Original Research Article

Comparison between magnesium sulphate and dexmedetomidine in controlled hypotension during functional endoscopic sinus surgery

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Abstract

Background: The current study aims to compare the efficacy of dexmedetomidine and magnesium sulphate to reduce blood loss and improve surgical site visibility by controlled hypotension during functional endoscopic sinus surgery(FESS). It also compares the following: satisfaction of the surgeon, time taken to achieve desired mean arterial pressure, total requirement of muscle relaxants, attenuation of hemodynamic response to tracheal manipulation, postoperative sedation and adverse effects. A randomized, prospective study was conducted on 40 patients(18-65 years) with ASA (American Society of Anesthesiologists) physical status I or 2 posted for FESS. Patients were randomly allocated into 2 groups: (1) group D, received 1 µg/kg dexmedetomidine 10 minutes prior to induction, followed by 0.5-1 µg/kg/hr as maintenance dose, and (2) group M, received 40 mg/kg of magnesium sulphate 10 minutes prior to induction followed by 10 - 15 mg/kg/hour as maintenance dose. The goal was to achieve a 20%-30% decrease from baseline mean arterial pressure (MAP). Blood loss was lower and surgeon's satisfaction was higher in Group D. Patients in Group D group required frequent administration of atracurium. **Conclusion:** Dexmedetomidine proved to be a superior agent to provide controlled hypotension

Key Words: Controlled Hypotension, Dexmedetomidine, Magnesium Sulfate, FESS(Functional Endoscopic Sinus Surgery), MAP (Mean Arterial Blood Pressure).

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INTRODUCTION

A large number of Functional Endoscopic Sinus Surgeries are performed worldwide. The indications vary but the most common one is chronic rhinosinusitis. Bleeding poses a serious problem not only to the anaesthesiologist but to the surgeon as well. It hampers visibility, prolongs the surgical time, increases transfusion requirements and worsens post operative edema and ecchymosis. The above problems can be avoided by employing controlled hypotension. It most commonly describes a reduction in systolic pressure below 80-90mm Hg or a reduction in mean arterial pressure upto 60-65 mm Hg or a 30% fall from the baseline MAP. Dexmedetomidine is one of the newer drugs in the anaesthesiologist's armamentarium used for this very purpose. Being a highly selective alpha 2 adrenergic agonist it has a wide clinical application in the following spheres: premedication, sedation, adjuvant in regional techniques, controlled hypotension, attenuation of hemodynamic response to tracheal manipulation, post operative analgesia and awake intubation. That being listed, dexmedetomidine has a side effect profile which includes hypotension, bradycardia, dry mouth and nausea.

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Reversal of sedation and sympatholytic effect can be achieved with Atipamezole, an alpha2 receptor antagonist, in a dose dependent manner. Magnesium sulphate which exerts its effect by blocking NMDA receptors and calcium channels has been used in the treatment of eclampsia, arrhythmias, refractory hypokalemia, shivering, status asthmaticus, premature labour and for analgesia, controlled hypotension, attenuation of hemodynamic response during intubation and extubation. This study aims to compare the blood loss and operative site visibility during FESS with controlled hypotension by using dexmedetomidine or magnesium sulphate to determine the better drug. Other indicators used were surgeon's satisfaction, time required to achieve controlled hypotension, use of muscle relaxants, attenuation of hemodynamic response during tracheal intubation and extubation, post operative sedation and complications.

