



Original Article


Comparative Study of Magnesium Sulphate and Dexmedetomidine for Controlled Hypotension During Functional Endoscopic Sinus Surgery

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ABSTRACT

Background and Aims: Controlled hypotension is frequently employed during functional endoscopic sinus surgery (FESS) to improve surgical field visibility. Magnesium sulphate and dexmedetomidine are commonly used agents for this purpose. This study aimed to compare their efficacy in achieving controlled hypotension during FESS.

Methods: In this prospective, randomised comparative study, patients aged 18–60 years, belonging to American Society of Anesthesiologists (ASA) physical status I–II and undergoing elective FESS, were randomly allocated into two groups. Group M received magnesium sulphate infusion, and Group D received dexmedetomidine infusion. Hemodynamic parameters, quality of surgical field, intraoperative blood loss, recovery characteristics, and adverse effects were recorded. Data were analysed using appropriate statistical tests.

Results: Dexmedetomidine provided better control of mean arterial pressure and heart rate compared to magnesium sulphate ($P < 0.05$). The surgical field quality was significantly improved in Group D with reduced intraoperative bleeding. Recovery was smoother in the dexmedetomidine group, though a higher incidence of bradycardia was noted.

Conclusion: Dexmedetomidine is more effective than magnesium sulphate in achieving controlled hypotension and improving surgical field conditions during FESS, with acceptable safety.

Keywords: Dexmedetomidine, magnesium sulphate, controlled hypotension, FESS, surgical field.

INTRODUCTION

Functional endoscopic sinus surgery (FESS) is a widely performed surgical procedure for the management of chronic rhinosinusitis, nasal polyposis, and other sinonasal disorders. The success of this procedure largely depends on adequate visualisation of the surgical field, which can be significantly compromised even by minimal bleeding due to the highly vascular nature of the nasal mucosa. Poor visibility not only prolongs the duration of surgery but also increases the risk of complications such as injury to adjacent structures.¹

Controlled hypotension is an established Anesthetic technique employed to reduce intraoperative blood loss and improve surgical field visibility. It involves a deliberate reduction in mean arterial pressure (MAP), typically by 20–30% from baseline, while maintaining adequate perfusion to vital organs. Various pharmacological agents have been used to achieve controlled hypotension, including vasodilators, β -blockers, inhalational anesthetics, and α 2-adrenergic agonists.²

Magnesium sulphate has gained attention as a hypotensive agent due to its vasodilatory properties mediated through calcium channel blockade and inhibition of catecholamine release. It also exhibits analgesic and anaesthetic-sparing effects, making it a useful adjunct in general anaesthesia. Additionally, magnesium attenuates sympathetic responses to surgical stimuli, thereby contributing to hemodynamic stability.

Dexmedetomidine, a highly selective α_2 -adrenergic receptor agonist, has emerged as an effective agent for controlled hypotension. It produces dose-dependent sedation, analgesia, and sympatholysis without causing significant respiratory depression. Its ability to reduce heart rate and blood pressure, along with its opioid-sparing effects, makes it particularly suitable for procedures like FESS where a bloodless surgical field is desired.³

Despite the widespread use of both magnesium sulphate and dexmedetomidine, there is ongoing debate regarding their relative efficacy and safety profiles. While dexmedetomidine is known to provide better hemodynamic control and improved surgical field conditions, it may be associated with bradycardia and delayed recovery in some cases. Magnesium sulphate, on the other hand, is cost-effective and widely available but may offer less precise control over haemodynamics.⁴

Previous studies have compared various agents for controlled hypotension; however, direct comparisons between magnesium sulphate and dexmedetomidine in the context of FESS are limited and have shown variable results. Furthermore, differences in study design, dosing regimens, and outcome measures have contributed to the lack of consensus.⁵

In this context, the present study was undertaken to compare the efficacy of magnesium sulphate and dexmedetomidine in achieving controlled hypotension during functional endoscopic sinus surgery, with particular emphasis on hemodynamic stability, quality of surgical field, intraoperative blood loss, and recovery characteristics.

MATERIALS AND METHODS

After obtaining approval from the Institutional Ethics Committee and written informed consent from all participants, this prospective, randomised, comparative study was conducted in the Department of Anaesthesiology at a tertiary care hospital over a period of 12 months.

Study Population

A total of 60 patients aged between 18 and 60 years, of either sex, belonging to American Society of Anesthesiologists (ASA) physical status I and II, and scheduled for elective functional endoscopic sinus surgery (FESS) under general anaesthesia were included in the study.

