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Effect of Controlled Hypotension with Dexmedetomidine versus Nitroglycerin on Intraoperative Blood Loss during FESS

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Abstract:
Bbackground: *Functional endoscopic sinus surgery (FESS) is a surgical procedure, during which all necessary manipulations are performed using nasal endoscopic video assisted fibreoptic camera. So bleeding has to be minimized, since even small amount of blood may completely obstruct vision. Controlled hypotension is a technique used to limit intraoperative blood loss to provide the best possible surgical field.* ***Methods:*** *After approval by our institutional Ethics Committee, 60 patients were recruited and randomized into two drug groups: nitroglycerine (Group N) and dexmeditomidine (Group D). After induction of anesthesia, an infusion for group N was started with nitroglycerine 0.5-10 µg/kg/min & for group D with dexmedetomidine loading dose of 1 µg/kg over 10 min followed by maintenance infusion rate of 0.2- 0.7 µg/kg/hr. The infusion rates were then titrated to maintain MAP between 65-75 mm of Hg. Intraoperative blood loss in both the groups was recorded.*
Results: *The target mean arterial pressure is achieved in both the groups with the blood loss significantly less in group D (p value < 0.05).*
Conclusion: *Dexmedetomidine is superior to nitroglycerin in reducing blood loss during FESS*
Keywords: *Controlled Hypotension, Dexmedetomidine, FESS, Intraoperative blood loss, Nitroglycerin*

I. Introduction

Rhinosinusitis is a well recognized clinical syndrome affecting patients of all ages and gender. It is a condition manifested due to inflammation of the mucous membranes of the nasal cavity and paranasal sinuses, resulting in fluid within these cavities or the underlying bone. Chronic rhinosinusitis is sinusitis lasting more than 12 weeks.[1]

Functional endoscopic sinus surgery aims at correcting the underlying pathology in the ethmoids and helps to re-establish normal ventilation and mucociliary clearance of the dependent sinuses. The results after FESS are good, with most studies reporting an 80 to 90 percent rate of success.[2] However, FESS is not devoid of complications, which include CSF leak, intracranial infection, orbital complications, hemorrhage requiring transfusion or surgical control & even death.[3] Most of these complications are due to poor visibility of surgical field due to bleeding. The basic method to reduce the bleeding from the nasal mucous membranes is to constrict the capillaries of the area involved, which can be accomplished by local vasoconstriction, positioning or by controlled hypotension.

Controlled (deliberate/induced) hypotension is a technique wherein the arterial blood pressure is lowered in a deliberate but controllable manner to minimize surgical blood loss and enhance the operative field visibility.[4,5,6] However, deliberate hypotension is not without potential complications, including permanent cerebral damage, delayed awakening, cerebral thrombosis, brain ischemia and death.

There are several pharmacological and non-pharmacological techniques for inducing hypotension. The non-pharmacological (mechanical) methods for deliberate hypotension include positioning the patient and IPPV to control venous return. The various pharmacological interventions include volatile anesthetics, direct- acting vasodilator drugs, ganglion blocking drugs, alpha blockers, beta blockers, combined alpha and beta blockers, calcium channel blockers, propofol, magnesium sulphate, alpha-2 agonists, prostaglandins, tranexamic acid etc.,[7,8]

Nitroglycerin is a direct acting peripheral vasodilator, which primarily dilates capacitance vessels, reducing venous return with concomitant reduction in stroke volume and cardiac output.[7] Dexmedetomidine is an alpha2 adrenergic receptor agonist for short-term sedation & analgesia in ICU. It also improves perioperative hemodynamic stability & causes controlled hypotension by its central & peripheral sympatholytic action.[9]

The aim of this study is to compare nitroglycerine versus dexmedetomidine for reducing blood loss during controlled hypotensive anaesthesia induced by either drug.

