Original Research Paper

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A COMPARATIVE EVALUATION OF DEXMEDETOMIDINE FOR HYPOTENSIVE ANAESTHESIA DURING NASAL ENDOSCOPIC SINUS SURGERY UNDER GENERAL ANAESTHESIA WITH CONTROL GROUP IN TERTIARY CARE CENTRE.

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ABSTRACT **Introduction:** Functional endoscopic sinus surgery (FESS) is a commonly performed and effective procedure for patients with chronic rhinosinusitis that does not respond to medical treatment. Capillary bleeding during FESS is major concern as it obstructs the surgical field; Dexmedetomidine is highly selective alpha 2 adrenergic agonist. It can produce analgesia, sedation, and anxiolysis. It provides stable hemodynamic status during surgery if used cautiously. **Aims and Objectives:** To compare the Mean Arterial blood Pressure (MABP) in Dexmedetomidine and control group of patients undergoing nasal endoscopic sinus surgery. **Materials And Methods:** Patients posted for elective nasal endoscopic sinus surgery under General anaesthesia were randomly assigned into two groups. Dexmedetomidine Group patients (Group D) received loading dose of 1 mcg/kg of dexmedetomidine IV over 15 mins before induction and maintenance dose of 0.3mcg/kg/hr after induction of anaesthesia, while control group (Group C) received normal saline. Heart rate, Blood Pressure, oxygen saturation (SpO_2), End tidal carbondioxide ($EtCO_2$) were recorded. The surgical field quality was analysed by Boezaart surgical field scale. Grade 2 and 3 were satisfactorily accepted surgical field quality. Intraoperative Blood loss was measured. Recovery profile (Nausea and Vomiting) were monitored. **Conclusion:** The study concluded that the use of Dexmedetomidine drug intravenously in patients undergoing Nasal endoscopic sinus surgery helps in maintaining controlled-hypotension.

KEYWORDS : Dexmedetomidine, Nasal Endoscopic sinus surgery, Hypotensive Anaesthesia.

INTRODUCTION:

Functional endoscopic sinus surgery (FESS) is a frequently utilized and successful procedure for individuals with chronic rhinosinusitis who do not improve with medical management.[1] The Functional endoscopic sinus surgery can be performed under General Anaesthesia or Local Anaesthesia if the pathology of the disease is limited and Duration of surgery is short. The main obstacle to good visibility is excessive bleeding during surgery that can compromise the safety and efficiency of this surgical procedure.

To minimize bleeding and enhance visibility in the surgical field, many anesthetists have utilized induced hypotension. Hypotensive anesthesia can be achieved through both non-pharmacological and pharmacological approaches. Non-pharmacological methods include appropriate patient positioning, applying positive airway pressure, and fluid management.[2] Several pharmacological agents are utilized to achieve controlled hypotension, such as direct-acting vasodilators (e.g., sodium nitroprusside, nitroglycerin), ganglion-blocking agents, β-adrenergic blockers (e.g., esmolol), calcium channel blockers (e.g., nicardipine), α2-agonists (e.g., clonidine, dexmedetomidine), volatile anesthetics, and magnesium sulfate.[3,4]

Dexmedetomidine is a selective, short-acting central α2-adrenergic agonist. It protects the patient from harmful sympathetic stimulation and hemodynamic fluctuations during surgery. Additionally, it reduces salivation, secretions, and gastrointestinal motility; causes contraction of vascular and smooth muscle; inhibits renin release; increases glomerular filtration; and enhances sodium and water excretion in the kidneys. It also lowers intraocular pressure and reduces insulin release from the pancreas. Presynaptic activation of alpha2 adrenoceptors inhibits norepinephrine release, thereby stopping the transmission of pain signals.[5] Postsynaptic activation of alpha2 adrenoceptors in the central nervous system (CNS) inhibits sympathetic activity, leading to reduced blood pressure and heart rate. Together, these effects contribute to analgesia, sedation, and anxiolysis. This study was undertaken to establish the role of dexmedetomidine in the patients undergoing FESS surgeries.

