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STUDY THE EFFECTS OF DEXMEDETOMIDINE ON THE RECOVERY PROFILE IN SUBJECTS UNDERGOING ENDOSCOPIC SINUS SURGERY USING GENERAL ANAESTHESIA

Dr. Rahul Shrirang Jadhav Associate professor, Department of Anesthesiology, RCSM GMC Kolhapur.

Dr. Pradeep Shivaji Raut Associate professor, Department of Anesthesiology, RCSM GMC Kolhapur.

Dr. Pradnya Sunil Pisal Junior Resident, Department of Anesthesiology, RCSM GMC Kolhapur.

Dr. Supriya Balasaheb Desai* Assistant Professor, Department Of Anaesthesiology, RCSM GMC, Kolhapur. *Corresponding Author

ABSTRACT

Background: Functional Endoscopic Sinus Surgery (FESS) requires hemodynamic stability and minimal bleeding for optimal outcomes. Dexmedetomidine, a selective 2-adrenergic agonist, may help by providing sedation, analgesia, and hypotension without respiratory depression, yet its role in recovery profiles remains under-evaluated. **Objectives:** To assess the effects of dexmedetomidine on the recovery profile, hemodynamic stability, emergence agitation, and postoperative pain in patients undergoing FESS under general anaesthesia. **Methodology:** This observational study was conducted at a tertiary care center from January 2023 to December 2024. Sixty adult patients undergoing FESS under general anaesthesia were randomized into two groups: Group A (control) and Group B (dexmedetomidine). Group B received 0.5 µg/kg dexmedetomidine post-intubation. Hemodynamic parameters, emergence time, agitation, postoperative pain (VAS), and complications were recorded. Statistical analysis was performed using SPSS with t-tests and Chi-square tests, considering $p < 0.05$ as significant. **Results:** Baseline demographic and physiological parameters were comparable between groups. Group B (dexmedetomidine) showed significantly lower heart rate, systolic and diastolic blood pressure, MAP, respiratory rate, and EtCO2 during emergence ($p < 0.001$). SPO2 remained similar in both groups. Emergence agitation was significantly lower in Group B (23.3%) versus Group A (83.3%) ($p < 0.001$). Mean VAS scores were significantly lower in Group B, indicating better postoperative pain control ($p < 0.001$). Postoperative adverse events like nausea, vomiting, and shivering were fewer in Group B, though drowsiness and hypotension were slightly higher. No significant respiratory depression or desaturation was noted in either group. Recovery times were not prolonged by dexmedetomidine. The drug provided better hemodynamic stability and smoother recovery without major side effects. **Conclusion:** Dexmedetomidine effectively stabilizes intraoperative hemodynamics, reduces postoperative pain and agitation, and improves recovery profile without prolonging recovery or causing significant adverse events, making it a safe and valuable adjunct in FESS under general anaesthesia.

INTRODUCTION:

Functional endoscopic sinus surgery (FESS) is an effective approach for treating chronic rhinosinusitis. This procedure demands high precision and accurate landmark identification to prevent complications[1]. Extubation is the process of removing the artificial airway once the conditions that required its use-such as ventilation support, airway protection, airway obstruction and hypoxia—have been resolved. The heightened sympatho-adrenal activity could lead to tachycardia, hypertension, arrhythmias and elevated myocardial oxygen consumption[2]. These hemodynamic alterations are typically seen as increase in heart rate and arterial blood pressure and are often variable, transient and unpredictable[3].

Patients with systemic hypertension, intracranial aneurysms, heart disease or cerebrovascular disease are at increased risk. To improve the surgical field, various methods such as local vasoconstrictors, antifibrinolytics and MAP-lowering drugs are used[4]. Sodium nitroprusside and nitroglycerin are favoured for their rapid onset and termination, though they require intra-arterial blood pressure monitoring. Inhalational agents like sevoflurane are popular due to their ease of titration and rapid washout, which helps the patient awaken quickly after the procedure. However, high concentrations of sevoflurane may cause hemodynamic instability and delayed recovery[5].

