Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 32s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

Effect Of Intravenous Magnesium Sulphate And Lidocaine Infusions On Intraoperative Haemodynamics And Muscle Relaxant Requirement In Functional Endoscopic Sinus Surgery (Fess)

Dr. Kota Likitha[1*], Dr. Shiny Priya Darshini aarumulla[2], Dr. Gundlakunta Swathi[3], Dr. K. Krishna Chaitanya[4], Dr. Avula Charan Teja Reddy[5], Dr. Williams Angela Ishwarya[6]

[*1]Junior resident, Department of Anaesthesiology, Narayana Medical College and Hospital, Nellore, Andhra Pradesh, India

[2.] Associate Professor, Department of anaesthesiology, Narayana medical college, Nellore, Andra pradesh , INDIA

[3.] Assistant Professor, Department of Anaesthesiology, Narayana Medical College and Hospital, Nellore, Andhra Pradesh, India

[4.] Professor and HOD, Department of Anaesthesiology, Narayana Medical College and Hospital, Nellore, Andhra Pradesh, India

[5]Assistant professor Department of Anaesthesiology, Narayana Medical College and Hospital, Nellore, Andhra Pradesh, India

[6] Senior resident, Department of Anaesthesiology, Narayana Medical College and Hospital, Nellore, Andhra Pradesh, India

[*]**Corresponding author:**

Dr . Kota Likitha

.Cite this paper as: Dr. Kota Likitha, Dr. Shiny Priya Darshini aarumulla, Dr. Gundlakunta Swathi, Dr. K. Krishna Chaitanya, Dr. Avula Charan Teja Reddy, Dr. Williams Angela Ishwarya, (2025) Effect Of Intravenous Magnesium Sulphate And Lidocaine Infusions On Intraoperative Haemodynamics And Muscle Relaxant Requirement In Functional Endoscopic Sinus Surgery (Fess). *Journal of Neonatal Surgery*, 14 (32s), 4885-4890.

ABSTRACT

Background: FESS requires hypotension to decrease intraoperative bleeding for better visibility and to reduce duration of procedure. Controlled hypotension using agents like magnesium sulphate and lidocaine may improve outcomes. We compare intravenous magnesium sulphate and lidocaine infusion for maintaining intraop hemodynamics and its effect on muscle relaxant requirement and surgical field

AIM: To compare the effectiveness of intravenous magnesium sulphate and lidocaine in achieving controlled hemodynamics and reducing muscle relaxant requirements in patients undergoing FESS.

Methodology: The Institutional Ethics Committee of our college approved this randomized, prospective, double-blinded controlled study. A total of 80 patients scheduled to undergo Functional Endoscopic Sinus Surgery (FESS) were randomly allocated into two groups. Group L (n = 40) received intravenous lidocaine with a loading dose of 1.5 mg/kg followed by a maintenance infusion of 1.5 mg/kg/hour. Group M (n = 40) received intravenous magnesium sulfate with a loading dose of 40 mg/kg diluted in 100 mL of normal saline administered over 10 minutes, followed by a maintenance infusion of 15 mg/kg/hour. The primary outcomes were intraoperative hemodynamic parameters, specifically heart rate (HR) and mean arterial pressure (MAP), measured at 10-minute intervals, and the total muscle relaxant requirement. The secondary outcome was assessment of surgical field clarity, evaluated using the six-point Fromme and Boezaart scale by a surgeon blinded to the study groups.

Results: Magnesium showed statistically significant difference in haemodynamics and surgical field visibility than lidocaine . Magnesium showed significant decrease in muscle relaxant requirement (p – 0.001) than lidocaine

Conclusion: Magnesium sulphate maintained intra op hemodynamics and better surgical field visibility than lidocaine. Magnesium sulfate had a lower muscle relaxant requirement.