MATERIALS AND METHODS

Study Design

A prospective double blind randomized study was conducted on Patients admitted in a tertiary care hospital and posted for elective nasal endoscopic sinus surgery under General Anaesthesia. After thorough pre anaesthetic checkup and fulfilment of inclusion criteria, Patients were randomly assigned into two groups (35 Patients each in group D and C) by chit method. Entire procedure was explained, written informed consent was taken from the patient. After taking the patient into the operating room, all standard monitors were attached and IV line was secured with 18 G intravenous catheter. Group A patients received a loading dose of 1 mcg/kg of dexmedetomidine diluted in 20 ml sterile water IV over 15 mins. Group B patients were given 20ml of normal saline as loading dose.

All patients were premedicated with inj. midazolam 0.03 mg/kg, inj. Glycopyrrolate 4 µg/kg and inj. butorphanol 0.03 mg/kg intravenously and pre-oxygenated with 100% oxygen. All patients were induced with inj, Propofol in the doses of 1.5 - 2 mg/kg intravenously where loss of eyelash reflex was the end point. Inj. succinylcholine 1.5 mg/ kg intravenously was used to facilitate endotracheal intubation. Group A patients received a maintenance dose of 0.3 mcg/kg/hr of dexmedetomidine while Group B patients received normal saline and anaesthesia was maintained with 50:50 Oxygen-nitrous oxide, isoflurane and on controlled volume ventilation (Tidal volume : 7 ml/kg, Respiratory Rate : 10 cycles/min) with Inj. Vecuronium as muscle relaxant. Patients in both groups were infiltrated with 2 ml of 2 % lignocaine with epinephrine 1 in 200,000 dilution before commencement of surgery at the surgical field.

Loading dose of study drug was given 10 min before intubation of general anaesthesia (GA), and its maintenance dose infusion was started soon after intubation and continued intraoperatively until 5 min before the completion of surgery or stopped on the occurrence of severe hypotension and Bradycardia below 30% from the baseline, whichever was earlier. Intraoperative haemodynamic parameters such as heart rate (HR), systolic blood pressure, diastolic blood pressure, mean arterial pressure (MAP), Electrocardiogram (ECG), oxygen saturation (SpO2), EtCO2 were recorded at baseline, during the infusion, after the loading dose, after intubation, 5 min after intubation and thereafter every 10 min until shifting of patient to recovery room. At the end of the surgery after spontaneous respiratory attempts, reversal done. Residual muscle paralysis was reversed with Inj. Neostigmine 0.05 mg/kg + Inj. Glycopyrolate 80 mcg/kg intravenously. Patient extubated after full filling extubation criteria. Patient shifted to recovery.

The surgical field quality was analysed by Boezaart surgical field scale [score 0 = no bleeding; score 1 = slight bleeding, no suctioning of blood required; score 2 = slight bleeding, occasional suctioning required, surgical field not threatened; score 3 = slight bleeding, frequent suctioning required, bleeding threatens surgical field a few seconds

after suction is removed; score 4 = moderate bleeding, frequent suctioning required, bleeding threatens surgical field directly after suction is removed; score 5 = severe bleeding, constant suctioning required, bleeding appears faster than can be removed by suction, surgical field severely threatened and surgery suspended] Grade 2 and 3 were satisfactorily accepted Surgical field quality. Intraoperative Blood loss was measured. Recovery profile (Nausea and Vomiting) were monitored.

Inclusion Criteria:
- Patients of both the gender and age between 20 to 50 years with consent for anaesthesia as well as planned surgery
- ASA I or II
- Elective nasal endoscopic sinus surgeries.

Exclusion Criteria:
- Patient's refusal
- Pregnant women
- Recurrent sinus surgeries
- Patients on anti- coagulation drugs
- Patient is on beta-blocker, calcium blocker.
- Patient with history of syncope/ TIA
- Patients with the diagnosis of vascular sinus tumor

Statistical Analysis:
Data entry and statistical evaluation were performed using ANOVA software. Comparisons between different groups were made using mean values, standard deviations, Student's t-test, and the Chi-square test. A p-value of less than 0.05 was considered statistically significant.

Ethical Approval:
Prior to data collection, the purpose and details of the study were thoroughly explained to all participants, and informed written consent was obtained. The study protocol received approval from the Ethical Committee of SMBT IMS and RC, Dhamangaon, Igatpuri.