Dexmedetomidine, a selective α2-adrenergic receptor agonist, provides sedation, analgesia and sympatholytic effects without impairing respiratory function. It reduces arterial blood pressure and heart rate by activating α2-adrenergic receptors and releasing norepinephrine[6]. Intraoperative dexmedetomidine infusion effectively decreases anaesthetic requirements, postoperative pain and the hemodynamic response to intubation and extubation. It is used in doses ranging from 0.2 to 1 mcg/kg/hour to provide hypotensive anaesthesia during endoscopic nasal and middle ear surgeries. While lower doses achieve reduced MAP and improved surgical visibility, higher doses (1 mcg/kg/hour and above) may cause bradycardia in some patients[7].

Despite its potential benefits, there is limited data on how dexmedetomidine affects recovery profiles from GA in patients undergoing endoscopic sinus surgery. This study aims to evaluate the impact of dexmedetomidine on recovery outcomes from general anaesthesia in FESS patient.

MATERIALS AND METHODS:

The present Observational study was conducted in dept of Anesthesia at a tertiary care centre between January 2023 to December 2024. Subjects who scheduled for FESS for chronic sinusitis under general anaesthesia with ASA I or II, Age >18 years, were included. Patients with cardiovascular or respiratory disorder, renal and/or hepatic insufficiency, allergy to α2-agonists and chronic use of psychotropic medications, were excluded.

Study Methodology:

Prior to the surgery, a preoperative visit was made for every patient. Informed consent was taken and the nature of the procedure was explained to them. The patients were allocated to either of the two groups (Group A and Group B) of

30 each. The patient was shifted to the operating room and preoxygenation was done with 100% oxygen for 3 minutes with a face mask at a flow rate of 8-10L/min.

All patients received premedication with Inj. Ondansetron (0.08 mg/kg), Inj. Midazolam (0.03 mg/kg), Inj. Glycopyrrolate (4 mcg/kg), Inj. Pentazocine (0.4-0.6 mg/kg). General anaesthesia was induced with Inj. Propofol (1.5-2 mg/kg). Inj. Atracurium (0.5 mg/kg) was intravenously injected to facilitate oral tracheal intubation. Anaesthesia was maintained with inhalation of 2.0%-3.0% sevoflurane and 50% oxygen with 50% nitrous oxide and intravenous infusion of Inj. Atracurium (0.1 mg/kg) was given. Mechanical ventilation was adjusted to maintain end-tidal pressure of CO_2 ($EtCO_2$) between 35-45 mmHg. Heart rate (HR) and mean arterial pressure (MAP) were kept between 80% and 120% of the preanesthetic baseline levels by adjusting the anaesthetic concentrations. Bradycardia (HR < 40 beats/min) was treated with Inj. Atropine (0.5 mg IV bolus). Hypotension (MAP < 60 mmHg) was treated with Inj. Mephentermine (6 mg IV bolus).

For Group B, dexmedetomidine was diluted with normal saline to a concentration of 4 µg/ml in a 50 ml syringe. Group A was without dexmedetomidine. After intubation, patients in Group B received intravenous administration of dexmedetomidine (0.5 µg/kg bolus given over a 10 min period). HR and MAP values were recorded before anaesthesia induction (T0), at the end of surgery (T1), at the time of eye opening (T2), at extubation (T3) and 5 min after extubation (T4).

Emergence was defined as the period from discontinuation of anaesthetic to 5 min after extubation. During emergence, the following variables were recorded: Time to eye opening and Time to extubation. Agitation was defined as a sedation-agitation scale score of ≥ 5, and the incidence of emergence agitation was recorded. After arrival in the PACU, postoperative pain was assessed with a visual analogue scale (VAS; 0=no pain and 10=the worst imaginable pain). Adverse events such as nausea, vomiting and desaturation (SpO_2 <90%) were also recorded.

All statistical analysis was performed with SPSS. Continuous variables were analysed with Student's t-test. Categorical variables were compared using Chi-square tests. Data were presented as mean and standard deviation or number (%) as appropriate. P < 0.05 was considered statistically significant.

