

## Research Article

# Comparison of Dexmedetomidine-Isoflurane versus Fentanyl-Propofol based anesthesia for controlled hypotension in functional endoscopic sinus surgery

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### Abstract

**Introduction:** During functional endoscopic sinus surgery (FESS), effective control of bleeding is essential to maintain a clear operative field and to minimize complications. Controlled hypotension is a technique used to limit intraoperative blood loss to provide the best possible field for surgery. Study was designed to compare dexmedetomidine-isoflurane versus fentanyl-propofol based anesthesia in FESS surgery and to determine whether controlled hypotension and better operative conditions can be achieved when compared to each other.

**Methods:** Prospective randomized study includes a total of 60 ASA I-II patients who underwent elective FESS surgery. Patients randomly assigned in two groups Dexmedetomidine-Isoflurane (DI) and Fentanyl-Propofol (FP). Intraoperative mean arterial pressure (MAP), heart rate (HR) and surgical grade of bleeding (based on Fromme-Boezart scale) were recorded.

**Results and conclusion:** This study demonstrated that Controlled hypotension can be achieved equally and effectively by both Dexmedetomidine-Isoflurane and Fentanyl-Propofol based anesthesia. Both are equally effective in providing ideal surgical field during FESS. MAP and heart rate were significantly higher at some occasion in FP group as compare to DI group.

**Keywords:** Controlled hypotension, Dexmedetomidine, Isoflurane, Fentanyl, Propofol, FESS, Fromme-Boezart scale.

## 1. Introduction

Chronic rhinosinusitis and chronic polypous rhinosinusitis are commonly detected diseases that affect a number of people. Functional Endoscopic Sinus Surgery (FESS) is a highly sophisticated type of surgery, which has revolutionized the surgical management of chronic sinus diseases. Excessive bleeding during extensive endoscopic surgery of the paranasal sinuses can compromise the safety and efficiency of the surgical procedure. Bleeding can cause the procedure to take longer or can accidentally damage surrounding structures, including the eyes and the brain. Controlled hypotension is a technique used to limit intraoperative blood loss to provide the best possible field for surgery. Various agents such as beta adrenergic antagonist, nitroglycerine, high doses of potent inhaled anesthetics, alpha-2 agonist and magnesium sulfate have been used to achieve controlled hypotension<sup>1,2,3</sup>.

Total intravenous anesthesia (TIVA) using propofol for achieving controlled hypotension in various endoscopic surgeries has gained wide popularity<sup>4,5,6</sup>. Dexmedetomidine (DEX) is a potent highly selective alpha-2 adrenergic receptor agonist. The central and peripheral sympatholytic action of dexmedetomidine is mediated by alpha-2 adrenergic receptor and is manifested by dose-dependent decrease in arterial blood pressure, heart rate, cardiac output and norepinephrine release<sup>7</sup>. Dexmedetomidine augments hypotensive action and reduce intraoperative bleeding. Various studies show that dexmedetomidine can be used for induced hypotension in endoscopic surgeries under general anaesthesia<sup>1,8,9</sup>.

### 1.1 Objectives:

This study was designed to compare dexmedetomidine-isoflurane versus fentanyl-propofol based anesthesia in FESS surgery and to determine whether controlled hypotension and better operative conditions can be achieved when compared to each other.

## 2. Material and Methods

This is a prospective, randomized, single blinded study conducted in institute after approval from the institutional research and ethics committee and written informed consent was obtained from patients during the pre-anesthetic evaluation. A total number of 60 patients with ASA physical status I or II age, 20-50 years scheduled for elective FESS were included in study. Patients divided in two groups- Group DI (dexmedetomidine-isoflurane) and Group FP (fentanyl-propofol) with 30 patients (n=30) in each group. Patients with coronary artery disease, recurrent sinus surgery, on antihypertensive drugs, coagulopathy disorder, or with major organ dysfunction were excluded from study. The patients were assessed clinically in addition to basic routine blood investigation and electrocardiogram (ECG). Primary goal was to know which of the either technique is superior in controlled hypotension. Secondary goal was to access surgeon's opinion regarding the surgical field.

