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Research Article

Bilateral Sphenopalatine Ganglion Block Versus Dexmedetomidine Infusion for Hypotensive Anaesthesia During Functional Endoscopic Sinus Surgery

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Abstract

Objective: To compare the efficacy and safety of dexmedetomidine versussphenopalatine ganglion block for hypotensive anaesthesia and postoperative analgesia in Functional Endoscopic sinus surgery.

Materials and Methods: A comparative interventional study was conducted in GMC ANANTNAG over period one year. The study included 60 patients of ASA l and II randomly taken from random number table and divided into two groups with 20 patients in each group. Group D was given dexmedetomidine initially at a loading dose of 1 microgram per kg diluted in 10 ml NS infused over 10 minutes followed by infusion @0.2 - 0.7 microgram per kg per hour. Group B was given bilateral sphenopalatine ganglion block using 0.5%ropivacaine. Hemodynamic variables, surgical field visibility, intraoperative bleeding scores, surgeon satisfaction, duration of surgery, emergence time, PACU scoring, postoperative VAS scoring and time to rescue analgesia were noted.

Results: The desired MAP was achieved in both study groups, however, incidence of bradycardia and hypotension was noted more in group D. Again emergence time and sedation scores were found to be more and PACU scoring less in group D compared to group B. Time to rescue analgesia was delayed and VAS scoring was less in group B. All other parameters were comparable between two groups.

Conclusion: It was concluded in our study that sphenopalatine ganglion block is better than dexmedetomidine in maintaining more stable hemodynamic parameters, smooth recovery and postoperative analgesia than dexmedetomidine.

Keywords: Infusion; Anaesthesia; Surgery

Introduction

FESS is a nasal endoscopic technique that allows visualisation of the paranasal sinuses and nasal cavity without a skin incision. It is associated with a high rate of success (approximately 90%) for symptomatic improvement in patients with medically refractory chronic rhinosinusitis and chronic polypous rhinosinusitis [1]. Although, FESS is a commonly performed procedure, intraoperative bleeding and postoperative pain are two main concerns. Hemorrhage decreases visibility of surgical field during FESS procedure and is directly related to risk of vascular, orbital and intracranial complications as well as procedural failure [2,3]. Furthermore bleeding increases duration of surgery and increased blood transfusion risk. Also, procedures involving the nasal sinuses are very painful, and in most of them, patients are obligated to

breathe through their mouth post-operatively [4]. Thus, obtaining adequate homeostasis and providing sufficient analgesia are of utmost importance during endoscopic sinus surgeries. Induced or controlled hypotension has been widely advocated for controlling the surgical field bleeding. Controlling of hypotension during the surgery is a technique that is used to limit the intraoperative blood loss and is effective to provide the best possible field for surgery [5-8]. In controlled hypotension during anaesthesia, the blood pressure of the patient is reduced such that the mean arterial pressure (MAP) is lowered by 30% from baseline or at 60-70 mm Hg, whichever is greater [910]. Another alternative for the induced hypotensive anaesthesia is administering regional anaesthesia for the cavity of the nose and nasal sinuses. This would help, not only, in decreasing the blood loss thus enhancing the surgical field, but also would help in maintaining a stable nonfluctuating hemodynamic profile, and would provide a good postoperative analgesia.

The aim of this study is to compare the efficacy of combined regional nasal anaesthesia and general anesthesia in a group of patients undergoing FESS versus the efficacy of general anesthesia with induced hypotension using dexmedetomidine as hypotensive agent.

Material and Methods

A comparative interventional study was carried out in Government Medical College Anantnag, after approval of the local ethical committee. Written informed consent was obtained from all patients. The study included 40 adult ASA l and ll patients, 18-60 years of age and of both sexes scheduled for elective endoscopic sinus surgeries, with no history of hypersensitivity or idiosyncrasy to any drugs. Exclusion criteria for the study included patients with age under 18 or above 60, ASA >lII, coagulation disorders, history of cardiovascular and cerebrovascular disease, poor BP control, pregnancy, body mass index (BMI) > 35, patients with liver and renal dysfunction.

Patients were randomly allocated into two equal groups using random number table. In Group D, patients received general anaesthesia followed by use of a dexmedetomidine infusion whereas in Group B, patients received general anaesthesia followed by sphenopalatine ganglion block using ropivacaine 0.5%.

Preoperatively, patients were subjected to careful history taking and clinical examination; investigations included complete blood picture, coagulation profile, liver and renal function tests, chest x ray and ECG.