RESULTS:

Table 1. Distribution Of The Study Participants As Per Age (N=60)

Age and Gender Distribution		Study Group (n=30) (%)	Control Group (n=30) (%)	Chi-square value, (p-value)
Age Group (years)	20 to 29 years	5 (16.7)	5 (16.7)	0.12, 0.989
	30 to 39 years	11 (36.7)	12 (40)	
	40 to 49 years	7 (23.3)	6 (20)	
	50 years or more	7 (23.3)	7 (23.3)	
	Mean age (Years)	39.13 ± 10.1	40.37 ± 9.6	0.633
Gender	Male	20 (66.6)	21 (70)	0.781, 0.077
	Female	10 (33.4)	9 (30)	
ASA grade	Grade I	13 (43.3)	14 (46.6)	0.795, 0.06
	Grade II	17 (56.7)	16 (53.4)	
Total		30 (100)	30 (100)	

Among the study group, most (36.7%) belong between 30 to 39 years and their mean age was 39.13 ± 10.1 years, whereas in the control group, also most (40%) belonged to 30 to 39 years and their mean age was 40.37 ± 9.6 years. There was no significant difference in the mean age of the study group & control group (unpaired t-test statistic – 0.481, p-value 0.633). Among the study group, 66.6% were male, whereas in the control group, also 70% were male & there was no significant statistical difference in the gender among the study group & control group.

Among the study group, 43.3% and in the control group, 46.6% participants had ASA grade I and 56.7% had ASA grade II in study group, whereas control group has 53.4% ASA grade II. there was no significant statistical difference in the ASA grading among the study group & control group.

Table 2. Distribution Of The Study Participants As Per Baseline Parameters (N=60)

Parameters at T0	Study Group (n=30)	Control Group (n=30)	Unpaired t-test statistic	p-value
Heart rate (Beats/minute)	82.07 ± 9.8	81.33 ± 8.2	0.312	0.756
Systolic BP (mm of Hg)	130.8 ± 7.9	131.93 ± 15.7	0.352	0.726
Diastolic BP (mm of Hg)	81.13 ± 7.7	77.40 ± 3.9	0.945	0.06
MAP* (mm of Hg)	97.6 ± 6.6	91.5 ± 6.05	1.726	0.07
RR# (breath per minute)	13.5 ± 1.07	13.53 ± 1.3	0.105	0.916
SpO_2 (%)	98.07 ± 0.7	98.1 ± 0.7	0.172	0.864
$EtCO_2$ (mm of Hg)	29.74 ± 2.2	26.1 ± 1.5	1.831	0.05

*Mean Arterial Pressure, # Respiratory Rate

There was no statistically significant difference in the parameters between the study group and control group at baseline (T0).

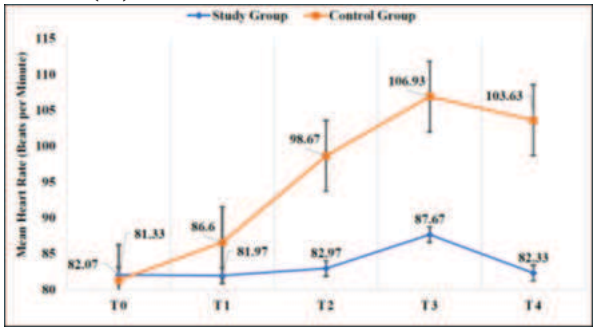

Fig 1. Distribution Of The Study Participants As Per Heart Rate At Different Timeline:

Participants in study group (n=30) has statistically significant levels (Repeated measures ANOVA statistic 41.946, p-value < 0.001) of low mean heart rate during different time period in comparison to the control group participants (n=30).

