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Original Research Article

# Effect of dexmedetomidine on consumption of anesthetic agents, duration of surgery, time to extubationand post-operative emergence during endoscopic nasal surgeries: a pilot study

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**Abstract:** Our aim was to study the effects of dexmedetomidine on anesthetic consumption, duration of surgery, time to extubation and post-operative emergence when used as an adjunct to general anesthesia in endoscopic nasal surgeries. Fifty two patients scheduled for elective nasal surgery (Functional Endoscopic Sinus Surgery and Functional Endoscopic Nasal surgery) were randomized into two groups.Dexmedetomidine - group (D) and placebo or control - group (C).Dexmedetomidine was administered to the D group at a bolus dose of 0.5 ug/kg via an intravenous infusion pump over 10 min. Intraoperative maintenance was supplied by a continuous infusion of 0.2 ug/kg/hr. Infusion of Dexmedetomidine was stopped when the major surgical intervention was over.Group C was given equal amounts of normal saline, instead of Dexmedetomidine.The intraoperative hemodynamics during the surgery were recorded on a proforma. The duration of surgery, time to extubation and amount of anesthetic agents consumed in both the groups were noted. We found that there was a statistically significant difference in anesthetic consumption between both groups. The time to extubation was more in group C($p$ value $< 0.05$) .Awakening scores were better in group D($p$ value $< 0.05$).No significant difference in the duration of surgery was found.Our conclusion was that Dexmedetomidine reduces anesthetic agent consumption significantly when used as an adjunct in endoscopic nasal surgeries, thereby leading to shorter extubation times and better awakening scores.
**Keywords:**Dexmedetomidine, endoscopicsurgeries,propofol,sevoflurane,controlled hypotension,awakening score.

## INTRODUCTION

Functional endoscopic sinus surgery is a minimally invasive technique used to restore sinus ventilation and normal function in whichmedical treatment has failed. The procedure can be performed under general anesthesia as well as monitored anesthesia care. Now-a-days an increasing number of patients opt for general anesthesia and since general anesthesia may influence surgical bleeding in physiological and pharmacological pathways, specific measures need to be taken for achieving a good surgical field in these cases. A bloodless surgical field is very important during endoscopic surgeries because even a little bleeding obscures surgeon's vision due to amplification. Controlled hypotension can be used as a specificmeasure in reducing surgical bleeding, especially in possible cases of more extensive blood loss due to the presence of extended pathological process[1, 2].

Various agents (eg, magnesium sulfate, sodium nitroprusside, nicardipine, nitroglycerine, esmolol, α2-agonists, labetalol) and high doses of potent inhaled anesthetics (eg, isoflurane)[3] have been used to achieve controlledhypotension[4]. These agents have many disadvantages such as resistance to vasodilators, tachyphylaxis and cyanide toxicity with sodium nitroprusside, myocardial depression with esmolol and magnesium sulfate, and a long post anesthetic recovery period with isoflurane.

When used alone, inhalational anesthetics require very high concentrations to achieve a significant reduction in bleeding .Such high concentrations can lead to hepatic or renal injury as well as delayed recovery from anesthesia.Dexmedetomidine, an alpha - 2 agonist augments the hypotensive action of anesthetic drugs and therefore reduces intraoperative bleeding.

Ear, nose, and throat (ENT) surgery is also associated with a higher incidence of emergence agitation. After nasal surgery, awake extubation is preferred because the airway is contaminated by blood, and the nasal airway is blocked with surgical packs. However, awake extubation may intensify emergence agitation.

So, emergence agitation is a cause of concern in the immediate post operative period. Dexmedetomidine is a useful adjunct in facilitating a smooth recovery from anesthesia.

Currently,dexmedetomidine has been used in patients undergoing otorhinolaryngological procedures under local anesthesia as a sedative-analgesic.

We aim to study dexmedetomidine as an adjuvant to general anesthesia in patients undergoing endoscopic nasal surgeries, taking into consideration its effect on analgesic and anesthetic agent consumption and post operative emergence.

## MATERIALS AND METHODS

After approval by the Ethics and Scientific Committee of Fortis Escorts Hospital,Jaipur, a written informed consent was obtained from all study participants prior to initiation of the study cases.

Fifty two patients scheduled for elective nasal surgery (Functional Endoscopic Sinus Surgery and Functional Endoscopic Nasal surgery) were randomized into two groups.

Dexmedetomidine - group (D) and placebo or control group (C).

Randomization was done with a computer based randomization programme.

