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Title: Comparison between magnesium sulfate and dexmedetomidine in controlled hypotensionduring functional endoscopic sinus surgery.

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Abstract:

Background: Functional endoscopic sinus surgery (FESS) has been recommended as a treatment option for chronic sinusitis patients who have failed to respond to medical treatment. In order to maximize the visibility of the operative site during functional endoscopic sinus surgery (FESS), it is critical to reduce bleeding. The goal of this study was to examine the effectiveness of dexmedetomidine and magnesium sulphate as hypotensive agents in FESS in adult patients in order to achieve a bloodless surgical field.

Materials and methods: Sixty patients aged between 18-65 years were randomly assigned into two groups, the D group for dexmedetomidine (n = 30) the and M group for magnesium sulfate (n = 30). Patients in the D group received a loading dose of 1 g/kg dexmedetomidine in 100 mL saline solution 10 minutes before induction and a 0.5–1 g/kg/h infusion via syringe pump throughout the surgery. Patients in the M group received 40 mg/kg magnesium sulfate in 100 ml saline solution over 10 min as the intravenous loading dose 10 min before induction,followed by a 10–15 mg/kg/h infusion.

Result: Except for the initial stage, following induction, and 5 minutes after intubation, mean arterial pressure values in Group D were considerably lower than in Group M. Except for the initial stage, patients in the (D group) exhibited a statistically significant lower heart rate than

those in the (M group).The bleeding score was significantly decreased in Group D and surgeon satisfaction was significantly increased in the same group ($p = 0.001$).
Conclusion: Dexmedetomidine is more efficient than Magnesium sulfate at inducing hypotension during Functional Endoscopic Sinus Surgery, resulting in enhanced operative site visibility.
Keywords:Dexmedetomidine, Magnesiumsulfate, FESS, MAP

Introduction:

By lowering arterial pressure until hypotension is established, controlled hypotension is used to minimize blood loss and the need for transfusions during surgery, as well as to increase the visibility of the surgical site. [1] Functional endoscopic sinus surgery is the primary surgical therapy for chronic rhinosinusitis (FESS). Intraoperative bleeding might make the surgery site less visible, resulting in a higher risk of complications. Therefore, improving the visibility of the surgical site by reducing bleeding during FESS is an important concern foranesthesiologists. [2]

Several medications have been used to induce controlled hypotension, either alone or in combination; nevertheless, there is no such thing as an optimal agent for causing controlled hypotension. Easy administration, a short onset time, an effect that fades quickly when administration is stopped, rapid elimination without toxic metabolites, negligible effects on vital organs, and predictable and dose-dependent effects are all desirable characteristics for a controlled hypotension agent [1,3-5].Dexmedetomidine is a 2-adrenoceptor agonist having sedative, anxiolytic, and analgesic properties. Dexmedetomidine acts as a ligand for central 2A and imidazoline type 1 receptors. The activation of these central receptors reduces norepinephrine release and hence lowers blood pressure and heart rate. [6]

It has been reported that magnesium sulphate is a good agent for controlled hypotension and that it stabilises the cell membrane and intracytoplasmic organelles by mediating the activation of the enzymes Na+-K+ ATPase and Ca++ ATPase, which play a role in transmembrane ion exchange during the depolarization and repolarization phases.

[5,7,8]. Furthermore, Mg++ suppresses norepinephrine release by blocking N-type Ca++ channels at nerve terminals, lowering blood pressure. [9]

Because there have been few studies comparing these two drugs in terms of their role in achieving controlled hypotension in patients undergoing FESS, the current study was conducted to compare the effects of dexmedetomidine and magnesium sulphate in achieving controlled hypotension in patients undergoing FESS

Methods:

From June 2019 to May 2020, a randomised prospective comparative research was undertaken at a government medical college and general hospital in Nizamabad. After approval of the Ethical Committee, written informed consent was obtained from all participants.After meeting the inclusion criteria, sixty patients were included in the study and were randomly allocated to one of two groups: D for dexmedetomidine (n = 30) and M for magnesium sulphate (n = 30). Randomization was done by the use of sequentially numbered, opaque, sealed envelopes containing 1:1 computer-generated random allocations.

Patients with grades I and II according to the American Society of Anesthesiology physical status (ASA-PS) of either sex from 18 to 65 years of age who were scheduled for FESS under general anaesthesia were excluded from the study, as were patients who refused, were under 18 or > 65 years of age, pregnant women, and patients with hypertension, ischemic heart disease, cerebrovascular insufficiency, neuromuscular diseases, diabetic neuropathy, peripheral vascular diseases, renal impairment, and Patients with coagulopathies or who were taking medicines that affected blood coagulation were also excluded.