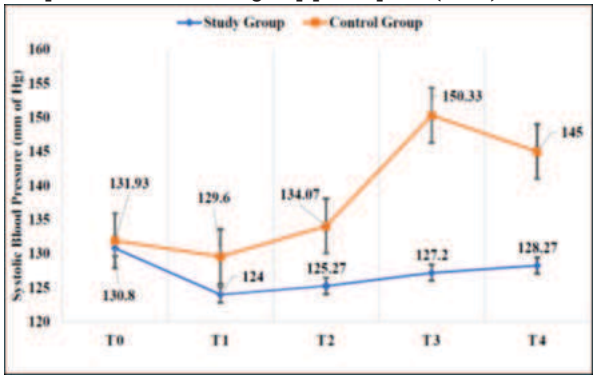

Fig 2. Distribution Of The Study Participants As Per Systolic Blood Pressure At Different Timeline (N=60):

Participants in study group (n=30) has statistically significant levels (Repeated measures ANOVA statistic 16.39, p-value < 0.001) of low systolic blood pressure during different time period in comparison to the control group participants (n=30)

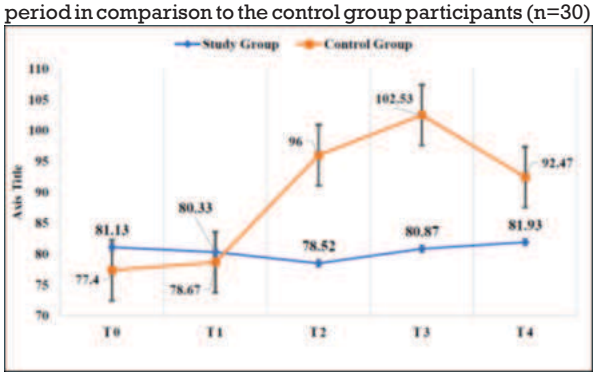

Fig 3. Distribution Of The Study Participants As Per Diastolic Blood Pressure At Different Timeline **(N=60):**

Participants in study group (n=30) has statistically significant levels (Repeated measures ANOVA statistic 24.425, p-value < 0.001) of low diastolic blood pressure during different time period in comparison to the control group participants (n=30)

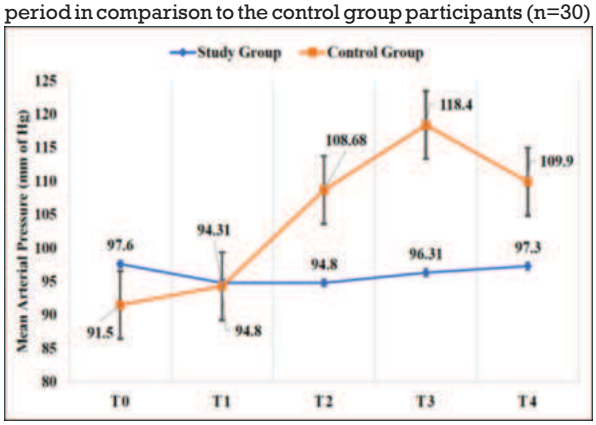

Fig 4. Distribution Of The Study Participants As Per MAP At Different Timeline:

Participants in study group (n=30) has statistically significant levels (Repeated measures ANOVA statistic 24.054, p-value < 0.001) of low mean arterial pressure during different time period in comparison to the control group participants (n=30).

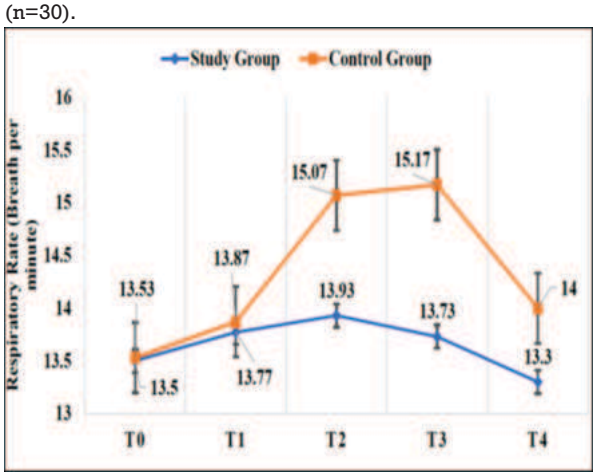

Fig 5. Distribution Of The Study Participants As Per Respiratory Rate At Different Timeline (N=60):

Participants in study group (n=30) has statistically significant levels (Repeated measures ANOVA statistic 11.582, p-value 0.001) of low respiratory rate during different time period in comparison to the control group participants (n=30)