On arrival to the operating room, fasting status was confirmed, 20 guage IV cannula was inserted and intravenous fluid ringer lactate was started @5-7 ml/kg/hr. Standard monitors were applied (non invasive blood pressure, Ecg, Spo_2) and baseline values (values taken after premedication) of blood pressure (SP, DP, MAP), HR, and peripheral oxygen saturation (SPO2) were recorded. All patients were preoxygenated for 3-5 min before the induction of anaesthesia, and patients were induced using 2 µg/kg fentanyl, propofol 1.5-2.5 mg/kg, and vecuronium 0.1 mg/kg. Tracheal intubation was performed using cuffed, PVC endotracheal tube (7 mm for females and 7.5 for males). Subsequently, endotracheal tube was connected with the anaesthesia machine to control the breathing, and respiratory parameters were adjusted to the following: Tidal volume 6-10 ml/kg, respiratory rate 12-16 times/min, inspiration/expiration ratio 1:2; end tidal CO_2 maintained at 35-45 mmHg; and airway pressures were kept less than 30 cm H_2O. Subsequently anaesthesia was maintained by 1% isoflurane in oxygen/nitrous oxide flow (50:50). All patients were kept in slightly head up at least 15 degree position to facilitate venous drainage and oropharyngeal pack was placed. After the induction of general anaesthesia, patients in group D received a loading dose of 1 µg/kg dexmedetomidine diluted in 50 ml 0.9% saline infused over 10 min, followed by continuous intravenous infusion of 0.2-0.7 µg/kg/h titrated to gain target MAP between 60 - 70 mmHg before skin incision.

While as group B patients received bilateral sphenopalatine ganglion block using 0.5% ropivacaine via the greater palatine foramen approach. Procedure was carried out using Wormald technique [16]. The greater palatine foramen has a constant location posteromedial to the third maxillary molar and anteromedial to the maxillary tuberosity and pterygoid hamulus. The patients were placed in reverse trend lenberg position at an angle of 15 degree. The curved blade laryngoscope was used to provide adequate exposure and illumination after endotracheal intubation. A 5 ml syringe with 25-gauge needle bent at 25-30 mm was advanced through the foramen at an angle of 60 degrees at a superior and slightly posterior trajectory. After negative aspiration, 3 ml of 0.5% ropivacaine was injected on either side. Air bubbles or bloody aspirate indicated entry into the nasopharynx or a vessel, in which case needle was withdrawn and repositioned.

Adequate muscle relaxation was maintained using 0.01 mg/kg vecuronium after every 30 minutes. Intraoperatively patient received 0.1 mg/kg dexamethasone and 0.15 mg/kg Ondansetron as antiemetic. Approximately 20 minutes before the end of surgery, intravenous infusion of paracetamol @15 mg/kg for 15-20 minutes was given in both group A and group B patients. At the completion of surgery, dexmedetomidine infusion was stopped in group D patients. Residual neuromuscular blocker was antagonized when spontaneous breathing movements began, and muscle paralysis was reversed with neostigmine at 0.06 mg/kg and glycopyrolate at 0.01 mg/kg. Oropharyngeal pack was removed and after proper oropharyngeal suctioning ,patients were extubated. After extubation, patients were transferred to the post anesthesia care unit (PACU) to be observed for 30 minutes for postoperative monitoring of hemodynamic changes and time to first rescue analgesia, which was tramadol at 1 mg/kg slow intravenously. After a modified Aldrete score of more or equal to 9, patients were discharged from recovery room to ward. Sedation score was assessed using Ramsay Sedation Scale (RSS).

Intraoperative fluid administered for all patients included LR as a maintenance fluid and NS for deficits and losses. The intraoperative estimated blood loss for each procedure was calculated by weighing the surgical gauze pads and measuring the contents of the suction bottle.

The two groups were compared with reference to

Patient characteristics (Age, weight, sex, ASA). Hemodynamic parameters (HR, MAP at baseline and every 15 minutes thereafter). Intraoperative fentanyl consumption (microgram/kg). Amount of blood loss in millilitres. Bleeding score was assessed using Fromme - Boezaart scale (0-5) [11]. Surgeon satisfaction was assessed using satisfaction scores in which 4 = excellent, 3 = good, 2 = fair, and 1= bad. PACU scoring using modified Alderet score. Pain intensity was assessed using visual analogue scale (VAS) scores where 0 is defined as no pain at all and 10 as the worst possible pain at 2, 6, 12, and 24 hours postoperatively.

The time to first rescue medication and analgesic requirements were assessed. Whenever the VAS was greater than 4, tramadol @ 1 mg/kg was given IM/slow IV as rescue analgesia. After being transferred to the ward, the patients were managed with a standard protocol including injection of paracetamol every 8 hourly for the first 24 h.

