

CONTROLLED HYPOTENSIVE ANAESTHESIA WITH DEXMEDETOMIDINE FOR FUNCTIONAL ENDOSCOPIC SINUS SURGERY: A PROSPECTIVE RANDOMIZED DOUBLE BLIND STUDYSunil Chiruvella¹, Balaji Donthu², Venkata Siva J³, Dora Babu S⁴**HOW TO CITE THIS ARTICLE:**

Sunil Chiruvella, Balaji Donthu, Venkata Siva J, Dora Babu S. "Controlled Hypotensive Anaesthesia with Dexmedetomidine for Functional Endoscopic Sinus Surgery: A Prospective Randomized Double Blind Study". *Journal of Evolution of Medical and Dental Sciences* 2014; Vol. 3, Issue 37, August 21; Page: 9556-9563, DOI: 10.14260/jemds/2014/3236

ABSTRACT: OBJECTIVE: Controlled hypotension is commonly used to achieve a bloodless operative field which is needed for successful FESS. This study was carried out to assess the hypotensive effect of dexmedetomidine (DEX) during FESS. **METHODS:** Fifty ASA grades I and II patients of either sex aged 20–50 years undergoing FESS were randomly divided into two groups of 25 each. Group D received 10–15 min prior to induction of anesthesia 1 µg/kg IV bolus DEX diluted in 10 ml of normal saline over 10 min. Immediately thereafter an infusion of 0.4 µg/kg/hr of DEX commenced. Group C received placebo bolus and infusion of saline at a rate similar to DEX in Group D. Standard anesthetic technique was used. The surgical field was assessed using Average Category Scale and average blood loss was calculated. Hemodynamic variables (MAP and HR); emergence time and total recovery from anesthesia (Aldrete score ≥9) were recorded. **RESULT:** Group D reached the desired MAP (55-65 mmHg). In group D patients the average MAP was 55.9±5.3 mm of Hg, where as in group C it was 86.2±11.4 mm of Hg. Patients in group D had a better surgical field, and the duration of surgery was significantly reduced(78.34±16.7mins in group D vs 103.2±113.1 mins in group C) The mean awakening time was significantly reduced in patients of Group D (9.1±2.7 mins in group D vs 12.8±2.2 mins in group C) when compared to patients of Group C. **CONCLUSION:** This study demonstrated that dexmedetomidine is a safe agent for controlled hypotension and is effective in providing ideal surgical field during FESS.

KEYWORDS: Controlled hypotension, dexmedetomidine, FESS.

INTRODUCTION: In functional endoscopic sinus surgery (FESS), classic local anesthesia in FESS is gradually being replaced by general anesthesia. General anesthesia has the following apparent advantages: an immobile surgical field for performing a surgical operation; effective protection of the respiratory tract; adequate analgesia and ventilation. The only serious limitation during general anesthesia is that bleeding is more intensive than during local anesthesia.^{1,2}

Controlled hypotension is a technique used to limit intraoperative blood loss to provide the best possible field for surgery.^{3,4} Benefits for controlled hypotension for FESS include reduction in blood loss with improved quality of surgical field.

The ideal hypotensive agent should have the following characteristics: ease in administration, predictable hypotensive response with different anesthetic agents, and absence of serious adverse effects while maintaining adequate perfusion of the vital organs.

Many anesthetic agents and vasoactive drugs are used frequently to produce controlled hypotension, including inhalational anesthetics, direct-acting vasodilators, autonomic ganglion blockers, b-adrenergic blockers, and calcium channel blockers.⁵

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Dexmedetomidine (DEX) is a potent highly selective α_2 adrenergic receptor agonist. It has sedative, analgesic and anesthetic sparing effect, and sympatholytic properties.⁶ The central and peripheral sympatholytic action of (DEX) is mediated by α_2 adrenergic receptor and is manifested by dose-dependent decrease in arterial blood pressure, heart rate, cardiac output and norepinephrine release.^{7,8}

Several studies proved that intraoperative infusion of dexmedetomidine reduces the perioperative analgesic requirements,⁹ and others studies concluded that dexmedetomidine helps in reducing intraoperative blood pressure and provide satisfactory surgical field conditions.¹⁰

The aim of this study is to assess the effectiveness, safety, and analgesic effect of DEX-induced deliberate hypotension for adult patients undergoing a FESS operation.