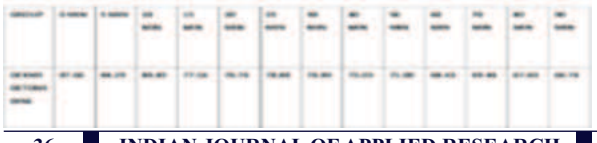
RESULTS:
In Group D (Dexmedetomidine Group) the mean age was 37.46 years, with a standard deviation (SD) of 11.52 while in Group C (Control Group) the mean age was 39.80 years, with an SD of 13.75. In the group D, 62.9% were male, and 37.1% were female. In the Group C, 68.6% were male, and 31.4% were female. Both groups had a higher percentage of male patients, with a similar distribution across genders (p<0.615). In Group D, 71.4% of patients were classified as ASA Grade 1, while 28.6% were classified as ASA Grade 2. In the Group C, 48.6% were ASA Grade 1, and 51.4% were ASA Grade 2. The p-value of 0.051 suggests a borderline significance, indicating a potential difference in ASA grading between the two groups, with the Dexmedetomidine group having more patients in the lower risk ASA Grade 1. The mean weight in group D and group C was 61.34 kg with an SD of 9.70 and 61.00 kg with an SD of 8.51. Ref.,Table 1.

Table 1: Mean Comparison Of Study Groups As Per Age, ASA Grade And Weight

Variable	Group D (Dexmedetomidine)	Group C (Control)
Mean age (Years)	37.46 ± 11.52	39.80 ± 13.75
ASA Grade (%)		
Grade 1	71.4%	48.6%
Grade 2	28.6%	51.4%
Mean Weight (kg)	61.34 ± 9.70	61.00 ± 8.51

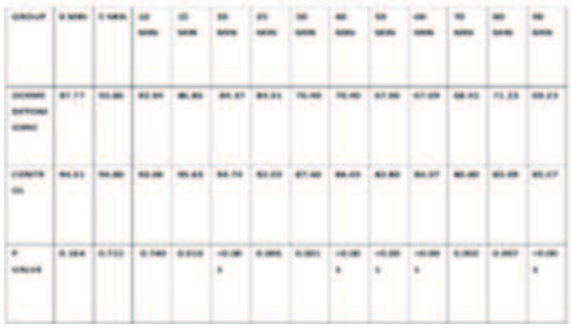
The t-test for mean differences revealed a notable disparity (p = 0.010), indicating that the baseline heart rate (HR) was higher in the Dexmedetomidine group compared to the Control group. At 15 minutes, the difference approached statistical significance (p = 0.065), suggesting a trend toward a lower HR in the Dexmedetomidine group. By 25 minutes, the difference became statistically significant (p = 0.005), showing a lower HR in the Dexmedetomidine group and the heart rate difference continues to be significant throughout the surgery.Ref., Table 2.

Table 2: Mean comparison of study groups as per Heart Rate (HR)



The t-test showed no significant difference in the Baseline (p =0.164). The statistically significant difference (p = 0.010), came at 15 mins showing that Dexmedetomidine significantly reduced MAP and this effect was statistically significant at nearly all time points.Ref.,Table 3. Group D required mean induction dose of Propofol 100.00 mg with a standard deviation (SD) of 9.39 while the Group C required 105.43 mg with an SD of 10.39. The mean duration of surgery in group D was 96.37 minutes with an SD of 31.84. In group C the mean duration of surgery was 102.40 minutes with an SD of 45.94. The mean total blood loss in Dexmedetomidine group was 61.14 ml with an SD of 36.94. The mean total blood loss in control group was 88.29 ml with an SD of 36.28.