Keywords: *Magnesium sulphate, Lidocaine, Controlled hypotension, FESS, Muscle relaxant, Surgical field visibility.*

1. INTRODUCTION

Functional endoscopic sinus surgery (FESS) is a minimally invasive procedure used in the management of chronic rhinosinusitis, particularly in cases unresponsive to medical therapy. It enhances drainage and ventilation of the paranasal sinuses by widening their natural openings. FESS is also indicated for nasal polyps, selected sinonasal tumors, and optic nerve decompression in Graves' ophthalmopathy [1] .

Due to the confined surgical field, even minimal intraoperative bleeding can significantly impair visibility. This not only hampers surgical precision but also increases operative time, the need for blood transfusion, and the risk of postoperative edema and ecchymosis [2] . Therefore, minimizing bleeding is critical, and one key strategy is the attenuation of hemodynamic responses to surgical stimuli.

Various techniques are employed to achieve controlled hypotension [3] and reduce bleeding, including topical vasoconstrictors, local anesthetics, and pharmacological agents such as propofol, magnesium sulfate, nitroglycerin, lidocaine, dexmedetomidine, and esmolol. Controlled hypotension is typically defined as a systolic blood pressure reduction below 80–90 mmHg, a mean arterial pressure (MAP) [4] of 60–65 mmHg, or a 30% decrease from baseline .

This study aims to compare the effectiveness of magnesium sulfate and lidocaine in attenuating intraoperative hemodynamic responses, improving surgical field quality, and reducing the requirement for neuromuscular blocking agents.

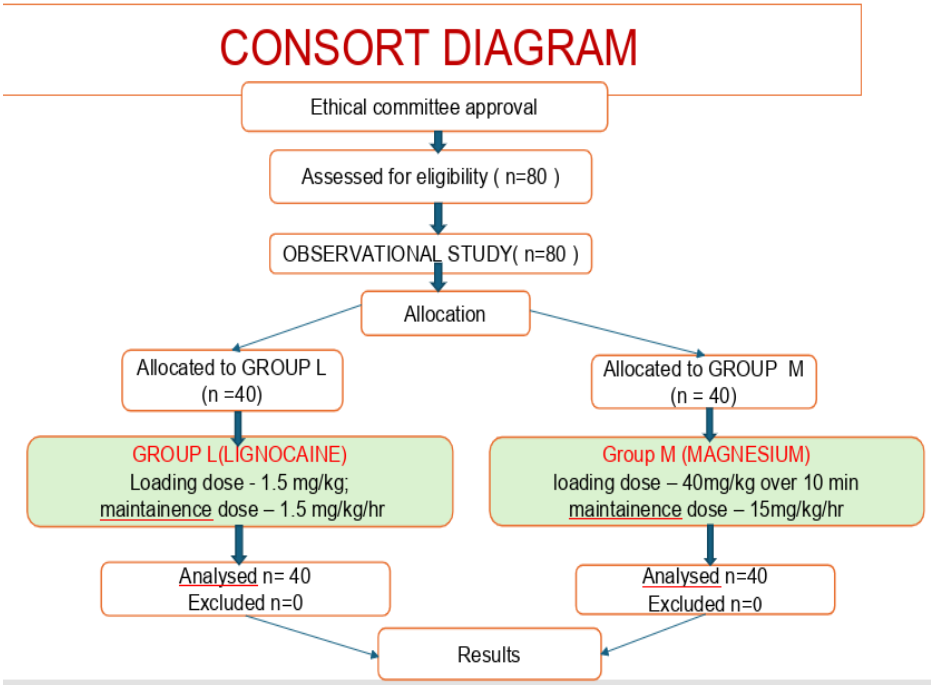
2. MATERIALS AND METHODS

This prospective, double-blinded observational study was conducted at Narayana Medical College & Hospital (NMCH), Nellore, between January and April 2024, after obtaining approval from the Institutional Ethics Committee. Eighty patients scheduled for elective Functional Endoscopic Sinus Surgery (FESS) were enrolled and randomly allocated into two equal groups: Group L (lidocaine, n = 40) and Group M (magnesium sulphate, n = 40). Group L received a loading dose of lidocaine 1.5 mg/kg followed by a continuous infusion at 1.5 mg/kg/hour, whereas Group M received a loading dose of magnesium sulphate 40 mg/kg over 10 minutes followed by an infusion at 15 mg/kg/hour. Patients aged between 20 and 50 years, with an American Society of Anesthesiologists (ASA) physical status of I or II, were included in the study. Exclusion criteria comprised patients younger than 20 or older than 50 years, and those with a history of hypertension, diabetes mellitus, cardiovascular disease, renal or hepatic dysfunction, or classified as ASA physical status III or IV .

