1	3.3±0.8	1.5±1.15	< 0.001*	P1 < 0.001* P2 = 0.949 P3 < 0.001*

Data are demonstrated as number of (%) and Average ± SD, P1: P Value between group one and Group two, P2: P Value between group one and Group three, P3: P Value between group two and Group three, * Significant $p<0.05$.

There were substantial differences shown between the three groups in terms of, time to complete postoperative recovery and intraoperative bradycardia following surgeon satisfaction and PACU admission, and. Bradycardia was significantly elevated in Group one than Group three and Group two and insignificantly variant between Group three and Group two. Intraoperative hypotension declines less than the desired level, vomiting, shivering and postoperative nausea were insignificantly variant between the three groups. The duration required for complete postoperative recovery after admission to the (PACU) was shown to be substantially longer in Group one compared to both Group three and Group two. Conversely, the recovery time was demonstrated to be shorter in Group two when compared to Group three. The level of satisfaction among surgeons was found to be considerably greater in Group one compared to Group two ($p<0.001$), whereas there was no significant variance in satisfaction between Group three and Group one. The level of satisfaction among surgeons in Group two was found to be considerably lower compared to Group three (Table five).

Table 5: Comparison between the three studied groups according to surgeon satisfaction, complications and time to full postoperative recovery (min) after PACU admission

		Group one (N=Twenty)	Group two (N=Twenty)	Group three (N=Twenty)	P Value	
Intraoperative bradycardia		14 (70%)	0 (0%)	1 (5%)	< 0.001*	P1 < 0.001* P2 < 0.001* P3 = 0.311
Intraoperative hypotension		2(10%)	0(0%)	3(15%)	0.217	
Nausea		3 (15%)	7 (35%)	4 (20%)	0.298	
Vomiting		2 (10%)	5 (25%)	2 (10%)	0.308	
Shivering		3 (15%)	4 (20%)	3 (15%)	0.886	
Satisfaction of Surgeon	Satisfied 3-4	15 (75%)	2 (10%)	14 (70%)	< 0.001*	P1 < 0.001* P2 = 0.723 P3 < 0.001*
	Dissatisfied 1-2	5 (25%)	18 (90%)	6 (30%)		
Satisfaction of Surgeon		3.4±0.88	1.75±0.79	3.05±1.05	< 0.001*	P1 < 0.001* P2 = 0.451 P3 < 0.001*
Full postoperative recovery time (min) after PACU admission		18.4±2.54	12.05±1.73	15.65±2.87	< 0.001*	P1 < 0.001* P2 = 0.002* P3 < 0.001*

Data are demonstrated as number of (%) and Average ± SD, P1: P value between group one and Group two, P2: P Value between group one and Group three, P3: P Value between group two and Group three, * Significant $p<0.05$.

Discussion

Controlled hypotension plays a crucial role in FESS by effectively reducing intraoperative enhancing visibility quality and bleeding of the surgical site [9].

In accordance with our findings, Rokhtabnak *et al.* [10] concurred on the topic of bleeding, surgeon satisfaction and visibility in the field of surgical. Their research included that Dexmedetomidine exhibited greater efficacy compared to MgSO4 in achieving controlled hypotension, thereby enhancing surgeon satisfaction and facilitating a favorable surgical field condition. Chhabra A *et al.* [11] concluded that visibility and bleeding of the surgeon satisfaction and surgical field were better with Dexmedetomidine rather than $MgSO_4$.

In the same manner, the research done by PakalaSwathi and Gunda [12] arrived at the finding that Dexmedetomidine has higher effectiveness in comparison to MgSO4 in terms of inducing hypotension and decreasing HR FESS. The final result leads to enhance the surgical area visibility and increased satisfaction between surgeons. Also, Modir *et al.* [13] reported that bleeding was minimal and surgeon satisfaction was better with Dexmedetomidine than other groups. Furthermore, a study conducted by Bayram *et al.* [14] shown that the use of Dexmedetomidine, as opposed to MgSO4, resulted in superior the operative field visualization. In contrast, Aboushanab OH *et al.* [15] proposed that both Dexmedetomidine and (MgSO4) effectively effectively hypotension in patients undergoing middle ear surgery, resulting in comparable surgical field quality and surgeon satisfaction. In a research included by Elsharnouby N and Elsharnouby M *et al.* [16], it was shown that the MgSO4 group exhibited a shorter operating time and a higher quality of the surgical field when compared to the standard group.