**Inclusion criteria** – ASA grade 1 & 2 patients aged 18 to 65 years.

**Exclusion criteria** – Uncontrolled hypertension, uncontrolled diabetes, cardiovascular disease (CHF, CAD),cardiomyopathy, valvular heart disease, cerebrovascular insufficiency, coagulation defects, history of hepatic or renal insufficiency or hypersensitivity to any of the drugs used and BMI >30.

After the patients were wheeled inside the operation room ,intravenous access (20 G cannula in most patients) was established in all patients and a crystalloid infusion was started.

Then the patients were premedicated with intravenous glycopyrollate (0.005 – 0.01mg/kg), midazolam (0.07 – 0.15mg/kg) and ondansetron (0.08mg/kg) and fentanyl (1 ug/kg).All patients were preoxygenated with 100% oxygen for 3 minutes before anesthetic induction.

Standard monitoring was applied in all cases. Dexmedetomidine was administered to the D group at a bolus dose of 0.5 ug/kg via an intravenous infusion pump over 10 min. Intraoperative maintenance was supplied by a continuous infusion of 0.2 ug/kg/hr. Infusion of Dexmedetomidine was stopped when the major surgical intervention was over.

Group C was given equal amounts of normal saline.

Anesthesia was induced with intravenous propofol (1.5 – 2.5 mg/kg), and endotracheal intubation was facilitated with IV vecuronium (0.1 mg/kg).

Anaesthesia was maintained with $n_20$ in $0_2$ mixture of 60:40, together with propofol infusion @50 – 200ugmkg/min and sevoflurane 0.25% – 2% maintaining a mean arterial blood pressure of 60 to 70mm of Hg.

Subsequent vecuronium doses were given in the form of an intravenous infusion at 0.8 – 1.2 ug/kg/min with maintenance of 90 percent suppression of twitch response.In both groups, signs such as increases in arterial pressure greater than the targeted MAP or somatic responses (eg, movement, tearing, or sweating) were treated with additional fentanyl.

Post-surgery, all patients were reversed using neostigmine (0.04 – 0.08mg/kg) and glycopyrrolate (0.005 – 0.01mg/kg).The total requirement of anesthetic agents including Propofol,Sevoflurane,Fentanyl and Vecuronium as well as the use of an additional hypotensive agent (Esmolol, Diltiazem) was recorded.

Operation time was noted as the period from the study agent administration until extubation while time to extubation was recorded from the end of surgery till extubation.The extent of pre operative surgical lesion was classified as high (>=12) and low (<12) according to Lund and Mackay score[5] based on CT findings by the operating surgeon. Based on the patient's level of consciousness; control over airway and movement of limbs, Steward[6] described an awakening score which was recorded in all patients post extubation.

**Awakening score**

| | |
|---|---|
| **Consciousness** | |
| Awake | 2 |
| Responding to stimuli | 1 |
| Not responding to stimuli | 0 |
| **Airway** | |
| Coughing on command or crying | 2 |
| Maintaining good airway | 1 |
| Airway requires maintenance | 0 |
| **Movement** | |
| Moving limbs purposefully | 2 |
| Non purposeful movements | 1 |
| Not moving | 0 |
| **Total score** | _____Not |

**Statistical Analysis**

The number of patients enrolled in this study was determined based on our preliminary analysis and a desired power of 80% to detect a between group difference of 20% in the scale used to assess the amount of blood in the surgical field with a significance level of 5%.Forty four patients in each arm of the study were be needed. Assuming a dropout rate of 15%.A total of 52 patients were enrolled [7]. Statistical significance between different groups was evaluated by using appropriate statistical test. Intergroup difference between case & control group for continuous variables will be evaluated by using independent t test while chi-square test will be performed to differentiate categorical variables.

**RESULTS AND DISCUSSION**

Table-1 shows the mean age,weight,height,lean body weight and BMI in the study group and the control group. There was no statistically significant difference between these patient charac teristics.(p value > 0.05)

Table-2 compares the duration of surgery and time to extubation in both groups. The difference between extubation times in both the groups was found to be statistically significant (p value < 0.05).

Table-3 shows the mean awakening scores in Group D and Group C were 5.92 and 5.61 respectively. This difference was statistically significant (p value <0.05).

Table-4 compares the consumption of various anesthetic agents. The reduction in consumption of propofol, sevoflurane and fentanyl in Group D was statistically significant(p value < 0.05).However, the decrease in vecuronium consumption in Group D was not statistically significant(p value > 0.05).