Patients were connected to conventional monitors (non-invasive blood pressure monitor, 5-lead ECG, pulse oximetry, EtCO2, and temperature probe) to get baseline measurements. The monitoring took place every 5 minutes. Fluids were administered according to the Holliday Segar formula when intravenous access was obtained. Inj. glycopyrrolate 0.2 mg iv and inj. midazolam 1 mg iv were used to premedicate the patients. Patients in Group D got 1ug/kg dexmedetomidine infused over 10 minutes in 100 mL normal saline, whereas those in Group M received 40mg/kg magnesium sulphate infused over 10 minutes in 100 mL normal saline. After preoxygenation, inj. fentanyl 2ug/kg was given, followed by induction with inj. thiopentone 3-5 mg/kg. To provide appropriate intubating circumstances, Atracurium 0.5mg/kg was injected. Patients were intubated and mechanically ventilated using appropriate-sized cuffed endotracheal tubes (mode:controlled mechanical ventilation). A throat pack was placed in the patient's mouth. The nasal mucosa was infiltrated with 2 ml of 2% lignocaine with 1:200000 Adrenaline five minutes before the incision. Sevoflurane, oxygen-nitrous oxide combination, and Inj. Atracurium 0.1 mg/kg were used to maintain the anaesthetic plane. The entire amount of atracurium that was utilised was recorded. The skin temperature was kept above 32 degrees Celsius, while the EtCO2 level was kept between 35 and 40 millimetres of mercury.

Patients in Group M got a maintenance dosage of 10-15mg/kg magnesium sulphate, whereas those in Group D received 0.5- 1 g/kg Dexmedetomidine. To achieve hypotension, the infusion rate was titrated. Controlled hypotension was defined as a MAP reduction of 20% to 30% from baseline. The time it took for the baseline MAP to reduce by 20% was recorded. If this objective was not met within 15 minutes, despite the patient receiving the maximum upper limit of the maintenance dosage, an infusion of Inj.Nitroglycerine was initiated and titrated to meet the goal. However, if the MAP fell by more than 30% despite infusion of the lower limit of the maintenance dosage, Inj.Ephedrine 6 mg iv was administered. Bradycardia was defined as a drop in heart rate of more than 20% from baseline. The lower value was used, and 0.6 mg of atropine injection was administered. Ondansetron 0.1 mg/kg was injected 30 minutes before extubation. The infusions were halted at the conclusion of operation, and the patient was reversed with injections of neostigmine (50 g/kg) and glycopyrrolate (10 g/kg). Shivering was seen as a post-operative occurrence. A modified Aldrete score of 9 qualified the patient for ward transfer. The length of the procedure was recorded (from the infusion of the loading dosage to the patient's extubation). The surgeon evaluated surgical site visibility and conveyed the score. The evaluation was done 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:
SPSS version 16 was used to analyse the data collected. The mean and standard deviation were used to represent quantitative data (SD). Frequency and percentage were used to represent qualitative data. The tests that were carried out were as follows: When comparing two means, an independent sample t test of significance was utilised. To compare proportions between qualitative factors, the Chi-square (2) test of significance was applied. P-values of less than 0.05 were regarded as significant.

Result:
Sixty patients were enrolled in the study and all patients completed the study. Demographic data were similar in each group.

Demographic data	D Group (n=30)	MGroup (n=30)
Gender		
Male	14 (46.6%)	12 (40%)
Female	16 (53.4%)	18 (60%)
Age (Years)		
range	18-65	18-65
Mean SD	42.77 8.52	41.66 7.45
Weight (kg)		
range	55-85	55-85
Mean SD	74.52 12.42	73.48 14.82

MAP was significantly lower in Group D than in Group M for all measurements except the initial stage, after induction, and after intubation ($p < 0.05$) (Table 2).