As regard the effect of propofol on visibility and bleeding of surgeon satisfaction and the surgical field, Moshiri *et al.* [17] found that both groups were able to cause controlled hypotension, but there was no significant benefit observed between the two groups. There was no statistically significant difference in bleeding between the two groups, and the surgeons expressed a reasonably high level of satisfaction with both medicines.

Furthermore, Marzban *et al.* (2018) found that the propofol group had and improved field conditions and less bleeding compared to the Isoflurane group.

In relation to the Atracurium administration, the duration of spontaneous respiration subsequent to the cessation of anesthesia, as well as the time required for Extubation, are of particular interest. According to Rokhtabnak *et al.* [10], it was observed that patients in the Dexmedetomidine group necessitated a higher frequency of muscle relaxant administration and consumed a greater quantity compared to patients in the other group. Cizmeci P and Ozkose Z; [19] agreed with us, included that $MgSO_4$ can be used as an adjuvant to total intravenous anesthesia for day case surgeries to decline intraoperative muscle relaxant needs and potentiate neuromuscular blockade. Wang H *et al.* [20] have postulated that o vecuronium-induced muscle relaxation clinical enhancement by $MgSO_4$ can be attributed to synergism among non-depolarizing muscle relaxants and $MgSO_4$ at adult muscle-type acetylcholine receptors.

Chhabra and colleagues [11] also agreed with the findings of our research. The researchers observed that the anesthesia cessation and spontaneous breathing duration after Extubation and was notably longer in the group administered with MgSO4 compared to the group administered with Dexmedetomidine. This finding may be attributed to the nondepolarizing muscle relaxants enhancement by MgSO4.

Regarding propofol, it has been seen to effectively decline the use intraoperative muscle relaxants use. Lieutaud *et al.* [21] have substantiated the correlation between enhanced muscular relaxation and escalating dosages of propofol for anesthetic induction, resulting in improved intubating circumstances.

As regards serum cortisol level, Wfa MZ *et al.* [22] agreed with us as regard the Dexmedetomidine effect on stress response. They concluded that adding Dexmedetomidine in a total dose two mic/kg to twenty ml of 0.25% bupivacaine decreases stress response to surgery, Isoflurane total consumption, patient's number need rescue analgesia, delayed 1st dose of rescue analgesia and total doses of rescue analgesia. Additionally, Bi YH *et al.* [23] demonstrated a decline in levels of serum cortisol. Typically, as the surgical stimulus intensity increases, sensory nerve roots transmit impulses to the spinal cord dorsal root, which then proceed to the medulla. Eventually, these impulses stimulate and reach the hypothalamus, resulting in ACTH levels elevation in the bloodstream. Consequently, cortisol levels rise, leading to a reduction in the inflammatory mediator's production [24]. According to the findings of our research, it is consistent with the research conducted by Wang K *et al.* [25] and Paola A *et al.* [26], who have hypothesized that the perioperative Dexmedetomidine administration is linked to declined cortisol levels in individuals undergoing a range of surgical procedures.

Furthermore, the research conducted by Balata *et al.* [27] was relevant to our research. The researchers reached the conclusion that both magnesium sulfate and Dexmedetomidine effectively declined the increase in MAP, however lidocaine did not demonstrate the same attenuating effect. Furthermore, it should be noted that Dexmedetomidine only mitigated the alterations in HR, blood glucose level and serum cortisol.

Furthermore, research conducted by Bakr *et al.* [28] revealed a noteworthy decline in levels of blood cortisol at both one and twenty four hours after surgery in patients treated with Dexmedetomidine-bupivacaine, as compared to those treated with bupivacaine alone. However, Shams *et al.* [29] presented contrasting findings to our investigation in relation to the blood cortisol level.