All study patients were kept fasted as per the standard guidelines, premedicated with tab ranitidine 150 mg and tab alprazolam 0.5 mg 10 pm in night and 6 am in morning. Once patient in operating room, all standard ISA monitors (Spo2, ECG, NIBP, and ETCO2) were placed. Two intravenous lines were secured with 22G and 18G IV cannula, one for infusion of dexmedetomidine, fentanyl or propofol and the other for administration of fluids and other drugs respectively. Apart from regular monitoring end tidal isoflurane agent analyzer and peripheral neuromuscular blockade (NMB) was also used after induction. Baseline heart rate, systolic blood pressure (SBP), diastolic blood pressure (DBP) mean arterial pressure (MAP) and peripheral arterial oxygen saturation (SpO2) were recorded before induction and at the time of induction. All patients in both groups preoxygenated & induced with 2µg/kg of fentanyl, 2mg/kg of propofol, followed by 0.1mg/kg of vecuronium to facilitate endotracheal intubation. Latter vecuronium top up of 1/4<sup>th</sup> initial dose was given based on NMB monitoring. Oropharynx was packed with a saline soaked throat pack.

**Group DI (dexmedetomidine-isoflurane):**

All patients received loading dose of 1 µg/kg dexmedetomidine infused over 10 min before induction of anesthesia with syringe pump followed by continuous infusion of 0.5µg/kg/h. After induction, anaesthesia was maintained with nitrous and oxygen (60:40) and isoflurane 0.2% - 1%. The concentration of isoflurane was adjusted using agent analyzer according to the patient's response and to achieve a mean arterial pressure between 60 and 75 mmHg. However, it was decided not to exceed the end tidal concentration of isoflurane above 1%.

**Group FP (fentanyl-propofol):**

After induction, anaesthesia was maintained with nitrous and oxygen (60:40). Propofol infusion was started at 12 mg/kg/hr for 10 min following intubation, then 10 mg/kg/hr for next 10 min and continued at 8 mg/kg/hr. The infusion rate was increased or decreased according to the patient's response and to achieve a mean arterial pressure between 60 and 75 mmHg. However, it was decided not to exceed the maximal rate of propofol infusion above 12 mg/kg/hr. Fentanyl infusion started in separate infusion pump with rate of 0.5µg/ kg/hr.

Patients received ringer lactate at 4 ml/kg/hr perioperatively and were placed in a 15° reverse trendelenburg position to improve venous drainage. In both groups gauze soaked with epinephrine in a concentration of 1:200,000 was inserted into the nasal cavity. The surgeon was asked to estimate the bleeding in the surgical field. He was blinded to the hypotensive agent used. The surgeon estimated the quality of the surgical field using a predefined category scale. For evaluation of the visibility of the operative field during surgery, the quality scale proposed by Fromme and Boezaart was used<sup>10</sup>.

Grade 0: No bleeding.

Grade 1: Slight bleeding – No suctioning of blood required.

Grade 2: Slight bleeding – Occasional suctioning required. Surgical field not threatened.

Grade 3: Slight bleeding – Frequent suctioning required. Bleeding threatens surgical field a few seconds after suction is removed.

Grade 4: Moderate bleeding – Frequent suctioning required. Bleeding threatens surgical field directly after suction is removed.

Grade 5: Severe bleeding – Constant suctioning required. Bleeding appears faster than can be removed by suction. Surgical field severely threatened and surgery impossible.

Any episode of hypotension (MAP<50mmHg) managed with inj. ephedrine 6mg and bradycardia (pulse rate<50bpm) managed with inj. atropine 0.4 mg along with adjustment of dose of anaesthetic agents. Dexmedetomidine, Fentanyl and propofol infusion stopped ten minutes before the anticipated end of surgery, and isoflurane was stopped at the end of the surgery. After completion of surgery, patient was extubated after adequate reversal from muscle relaxant using inj neostigmine 0.05 mg/kg and inj. glycopyrrolate 0.01mg/kg.

**2.1 Statistical Method**

All the results and observations recorded were subjected to appropriate statistical analysis to draw the final conclusions. Fisher's test used to compare grade of bleeding and unpaired t test used to compare MAP and heart rate among the groups.