Table 3: Mean comparison of study groups as per Mean Arterial Pressure (MAP)



In the Dexmedetomidine group, 74.3% of patients were rated as Grade 2, 22.9% as Grade 3, and 2.9% as Grade 4 on the Boezaart Surgical Field Scale. In the Control group, 22.9% were rated as Grade 2, 54.3% as Grade 3, and 22.9% as Grade 4. The Dexmedetomidine group had a significantly (P< 0.001) higher percentage of patients with better surgical field quality (Grade 2). Out of 35 Patients in control group, 3 patients gave complaints of Nausea and 2 patients gave complaints of Vomiting in post-operative period. There were no significant differences between the Dexmedetomidine and Control groups in terms of nausea and vomiting. Both groups achieved the desired level of sedation without any cases of severe bradycardia (Heart rate < 50 beats/min) or severe hypotension (MAP < 50 mmhg).

DISCUSSION:
Functional Endoscopic Sinus Surgery (FESS) is often the most suitable approach for managing persistent Chronic Rhinosinusitis (CRS) and other related conditions[1]. FESS is a minimally invasive procedure that requires controlled hypotensive anaesthesia. Excessive bleeding during the surgery can lead to serious complications, including blindness, meningitis, cerebrospinal fluid leakage, and extended surgical time[6]. This study was conducted in a Tertiary care Centre with an aim to compare the Mean Arterial Blood Pressure (MABP) between patients administered group D (Dexmedetomidine) and those in the Group C (Control) undergoing functional endoscopic sinus surgery and to evaluate the effectiveness of Dexmedetomidine in maintaining MABP within the 60-70 mmHg range during functional endoscopic sinus surgery. In our study Both the Dexmedetomidine group and control group are comparable to each other in respect to mean age, sex, weight and ASA grading.

In our study, the heart rate (HR) analysis during functional endoscopic sinus surgery showed that the Dexmedetomidine group consistently maintained significantly lower Heart rate values compared to the Control group, particularly after the intervention began. The most pronounced differences were observed during intubation and from 25 to 90 minutes post-intervention, where HR in the Dexmedetomidine group was significantly lower, indicating better hemodynamic stability. This effect suggests that Dexmedetomidine is effective in controlling HR during surgery, reducing the risk of perioperative complications and enhancing overall patient stability. In our study, the analysis of mean arterial pressure (MAP) at various time points (D = 67.06 - 71.23 / C = 82.09 - 86.43 mm hg) during surgery revealed that Dexmedetomidine consistently achieved lower MAP levels compared

to the Control group. This difference was statistically significant especially during intubation ($P < 0.001$) and all most throughout the surgery ($P = 0.007 - < 0.001$). These results highlight Dexmedetomidine's effectiveness in managing controlled hypotension, which is advantageous for maintaining a stable surgical field during nasal endoscopic sinus surgery. The α2 receptors play a role in regulating both the autonomic and cardiovascular systems; they inhibit norepinephrine release at sympathetic terminals and mediate vasoconstriction in blood vessels. At lower doses, Dexmedetomidine primarily exhibits sympatholytic effects. By binding to α2 receptors, it reduces sympathetic outflow and enhances cardiac vagal activity, leading to decreased heart rate and cardiac output. Additionally, Dexmedetomidine provides analgesia, sympatholysis, and has sedative, anxiolytic, and hypnotic properties. [7]

This is similar to the study by Khalifa et al [8] where they showed Dexmedetomidine's hemodynamic profile was more stable, a result of the sympatholytic effects of α2 agonists. In summary, the findings strongly support the use of Dexmedetomidine for better hemodynamic management, which is essential for minimizing bleeding and enhancing the quality of the surgical field. The observed hemodynamic effects are likely due to Dexmedetomidine-induced bradycardia, α2-adrenergic receptor activation, and reduced oxygen demand(9). Our study, the group D required mean induction dose 100.00 +/- 9.39 mg of Propofol and Control Group required mean induction dose 105.43 +/- 10.39 mg of Propofol. The Dexmedetomidine group required a notably lower dose of Propofol ($P = 0.046$) 5.43% for induction, aligning with the sedative effects of Dexmedetomidine and potentially decreasing the need for additional anesthetic agent. This is similar to the study done by Vishwanath P Et al.[10] aimed to study the effects of a single Preanesthetic dose of Dexmedetomidine on Propofol induction. The comparable average durations and the non-significant p-value indicate that Dexmedetomidine did not substantially impact the total length of the surgical procedure compared to the Control group.