All participants received standard premedication with glycopyrrolate (0.01 mg/kg) and midazolam (0.1 mg/kg), followed by induction using propofol (2 mg/kg), fentanyl (2 µg/kg), dexamethasone (8 mg), and cisatracurium (0.2 mg/kg). Following induction, patients received an infusion of either lignocaine or magnesium according to the study protocol. Patients were intubated with an appropriately sized endotracheal tube. General anaesthesia was maintained with sevoflurane, adjusted to 1 minimum alveolar concentration (MAC). Intravenous cisatracurium (0.02 mg/kg) was administered as needed, based on TOF monitoring [5] . Mechanical ventilation was provided in volume-controlled mode with a tidal volume of 6–7 mL/kg and a respiratory rate adjusted to maintain end-tidal CO_2 between 35–40 mmHg. Positive end-expiratory pressure (PEEP) was set at 5 cmH_2O, using an oxygen/air mixture. Hemodynamic parameters, including heart rate and mean arterial pressure, were recorded at baseline (pre-induction), during induction, at intubation, and at 3, 5, 10, 15, 30, 45, 60, and 90 minutes post-induction, as well as at the time of extubation. The total maintenance dose of muscle relaxant required was noted. Muscle relaxant was given by monitoring neuromuscular blockade . The evoked responses at the thumb were measured by xavant stimpod nms450x nerve stimulator & TOF monitor. The maintenance dose of muscle relaxant was repeated at TOF ratio of 0.5 . Surgical field visibility was assessed every 15 minutes by the operating surgeon, who was blinded to group allocation, using the six-point Fromme–Boezaart scale. Infusion preparations were managed by an independent anesthesiologist not involved in intraoperative care or data collection to ensure blinding.

Grade	Assessment
0	No bleeding (cadaveric conditions)
1	Slight bleeding - no suctioning required
2	Slight bleeding - occasional suctioning required
3	Slight bleeding - frequent suctioning required; bleeding threatens surgical field a few seconds after suction is removed
4	Moderate bleeding - frequent suctioning required and bleeding threatens surgical field directly after suction is removed
5	Severe bleeding - constant suctioning required; bleeding appears faster than can be removed by suction; surgical field severely

Table 1 : Fromme–Boezaart scale



3. STATISTICAL ANALYSIS

All recorded data was entered using MS excel software and analysis using SPSS Statistics software v.21(IBM, Armonk, NY)software.

Quantitative data were recorded, mean ± standard deviation calculated and P value was calculated using student t test. (haemodynamic (HR,MAP) and muscle relaxant requirement)

Qualitative data were recorded and p value was calculated using Chi-square test.

$P < 0.05$ was considered statistically significant

4. RESULTS

Age, weight, gender, and ASA status were comparable between the groups with no statistically significant differences as shown in table 2 .

DATA	Mean ± SD Group L n=40	Group M n=40	P Value
AGE(years)	33.1±7.46	33.3±6.8	0.85
WEIGHT(kg)	63.7±9.4	66.6±8.6	0.152
GENDER(M/F)	21/19	22/18	0.795
ASA(I&II)	27/13	28/12	0.770

Table 2 : DEMOGRAPHICS

In the present study, baseline heart rates were comparable between the two groups. However, from induction onward, Group M (magnesium) consistently maintained significantly lower heart rates than Group L (lidocaine) at all measured time points—including induction, intubation, intraoperative intervals (3 to 90 minutes), and extubation—with all differences being

statistically significant ($p < 0.001$) as shown in table 3. These findings indicate that magnesium sulphate was more effective than lidocaine in attenuating the sympathetic response and maintaining stable intraoperative heart rate.