**3. Results**

There was no statistically significant difference between the demographic characteristics of both groups. Baseline preoperative values of MAP (DI-93.03±4.148, FP- 94.10±4.342) and HR (DI- 76.03±6.376, FP- 76.50±6.776) were comparable in both groups. There was a significant reduction of MAP in both groups compared to baseline value intraoperatively. Both groups were able to achieve the desired intraoperative MAP (60-75mmHg) in just 5 minute after induction and were able to maintain throughout the surgery. MAP at induction and after 10 minutes were significantly lower in DI group (at induction-88.17±3.815, at 10 min-69.07±4.456) as compare to FP group (at induction 94.10±4.342, at 10 min-71.47±3.875) with P value of 0.0001 and 0.029 respectively. There was statistically significant increase in MAP (Fig1) seen in FP group at 40 min post induction (FP- 73.23±13.253, DI-67.23±6.163). Heart rate at induction and at end of surgery was significantly lower in DI group (at induction-70.43±5.270, at end of surgery-66.50±1.732) as compare to FP group (at induction-76.50±6.776, at end of surgery-76±9.670). Intraoperatively also at 20, 30 and 90 minutes heart rate were significantly higher in FP group as compare to DI group (Fig 2).

On basis of grade of bleeding all patients were in grade 2 or in grade 3 in both groups with no statistically significant difference. (Fig 3)

**Fig. 1: Graph showing Comparison of Mean Arterial Pressure (MAP in mmHg)**

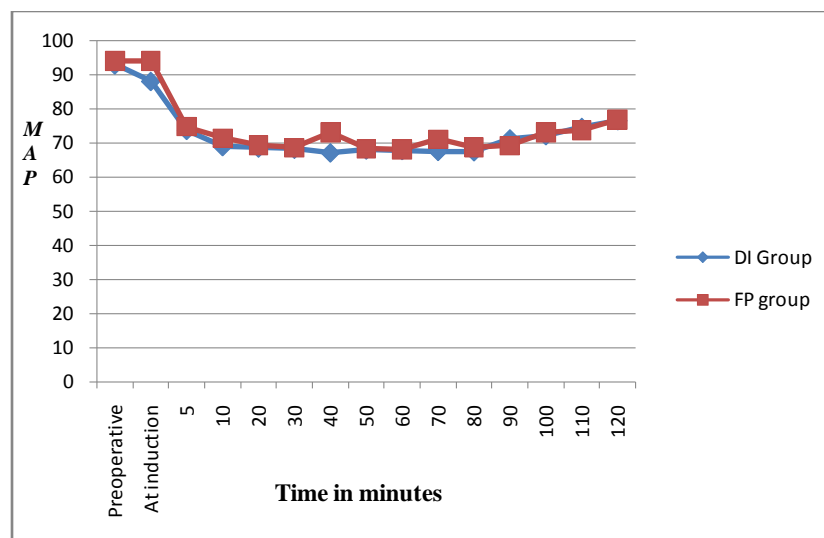


Fig. 2: Graph showing Comparison of Heart Rate (in beats/min)

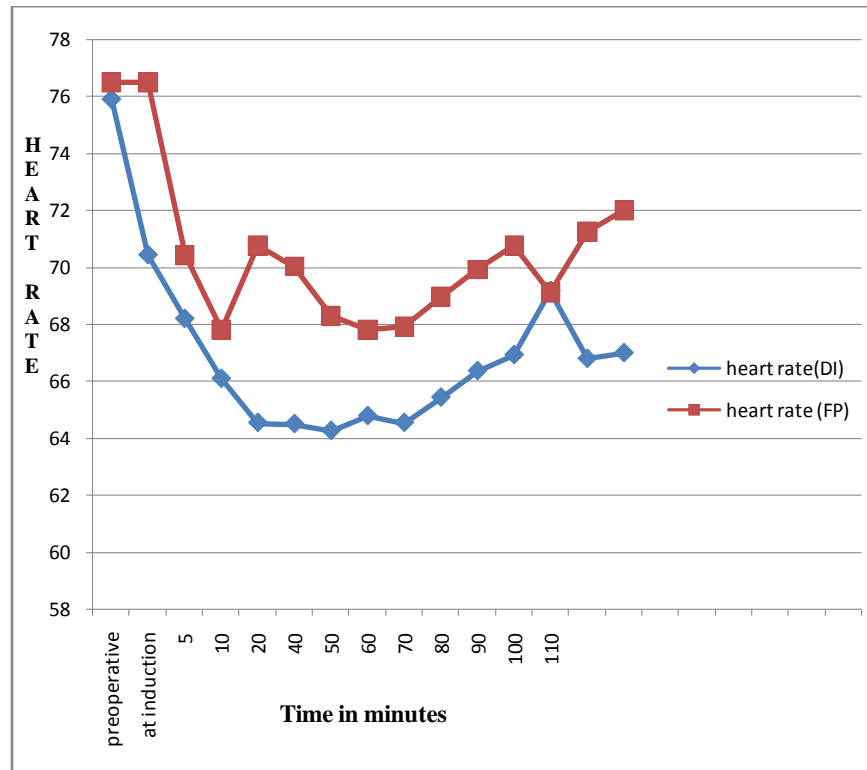
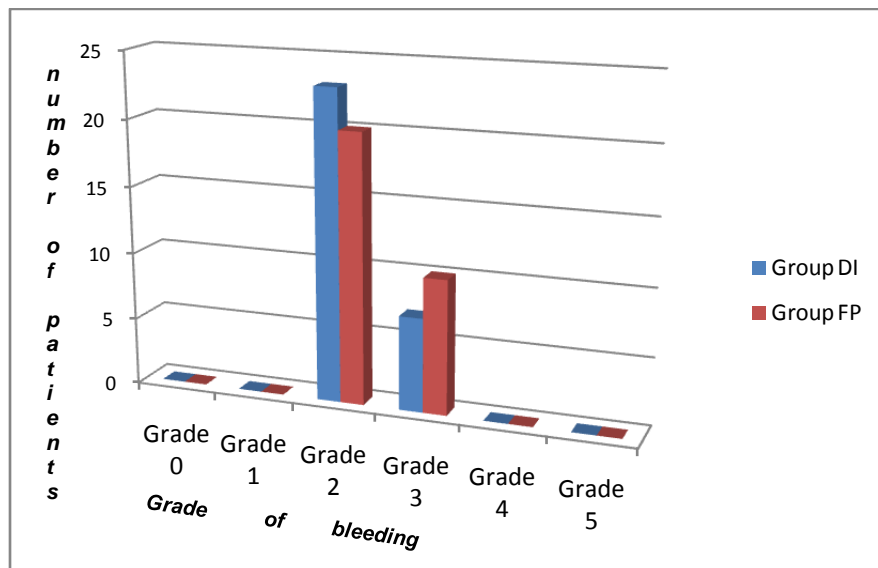