MATERIALS AND METHODS: After approval of the local ethical committee, written informed consent was obtained from patients during the pre-anesthetic evaluation. Fifty ASA physical status I or II patients aging 20-50 years scheduled for elective FESS. Patients with recurrent sinus surgery, hypertension, coronary artery diseases and renal, hepatic or cerebral insufficiency and patients with coagulopathies or receiving drugs influencing blood coagulation were excluded from the study. The patients were assessed clinically in addition to ECG, chest X ray and basal laboratory tests. Patients included in this study were randomly allocated into two groups.

Group C (control group): Received 10–15 min prior to induction of anesthesia placebo bolus and infusion of saline at a rate similar to DEX in Group II.

Group D (study group): Received 10–15 min prior to induction of anesthesia, 1 μ g/kg bolus DEX diluted to 10 ml in normal saline over 10 min. Immediately thereafter an infusion of 0.4 μ g/kg/hr of DEX commenced. This infusion was terminated 5–7 min prior to end of surgery.

On arrival to operating room, no sedation was given, iv line was cited and lactated ringer solution was infused 4–6 ml/kg/h. All the patients were pre medicated with injection glycopyrrolate 0.2 mg, 30 minutes prior to induction of anesthesia. All patients were monitored with non-invasive blood pressure (NIBP), electrocardiograph ECG, pulse oximeter (SpO₂) before induction of general anesthesia (GA) and capnography for end-tidal CO₂ (ETCO₂), after induction of GA.

After pre-oxygenating the patients for 3 min, anesthesia was induced with propofol 2 mg/kg iv, fentanyl 1 microgram/kg iv and vecuronium 0.1mg/kg intravenously. Trachea was intubated with cuffed orotracheal tube and anesthesia was maintained with 66% nitrous oxide in oxygen plus vecuronium 0.09 mg/kg intravenously and sevoflurane titrated to achieve a mean arterial pressure (MAP) 30% below the control value. Airway was secured by oro-pharyngeal packing and patients were positioned supine with head up 30degrees. ondansetron 4 mg slowly iv were given as emesis prophylaxis.

At the end of the surgery residual neuromuscular blockade was reversed with inj. neostigmine 0.04 mg/kg and glycopyrrolate 0.02 mg/kg i.v Concentration of halothane recorded in percentage every 15 min till conclusion of surgery.

Monitoring consisted of continuous EKG (lead II and V5) with HR, NIBP for systolic, diastolic and mean pressures (MAP), SpO₂, and ETCO₂. Blood loss was monitored directly from the collection into a calibrated bottle entrapped in-line with the suction from the operative field. Recording of the haemodynamic parameters were done at preinduction, postinduction, every 5 minutes in the intraoperative period and after extubation. But for statistical analysis HR and MAP were considered at pre induction, post induction, post incision (5 minutes after intramucosal infiltration of 2%

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xylocaine with 1:200, 000 of adrenaline), average intraoperative and immediate postoperative period only.

Surgical field in terms of visual blood loss estimation as reported by the surgeon was recorded.

Fromme-Boezaart surgical field grading¹¹:

- Grade 0: No bleeding.
- Grade 1: Slight bleeding. No suctioning of blood required.
- Grade 2: Slight bleeding. Occasional suctioning required. Bleeding does not threaten surgical field.
- 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 immediately after suction is removed.
- Grade 5: Severe bleeding. Constant suctioning required. Bleeding appears faster than can be removed by suction. Surgical field threatened and surgery not possible.

Awakening time following reversal of neuromuscular blockade was recorded. This duration comprised from administration of reversal of neuromuscular blockade till sustained eye opening (for >5 sec) on command.

RESULTS: The age of the patients were between 20-46 years in group C and 21-48 years in group D and the male patients were predominant (18 vs 16) in numbers in this series. The body weight and the duration of symptoms were similar in both the groups (Table I).