**Table 1: Demographic characteristics in both groups**

| | N | Mean | Std deviation | Std error mean | P value |
|---|---|---|---|---|---|
| Age - C group | 26 | 34.03 | 14.47 | 2.83 | 0.477 |
| D group | 26 | 36.96 | 14.94 | 2.91 | |
| Weight - C group | 26 | 67.36 | 12.12 | 2.37 | 0.117 |
| D group | 26 | 72.42 | 10.72 | 2.10 | |
| Height - C group | 26 | 165.38 | 6.75 | 1.32 | 0.094 |
| D group | 26 | 168.78 | 7.62 | 1.49 | |
| Lean body weight - C group | 26 | 47.72 | 6.47 | 1.26 | 0.050 |
| D group | 26 | 51.01 | 5.31 | 1.04 | |
| BMI - C group | 26 | 24.36 | 3.19 | 0.625 | 0.307 |
| D group | 26 | 25.33 | 3.56 | 0.699 | |

**Table 2: Comparison of duration of surgery and time to extubation in both the groups**

| | **N** | **Mean (min)** | **SD** | **Std. error mean** | **P value** |
|---|---|---|---|---|---|
| **Duration of surgery –Group C** | **26** | **128.07** | **4.54** | **8.53** | **0.830** |
| **Group D** | **26** | **125.19** | **52.25** | **10.24** | |
| **Time to extubation – Group C** | **26** | **33.65** | **7.14** | **1.40** | **0.000** |
| **Group D** | **26** | **23.11** | **5.93** | **1.16** | |

**Table 3: Comparison of awakeningscore in both groups**

| | **N** | **Group D Mean** | **Group C mean** | **P value** |
|---|---|---|---|---|
| **Awakening score** | **26** | **5.92** | **5.61** | **0.00** |

**Table 4: Comparison of volume of drug (ml) of anesthetic agents consumed in both groups**

| | N | Mean (ml) | SD | Std. error mean | P value |
|---|---|---|---|---|---|
| **Propofol – Group C** | 26 | 1194.61 | 450.98 | 88.44 | 0.002 |
| **Group D** | 26 | 805.46 | 398.89 | 78.23 | |
| **Sevoflurane – group C** | 26 | 20.25 | 8.84 | 1.73 | 0.037 |
| **Group D** | 26 | 15.65 | 6.45 | 1.26 | |
| **Fentanyl – Group C** | 26 | 121.15 | 28.61 | 5.61 | 0.00 |
| **Group D** | 26 | 65.00 | 23.49 | 4.60 | |
| **Vecuronium – group C** | 26 | 10.57 | 1.98 | 0.388 | 0.228 |
| **Group D** | 26 | 9.57 | 3.67 | 0.721 | |

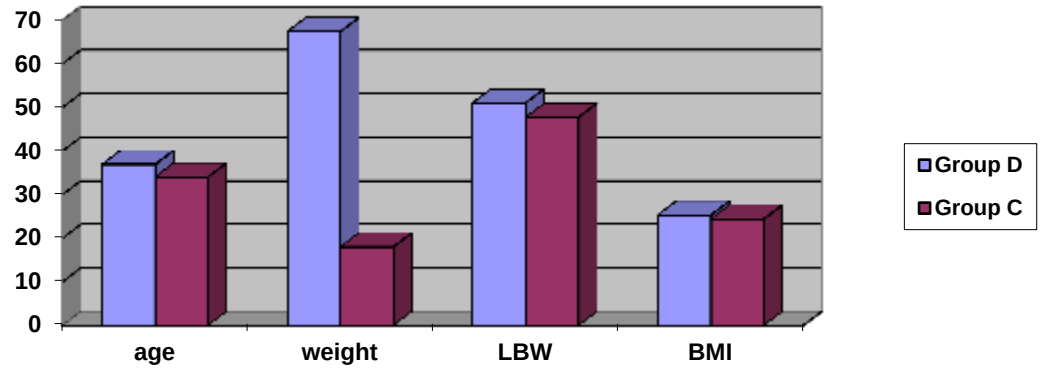


**Fig-1: A bar diagram showing distribution of age, weight, and lean body weight and body mass index in both the cases.**