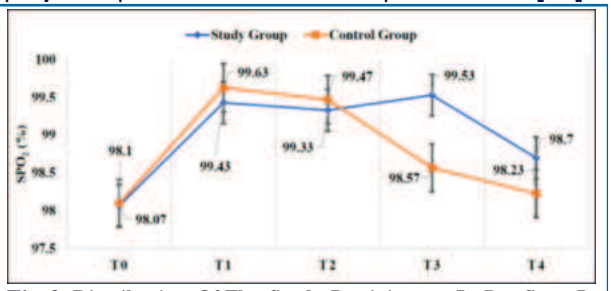

Fig 6. Distribution Of The Study Participants As Per Spo_2 At Different Timeline (N=60):

Participants in study group (n=30) had almost similar SPO_2 during different time period in comparison to the control group participants (n=30). Thus, it was not statistically significant (Repeated measures ANOVA statistic 3.668, p-value 0.06)

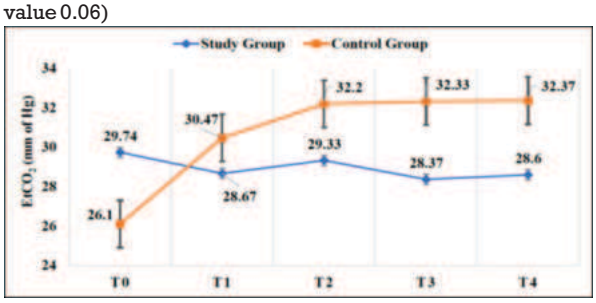

Fig 7. Distribution of the study participants as per $EtCO_2$ at different timeline (N=60):

Participants in study group (n=30) has statistically significant levels (Repeated measures ANOVA statistic 18.769, p-value <0.001) of low $EtCO_2$ during different time period in comparison to the control group participants (n=30).

Table 3: Distribution Of The Study Participants As Per RSA Scale (N=60)

RSA Category	Study Group (n=30) (%)	Control Group (n=30) (%)	Chi-square test statistic (df)	p-value
Agitated	7 (23.3)	25 (83.3)	21.696 (1)	< 0.001
Non-agitated	23 (76.7)	5 (16.7)		
Total	30 (100)	30 (100)		

Among the study group, 23.3% were agitated in post-operative period whereas in control group (n=30) it was 76.87% & it was statistically significant (Chi-square statistic 21.696, p-value < 0.001)

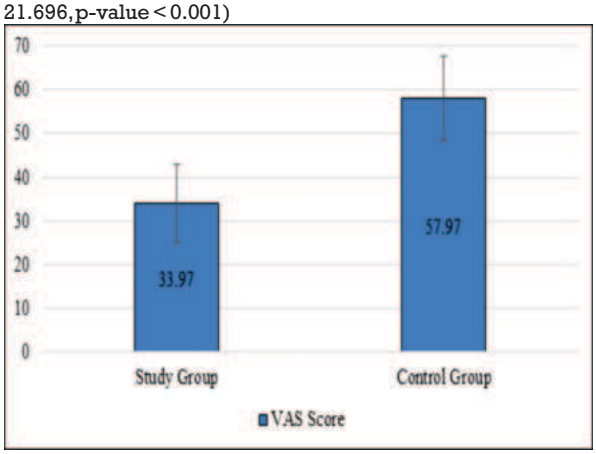

Fig 8. Distribution Of The Study Participants As Per VAS Score (N=60):

Study group participants has statistically significantly lower (Unpaired t- test statistic 9.911, p-value < 0.001) mean VAS score in comparison to control group participants.

Table 4: Distribution Of The Study Participants As Per Post-operative Events (N=60)

Post-operative events	Study Group (n=30) (%)	Control Group (n=30) (%)	p-value
None	25 (83.3)	22 (73.3)	0.049
Nausea	1 (3.3) *	4 (13.3)	
Vomiting	0 (0) *	2 (6.7) *	
Shivering	0 (0) *	2 (6.7) *	
Drowsiness	2 (6.7) *	0 (0) *	
Hypotension	2 (6.7) *	0 (0) *	
Total	30 (100)	30 (100)	

In comparison to study group (n=30) control group participants (n=30) had statistically significantly (chi-square statistic 8.353, p-value 0.049) lower post-operative adverse events like hypotension, drowsiness etc.