Time	Group	MEAN	SD	P VALUE
PRE-OP	Group L	82.525	5.67	0.939909348
	Group M	82.4	8.46	
INDUCTION	Group L	74.95	5.14	0.002768056
	Group M	71.1	5.51	
AT INTUBATION	Group L	79.375	4.19	<0.001
	Group M	70.225	5.35	
3 MIN	Group L	74.1	4.44	<0.001
	Group M	66.05	6.94	
5 MIN	Group L	71.55	3.93	<0.001
	Group M	65	5.91	
10 MIN	Group L	71.425	3.20	<0.001
	Group M	64.075	6.00	
15 MIN	Group L	71.175	2.86	<0.001
	Group M	63.775	6.41	
30 MIN	Group L	70.65	3.08	<0.001
	Group M	63.7	6.62	
45 MIN	Group L	71.925	3.06	<0.001
	Group M	63.625	6.93	
60 MIN	Group L	72.375	3.67	<0.001
	Group M	63.325	6.89	
90 MIN	Group L	72.9	3.37	<0.001
	Group M	64.475	6.73	
EXTUBATION	Group L	81.725	5.17	<0.001
	Group M	73.55	5.31	

Table 3: VARIATIONS IN HR

In the present study, baseline MAP values were similar between groups (Group L: 95.77 ± 5.7 mmHg; Group M: 96.23 ± 4.8 mmHg; $p = 0.692$). However, from induction onward, Group M (magnesium) showed significantly lower MAP at all time points. At induction and intubation, MAP was notably lower in Group M (93.3 ± 5.3 and 94.13 ± 4.7 mmHg) compared to Group L (102.4 ± 6.8 and 106.6 ± 5.6 mmHg; $p < 0.001$). This difference persisted at 3, 5, 10, 15, 30, 45, 60, and 90 minutes, as well as at extubation, with Group M consistently demonstrating lower MAP values (all $p < 0.001$) as shown in table 4. These findings indicate that magnesium sulphate was more effective than lidocaine in blunting the pressor response and maintaining stable intraoperative MAP.

Time	Group	MEAN	SD	P VALUE
PRE-OP	Group L	94.67	7.54	0.459
	Group M	93.4	7.79	
INDUCTION	Group L	80.9	4.93	<0.001
	Group M	74.5	6.34	
AT INTUBATION	Group L	95.2	7.03	<0.001
	Group M	69.25	6.39	
3 MIN	Group L	78.6	3.92	<0.001
	Group M	64	4.55	
5 MIN	Group L	74.15	3.33	<0.001
	Group M	61.72	3.65	
10 MIN	Group L	73.12	3.33	<0.001
	Group M	60.35	3.32	
15 MIN	Group L	73.35	3.79	<0.001
	Group M	59.77	3.44	
30 MIN	Group L	74	3.41	<0.001
	Group M	59.72575	4.26	
45 MIN	Group L	75	3.44	<0.001
	Group M	59.4	3.97	
60 MIN	Group L	76.72	4.35	<0.001
	Group M	60.35	3.101	
90 MIN	Group L	79.17	6.205	<0.001
	Group M	61.92	4.04	
EXTUBATION	Group L	90.7569	9.38	<0.001
	Group M	69.975	2.92	

Table 4 : VARIATIONS IN MAP

In the present study, the mean maintenance dose of muscle relaxant was significantly lower in the magnesium group (Group M: 2 ± 0.8 mg) compared to the lidocaine group (Group L: 4 ± 1.414 mg; $p < 0.001$) as shown in table 5. This indicates that magnesium sulphate effectively reduced the requirement for additional neuromuscular blocking agents during surgery.