Methods

Study design

The study is a prospective, randomised trial with 40 participants

Participants and Study procedure

Patients aged between 18 to 65 years, with a BMI less than 35kg/m2, posted for elective FESS with ASA PS- 1 or 2 were enrolled after obtaining informed consent. Patients with hepatic or renal dysfunction, bleeding and coagulation disorders, history of atopy and those on calcium channel blockers were excluded. Patients were allocated into Group D and Group M by randomisation. Inside the operating theatre , patients were connected to standard monitors (non invasive blood pressure monitor, 5 lead ECG, pulse oximetry, EtCO2 and temperature probe) and baseline readings were obtained. The frequency of monitoring was every 5 minutes. Intravenous access was established and fluids were given in accordance with the Holliday Segar formula. Patients were premedicated with inj. glycopyrrolate 0.2 mg iv and inj. midazolam 1 mg iv. Before induction of anaesthesia patients in Group D received 1ug/kg of dexmedetomidine in 100 ml normal saline over 10 minutes and Group M received 40mg/kg of magnesium sulphate in 100 ml normal saline infused over 10 minutes. Preoxygenation was followed by administration of inj. fentanyl 2ug/kg and induction with inj. thiopentone 3-5 mg/kg. Inj. Atracurium 0.5mg/kg was given to ensure optimal intubating conditions. Patients were intubated with cuffed endotracheal tubes of appropriate size and mechanically ventilated (mode: controlled mechanical ventilation). A throat pack was inserted. Five minutes prior to incision the nasal mucosa was infiltrated with 2 ml of 2% lignocaine containing 1:200000 Adrenaline. The anaesthetic plane was maintained with sevoflurane, oxygen-nitrous oxide mixture and Inj. Atracurium 0.1 mg/kg . The total dose of atracurium used was noted. Skin temperature was maintained above 32ºC and EtCO2 between 35-40mm Hg. Patients in Group M received a maintenance dose of 10-15mg/kg of magnesium sulfate and group D received 0.5-1 µg/kg of Dexmedetomidine. The infusion rate was titrated to achieve hypotension. Controlled hypotension was defined as a decrease of 20% - 30% from the baseline MAP. The time taken for the baseline MAP to fall by 20 % was recorded. If this target was not achieved within 15 minutes inspite of the patient receiving the maximum upper limit of the maintenance dose, an infusion of Inj. Nitroglycerine was started and titrated to achieve the goal. However if the MAP decreased by more than 30% despite infusion of the lower limit of maintenance dose, Inj. Ephedrine 6 mg iv was given. Bradycardia was defined as a decrease in heart rate more than 20% from baseline or a heart rate below 50 beats/minute. The lower value was taken into consideration and Inj. atropine 0.6 mg was administered. Inj. Ondansetron 0.1 mg/kg was given 30 minutes prior to extubation. At the end of surgery the infusions were stopped and the patient was reversed with Inj. Neostigmine (50 µg/kg) and Inj. Glycopyrrolate (10 µg/kg). The Modified Ramsay sedation scale was used.

SCORE CHARACTERISTICS

1 Awake and alert, minimal or no cognitive impairment
2 Awake but tranquil, purposeful responses to verbal commands at conversational level
3 Appears asleep, purposeful responses to verbal commands at conversational level
4 Appears asleep, purposeful responses to verbal commands but at louder than conversational level or light glabellar tap
5 Asleep, sluggish purposeful responses only to loud verbal commands or strong glabellar tap
6 Asleep, sluggish purposeful response only to painful stimuli
7 Asleep, reflex withdrawal to painful stimuli only
8 Unresponsive to external stimuli, including pain

2-3 Minimal sedation
4-5 Moderate sedation
6-8 Deep sedation

Post operative events like shivering were noted. Modified Aldrete score ≥ 9 made the patient eligible for ward transfer. The duration of surgery was noted(time taken from the infusion of the loading dose to extubation of patient)

The surgeon evaluated the surgical site visibility and communicated the score. Evaluation was based on a 6 point scale.

0 – No bleeding
1 –Mild bleeding, suction not necessary

2 – Mild bleeding, occasional suctioning required, non threatened surgical field
3 – Mild bleeding, frequent suctioning required, bleeding threatens surgical field few seconds after suction
4 – Moderate bleeding, frequent suctioning required, bleeding threatens surgical site immediately after suction
5 – Severe bleeding, continued suction needed, bleeding appears faster than it can be removed by suction

The surgeon's satisfaction was denoted by a 4 point scale 1 – poor, 2 – moderate, 3 – good, 4- very good

Statistical analysis

Data entry was done in Microsoft Excel 2013 and analysed using IBM.SPSS statistics software 23.0 Version. For continuous variables the mean and standard deviation were used. Categorical variables were subjected to descriptive statistics, frequency and percentage analysis. Significant differences between the bivariate samples in independent groups was analysed using unpaired sample t-test. The Chi- Square test was employed to find the significance of categorical data. If the expected cell frequency was less than 5 in 2×2 tables then the Fisher's exact test was used. The probability value of 0.05 or less was considered significant in all the above tests.

RESULTS

The difference in age distribution, gender, mean weight, ASA physical status, mean duration of surgery and baseline MAP between the study groups was not statistically significant. Group D had a lesser increase in MAP when compared to Group M post intubation and post extubation. Both groups were comparable with regards to MAP during the following: post induction, intraoperative period (5 minutes, 10 minutes, 15 minutes, 30 minutes and 45 minutes) and 5 minutes post extubation.