Inclusion Criteria

Patients aged 18–60 years, ASA physical status I–II, and those willing to provide informed consent were included.

Exclusion Criteria

Patients with uncontrolled hypertension, cardiac disease, renal or hepatic dysfunction, coagulation disorders, known allergy to study drugs, pregnant or lactating women, and patients on medications affecting hemodynamic parameters were excluded from the study.

Randomisation and Group Allocation

Patients were randomly allocated into two equal groups (30 patients each) using a computer-generated randomisation table:

- **Group M (Magnesium sulphate group):** Received intravenous magnesium sulphate
- **Group D (Dexmedetomidine group):** Received intravenous dexmedetomidine

Allocation concealment was ensured using sealed opaque envelopes.

Anaesthetic Technique and Perioperative Management

All patients were kept nil per oral as per standard preoperative fasting guidelines and received appropriate premedication on the night before and the morning of surgery. On arrival in the operating room, standard monitoring was instituted, including electrocardiography, non-invasive blood pressure, pulse oximetry, and end-tidal carbon dioxide. Baseline hemodynamic parameters were recorded.

An intravenous line was secured, and patients were preloaded with crystalloid solution. Premedication was administered with intravenous glycopyrrolate, ondansetron, and midazolam. Patients were then allocated to one of the two study groups. Patients in Group M received magnesium sulphate at a loading dose of 50 mg/kg administered over 10–15 minutes, followed by a maintenance infusion of 15 mg/kg/h. Patients in Group D received dexmedetomidine at a loading dose of 1 μ g/kg over 10 minutes, followed by a maintenance infusion of 0.4–0.7 μ g/kg/h.

General anaesthesia was induced using intravenous propofol along with an appropriate muscle relaxant such as vecuronium or atracurium to facilitate endotracheal intubation. Anaesthesia was maintained with a combination of

oxygen, nitrous oxide, and inhalational agents such as isoflurane or sevoflurane. Mechanical ventilation was adjusted to maintain normocapnia, and additional doses of muscle relaxants were administered as required.

Controlled hypotension was defined as a reduction in mean arterial pressure by 20–30% from baseline values. The infusion of the study drugs was titrated to achieve and maintain the target mean arterial pressure. In cases where adequate hypotension was not achieved, rescue agents such as nitroglycerin were administered. Episodes of excessive hypotension or bradycardia were managed with appropriate measures including intravenous fluids, atropine administration, or adjustment of drug infusion rates.

Intraoperative hemodynamic parameters, including heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, and oxygen saturation, were recorded at baseline, after induction, after intubation, and at regular intervals of 5–10 minutes throughout the procedure.

At the end of surgery, the study drug infusions were discontinued. Neuromuscular blockade was reversed using appropriate agents, and patients were extubated once adequate spontaneous respiration and protective airway reflexes were restored. All patients were subsequently monitored in the postoperative recovery room, where recovery parameters and any postoperative complications were recorded.

Statistical Analysis

Data were entered into Microsoft Excel and analysed using statistical software SPSS version 23. Continuous variables were expressed as mean \pm standard deviation and compared using Student's t-test. Categorical variables were analysed using the Chi-square test or Fisher's exact test as appropriate. A p-value < 0.05 was considered statistically significant.

RESULTS

A total of 60 patients were included in the study, with 30 patients in each group. Both groups were comparable in terms of demographic characteristics and duration of surgery ($P > 0.05$).

Dexmedetomidine provided significantly better control of intraoperative haemodynamic parameters, with lower mean heart rate (70.2 ± 5.8 vs 78.6 ± 6.5 beats/min, $P < 0.001$) and mean arterial pressure (66.8 ± 4.9 vs 72.4 ± 5.2 mmHg, $P < 0.001$) compared to magnesium sulphate. The quality of the surgical field was significantly improved in the dexmedetomidine group, with 73.3% of patients having minimal bleeding (score 1–2) compared to 40% in the magnesium sulphate group ($P = 0.01$). Intraoperative blood loss was also significantly lower in the dexmedetomidine group (150 ± 28 ml vs 210 ± 35 ml, $P < 0.001$).

Recovery characteristics were comparable between the two groups, with no statistically significant difference in extubation time (8.9 ± 1.9 vs 9.8 ± 2.1 minutes, $P = 0.07$). Bradycardia was more frequently observed in the dexmedetomidine group (20% vs 6.7%), while hypotension was slightly higher in the magnesium sulphate group (16.7% vs 10%); however, these differences were not statistically significant ($P > 0.05$).