GROUPS	MEAN (mg)	SD	P VALUE
GROUP L	4	1.414	<0.001
GROUP M	2	0.8	

Table 5 : MUSCLE RELAXANT REQUIREMENT- MD

In the present study, surgical field clarity assessed by the Fromme-Boezaart bleeding score was significantly better in the magnesium group (Group M) compared to the lidocaine group (Group L). No patients in either group scored 0 or 5. In Group M, 32.5% scored 1 and 50% scored 2, indicating improved visibility, while only 5% and 25% of Group L achieved the same scores ($p = 0.01$ and $p = 0.02$, respectively). In contrast, higher bleeding scores (3 and 4) were more frequent in Group L (45% and 25%) compared to Group M (15% and 2.5%), with both differences being statistically significant ($p = 0.003$) as shown in table 6. These findings suggest that magnesium sulphate ensured significantly better surgical field conditions during FESS than lidocaine.

BLEEDING SCORE	GROUP L	GROUP M	CHI-SQUARE	P VALUE
0	0	0		
1	2(5%)	13(32.5%)	6.19	0.01
2	10(25%)	20(50%)	5.2	0.02
3	18(45%)	6(15%)	8.4	0.003
4	10(25%)	1(2.5%)	8.43	0.003
5	0	0		

Table 6:SURGICAL FIELD-FROMME AND BOEZAART SCALE

5. DISCUSSION

In Present study Magnesium provided better control in HR and blood pressure, and operative field clarity and the amount of blood loss were significantly better in the Magnesium group when compared to the Lidocaine group.

Our limitation was a small sample size, and more studies with larger sample sizes will be needed to confirm our results. The second was postoperative magnesium sulfate, and calcium levels were not measured

Lidocaine [6] - amide anesthetics, treat ventricular arrhythmias and blunt the sympathetic responses to surgical stimuli like laryngoscopy and intubation by reducing reflex vasoconstriction and tachycardia. Hypotension has been observed to occur after submucosal and systemic injection of lidocaine.. Systemic administration of lidocaine also induces mild vasodilation and hypotension, likely via smooth muscle relaxation and modulation of central stress and pain pathways.

Magnesium [7] acts as a physiological calcium channel blocker and a noncompetitive NMDA receptor antagonist . It reduces acetylcholine release at neuromuscular junctions by competing with calcium at presynaptic sites and promotes vasodilation through enhanced prostacyclin synthesis and inhibition of angiotensin-converting enzyme activity. Stabilizes the cell membrane and intracytoplasmic organelles by mediating the activation of Na^{+}-K^{+} ATPase and Ca^{++} ATPase enzymes, which have important role in transmembrane ion exchange during the depolarization and repolarization phases . Mg^{++} inhibits the release of norepinephrine by blocking the N-type Ca^{++} channels at nerve endings which decrease the blood pressure .

Vamshidhar et al [8] (2024) found comparable hemodynamic control and surgical field clarity among magnesium sulphate, lidocaine, and propofol groups during FESS, with magnesium showing a modest reduction in muscle relaxant requirement but a longer recovery time. In contrast, the present study demonstrated that magnesium sulphate provided significantly better control of heart rate and MAP, improved surgical field visibility, and reduced muscle relaxant usage compared to lidocaine.

These differences may be due to the higher magnesium dose and the use of TOF-guided neuromuscular monitoring in our study. While Vamshidhar et al. highlighted delayed recovery with magnesium, this outcome was not assessed in our study. Overall, our findings suggest that magnesium sulphate, when optimally dosed and monitored, offers superior intraoperative advantages.

Paula-Garcia et al [9] (2021) reported that both lidocaine and magnesium sulfate contributed to hemodynamic stability during general anesthesia, with magnesium significantly prolonging neuromuscular blockade (NMB) recovery times, while lidocaine alone had no effect on NMB characteristics. In contrast, the present study, which focused on patients undergoing FESS, found that magnesium sulfate was not only more effective than lidocaine in stabilizing intraoperative heart rate and mean arterial pressure, but also resulted in a reduced requirement for muscle relaxants without observed prolongation of recovery. These differences may be due to variations in study design, patient population, dosing regimens, and surgical context. While Paula-Garcia et al. included combination therapy and longer monitoring of full NMB recovery, the current study emphasizes magnesium's superior intraoperative performance as a sole agent in improving surgical field conditions and reducing anesthetic requirements.