Fig. 3: Graph showing Grade of bleeding



**4. Discussion**

Advances in the field of anaesthesiology have led to greater patient safety. Induced hypotension has been widely advocated to control bleeding during FESS to improve the quality of surgical field<sup>11</sup>. Theoretically ideal pharmaceutical agents for inducing controlled hypotension should meet the following requirements: easy and safe to use, predictable and controlled action, fast onset of action and decline, fast elimination without any tendency to accumulate. However, in practice this is not fully achieved due to the absence of ideal pharmacological agents<sup>12</sup>.

Isoflurane is a strong, dose dependent vasodilator<sup>13</sup>. This pharmaceutical agent is believed to act directly on the smooth muscles of the blood vessels and to decrease systemic blood vessel resistance. Subsequently, it reduces arterial blood pressure. Despite the lower perfusion pressure, tissue perfusion is increased following vasodilatation. Isoflurane may increase the velocity of blood flow in the muscles two or even three times<sup>14</sup>. Therefore, isoflurane usage in high concentration during FESS may increase perfusion of the nasal mucous membrane and surgical bleeding as well<sup>12</sup>. As in previous studies higher end tidal isoflurane concentration was used as a conventional technique to achieve controlled hypotension, which had led to increase bleeding or delayed recovery<sup>5</sup>. In group DI we had restricted the maximum end tidal isoflurane concentration to only 1%, as simultaneous use of dexmedetomidine infusion decrease the requirement of other anaesthetic agents<sup>8</sup>. This dexmedetomidine induced hemodynamic profile can be attributed to the known

sympatholytic effect of alpha-2 agonists. We had given similar dose of dexmedetomidine infusion based previous study by Tarek Shams, Nahla S El Bahnasawe<sup>1</sup>.

An application of an intravenous anesthetic agent, propofol, during FESS reduces surgical bleeding and provides better conditions for surgical operation in comparison with common inhalational anesthetics. When general anesthesia is required, a combination of nitrous oxide and opiate analgesics is used<sup>15</sup>. Propofol may decrease systolic blood pressure by 20% to 48%, by reducing heart contractility and systemic blood vessel resistance. We had used simultaneous infusion of propofol and fentanyl to maintain anaesthesia. We had given similar dose of propofol infusion based on previous study by Saravanan, Manickam Ponniah, VT Cherian, Sarah Thomas<sup>5</sup>.