The researchers conducted an assessment of the effectiveness of Dexmedetomidine as a hypotensive drug in contrast to esmolol in FESS. The cortisol levels exhibited statistically non-important variations both between and within the groups. Regarding the propofol impact on levels of serum cortisol, our findings align with those of Sedighinejad *et al.* [30]. The researchers reached the conclusion that in coronary artery bypass grafting (CABG) procedures including the use of cardiopulmonary bypass, the isoflurane-sufentanil administration resulted in a substantial reduction in the physiological stress response to surgery, as measured by plasma cortisol levels, as compared to the propofol-sufentanil administration.

Regarding the time of operation visibility and hemorrhage, of the operative area, Chhabra *et al.* [11] concurred with the findings of our investigation. The surgical procedure in the Dexmedetomidine group exhibited a comparatively shorter

length in comparison to the $MgSO_4$ group. The researchers obtained the conclusion that the Dexmedetomidine administration effectively managed hypotension, resulting in reduced operation duration improved surgical field vision and decreased occurrence of complications.

Moshiri *et al.* [17] concurred with our outcomes, demonstrating that propofol has the ability to considerably decrease HR in comparison to Dexmedetomidine. Multiple studies have shown a significant correlation between the occurrence of hypotension and bradycardia and improved vision in the surgical field [31, 32]. This has the potential to result in improved surgical conditions, as well as decreased surgical complications and duration. [33].

Rokhtabnak *et al.* [10] concurred with our results in terms of the length of operation. The researchers discovered that the operation length was considerably reduced in the Dexmedetomidine group compared to the $MgSO_4$ group. The researchers ascribed this phenomenon to the combined occurrence of bradycardia and hypotension. In terms of NTG consumption, there was a notable decline in Group one compared to Group two, but the difference in NTG consumption between Group three and both Group two and Group one was not statistically important. There was no statistically important variance in fentanyl intake among the three groups; however, the consumption was somewhat higher with propofol and $MgSO_4$ compared to Dexmedetomidine.

The findings of the trial conducted by Rokhtabnak *et al.* [10] align with the current investigation, since both studies observed that the MgSO4 group needed larger dosages of NTG and fentanyl. The Dexmedetomidine analgesic action is mediated via α2 receptors located in thespinal cord and locus coeruleus. [34]. Additionally, Ayoglu *et al.* [35] conducted research. The researchers found that the Dexmedetomidine administration resulted in a considerable a decreased need for fentanyl and reduction in intraoperative hemorrhage.

Durmus *et al.* [36] conducted research investigating the Dexmedetomidine impact on surgical site bleeding in patients undergoing sept rhinoplasty and tympanoplasty procedures. The group administered with Dexmedetomidine exhibited a significant decline in the intake of and Isoflurane and fentanyl. The standard group had a larger aggregate quantity of NTG administered.

Additionally, the findings of Shams *et al.* [29] match with our research in terms of intraoperative fentanyl intake. The research findings indicate that the fentanyl amount used during surgery was considerably reduced in the group receiving Dexmedetomidine compared to the group receiving esmolol. Various findings have been documented on the analgesic efficacy of magnesium. Magnesium has been observed to function as an NMDA receptor [37]. Nevertheless, Cizmeci P and Ozkose Z [19] have discovered that magnesium did not exhibit a reduction in analgesic needs during anesthesia.

Bayram *et al.* (2014) concurred with the findings of the current research. The researchers observed a decline in the dosage of NTG and fentanyl in the Dexmedetomidine group compared to the MgSO4 group. In research conducted by Ghodraty *et al.* (2018), it was observed that a greater proportion of patients in the Remifentanyl group (42.1%) needed nitroglycerin (NTG) to achieve the goal MAP compared to those in the magnesium sulfate ($MgSO_4$) group (twenty five%) [38]. Furthermore, the research conducted by YosryM and Othman I [39] shown that the MgSO4 administration resulted in similar hypotensive effects and facilitated favorable surgical circumstances for the removal of choroidal melanoma. This approach obviated the need for further administration of NTG and led to reduced consumption of fentanyl.