II. Materials And Methods

The study was undertaken after obtaining our institutional ethical committee clearance as well as informed consent from all patients during the period of December 2012 to June 2014. Inclusion criteria include all adult normotensive patients scheduled for functional endoscopic sinus surgeries, aged between 18 to 60 years of both sex, who are ASA grade I and II. Exclusion criteria include patients with known end organ damage, ie., cerebrovascular diseases, cardiovascular system disorders, hypertension, asthma or chronic obstructive lung disease, diabetes mellitus, coagulation defects, hepatic or renal failure, psychiatric diseases, known drug allergy or substance abuse.

The study population were randomly divided into the 2 groups, Group-N (n=30) receiving hypotensive anaesthesia with nitroglycerine & Group-D (n=30) receiving hypotensive anaesthesia with dexmedetomidine

The patients were premedicated with glycopyrrolate 0.2mg iv and Midazolam 1mg iv. Anaesthesia was induced with thiopentone 5mg/ kg body weight, fentanyl 1 µg/kg & succinylcholine 1.5mg/kg & intubated with cuffed oral endotracheal tube of appropriate size. The patients were ventilated with 50% O_2:N_2O mixture and isoflurane 1% to maintain $ETCO_2$ within normal range of 30-35 mm of Hg. Muscle relaxation was continued by atracurium.

In Group-D, an infusion of dexmedetomidine was made by adding 200µg (2ml) of dexmedetomidine to 48ml of normal saline, making it to a final concentration of 4µg/ml. The infusion was then started, with a loading dose of 1µg/kg over 10 min followed by a maintenance infusion at 0.2-0.7µg/kg/hr titrated according to the patients desired target blood pressure.[10,11]

In Group-N, an infusion of NTG was made by adding 25mg (5ml) of NTG to 45ml of normal saline making it to final concentration of 500µg/ml.The infusion was then started at the rate of 0.5µg/kg/min and titrated in between 0.5-10µg/kg/min according to the patients desired target blood pressure.[12,13]

The MAP was then gradually reduced in both the groups to achieve and maintain the target MAP of 65-75 mm of Hg. The surgical table was placed in 15º anti-Trendelenburg position. At the beginning of the surgery, the nasal mucosae of all the patients were infiltrated using 4ml of 2% xylocaine with adrenaline (1:200000). Continuous monitoring was carried out throughout the procedure for heart rate, cardiac rhythm, MAP, pulse oximetry & $ETCO_2$. Patients who developed severe hypotension (MAP<60 mmHg) were observed by discontinuation of the hypotensive agent and reducing the concentration of isoflurane. If the MAP did not improve, 6 mg bolus of inj. Ephedrine was given & these patients were excluded from the study. If any patients might develop bradycardia (<50bpm), then they were supposed to receive injection atropine and be excluded from this study.

Infusion of the hypotensive agent was stopped 5 minutes before the anticipated end of surgery. Any residual neuromuscular block was antagonized with neostigmine 50µg/kg & glycopyrrolate 10µg/kg.

III. Results

Both groups were similar demographically and there was no significant difference in terms of age, sex & body weight (Table 1)

Table 1: Demographic data

Criteria	Group N	Group D	P Value
Mean Age (years)	30.3±7.83	34.5±11.56	>0.05 (0.073)
Sex Ratio M:F	17:13	12:18	>0.05 (0.30)
Mean weight (kgs)	58.87	56.7	>0.05 (0.36)

The Mean arterial pressure changes in both the groups are documented periodically and the results were analysed and tabulated (Table 2). The target mean arterial pressure is achieved in both the groups.