Results

The two groups were comparable with reference to age, weight, sex and ASA physical status classes. With mean age 45 yrs and mean wt 55 yrs. The group D ASA 1 were 18 patients and 2 were ASA 2 and in group B ASA 1 were 16 with 4 being ASA 2.There was a no significant difference in mean of HR between two study groups. Mean heart rate was in the range of 60 to 80 in both groups, however in group D, 6 patients developed bradycardia with heart rate less than 50, for which atropine 0.5 mg boluses were used as well as lowering the rate of dexmedetomidine infusion or stopping the infusion accordingly. Whereas in group B patients, heart rate remained stable throughout the procedure.

Variables	Preoperative	15 min	30 min	45 min	60 min	90 min	120 min
Group D	65 - 110	55 - 73	49 - 70	53 - 69	67 -88	75 - 87	70 - 85
Group B	70 - 120	68 - 80	65 - 78	64 - 83	61 -85	60 - 87	62 - 90

Table 1: Comparison between group D and group B regarding HR (beats/min).

Variables	Preoperative	15 min	30 min	45 min	60 min	90 min	120 min
Group D	80 - 115	62 - 72	60 - 74	58 - 75	59 - 78	63 - 80	61 - 78
Group B	85 - 130	65 - 80	62 - 74	60 - 93	58 - 85	65 - 90	62 - 73

Table 2: Comparison between group D and group B regarding MABP (mmHg).

MAP was achieved within the desired range in both groups. There was no statistically significant difference found between group D and group B regarding mean arterial blood pressure at different times of measurement. However, 5 patients developed

hypotension more than desired range (MAP of 55mmHg)in group D which was treated with mephenteramine 6 mg boluses intravenously.

End tidal isoflurane concentration was maintained (1%) same in both groups throughout the procedure.

In addition to routine use of analgesics in both groups (paracetamol, diclofenac),fentanyl consumption was equal in both groups. Mean duration of surgery was comparable in both the groups. The average blood loss was less with bleeding scoring less than 2 in both the study groups and hence better surgeon satisfaction score in both the groups. Emergence time (first response to commands after endotracheal extubation) was significantly shorter in group B 5-8 min patients as compared to group D patients 12 - 17 min.

The time needed to achieved modified Aldrete score ≥ 9 at the recovery room was significantly earlier in the group B in comparison with group D. Time to rescue analgesia was earlier in group D as compared to group B and was found to be statistically significant and more patients required additional analgesia in group D in comparison to group B.

Variables	Group D	Group B
Time to achieve recovery	18 - 26	4 - 16
Score (>9)		

Table 3: Postoperative recovery score characteristics.

Variables	Group D	Group B
Time of first postoperative	60 - 90	180 - 240
Analgesia dose (min)		

Table 4: Time of first postoperative analgesia dose.

Variables	Group D	Group B
1 hour postoperatively	1 - 3	0 - 1
2 hours postoperatively	2 - 4	1 - 2
6 hours postoperatively	2 - 5	2 - 4
12 hours postoperatively	4 - 6	3 - 5
24 hours postoperatively	3 - 5	4 - 6

Table 5: Postoperative VAS scoring.

Discussion

Functional endoscopic sinus surgery is one of the routinely performed surgeries. The use of hypotensive anesthesia during endoscopic sinus surgery has greatly reduced blood loss and improved visibility and quality of surgical field and surgeon satisfaction. In our study, we compared the effects of dexmedetomidine given at a loading dose of 1 microgram per kg for a period of 10 minutes followed by infusion @0.2-0.7 microgram per kg per hour with bilateral sphenopalatine ganglion block for induced hypotension and postoperative analgesia for FESS. The two groups were compared regarding the hemodynamic stability, surgical field visualization, intraoperative bleeding, emergence time, recovery scoring and postoperative analgesia.

Dexmedetomidine is a selective alpha 2 adrenoceptor agonist, causes reduction in blood pressure, slowing of heart rate, sedation and analgesia. The fall in blood pressure is mainly due to inhibition of central sympathetic outflow and also due to stimulation of presynaptic alpha 2 adrenoceptors decreasing norepinehrine release [12].

Sphenopalatine ganglion is a parasympathetic ganglion located in pterygopalatine fossa. It sends neural inputs to the lacrimal gland, glands of nasal cavity, paranasal sinuses, palate and upper pharynx. The preganglionic parasympathetic axons synapse within the ganglion. The postganglionic parasympathetic and sympathetic neurons and somatosensory afferent branches of maxillary division of trigeminal nerve also pass through the ganglion. So, both the postganglionic parasympathetic, sympathetic neurons, and the somatosensory afferents can be inhibited by bilateral sphenopalatine ganglion block [13]. Lockade of this central ganglion and nerves reduces the blood loss owing to mucosal vasoconstriction and also attenuates the hemodynamic response associated with FESS.