Regarding the propofol impact on fentanyl intake, Bakan *et al.* [40] conducted a research. A reduced need for rescue analgesics and decrease in pain scores were seen during the first postoperative phase.

In terms of overall Isoflurane intake, the findings of Rokhtabnak *et al.* [10] correlate with our investigation results. The findings pertaining to Isoflurane consumption were consistent with our own studies, as they demonstrated a considerable decline when Dexmedetomidine was administered compared to MgSO4.

In research conducted by Elsharnouby N and Elsharnouby M *et al.* [16], it was determined that the MgSO4 administration resulted in a reduction in MAP, blood loss and HR. Additionally, the use of MgSO4 was shown to be linked with and shorter emergence time and decreased anesthetic needs in patients undergoing FESS.

The research done by Durmus M *et al.* [36] shown that the use of Dexmedetomidine led to a significant decrease in the usage of Isoflurane and fentanyl in comparison to the propofol group.

Shams *et al.* [29] also corroborated our findings. It has been observed that both esmolol and Dexmedetomidine are considered safe drugs for the purpose of controlled hypotension. Furthermore, both medications have shown efficacy in achieving an optimal surgical field during FESS. So, compared with esmolol, Dexmedetomidine offers the advantage of analgesic, sedative, and anesthetic sparing effect.

According to the findings of Gunalan *et al.* [41], the short duration of action demonstrated by Dexmedetomidine suggests that it has little impact on the process of anesthesia recovery. Additionally, it has been shown that this intervention leads to a reduction in the number of volatile anesthetics and opioids required during surgery to maintain anesthesia. This reduction is attributed to a decrease in the minimum alveolar concentration (MAC) of volatile anesthetics, which may be as much as ninty%. According to the postulation made by Gerlach AT and Dasta JF [42], it has been suggested that the Dexmedetomidine administration may lead to a reduction in the amount of anesthetic required for patients undergoing different surgical procedures.

In a study conducted by Ankichetty *et al.* [43], it was observed that the administration of propofol infusion resulted in a reduction in Isoflurane consumption.

The study conducted by Aboushanab OH *et al.* [15] presented opposing views to our research. The researchers have reached the conclusion that the end-tidal concentrations of sevoflurane exhibited similarity in both research groups.

Regarding the time duration required for complete postoperative recovery after admission to the PACU, our findings align with the research conducted by Aboushanab OH *et al.* [15]. Both of the medications that were evaluated successfully achieved the desired target MAP. There was no discernible disparity in the quality of the surgical field between the two groups. However, it was observed that the Dexmedetomidine group had a notably prolonged recovery time, while the MgSO4 group exhibited a comparatively shorter recovery time, resulting in early release from the

PACU.

Furthermore, Rokhtabnak *et al.* [10] corroborated the findings of the current research. The group administered with Dexmedetomidine had substantially and time required to achieve a modified Aldrete score of 9 and greater RSS levels compared to the group administered with MgSO4. Additionally, Chhabra A *et al.* [11] concurred with our findings.

The researchers discovered that patients who were administered Dexmedetomidine had a substantially prolonged duration in attaining an Aldrete score of nine more higher, as well as a lengthier period for discharging patients from the PACU, as compared to patients who received MgSO4. Shams *et al.* [29] also corroborated our findings.

The time and the length of emergence needed to achieve an Aldrete score of nine were significantly declined in the esmolol group compared to the Dexmedetomidine group, as observed by the researchers. The esmolol group had a significantly reduced respiratory rate compared to the Dexmedetomidine group at fifteen, thirty-, and sixty-minutes post-surgery.

The group administered with Dexmedetomidine had a considerably prolonged duration before the first request for pain medication. Furthermore, Bajwa *et al.* [44] concurred with our investigation findings. According to the authors, Dexmedetomidine offers an added advantage by decreasing the facilitating postoperative sedation and need for analgesics.

Came against our research, Bayram A *et al.* [14] recorded that Aldrete recovery score ≥ nine duration was significantly shorter in Dexmedetomidine group.