	Group C (n=25)	Group D (n=25)
Age (years)	41± 13	40 ±10
Gender (male: female)	18 :7	16:9
Weight (kgs)	52± 8	51± 7
ASA I/ II	16/9	18/7
Duration of symptoms (months)	07±0.3	08 ±0.1

Table I: Demographic data

Main preoperative diagnosis (Table II) was Antrochoanal polyp (11vs 10), followed by maxillary sinusitis (10 vs 12) and ethmoidal polyps (04vs 03).

	Group C (n=25)	Group D (n=25)
Duration of Symptoms (Months)	0.7 ± 0.3	0.8 ± 0.1
Diagnosis		
Antrochoanal polyp	11	10
Fronto maxillary sinusitis	10	12
Ethmoidal polyp	4	3

Table II: Preoperative Clinical Diagnosis

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Mean HR in both the groups were comparable at pre induction and post induction periods. There was rise ($p < 0.05$) in heart rate in group C patients after incision compared to group D patients. There was significant ($p < 0.01$) drop in HR in group D patients compared to group C (Table III) in the whole intraoperative period. Mean HR in group C patients were higher ($p < 0.05$) than group D patients in the immediate postoperative period also.

MAP dropped significantly ($p < 0.01$) in group D patients from post incision period and maintained so throughout the whole intraoperative period compared to group C patients (Table III). MAP in group C patients were higher ($p < 0.05$) than group D patients in the immediate postoperative period also.

	Group C (n=25)	Group D (n=25)
Heart Rate(bpm)		
• Preinduction:	84.2±13	83.1 ± 14.3
• Postinduction:	82.4±7.6	70.4± 6.9
• Postincision:	92.6±7.8	76.2± 8.3
• Average Intraop:	85.6±8.2	63.3± 6.1
• Immediate Postop:	88.4±9.6	79.2± 6.6
Mean Arterial Pressure (mmHg)		
• Preinduction:	85.8± 11.4	86.6± 12.4
• Postinduction:	89.6± 12.4	75.9± 8.8
• Postincision:	90.2± 6.7	69.6± 10.2
• Average Intraop:	86.2± 11.4	55.9± 5.3
• Immediate Postop:	91.5± 13.6	85.6± 9.7
Spo2 (%)		
• Preinduction:	99.3± 0.7	99.4± 0.6
• Postinduction:	99.2± 0.6	99.3± 0.5
• Postincision:	99.3± 0.5	99.3± 0.6
• Average Intraop:	99.3± 0.6	99.3± 0.7
• Immediate Postop:	99.2± 0.6	99.3± 0.5
Etco2 (mm of Hg)		
• Preinduction:	31.6± 3.3	31.2± 2.9
• Postinduction:	31.1± 3.3	32.1± 3.4
• Postincision:	31.4± 4.3	31.2± 6.2
• Average Intraop:	31.4± 2.9	31.4± 2.9
• Immediate Postop:	34.7± 6.2	36.4± 7.1

Table III: Intraoperative haemodynamic parameters

The mean blood loss in group C patients was higher than group D patients. Two patients in group C required blood transfusion. The duration of surgery was higher in group C patients ($p < 0.05$) compared to group D (Table IV).

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	Group C (n=25)	Group D (n=25)
Duration of Surg.(min)	103.2±113.1	78.34±16.7
Blood Loss		
• Grade I	7	14
• Grade II	12	9
• Grade III	4	2
• Grade 1V	2	-
• Grade V	-	-
Awakening time (mins)	12.8±2.2	9.1±2.7
Blood Transfusion	2	-
Table IV: Intraoperative events		

There were no neurological or renal complications in the postoperative period in any patients of group D.

DISCUSSION: Controlled hypotension has been defined as a reduction of systolic blood pressure to 80 to 90 mmHg or a 30 % reduction of baseline MAP. It has been used to limit intraoperative blood loss and it may improve visualization of the surgical field. Advances in drug therapy have provided the clinician with several options for controlled hypotension.

A lot of efforts have been done to optimize the surgical conditions for FESS. Induced hypotension has been widely advocated to control bleeding during FESS to improve the quality of surgical field.¹² A number of techniques/agents have been advocated to achieve hypotension during FESS. Amongst the pharmacological agents, DEX is the most recently introduced drug to provide hypotensive anesthesia during FESS.