The observations of our study found that hemodynamic parameters were achieved in both the study groups in the desired range as per the definition of hypotensive anaesthesia with a mean arterial pressure of up to 60 -70 mmHg, or a decrease up to 30% MAP from baseline whichever is greater. However the hemodynamic fluctuations were found more in group D where 6 patients developed bradycardia and 4 patients developed hypotension in comparison to group B where no such fluctuations were found.

The hemodynamic effects of demedetomidine are attributed to sympatholytic effect of alpha -2 agonists. The alpha-2 receptors are involved in regulating the autonomic and cardiovascular systems. Alpha-2 receptors are located in blood vessels where they mediate vasoconstriction, and in the sympathetic terminal, where they inhibit norepinephrine release [14].

The results of our study are consistent with Rokhtabnak F et al who conducted a study on controlled hypotension during rhinoplastyusing dexmedetomidine and $Mgso_4$ and found improved hemodynamics with dexmedetomidine but heightened the risk of bradycardia and sedation scores [15]. Our results also go in agreement with Abdullah et al, in which bradycardia was most frequent adverse effect in dexmedetomidine group [16].

Another study which is in agreement with our results comes from Gaafar et al, who conducted a study to compare effects of bilateral sphenopalatine ganglion block versus intravenous clonidine premedication for surgical field improvement and postoperative pain relief in endoscopic sinus surgery and found that sphenopalatine ganglion block is effective for better hemodynamic control, and improved surgical field visibility in endoscopic sino-nasal surgery when compared with IV clonidine premedication. Low HR permits more filling rate of the venous vessels, so, this decreased the venous ooze in the field of surgery. Moreover, sphenopalatine ganglion block with local anaesthetic agent could decrease the nasal sinusesmucosal blood flow. This might be due to mucosal vasoconstriction and so a better clear field of the surgery [17].

Wormald et al also found that unilateral trans-oral pterygopalatine fossa infiltration with lidocaine improved the surgical conditions with more stable hemodynamic parameters relative to the other side during FESS [18].

Sarhan et al studied effects of bilateral sphenopalatine ganglion block in FESS under general anaesthesia and concluded that the sphenopalatine ganglion block maintained more stable hemodynamic parameters, with improved surgical field visibility, reduced blood loss and excellent postoperative analgesia, all these findings are consistent with our study [19].

Our study observations found that time to rescue analgesia was significantly longer in group B and also postoperative analgesia consumption was found to be less in group B. Although dexmedetomidine has analgesia sparing effect, however in our study, sphenopalatine ganglion block showed improved and prolonged analgesic effects due to the use of ropivacaine as local anaesthetic.

The results of our study are in agreement with Rezaein et al, who studied effects of sphenopalatine ganglion block with bupivacaine on postoperative pain in endoscopic sinus surgery and found that VAS scores and rescue analgesia were significantly lower in the intervention group in comparison to control group [20].

Kesmici E et al conducted a study on the role of sphenopalatine ganglion block on postoperative analgesia after FESS and concluded the superiority of sphenopalatine ganglion block on lowering of VAS scores and overall analgesia consumption in the block group [21].

Again our findings are in agreement with Al-Qudah M who concluded in a study that sphenopalatine ganglion block using lidocaine following FESS is effective in reducing rescue analgesia consumption with significantly lower VAS scores [22].

In our study it was found that emergence time was found more in group D and time to achieve modified aldrete score was more, and hence transfer from PACU is delayed in group Din comparison to group B. Longer duration of recovery time can be explained by sedative and analgesic effects of dexmedetomidine via central actions in the locus coeruleus and in the dorsal horn of spinal cord [23].

Khalifa et al also showed a significantly longer time to achieve modified Aldrete score of 9 or greater with dexmedetomidine [24].

The results of our study are consistent with Bajwa et al where significantly higher RSS was observed with dexmedetomidine when compared with NTG and esmolol [25].

Chhabra et al [26] and Aboushanab OH et al [27] compared dexmedetomidine with $Mgso_4$ in inducing hypotensive anaesthesia in FESS and middle ear surgery respectively and concluded that dexmedetomidine provided stable hemodynamic but delayed recovery and higher sedation scores which is in consistent with our study.

Conclusion

Both are effective in providing ideal surgical field and minimise the duration of surgery during FESS. However compared with dexmedetomidine bilateral sphenopalatine ganglion block offers an advantage of more stable hemodynamic parameters, smooth recovery, less sedation scores and improved postoperative analgesia.

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