DISCUSSION:

Functional Endoscopic Sinus Surgery (FESS) is a key approach for managing chronic rhinosinusitis that does not respond to medical treatments. To mitigate the risks of nasal bleeding and pulmonary aspiration, awake extubation is typically preferred. However, this can lead to tracheal and laryngeal irritation, which may result in coughing, agitation, laryngospasm, hypertension and tachycardia. Topical vasoconstrictors help reduce mucosal congestion and bleeding but can lead to tachycardia and hypertension.

The impact of changes in circulatory and airway responses during intubation has been extensively discussed in comparison to extubation. Various theories have been proposed to explain the sudden increases in pulse rate and blood pressure during extubation, including elevated catecholamine levels, airway irritation from suction, intense pain from surgical wounds and emergence. Dexmedetomidine has been found to be effective in controlling these hemodynamic changes and alleviating stressful airway responses.

Hemodynamic Parameters

There was no statistically significant difference in heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, respiratory rate, SpO_2, $EtCO_2$ between the study group and control group at baseline (T0) before induction of anaesthesia.

Heart rate, Systolic BP, Diastolic BP and Mean Arterial Pressure:

Participants in study group has statistically significant levels (p-value < 0.001) of low Heart rate, systolic blood pressure, Diastolic blood pressure and MAP during different time period in comparison to the control group participants (n=30).

Barkha Bindu et al[7], compared the effects of dexmedetomidine with placebo in 50 patients of 25 in each group. They found statistically significant difference in the MA beginning from 10 minutes from the time of dexmedetomidine administration which continued till 20 minutes after extubation.

Percent Saturation Of Oxygen In The Blood

Participants in study group had almost similar SPO_2 during different time period in comparison to the control group participants. Thus, it was not statistically significant (p-value 0.06).

Goyal S et al[8], conducted a study to evaluate the effect of dexmedetomidine on hemodynamic response during endotracheal extubation in patients undergoing craniotomies for intracranial space occupying lesion (ICSOL) in 60 patients. No significant difference in SpO_2 after extubation until end of study among 3 groups. Similar finding were consistent in R. Aksu et al[9] conducted study to compare the effects of dexmedetomidine and fentanyl on airway reflexes and hemodynamic responses to tracheal extubation in patients undergoing rhinoplasty. Observed there were no significant differences in SpO_2 between the 2 groups after tracheal extubation. Desaturation was not observed in any patient in either group.

In our study, dexmedetomidine infusion significantly reduced intraoperative heart rate, blood pressure and surgical bleeding due to its alpha-2 effects causing central sympatholysis leading to hypotension. The effectiveness of intraoperative use of dexmedetomidine for an ideal surgical field has been extensively reported for middle ear and maxillo-facial surgeries. The optimal anaesthetic technique of relative bradycardia and associated hypotension found by Ulger et al[10] compared dexmedetomidine with nitroglycerin to achieve controlled hypotension for middle ear surgeries. They found that dexmedetomidine maintains hemodynamic stability and better surgical visibility. In our study, we found that dexmedetomidine provided excellent controlled hypotension that assured surgical visibility with minimal bleeding. Contrary to administration of nitroglycerin any reflex tachycardia or rebound hypertension was not observed.

Bajwa et al.[11] showed that dexmedetomidine achieved desired mean arterial pressure, slightly higher sedation score and prolonged recovery time when compared with nitroglycerine and esmolol. Also, the request for analgesia was delayed in postoperative period (time of first analgesic request) in the dexmedetomidine group similar to our study, signifying the analgesic effects of dexmedetomidine.

Shams T et al.[12] and Karabayirli S et al.[13] in their independent studies found that dexmedetomidine is a better alternative to other drugs for controlled hypotension, blood loss and better surgical visibility. Also, they found, dexmedetomidine has analgesic and anaesthetic properties that help reducing perioperative analgesic and anaesthetic requirements.