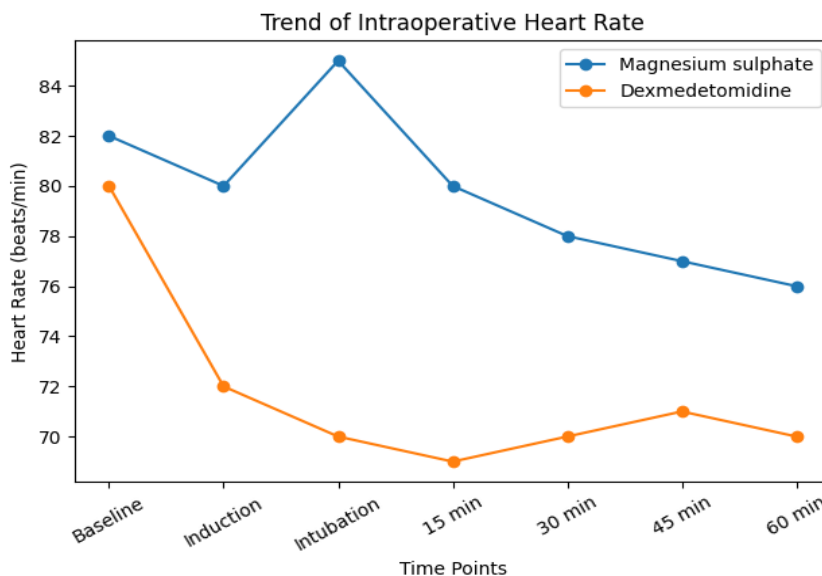


Figure 1: Trend of intra operative heart rate

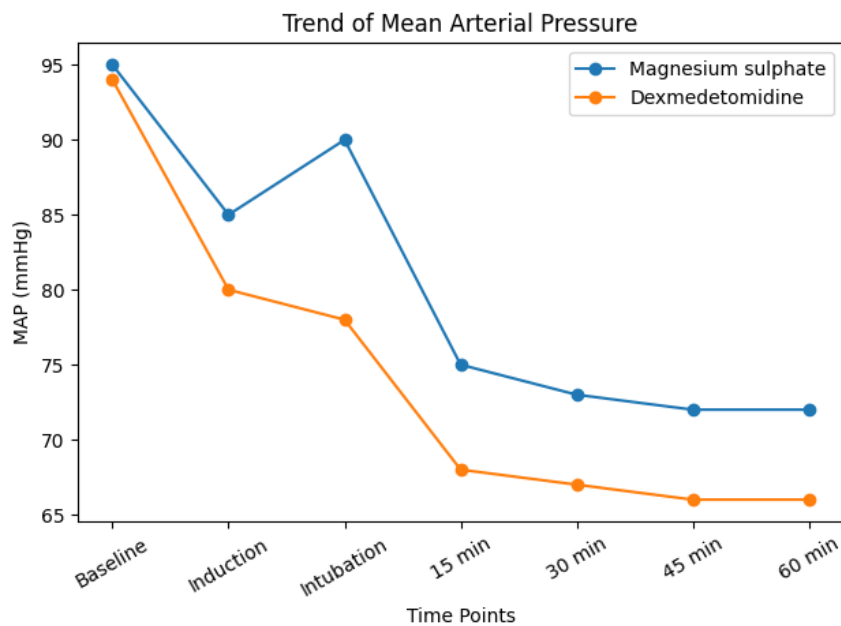


Figure 2: Trend of mean arterial blood pressure

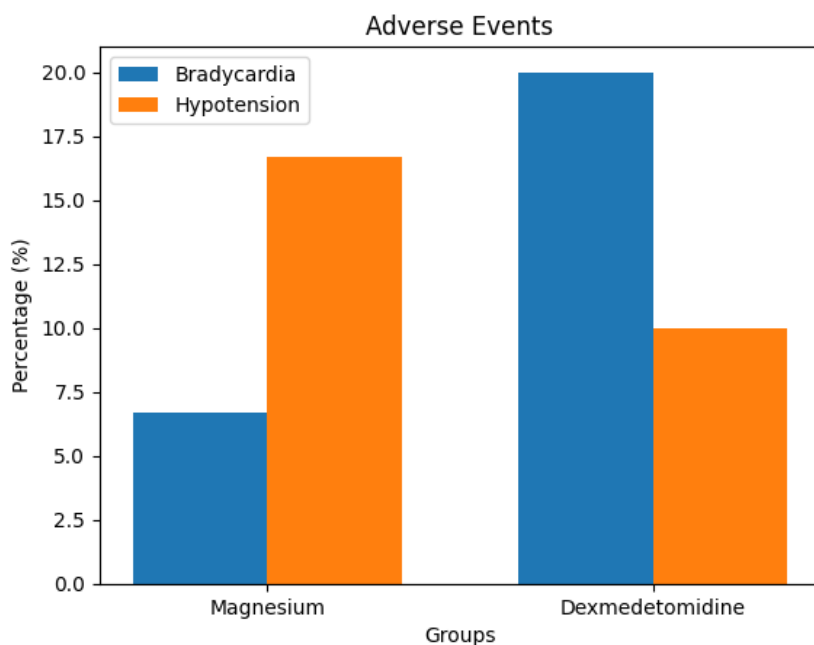


Figure 3: Incidence of adverse events

DISCUSSION

Controlled hypotension is a well-established anaesthetic technique used to improve surgical field visibility and reduce intraoperative blood loss during functional endoscopic sinus surgery (FESS). The present study compared magnesium sulphate and dexmedetomidine in achieving controlled hypotension and demonstrated that dexmedetomidine provides superior hemodynamic stability, improved surgical field conditions, and reduced intraoperative blood loss.

In the present study, dexmedetomidine was associated with significantly lower intraoperative heart rate and mean arterial pressure compared to magnesium sulphate ($P < 0.001$). This can be attributed to its potent α_2 -adrenergic agonist activity, which leads to central sympatholysis, reduced catecholamine release, and decreased heart rate and blood pressure. These findings are consistent with the study by Durmuş et al.⁵, who reported better hemodynamic control with dexmedetomidine compared to magnesium sulphate during FESS. Similarly, a study by Gupta et al.⁶ demonstrated that dexmedetomidine provided more stable hemodynamics and effective controlled hypotension compared to other hypotensive agents.

Magnesium sulphate, although effective in reducing blood pressure, acts primarily through calcium channel blockade and inhibition of catecholamine release. However, its effect on hemodynamic parameters is less predictable compared to

dexmedetomidine. In the present study, patients receiving magnesium sulphate showed higher intraoperative heart rate and mean arterial pressure, indicating comparatively less effective control. These findings are in agreement with studies by Elsharnouby et al.⁷, who reported that magnesium sulphate required additional agents to maintain target hypotension. The quality of the surgical field, assessed using the bleeding score, was significantly better in the dexmedetomidine group ($P = 0.01$). Approximately 73.3% of patients in the dexmedetomidine group had minimal bleeding compared to 40% in the magnesium sulphate group. Improved surgical field visibility with dexmedetomidine has been reported in multiple studies and is attributed to its ability to provide controlled hypotension along with reduced heart rate, leading to decreased bleeding. These findings are comparable to those reported by Richa et al.⁸, who observed superior surgical field conditions with dexmedetomidine during FESS.