As regard propofol effect on modified aldrete score, Moshiri E *et al.* [17]. The aldrete score was insignificantly different between the two groups, while full recovery time of patients in Dexmedetomidine group was longer than that with propofol. This is consistent with our study. Moreover, Paliwal B *et al.* [45] Level of sedation were monitored with level four or five of RSS were target for sedation. Adequate sedation was achieved with insignificant variance between both drugs.

Regarding the occurrence of hypotension and bradycardia, the findings of Rokhtabnak *et al.* [10] correspond with the outcomes of our investigation. The researchers obtained the conclusion that the Dexmedetomidine administration was associated with an elevated incidence of bradycardia. Furthermore, it was observed that the use of atropine was more often required in conjunction with Dexmedetomidine, but the magnesium sulfate administration did not need the atropine use.

Our analysis aligns with the findings of Sriram Sundar M [46], who observed that the occurrence of marked hypotension and bradycardia below the target threshold was higher in the Dexmedetomidine group compared to the propofol and MgSO4 groups. In contrast, Aboushanab *et al.* [15] conducted a comparative analysis between Dexmedetomidine and $MgSO_4$ determined that both groups had comparable requirements for ephedrine and atropine. In contrast to our findings, those of Yuan F *et al.* [47], who used propofol, reported that the bradycardia incidence was considerably greater in the Dexmedetomidine fentanyl group. However, Moshiri E *et al.* [17] weren't present. Propofol was shown to be more effective than Dexmedetomidine in lowering HR. Regarding the side effects occurrence, it was seen that postoperative vomiting, shivering and nausea did not show a significant difference among the three groups. Nevertheless, it was shown that the these adverse effects incidence was higher in the MgSO4 group in comparison to the propofol and Dexmedetomidine groups. According to the study done by Rokhtabnak *et al.* (2010), it was observed that the occurrence of nausea, vomiting, and shivering was less in the group administered with Dexmedetomidine in comparison to the group administered with MgSO4. Nevertheless, the observed differences did not reach statistical significance. This finding matches the outcomes of our research. Our analysis matches the findings of Chhabra A *et al.* [11], which indicated that there was no significant variance in the incidence of postoperative nausea, vomiting, and shivering between patients administered Dexmedetomidine and MgSO4.

Bajwa SJ *et al.* [44] compared between NTG, Dexmedetomidine and esmolol for induced hypotension during FESS and reported that incidence of vomiting, shivering and nausea was less with Dexmedetomidine than the other two drugs but insignificant. On the other hand, Ryu J-H *et al.* [48] compared between Remifentanyl and $MgSO_4$ and proved that both drugs can induce adequate hypotension for middle ear surgery but $MgSO_4$ was associated with better postoperative analgesia and less postoperative nausea, shivering and vomiting.

As regard propofol, Raftery S and Sherry E [49] concluded that total intravenous anesthesia with alfentanil and propofol is superior to inhalational maintenance with nitrous oxide and enflurane in that it is associated with lower incidence of vomiting and nausea and less requirement for anti-emetic medication.

The researchers are recommended with a greater number of patients to test the loading I.V dose of 0.5mcg/kg of Dexmedetomidine to achieve slow HR and controlled hypotension at practically useful implications and safe levels.

Conclusions

The efficacy of Dexmedetomidine is better than MgSO4and propofol and for controlled hypotension during FESS.

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References

1. Zamani F, Naseri N, Farmani F, Kamali A. Comparison of the effect of Dexmedetomidine and Remifentanil on controlled hypotension during rhinoplasty: A clinical trial study. The International Tinnitus Journal. 2020 Nov 26;24(2):60-4.
2. Shander A. Surgery without blood. Crit Care Med. 2003;31:708-14.
3. Davies MJ. Minimising intra-operative blood loss. Transfusion and apheresis science. 2002 Aug 1;27(1):55-7.
4. Lang B, Zhang L, Lin Y, Zhang W, Li F-S, Chen S. Comparison of effects and safety in providing controlled hypotension during surgery between Dexmedetomidine and magnesium sulphate: A meta-analysis of randomized controlled trials. PLOS One. 2020;15:227-410.