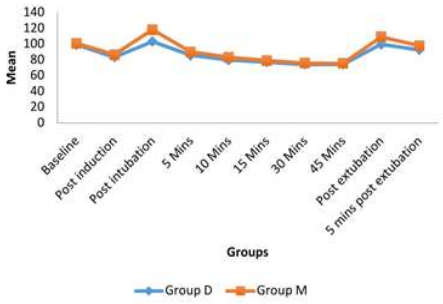

Figure 1: Comparison of MAP among groups

The two groups had comparable baseline heart rate. However, differences in heart rate during the post intubation period, post extubation period and 5 minutes post extubation were statistically significant. Group D had a lesser increase in heart rate when compared to Group M post intubation, post extubation and 5 minutes post extubation. Differences in heart rate post induction, intraoperative period (5 minutes, 10 minutes, 15 minutes, 30 minutes and 45 minutes) and post intubation were not statistically significant.

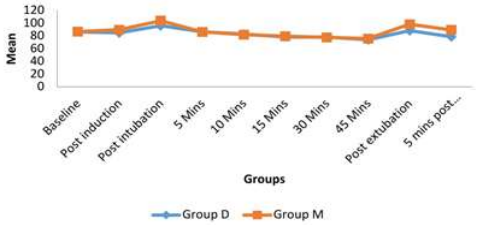

Figure 2: Comparison of heart rate among groups

The difference in bleeding scores and surgeon's satisfaction was statistically significant .Group D had lower bleeding scores and higher surgeon satisfaction

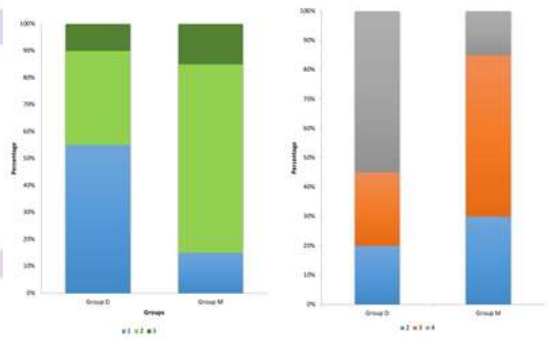

Figure 3: Bleeding score; **Figure 4:** Surgeon satisfaction with group

The time taken for the MAP to decrease by 20% was comparable in both groups. The requirement of NTG was comparable between both the groups. Patients in group M had statistically significant decreased intraoperative requirement of Atracurium to achieve neuromuscular blockade (45 vs. 52.8).

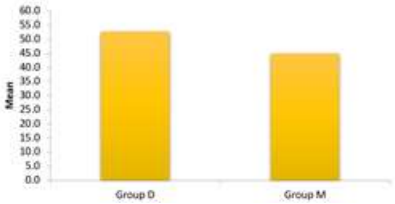

Figure 5: Atracurium dose

The difference in postoperative sedation,incidence of bradycardia, hypotension and shivering between both groups were not statistically significant.

DISCUSSION

FESS, an endoscopic surgical procedure requires good visibility for optimal operating conditions. In this study we have compared dexmedetomidine and magnesium sulfate for achieving controlled hypotension. There was no significant difference in terms of age, weight, gender and the physical status of patients . Our findings revealed that dexmedetomidine was a better drug for controlled hypotension in Functional endoscopic sinus surgery when compared to magnesium sulfate. It provides better surgical site visibility and surgeon satisfaction, as observed by Adnan Bayram *et al.*[6] and Ackan Akkaya [3]. Duration of surgery between the two groups was similar(Akkaya *et al.*[3], Aboushanab *et al..*[1] and Modir *et al.*[28]). The time taken to achieve 20% decline in MAP was not statistically significant, unlike the study by Omyma S.M. Khalifa *et al..* [26]. There was a significant difference in atracurium requirement. Patients in group M required a lesser dose than those in Group D. This was discordant to the observation by Rabie Solimon *et al.*[33]. The intraoperative values of MAP and heart rate were not significantly different except in the post intubation and post extubation period as dexmedetomidine attenuated the hemodynamic stress response to tracheal manipulation. Comparison of postoperative sedation scores was not statistically significant, unlike results in other studies (Omyma, Aboushanab and Hesameddin). There was no significant difference in the incidence of bradycardia and hypotension unlike the observations made by Rabie Solimon *et al.*[33]

LIMITATIONS

A control group was not included in the study as the surgeons required deliberate hypotension for all patients.

CONCLUSION

In this study Dexmedetomidine proved to be superior in providing controlled hypotension than magnesium sulfate in FESS by improving surgical site visibility and surgeon satisfaction. A better attenuation of hemodynamic stress response to tracheal manipulation, without prolonging recovery period or increasing complications has led us to recommend Dexmedetomidine as a safe agent for controlled hypotension in patients posted for FESS.

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