Table 2: Comparison of mean arterial blood pressure (MAP) (mmHg) among groups

MAP (mmHg)	D group (n = 30)	M group (n = 30)	P-value
Baseline	85.79 ± 5.77	84.85 ± 5.7	0.082
After induction	74.41 ± 5.11	77.33 ± 5.31	0.354
After Intubation	65.96 ± 4.52	68.64 ± 4.7	0.243

After 15 min	58.37 ± 3.99	60.74 ± 4.15	0.032*
After 30 min	54.95 ± 3.75	57.27 ± 3.9	0.012*
After 45 min	58.24± 3.97	60.56 ± 4.14	0.042*
End of surgery	66.62± 4.56	69.25 ± 4.75	0.035*
Post-extubation	71.22 ± 4.89	75.15 ± 5.16	0.042*
Post-operative 30 min	66.53 ± 4.56	73.11 ± 4.74	0.025*

Using Independent sample t test:
*p-value <0.05significant

Heart rate was significantly lower in Group D than in Group M for all measurements except the initial stage, after induction, and after intubation ($p < 0.05$) (Table 3).

Table 3: Comparison of Heart rate (beat/min) among groups

Heart rate (beat/min)	D group (n = 30)	M group (n = 30)	P-value
Baseline	82.68 ± 6.58	81.64 ± 5.64	0.072
After induction	74.17 ± 4.94	79.85 ± 4.44	0.015*
After Intubation	67.68 ± 5.12	73.24 ± 5.89	0.023*
After 15 min	61.34 ± 4.21	66.58 ± 4.58	0.034*
After 30 min	58.45 ± 4.00	63.45 ± 4.35	0.035*
After 45 min	61.32 ± 4.20	66.92 ± 4.57	0.015*
End of surgery	61.28 ± 4.37	68.77 ± 4.75	0.005*
Post-extubation	75.54 ± 5.19	83.78 ± 5.77	0.031*
Post-operative 30 min	69.45 ± 4.78	76.12 ± 6.81	0.027*

Using Independent sample t test;
*p-value <0.05significant
Bleeding score was significantly higher among M group than D group which was statistically significant.(Table 4)

Table 4: Comparison of bleeding score among groups

Bleeding Score	D group (n = 30)	M group (n = 30)	P-value
0	2(6.7%)	0	0.023*
1	4(13.3%)	0	0.034*

2	14(46.7%)	5(16.7%)	0.042*
3	7(23.3%)	5(16.7%)	0.025*
4	2(6.7%)	11(36.6%)	0.032*
5	1(3.3%)	9(30%)	0.026*

Using $\chi 2$ chi-square test;
*p-value <0.05significant
The surgical satisfaction was significantly higher in the D group than in the M group which was statistically significant.(Table 5)
Table 5: Comparison of surgical satisfaction among groups

Surgeon satisfaction	D group (n = 30)	M group (n = 30)	P-value
Bad	1(3.3%)	7(23.3%)	0.002*
Moderate	6(20%)	13(43.3%)	0.028*
Good	7(23.3%)	8(26.7%)	0.032*
Excellent	16(53.4%)	2(6.7%)	0.045*

Using $\chi 2$ chi-square test;
*p-value <0.05significant

Discussion:
We examined dexmedetomidine and magnesium sulphate for attaining controlled hypotension in this study. When compared to magnesium sulphate, dexmedetomidinewas found to be a preferable medication for controlled hypotension in functional endoscopic sinus surgery. The duration of operation was similar in both groups, as described in previous studies (10-12).
When comparing the D group to the M group, the bleeding score was lower in the D group. Patients in the D group had a higher surgeon satisfaction score for operating field visibility. Aside from the decreased BP and HR effects, peripheral vasoconstriction might be another cause for reduced bleeding and a better surgical field in the D group. These findings were comparable to those of the Faranak et al. trial, in which the dexmedetomidine group had a lower bleeding score and a better surgeon satisfaction score than the magnesium group (13). In a research by Bayram et al., which examined the efficiency of MgSO4 and dexmedetomidine in generating hypotension in FESS procedures, dexmedetomidinewas shown to yield better surgeon satisfaction than magnesium (14).
Previous studies have found that hemodynamic indicators such as heart rate and mean arterial pressure were considerably lower in the Dexmedetomidine group than in the Magnesium

Sulphate group. (15,16), whereas Sie'skiewicz and colleagues reported in a study on the assessment of the relationship between mean arterial pressure and intraoperative bleeding during endoscopic sinus surgery in patients with low heart rates that by lowering the HR, better operative field conditions could be achieved without the need to lower MAP to risky low levels (if HR was maintained as low as 60 beats/min) (17).

Conclusion:

From this study,it was concluded that dexmedetomidine is more effective than magnesium sulphate in achieving controlled hypotension in FESS patients. Dexmedetomidine regulated blood pressure better than magnesium sulphate, resulting in a better surgical field, higher surgeon satisfaction, and less bleeding.

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