5. Amaranath L, Kellermeyer Jr WF. Tachyphylaxis to sodium Nitroprusside. The Journal of the American Society of Anesthesiologists. 1976 Apr 1;44(4):345-7.
6. Degoute CS, Ray MJ, Manchon M, Dubreuil C, Banssillon V. Remifentanil and controlled hypotension; comparison with Nitroprusside or esmolol during tympanoplasty. Canadian journal of anaesthesia. 2001 Jan;48(1):20-7.
7. Dal D, Çelıker V, Özer E, Başgül E, Salman MA, Aypar Ü. Induced hypotension for tympanoplasty: a comparison of desflurane, Isoflurane and sevoflurane. European journal of anaesthesiology. 2004 Nov;21(11):902-6.
8. Rokhtabnak F, Motlagh SD, Ghodraty M, Pournajafian A, Delarestaghi MM, Banihashemi AT, *et al.* Controlled hypotension during rhinoplasty: A comparison of Dexmedetomidine with magnesium sulfate. Anesth Pain Med. 2017;7(6):4-7.
9. Bafna U, Sharma P, Singhal RK, Gurjar SS, Bhargava SK. Comparison of hypotensive properties of Dexmedetomidine versus clonidine for induced hypotension during functional endoscopic sinus surgery: A randomised, double-blind interventional study. Indian Journal of Anaesthesia. 2021 Aug;65(8):579.
10. Rokhtabnak F, Motlagh SD, Ghodraty M, Pournajafian A, Delarestaghi MM, Banihashemi AT, *et al.* Controlled hypotension during rhinoplasty: A comparison of Dexmedetomidine with magnesium sulfate. Anesthesiology and pain medicine. 2017;7.
11. Chhabra A, Saini P, Sharma K, Chaudhary N, Singh A, Gupta S. Controlled hypotension for FESS: A randomised double-blinded comparison of magnesium sulphate and Dexmedetomidine. Indian J Anaesth. 2020;64(1):24-30.
12. PakalaSwathi D, Gunda S. Comparison between magnesium sulfate and Dexmedetomidine in controlled hypotension during functional endoscopic sinus surgery. Eur J Mol Clin Med 2022;9:504-11.
13. Modir H, Modir A, Rezaei O, Mohammadbeigi A. Comparing Remifentanil, magnesium sulfate, and Dexmedetomidine for intraoperative hypotension and bleeding and postoperative recovery in endoscopic sinus surgery and tympanomastoidectomy. Medical Gas Research. 2018;8(2):42-50.
14. Bayram A, Ülgey A, Günes I, Ketenci I, Çapar A, Esmaoglu A, *et al*. Comparison between magnesium sulfate and Dexmedetomidine in controlled hypotension during functional endoscopic sinus surgery. Rev Bras Anestesiol. 2015;65:61-7.
15. Aboushanab OH, El-Shaarawy AM, Omar AM, Abdelwahab HH. A comparative study between magnesium sulphate and Dexmedetomidine for deliberate hypotension during middle ear surgery. Egypt J Anaesth. 2011;27(4):227-32.
16. Elsharnouby N, Elsharnouby M. Magnesium sulphate as a technique of hypotensive anaesthesia. BJA. 2006;96(6):727-31.
17. Moshiri E, Modir H, Yazdi B, Susanabadi A, Salehjafari N. Comparison of the effects of propofol and Dexmedetomidine on controlled hypotension and bleeding during endoscopic sinus surgery. Ann Trop Med Public Health. 2017;10(3):63-77.
18. Marzban S, Haddadi S, Nia HM, Heidarzadeh A, Nemati S, Nabi BN. Comparison of surgical conditions during propofol or isoflurane anesthesia for endoscopic sinus surgery. Anesth Pain Med. 2013;3(2):234-40.