In our study we had found that in both DI and FP group controlled hypotension achieved within 10 min of post induction in most of the cases and maintained throughout surgery. MAP was comparable in both groups except at few moments where it was significantly higher in FP group compare to DI group. Heart rate at induction and at end of surgery was significantly lower in DI group. In our study, the operative field assessed by Fromme-Boezart scale was similar in both the groups.

## 5. Conclusion

This study demonstrated that Controlled hypotension can be achieved equally and effectively by both Dexmedetomidine- Isoflurane and Fentanyl-Propofol based anesthesia. Both are equally effective in providing ideal surgical field during FESS. MAP and heart rate were significantly higher at some occasion in FP group as compare to DI group.

## Acknowledgements

We are thankful to our patients who participated in study and our institute for supporting the study.

## References

1. Tarek Shams, Nahla S E Bahnasawe, Mohamed Abu-Samra, and Ragaa El-Masry. Induced hypotension for functional endoscopic sinus surgery: A comparative study of dexmedetomidine versus esmolol. *Saudi J Anaesth*. 2013 Apr-Jun; 7(2): 175–180.
2. Srivastava U., Dupargude A. B., Kumar D., Joshi K., Gupta A.. Controlled Hypotension for Functional Endoscopic Sinus Surgery: Comparison of Esmolol and Nitroglycerine. *Indian Journal of Otolaryngology and Head & Neck Surgery*. 08/2013; 65(2).
3. ZHOU Wei-min<sup>1</sup>, CHEN Xi-ming<sup>2</sup>, HOU Rui-jiao<sup>1</sup>, SHEN Bo-xiong. Clinical study of controlled hypotension with magnesium sulphate during functional endoscopic sinus surgery. *Journal of Shanghai Jiaotong University*. 2009; 29 (12): 1502.
4. Boonmak S, Boonmak P, Laopaiboon M. Deliberate hypotension with propofol under anaesthesia for functional endoscopic sinus surgery (FESS). *Cochrane Database of Systematic Reviews* 2013, Issue 6. Art. No.: CD006623.
5. Saravanan P Ankichetty, Manickam Ponniah, VT Cherian, Sarah Thomas, Kamal Kumar, L Jeslin, 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 Jul-Sep; 27(3): 328–332.
6. Jarosław Miłon'ski, Hanna Zielińska-Bliz'niewska, Wojciech Golusiński, Joanna Urbaniak, Rafał Soban'ski, Jurek Olszewski. Effects of three different types of anaesthesia on perioperative bleeding control in functional endoscopic sinus surgery. *Eur Arch Otorhinolaryngol* (2013) 270:2045–2050.
7. Bloor BC, Ward DS, Belleville JP, Maze M. Effect of intravenous dexmedetomidine in humans. Hemodynamic changes. *Anesthesiology* 1992; 77:1134–42.
8. Martina Aho, A-M Lehtinen, O. Erkola, A. Kallio. Effect of intravenous administered dexmedetomidine on perioperative haemodynamics and isoflurane requirements in patient undergoing abdominal hysterectomy. *Anesthesiology* 74:997-1002, 1991.
9. Lee JI, Kim Y, Park C, Jeon Y, Kim D, Joo J, Kang H. Comparison between dexmedetomidine and remifentanyl for controlled hypotension and recovery in endoscopic sinus surgery. *Ann Otol Rhinol Laryngol*. 2013 Jul; 122(7):421-6.
10. Boezart AP, van der Merwe J, Coetzee A. Comparison of sodium nitroprusside and esmolol induced controlled hypotension for functional endoscopic sinus surgery. *Can J Anaesth*. 1995; 42:373–6.
11. Eberhart LH, Folz BJ, Wulf H, Geldner G. Intravenous anesthesia provides optimal surgical conditions during microscopic and endoscopic sinus surgery. *Laryngoscope* 2003; 113:1369–73.
12. Darius Činčikas<sup>1</sup>, Juozas Ivaškevičius<sup>1</sup>, Jonas Laimutis Martinkėnas<sup>2</sup>, Svajūnas Balseris<sup>2</sup>. A role of anesthesiologist in reducing surgical bleeding in endoscopic sinus surgery. *Medicina (Kaunas)* 2010; 46(11):730-4.
13. Mandal P. Isoflurane anaesthesia for functional endoscopic sinus surgery. *Indian J Anaesth* 2003; 47:37-40.
14. Pavlin JD, Colley PS, Weymuller Jr, van Norman GV, Gunn HC, Koerschgen ME. Propofol versus isoflurane for endoscopic sinus surgery. *Am J Otolaryngol* 1999; 20:96-101.