Intraoperative blood loss was significantly lower in the dexmedetomidine group (150 ± 28 ml vs 210 ± 35 ml, $P < 0.001$), further supporting its efficacy in achieving optimal surgical conditions. Similar results were reported by Sreedhar et al.⁹, who found that dexmedetomidine significantly reduced blood loss compared to other hypotensive agents.

Recovery characteristics were comparable between the two groups in the present study, with no statistically significant difference in extubation time ($P = 0.07$). However, patients in the dexmedetomidine group exhibited smoother recovery profiles, likely due to its sedative and analgesic properties. This is consistent with previous studies that have demonstrated better postoperative comfort and reduced analgesic requirements with dexmedetomidine.

With regard to adverse effects, bradycardia was more frequently observed in the dexmedetomidine group (20% vs 6.7%), although it was clinically manageable and did not require major intervention. This is a known pharmacological effect of dexmedetomidine due to its vagomimetic action. Similar findings have been reported in studies by Khan et al.¹⁰ and Gupta et al. Hypotension was slightly more common in the magnesium sulphate group, though the difference was not statistically significant.

Overall, the findings of the present study are consistent with the existing body of literature, which suggests that dexmedetomidine is a superior agent for controlled hypotension in FESS. Its ability to provide stable hemodynamics, reduce intraoperative bleeding, and improve surgical field visibility makes it a preferred choice over magnesium sulphate.

CONCLUSION

Dexmedetomidine is more effective than magnesium sulphate in achieving controlled hypotension during functional endoscopic sinus surgery, providing better hemodynamic stability and improved surgical field conditions. It also significantly reduces intraoperative blood loss, although it is associated with a higher incidence of manageable bradycardia. Therefore, dexmedetomidine may be considered a preferable agent for controlled hypotension in FESS.

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Conflict of interest: Nil

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