19. Cizmeci P, Ozkose Z. Magnesium sulphate as an adjuvant to total intravenous anesthesia in septorhinoplasty: A randomized controlled study. Aesthetic Plast Surg. 2007;31:167-73.
20. Wang H, Liang Q-s, Cheng L-r, Li X-h, Fu W, Dai W-t, *et al*. Magnesium sulphate enhances non-depolarizing muscle relaxant vecuronium action at adult muscle-type nicotinic acetylcholine receptor *in vitro*. Acta Pharmacologica Sinica. 2011;32(12):1454-9.
21. Lieutaud T, Billard V, Khalaf H, Debaene B. Muscle relaxation and increasing doses of propofol improve intubating conditions. Can J Anaesth. 2003;50(2):121-30.
22. Wfa MZ, El-Gebaly ASA, El-Baradey GF, Hekal KE-dAM, Darwish JME. Comparative study of patients outcomes by using Dexmedetomidine with bupivacaine versus bupivacaine alone in ultrasound-guided thoracolumbar interfacial plane block for spine surgeries. J Adv Med Med Res. 2022;34(6):67-77.
23. Bi YH, Cui XG, Zhang RQ, Song CY, Zhang YZ. Low dose of Dexmedetomidine as an adjuvant to bupivacaine in cesarean surgery provides better intraoperative somato-visceral sensory block characteristics and postoperative analgesia. Oncotarget. 2017;8(38):635-87.
24. Kahveci K, Ornek D, Doger C, Aydin G, Aksoy M, Emre C, *et al*. The effect of anesthesia type on stress hormone response: comparison of general versus epidural anesthesia. Niger J Clin Pract. 2014;17(4):523-7.
25. Wang K, Wu M, Xu J, Wu C, Zhang B, Wang G, *et al*. Effects of Dexmedetomidine on perioperative stress, inflammation, and immune function: systematic review and meta-analysis. BJA. 2019;123(6):777-94.
26. Paola A, Carlo L, Cinzia D, Valter P, Pierluigi N, Liliana S. Stress response to surgery, anesthetics role and impact on cognition. J Anesth Clin Res. 2015;6(7):539-40.
27. Balata AAH, Abdel Latif HK, Waly SH, Mohamed AB. Dexmedetomidine versus magnesium sulphate or lidocaine for blunting stress response to direct laryngoscopy and endotracheal intubation in abdominal surgeries. ZUMJ. 2018;24(6):492-500.
28. Bakr MA, Mohamed SA, Mohamad MF, Mohamed MA, El Sherif FA, Mosad E, *et al*. Effect of Dexmedetomidine added to modified pectoral block on postoperative pain and stress response in patient undergoing modified radical mastectomy. Pain physician. 2018;21(2):87-90.
29. Shams T, El Bahnasawe NS, Abu-Samra M, El-Masry R. Induced hypotension for functional endoscopic sinus surgery: A comparative study of Dexmedetomidine versus esmolol. Saudi J Anaesth. 2013;7(2):175-76.
30. Sedighinejad A, Imantalab V, Mirmansouri A, Naderi Nabi B, Tarbiat M, Sadeghi AM, *et al*. Comparing the effects of isoflurane-sufentanil anesthesia and propofol-sufentanil anesthesia on serum cortisol levels in open heart surgery with cardiopulmonary bypass. Anesth Pain Med. 2016;6(6):420-66.
31. Nair S, Collins M, Hung P, Rees G, Close D, Wormald PJ. The effect of beta-blocker premedication on the