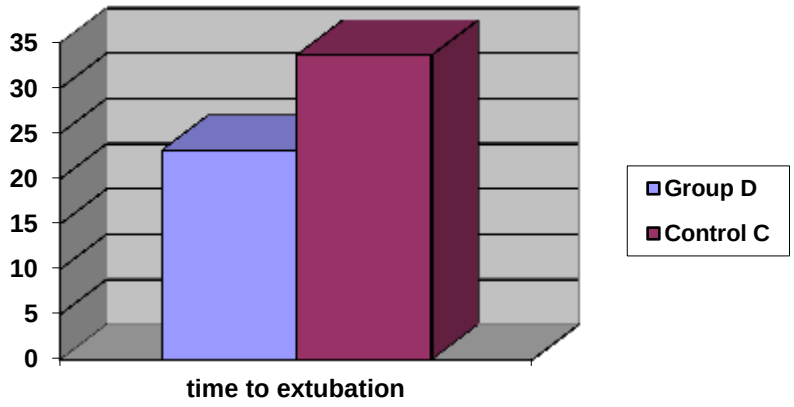


**Fig-2: A bar diagram comparing the time to extubation in both the groups**

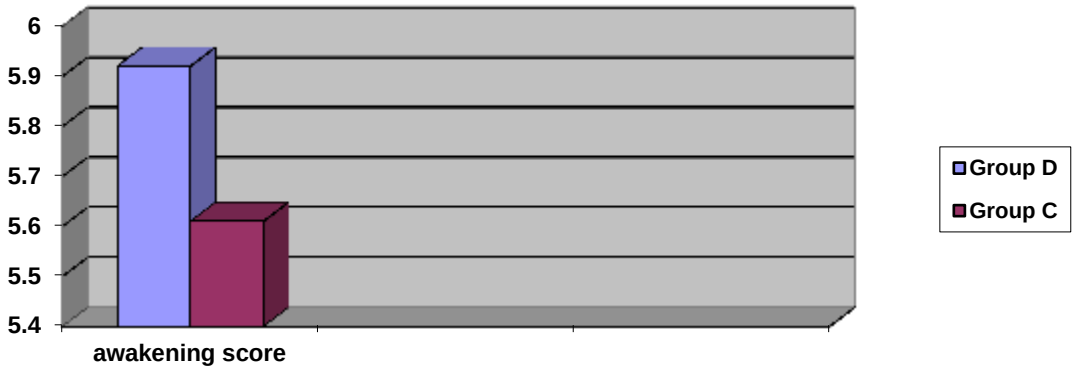


**Fig-3: A bar diagram comparing the awakening scores in both the groups**

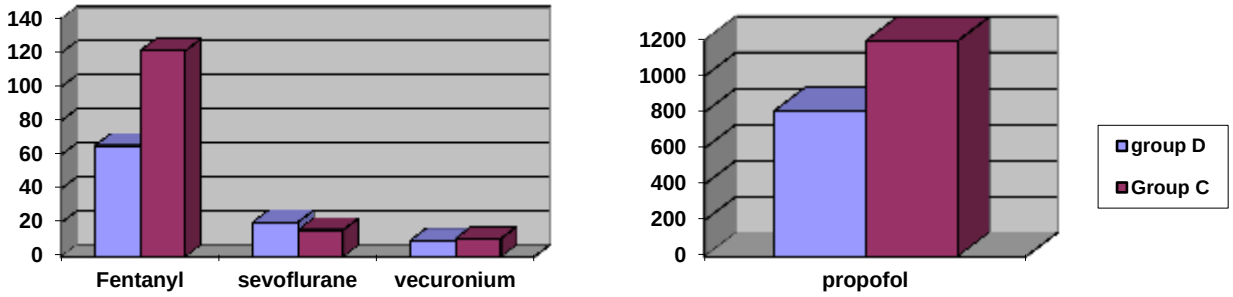


**Fig-4: Comparison of volume of drug (ml) of anesthetic agents**

Fentanyl, propofol and sevoflurane consumption was much more in C group as compared to D group.[ p value <0.05]

**DISCUSSION**

In our studywe observed that dexmedetomidine, when used in combination with sevoflurane and propofol, provided an optimal surgical field. Dexmedetomidine was effective in reaching MAP of 60 to 70 mm Hg while ensuring good surgical conditions.

Our study evaluates the effects of Dexmedetomidine in combination with Sevoflurane and Propofol in providing controlled hypotension and improving surgical field exposure during Endoscopic Nasal Surgery under General Anesthesia.

Both the groups were homogenous with regard to age, sex, BMI,LBW , ASA Status and LM score as p value was >0.05 for all these parameters.LM score was allotted to each patient by the operating surgeon.The targeted MAP in all patients was between 60 to 70 mm Hg, which is considered to be moderate controlled hypotension [8, 9].