Table 2: MAP changes at regular intervals

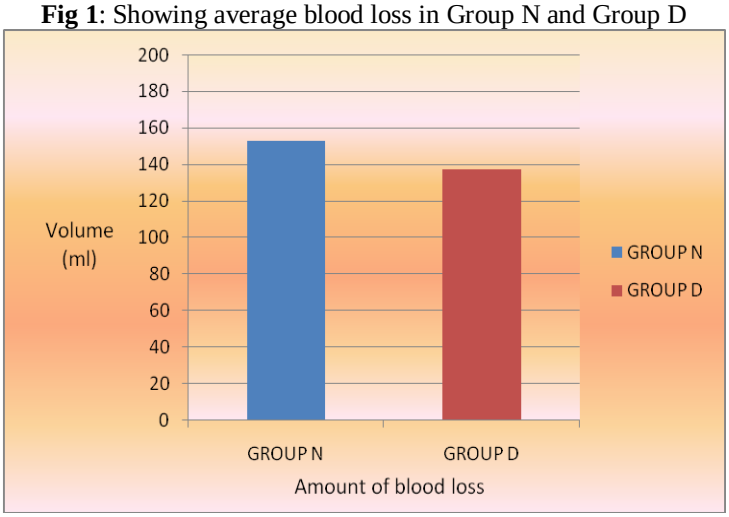
Time	Group N (n=30)	Percentage change	Group D (n=30)	Percentage change	P value
Basal	92.47±8.05	0	89.63±11.6	0	> 0.05 (0.20)
Intubation	109.87±11.6	Increase 18%	105±11.83	Increase 17%	> 0.05 (0.12)
5 mins	91.13±8.2	Decrease 1.5%	89.1±7.51	Decrease 0.5%	> 0.05 (0.35)
10 mins	81.6±7.51	Decrease 12%	82±7.9	Decrease 8.5%	> 0.05 (0.82)
15 mins	75.8±6.69	Decrease 18%	76.67±7.34	Decrease 15%	> 0.05 (0.64)
30 mins	71.03±4.56	Decrease 23%	72.77±6.95	Decrease 19%	> 0.05 (0.24)
45 mins	67.73±4.13	Decrease 27%	70±7.97	Decrease 22%	> 0.05 (0.83)
60 mins	66.6±3.92	Decrease 28%	68.5±7.21	Decrease 24%	> 0.05 (0.22)
75 mins	65.4±4.39	Decrease 29%	68	Decrease 24%	> 0.05 (0.58)
90 mins	64.33±3.2	Decrease 30%	67.81	Decrease 24%	> 0.05 (0.73)

The blood loss was measured as blood volume in suction bottle and weight of the soaked swabs. The average blood loss in group D (137.33ml) is less than the average blood loss in group N (152.9ml). The difference in blood loss between both the groups is statistically significant. (Table 3 & Figure 1)

Table 3: Showing average blood loss in Group N and Group D

Volume (ml)	Group N (n=30)	Group D (n=30)
Mean Blood Loss	152.9±23.78	137.33±23.91
P value	P < 0.05	

Fig 1: Showing average blood loss in Group N and Group D



IV. Discussion

Controlled hypotension is defined as pharmacologically induced reduction in MAP to 50-70 mm of Hg either by decreasing myocardial contractility or by peripheral vasodilatation. Nitroglycerin is a peripheral vasodilator which selectively dilates the venous capacitance vessels with reduction in venous return to the heart. This causes concomitant reduction in cardiac ouput and systemic blood pressure. But this decrease in systemic blood pressure causes reflex tachycardia partially offsetting the beneficial effects of hypotension.[7] Also, the organic nitrate vasodilators inhibit platelet function via production of nitric oxide, but it is unclear whether this is a contributing factor in the increased bleeding in the surgical field for the nitroglycerine group.[14] Dexmedetomidine is an alpha-2 receptor agonist with central sympatholytic action similar to clonidine. This results in decrease in both systemic blood pressure and heart rate.[9]

Results of our study show that, groups N and D were well matched demographically. The dose, method of drug administration & hemodynamic variables were also similar in both the groups. The average blood loss was more with Nitroglycerin when compared to dexmedetomidine. This can be due to increased heart rate & prolongation of bleeding time by NTG due to inhibition of platelet aggregation because similar decrease in mean arterial pressure is achieved by both the drugs.

V. Conclusion

Both nitroglycerine and dexmedetomidine can be used safely for controlled hypotension in functional endoscopic sinus surgeries to achieve a target mean arterial pressure around 65-75mm of Hg. But the average blood loss is less with dexmedetomidine when compared with nitroglycerin.

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