surgical field during endoscopic sinus surgery. Laryngoscope. 2004;114(6):1042-6.
32. Eberhart LH, Folz BJ, Wulf H, Geldner G. Intravenous anesthesia provides optimal surgical conditions during microscopic and endoscopic sinus surgery. The Laryngoscope. 2003;113(8):1369-73.
33. Nekhendzy V, Lemmens HJ, Vaughan WC, Hepworth EJ, Chiu AG, Church CA, *et al*. The effect of deliberate hypercapnia and hypocapnia on intraoperative blood loss and quality of surgical field during functional endoscopic sinus surgery. Anesth Analg. 2007;105(5):1404-9.
34. Guo T-Z, Jiang J-Y, Buttermann AE, Maze M. Dexmedetomidine injection into the locus ceruleus produces antinociception. ASA. 1996;84(4):873-81.
35. Ayoglu H, Yapakci O, Ugur MB, Uzun L, Altunkaya H, Ozer Y, *et al*. Effectiveness of Dexmedetomidine in reducing bleeding during septoplasty and tympanoplasty operations. J Clin Anesth. 2008;20(6):437-41.
36. Durmus M, But A, Dogan Z, Yucel A, Miman M, Ersoy M. Effect of Dexmedetomidine on bleeding during tympanoplasty or septorhinoplasty. Eur J Anaesthesiol. 2007;24(5):447-53.
37. Srebro D, Vuckovic S, Milovanovic A, Kosutic J, Savic Vujovic K, Prostran M. Magnesium in pain research: state of the art. Curr Top Med Chem. 2017;24(4):424-34.
38. Ghodraty MR, Homaee MM, Farazmehr K, Nikzad-Jamnani AR, Soleymani-Dodaran M, Pournajafian AR, *et al*. Comparative induction of controlled circulation by magnesium and Remifentanyl in spine surgery. World J Orthop. 2014;5(1):51-60.
39. Yosry M, Othman I. Controlled hypotension in adults undergoing choroidal melanoma resection: comparison between the efficacy of nitroprusside and magnesium sulphate. Eur J Anaesthesiol. 2008;25(11):891-6.
40. Bakan M, Umutoglu T, Topuz U, Uysal H, Bayram M, Kadioglu H, *et al*. Opioid-free total intravenous anesthesia with propofol, Dexmedetomidine and lidocaine infusions for laparoscopic cholecystectomy: a prospective, randomized, double-blinded study. Rev Bras Anestesiol. 2015;65:191-9.
41. Gunalan S, Venkatraman R, Sivarajan G, Sunder P. Comparative evaluation of bolus administration of Dexmedetomidine and fentanyl for stress attenuation during laryngoscopy and endotracheal intubation. J Clin Diagn Res. 2015;9(9):6-9.
42. Gerlach AT, Dasta JF. Dexmedetomidine: an updated review. Ann Pharmacother. 2007;41:245-54.
43. Ankichetty SP, Ponniah M, Cherian V, Thomas S, Kumar K, Jeslin L, *et al*. Comparison of total intravenous anesthesia using propofol and inhalational anesthesia using isoflurane for controlled hypotension in functional endoscopic sinus surgery. J Anaesthesiol Clin Pharmacol. 2011;27(3):328-32.
44. Bajwa SJ, Kaur J, Kulshrestha A, Haldar R, Sethi R, Singh A. Nitro-glycerine, esmolol and Dexmedetomidine for induced hypotension during functional endoscopic sinus surgery: A comparative evaluation. J Anaesthesiology Clin Pharmacology. 2016;32(2):192-7.
45. Paliwal B, Rai P, Kamal M, Singariya G, Singhal M, Gupta P, *et al*. Comparison between Dexmedetomidine and propofol with validation of bispectral index for sedation in mechanically ventilated intensive care patients. J Clin Diagn Res. 2015;9(7):30-66.
46. Sriram Sundar M. Comparison between Magnesium Sulfate and Dexmedetomidine in Controlled Hypotension during Functional Endoscopic Sinus Surgery. Curr Top Med Chem. 2020;6:52-93.
47. Yuan F, Fu H, Yang P, Sun K, Wu S, Lv M, *et al*. Dexmedetomidine-fentanyl versus propofol-fentanyl in flexible bronchoscopy: A randomized study. Exp Ther Med. 2016;12(1):506-12.
48. Ryu J-H, Sohn I-S, Do S-H. Controlled hypotension for middle ear surgery: a comparison between Remifentanil and magnesium sulphate. BJA. 2009;103(4):490-5.
49. Raftery S, Sherry E. Total intravenous anaesthesia with propofol and alfentanil protects against postoperative nausea and vomiting. Canadian Journal of Anaesthesia. 1992;39:37-40.

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