The hemodynamic effect of DEX is mediated by its alfa 2-agonistic effect. The regulation of the autonomic and cardiovascular systems is mediated through alfa 2- receptors'. Are located on blood vessels mediating vasoconstriction, and on sympathetic terminals, inhibiting norepinephrine release. Sympatholysis is the prominent action of low-dose DEX.¹³ The stimulation of the central receptor decreases the tonic level. of sympathetic outflow and accentuates the cardiac vagal activity, which results in a reduction in HR and cardiac output.

In our study, we choose a target MAP 55–65 mmHg to provide the best surgical conditions without the risk of tissue hypo-perfusion depending on a study conducted by Yoshikawa et al.¹⁴ which concluded that hypotensive anesthesia induced by using sodium nitroprusside or nitroglycerine in mandibular osteotomy to achieve MAP 60–70 mmHg is safe and associated with no significant increase in pyruvate, lactate or glucose levels. Another study conducted by Boezaart et al³ demonstrated that the best surgical conditions for FESS obtained when the MAP ranged between 50 and 54 mmHg. Also, it is reported that the best operative field quality in FESS surgeries by using Fromme et al. rating scale is 2–3 points.¹⁵

Tobias et al were used dexmedetomidine for controlled hypotension in spinal surgery and found that dexmedetomidine could be titrated to achieve the desired MAP without reflex tachycardia.¹⁶ We preferred dexmetetomidine as an adjuvant for controlled hypotension in FESS.

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Our data showed that infusion of dexmedetomidine was effective in inducing consistent and sustained controlled hypotension.

A controlled trial conducted by Nasreen et al.¹⁷ Using low dose dexmedetomidine (0.4 microgram/kg/h) in addition to titrated halothane vol% in order to reduce MAP 30% from the preoperative values during middle ear surgeries, they observed significant reduction in halothane requirement in dexmedetomidine group with better surgical field compared to placebo group.

Another observation in our study is the ability of the pre induction bolus dose 1 microgram/kg of dexmedetomidine to attenuate the hemodynamic response to direct laryngoscopy and endotracheal intubation as no significant increase in HR or MAP in group D 1 min after inserting the endotracheal tube, the same observation was found in a study conducted by Bajwa et al.¹⁸ Whom reported the ability of dexmedetomidine 1 microgram/kg iv infusion more than 20 min given as premedication to attenuate the pressor response to endotracheal intubation, surgery and extubation.

In the present study, it is evident that patients receiving DEX (Group D) had a better surgical field as compared to patients receiving placebo (Group C). These findings can be attributed to the fact that DEX reduces sympathetic activity, resulting in lower blood pressure and reduced heart rate thereby decreasing blood loss at the surgical site and improving the quality of surgical field.¹⁹

In our study there is reduction in mean awakening time following administration of DEX. These findings are consistent with another study which evaluated the sedative effect of DEX in middle ear patients²⁰. This finding can be explained by two reasons. Firstly, the use of DEX reduces the requirement of sevoflurane. Secondly, patients receiving DEX are sedated yet easily arousable, a unique feature not observed with other sedatives and inhalation agents.^{21,22}

In the present study, none of the patients developed any complications during perioperative period. None of the patients developed heart rate <50 bpm following bolus or infusion of DEX at any stage during intraoperative period.

All the patients were hemodynamically stable and none of them required vasopressor support or bolus administration of fluids to maintain hemodynamic status. In the recovery room, patients were monitored for 120 min and then shifted. During this period no complications were noted and also no adverse events were reported during their stay in the ward subsequently.

In the present study, two patient required blood transfusion in group C. Blood loss was significantly lower in the DEX group than the control group. The intraoperative surgical field was significantly better in the DEX group than the control group at 15, 30, and 45 min after the beginning of surgery. The efficacy of DEX in providing a better surgical field and less blood loss during controlled hypotension has been reported in other studies.^{23,24}

There are some limitations in our study, that we couldn't measure nasal blood flow and depth of anesthesia. However we assessed the quality of the surgical field in terms of blood loss, dryness and surgeon satisfaction by the same attending surgeon who was unaware of the pharmacological treatments. We found that infusion of dexmedetomidine achieved clear surgical field during FESS.

CONCLUSION: This study demonstrated that dexmedetomidine is a safe agent for controlled hypotension and is effective in providing ideal surgical field during FESS.

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