The significantly lower blood loss ($P = 0.003$) observed in the Dexmedetomidine group suggests that its effect in maintaining lower mean arterial pressure (D = 67.06 - 71.23 / C = 82.09 - 86.43 mm hg) likely contributed to reduced bleeding during surgery, thus improving the surgical field which is similar to the study by Hilal et al. (11). Our study shows majority of patients in Dexmedetomidine group rated as grade 2 (74.3%) as majority and in control group rated as grade 3 (54.3%), grade 2 (22.9%) and grade 4 (22.9%) in boezaart surgical field scale. The highly significant p-value (< 0.001) underscores a substantial difference in surgical field quality between the two groups, indicating that Dexmedetomidine provides superior surgical conditions. These results also similar to the study done by Bafna et al. [12] There were no significant differences in nausea and vomiting between the Dexmedetomidine and Control groups. Both groups reached the desired sedation levels without any incidences of severe bradycardia or hypotension. These results support Dexmedetomidine as a safe and effective adjunct for managing hemodynamic parameters during nasal endoscopic sinus surgery, with minimal side effects.

CONCLUSIONS:

The study concluded that the use of α2-adrenergic agonist, Dexmedetomidine drug intravenously in patients undergoing Functional endoscopic sinus surgery helps in maintaining controlled hypotension and haemodynamic stability thereby reducing the intraoperative bleeding without any adverse effects during surgery and postoperative period.

REFERENCES:

[1] Senior BA, Kennedy DW, Tanabodee J, Korger H, Hassab M, Lanza D. Long term results of functional endoscopic sinus surgery. Laryngoscope 1998; 108:152–157.

[2] Rodrigo C. Induced hypotension during anesthesia with special reference to orthognathic surgery. Anesth Prog. 1995;42(2):41-58. PMID: 8934953; PMCID: PMC2148853.

[3] Degoute CS. Controlled hypotension: a guide to drug choice. Drugs 2007; 67:1053–1076.

[4] Elsharnouby NM, Elsharnouby MM. Magnesium sulphate as a technique of hypotensive anaesthesia. Br J Anaesth 2006; 96:727–731.

[5] Richa F, Yazigi A, Sleilaty G, Yazbeck P. Comparison between dexmedetomidine and remifentanil for controlled hypotension during tympanoplasty. Eur J Anaesthesiol 2008; 25:369–374.

[6] Castelnuovo P, Turri-Zanoni M, Battaglia P, Locatelli D, Dallan I. Endoscopic Endonasal Management of Orbital Pathologies. Neurosurg Clin N Am. 2015 Jul;26(3):463-72. [PubMed]

[7] Gertler R, Brown HC, Mitchell DH, Silvius EN. Dexmedetomidine: a novel sedative-analgesic agent. Proc (Bayl Univ Med Cent). 2001 Jan;14(1):13-21. doi: 10.1080/08998280.2001.11927725. PMID: 16369581; PMCID: PMC1291306.

[8] A comparative study of dexmedetomidine, magnesium sulphate, or glyceryl trinitrate in deliberate hypotension during functional endoscopic sinus surgery Omyma S.M. Khalifaa, Osama G. Awadb

[9] Taittonen MT, Kirvela OA, Aantaa R, Kanto JH. Effect of clonidine and dexmedetomidine premedication on perioperative oxygen consumption and haemodynamic state. Br J Anaesth 1997;78:400–406.

[10] Vishwanath P, Rao R, Vasudevarao SB. The effects of a single preanesthetic dose of dexmedetomidine on propofol induction, hemodynamics, and cardiovascular parameters. J Pharmacol Pharmacother 2020;11:8-12.

[11] Effectiveness of dexmedetomidine in reducing bleeding during septoplasty and tympanoplasty operations Hilal Ayoglu 1, Osman Yapakci, Mehmet Birol Ugur, Lokman Uzun, Hanife Altunkaya, Yetkin Ozer, Rahsan Uyanik, Fikret Cinar, Isil Ozkocak.

[12] 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 J Anaesth. 2021 Aug;65(8):579-585. doi: 10.4103/ija.IJA_57_21. Epub 2021 Aug 25. PMID: 34584280; PMCID: PMC8445218.