We found similar results in our study with dexmedetomidine providing controlled hypotension, reduced blood loss, stable hemodynamics with better sedation and pain scores.

Among the study group, 23.3% were agitated in post-operative period whereas in control group (n=30) it was 76.87% & it was statistically significant (Chi-square statistic 21.696, p-value < 0.001). Study group (n=30) participants has statistically significantly lower (Unpaired t-test statistic 9.911, p-value < 0.001) mean VAS score in comparison to control group participants (n=30).

Guler et al. [14] reported that administering a single dose of dexmedetomidine before extubation improved tolerance to the endotracheal tube and reduced both airway and cardiovascular responses during extubation. Talke et al. [15] investigated the hemodynamic and adrenergic effects of dexmedetomidine in patients undergoing vascular surgery and found that it mitigated increases in heart rate and plasma norepinephrine levels during the recovery period post-anaesthesia. In our study, we observed that heart rate and blood pressure were significantly lower in Group B compared to Group A during the peri-extubation period, indicating that dexmedetomidine effectively attenuates the sympathetic response to extubation and enhances hemodynamic stability. Emergence agitation (EA) is a common and problematic occurrence in postoperative period. Although typically self-limiting, EA can be severe and increase the risk of serious complications such as hypoxia, pulmonary aspiration, bleeding at the surgical site. EA is particularly prevalent after ear, nose, and throat (ENT) surgery. Yu et al[16]. reported a 55.4% incidence of EA following ENT surgery, with contributing factors including personal characteristics, preoperative anxiety, postoperative pain, rapid awakening

and the presence of a tracheal tube. Additionally, Eckenhoff et al[17]. suggested that a "sense of suffocation" during anaesthetic recovery might trigger EA in patients undergoing head and neck surgery.

Previous research has shown that dexmedetomidine is effective in reducing the incidence of EA following general anaesthesia in children and can also be successful in managing agitation in critically ill patients undergoing weaning from mechanical ventilation. In our study, intravenous administration of dexmedetomidine at 0.5 μg/kg after intubation significantly reduced postoperative pain and EA, likely due to its sedative and analgesic properties. Furthermore, dexmedetomidine provides a unique form of "conscious sedation," allowing patients to be easily aroused and communicative. Our study found no difference in recovery times between the two groups, suggesting that the "conscious sedation" effect and minimal respiratory depression contributed to a smooth recovery without delays in the dexmedetomidine group. A recent study indicated that the prolongation of extubation time with dexmedetomidine is dose-dependent; however, our use of a relatively low dose was effective in controlling EA without delaying anaesthesia recovery.

Consistent with our findings, Kim et al. [18] reported that intraoperative use of dexmedetomidine (0.4 μg/kg/h) reduced EA after nasal surgery without delaying extubation. While hypotension and bradycardia are common side effects of dexmedetomidine, we did not observe severe cases requiring intervention with the bolus dose of 0.5 μg/kg administered over 10 minutes. This suggests that proper dosing and slow infusion can minimize the risk of cardiovascular adverse effects. Gurbet et al.[19] demonstrated that intraoperative dexmedetomidine use did not increase postoperative nausea and vomiting, a finding corroborated by our study, which showed no significant difference between groups in the incidence of these complications. Dexmedetomidine does not cause respiratory depression at clinically relevant doses and no desaturation was observed in either group in our study.

CONCLUSION:

Administering dexmedetomidine intravenously prior to the FESS procedure not only provides sedation and reduces anxiety but also helps mitigate the stress response associated with tracheal intubation. Systemic administration of dexmedetomidine can reduce surgical time, intraoperative blood loss and the amount of inhaled anaesthetic gases required. It also helps lower postoperative pain and incidence of emergence agitation. Unlike opioids, dexmedetomidine is readily available and does not require stringent storage regulations.

Due to its favorable properties and safety profile, it is a valuable option for various surgeries, where controlling hemodynamic fluctuations and minimizing bleeding are important. Dexmedetomidine may be particularly effective and safe for surgical procedures like FESS, where controlled hypotension is beneficial.