Controlled hypotension is associated with considerable perioperative morbidity and mortality. The incidence of ischemic organ failure resulting in death was found to be 0.02% to 0.06% in surgeries involving controlled hypotension [10]. Therefore, we avoided profound controlled hypotension (MAP< = 50 mm Hg), while maintaining a MAP of 60 – 70 mm of hg in both the groups so as to facilitate the surgical procedure.

Using a high dose of inhalational anesthetics to decrease blood pressure is associated withmany unfavourable metabolic effects and a prolonged recovery from anesthesia leading to delayed patient discharge [11]. Another undesirable feature of inhalational anesthetics is peripheral vasodilatation which may further exacerbate surgical site bleeding. Hence, surgeries requiring hypotensive anesthesia mandate the use of additional hypotensive and anesthetic agents to achieve the desired hemodynamic effect and operative conditions.

The mean arterial pressures achieved in both the groups were comparable to meet the target MAP requirement. Several studies have found that perioperative use of dexmedetomidine has a pre - emptive effect and is associated with a significant decrease in the consumption of inhalational agents ($P$ < 0.05)[12] fentanyl ($P$ < 0.05),[13] and analgesics ($P$ < 0.05) [14] in a dose-dependent manner.

We also had a similar observation and found that Dexmedetomidine has anesthetic and analgesic-sparing effects as well. The amount of sevoflurane, propofol and fentanyl consumed was significantly lower in the D group[p<0.05].

Another important observation was longer times to extubation in the control group as compared to D group(p value<0.05).This is most likely due to higher doses of anesthetic agents administered in this group and the use of a low dosage of Dexmedetomidine for loading (0.05ug/kg) as well as maintenance (0.02ug/kg) in the D group unlike most of the studies which have used higher doses of Dexmedetomidine. Moreover the maintenance infusion in our study was discontinued once the major surgical intervention wasvover,thereby facilitating early extubation.Richa *et al.;* [15] have reported longer extubation times in patients receiving dexmedetomidine as compared to those receiving remifentanil for controlled hypotension ($P$ < 0.001).

However,there was no significant difference in the requirement of vecuronium between the two groups (p value >0.05).We found that the MAP of 60 - 70mm of Hg was more difficult to achieve in the control group even with high doses of anesthetic agents. Therefore hypotensive agents including esmolol and diltiazem had to be supplemented in most patients in this group. On the other hand, no additional hypotensive agent was required in the D group.

No untoward incidents such as bradycardia or profound hypotension necessitating any urgent intervention were observed in any of the patients throughout the peri-operative period.Co-morbidities in our patients included Hypertension, Diabetes,

Asthma/COPD and Hypothyroidism. In both groups, no adverse events were observed and there was no difficulty in achieving the target MAP.

We used a fixed dose of dexmedetomidine in all our cases and used varying amounts of propofol and sevoflurane to achieve the desired mean arterial pressures.Subsequently, the awakening scores were also significantly lower in the C group [$p<0.05$].

Some patients in group C were drowsy, demanding longer ICU stay, and an awakening score of 5. This was attributed to higher doses of anesthetic agents used in group C so as to maintain the target hemodynamics.No untoward incidents such as bradycardia or profound hypotension necessitating any urgent intervention were observed in any of the patients throughout the intra-operative period.Post-operative course of patients in both groups was also uneventful as we did not encounter bradycardia or hypotension in any patient.All patients had a smooth recovery without any emergence agitation/delerious phenomenon.

## CONCLUSION

For reasons of anatomical approach and surgical technique, the issue of surgical bleeding is of great concern during Endoscopic Paranasal Sinus surgery. Anesthetic technique plays a very crucial role in providing optimum conditions for surgical intervention. But the amount of anesthetic agents required, if used alone to achieve hypotensive anesthesia is very high and can lead to many other problems such as prolonged extubation times and increased requirement of anesthetic agents which in turn prolong the hospital stay as well as increase the cost of hospitalization.

Dexmedetomidine has been found to be an extremely useful drug with multifarious properties that are conducive to maintaining stable hemodynamics as well as providing a favourable surgical field. For endoscopic sinus surgeries where even a slight amount of bleeding is likely to obscure the surgical field; Dexmedetomidine minimizes surgical site bleeding by reducing the blood pressure and heart rate. It significantly reduces the perioperative analgesic and anesthetic requirements, thereby facilitating emergence from anesthesia.Dexmedetomidine is indeed a wonder drug and it is therefore used in all spheres of anesthetic practice.

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