REFERENCES:

1. Baker AR and Baker AB. Anaesthesia for endoscopic sinus surgery. Acta Anaesthesiol Scand 2010; 54: 795-803.
2. Afonso J and Reis F. Dexmedetomidine: current role in anesthesia and intensivecare. Rev Bras Anestesiol 2012; 62: 118-133.
3. Mantz J, Josserand J and Hamada S. Dexme- detomidine: new insights. Eur J Anaesthesiol 2011; 28: 3-6.
4. Bekker A, Haile M, Kline R, Didehvar S, Babu R, Martiniuk F and Urban M. The effect of intraoperative infusion of dexmedetomidine on the quality of recovery after major spinal surgery. J Neurosurg Anesthesiol 2013; 25: 16-24.
5. Kim SY, Kim JM, Lee JH, Song BM and Koo BN. Efficacy of intraoperative dexmedetomidine infusion on emergence agitation and quality of recovery after nasal surgery. Br J Anaesth 2013; 111: 222-228.
6. Chen JY, Jia JE, Liu TJ, Qin MJ and Li WX. Comparison of the effects of dexmedetomidine, ketamine, and placebo on emergence agitation after strabismus surgery in children. Can J Anaesth 2013; 60: 385-392.
7. Bindu B, Pasupuleti S, Gowd UP, Gorre V, Murthy RR, Laxmi MB. A double blind, randomized, controlled trial to study the effect of dexmedetomidine on hemodynamic and recovery responses during tracheal extubation. J Anaesthesiol Clin Pharmacol. 2013 Apr;29(2):162-7.
8. Goyal S, Bandil M, Bansal RP. The effectiveness of intravenous dexmedetomidine on haemodynamic responses during tracheal extubation in patients undergoing craniotomies. Int J Res Med Sci 2017;5:3626-30.
9. Aksu R, Akin A, Biçer C, Esmao□lu A, Tosun Z, Boyaci A. Comparison of the effects of dexmedetomidine versus fentanyl on airway reflexes and hemodynamic responses to tracheal extubation during rhinoplasty: A double-blind, randomized, controlled study. Curr Ther Res Clin Exp. 2009;70(3):209-220.
10. Ulger BV, Bozkurt A, Bilgin F, Yilmazlar A, Tokat O. Comparison of dexmedetomidine and nitroglycerin for controlled hypotension during tympanoplasty. Eur Rev Med Pharmacol Sci. 2020;24(6):2911-9.
11. Bajwa SJ and Kulshrestha A. Dexmedetomidine: An adjuvant making large inroads into clinical practice. Ann Med Health Sci Res 2013; 3: 475-483.
12. 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):175-80.
13. Karabayirli S, Ugur KS, Demircioglu RI et al. Surgical conditions during FESS; comparison of dexmedetomidine and remifentanil. Eur Arch Otorhinolaryngol 2017;274:239–45.
14. Guler G, Akin A, Tosun Z, Eskitascoglu E, Mizrak A and Boyaci A. Single-dose dexmedetomidine attenuates airway and circulatory reflexes during extubation. Acta Anaesthesiol Scand 2005; 49: 1088-1091.
15. Talke P, Chen R, Thomas B, Aggarwall A, Gottlieb A, Thorborg P et al. The hemodynamic and adrenergic effects of perioperative dexmedetomidine infusion after vascular surgery. Anesth Analg. 2000 Apr;90(4):834-9.
16. Yu HB, Sun JJ, Li X, Zhang X, Liu XJ. Risk factors of emergence agitation in adults undergoing ENT surgery: A systematic review and meta-analysis. J Clin Anesth. 2021;68:110083.
17. Eckenhoff JE, Kneale DH, Dripps RD. The incidence and etiology of postanesthetic excitement. Anesthesiology. 1961;22(5):667-73.
18. Voepel-Lewis T, Malviya S and Tait AR. A prospective cohort study of emergence agitation in the pediatric postanesthesia care unit. Anesth Analg 2003; 96: 1625-1630.
19. Gurbet A, Basagan-Mogol E, Turker G, Ugun F, Kaya FN, Ozcan B. Intraoperative infusion of dexmedetomidine reduces perioperative analgesic requirements. Can J Anesth. 2006;53(7):646-52.