Eldeen et al [10] (2022) compared magnesium sulphate, lidocaine, and nitroglycerin for controlled hypotension during tympanoplasty and found that lidocaine provided the most stable hemodynamics, least blood loss, and best surgical field quality, while magnesium sulphate was less effective in those parameters but superior to nitroglycerin . In contrast, the present study conducted in patients undergoing FESS demonstrated that magnesium sulphate was significantly more effective than lidocaine in attenuating intraoperative heart rate and mean arterial pressure, improving surgical field clarity, and reducing muscle relaxant requirement. The differing outcomes may be attributed to variations in surgical site, type of anesthesia, assessment time points, and intergroup sample sizes. Notably, Eldeen et al. reported a shorter extubation time and lower complication rates with lidocaine, outcomes not assessed in the current study. These differences highlight the context-specific effectiveness of these agents, with magnesium sulphate showing greater benefit during FESS, whereas lidocaine was more effective in tympanoplasty .

6. CONCLUSION

Magnesium sulphate was more effective than lidocaine in maintaining intraoperative hemodynamic stability, improving surgical field visibility, and reducing muscle relaxant requirements during FESS. It proved to be a safe and reliable agent for achieving controlled hypotension and optimal surgical conditions.

REFERENCES

[1] Murdoch I, Surda P, Nguyen-Lu N**.** Anesthesia for rhinological surgery. *BJA Educ.* 2021;21(6):225–31. doi:10.1016/j.bjae.2021.02.004.

[2] Ryu JH, Sohn IS, Do SH. Controlled hypotension for middle ear surgery: A comparison between remifentanil and magnesium sulphate. Br J Anaesth. 2009;103:490–5

[3] Ko S. Does choice of anesthetics affect intraoperative blood loss? *Korean J Anesthesiol.* 2012;63(4):295–6. doi:10.4097/kjae.2012.63.4.295.

[4] Elsharnouby NM, Elsharnouby MM. Magnesium sulphate as a technique of hypotensive anaesthesia. Br J Anaesth. 2006;96:727–31

[5] Carvalho H, Verdonck M, Cools W, Geerts L, Forget P, Poelaert J. Forty years of neuromuscular monitoring and postoperative residual curarisation: a meta-analysis and evaluation of confidence in network meta-analysis. *Br J Anaesth.* 2020;125(4):466–82.

[6] Dunn LK, Durieux ME. Perioperative use of intravenous lidocaine. *Anesthesiology.* 2017;126(4):729–37.

[7] Fawcett WJ, Haxby EJ, Male DA. Magnesium: physiology and pharmacology. *Br J Anaesth*. 1999;83(2):302–320. doi:10.1093/bja/83.2.302

[8] Vamshidhar M, Pakhare V, Gooty S, Nanda A, Gopinath R, Kumar KD, et al. A comparative study of magnesium sulfate, lignocaine, and propofol for attenuating hemodynamic response during functional endoscopic sinus surgery under general anaesthesia: a prospective randomized trial. *Turk J Anaesthesiol Reanim.* 2024;52(5):188–95. doi:10.4274/TJAR.2024.241573.

[9] Paula-Garcia WN, Oliveira-Paula GH, de Boer HD, Garcia LV. Lidocaine combined with magnesium sulfate preserved hemodynamic stability during general anesthesia without prolonging neuromuscular blockade: a randomized, double-blind, controlled trial. *BMC Anesthesiol.* 2021;21:91. doi:10.1186/s12871-021-01311-y.

[10] Eldeen A, Saleh Z, Elattar H, Aamer R. Magnesium sulphate, lidocaine or nitroglycerin for controlled hypotension and quality of the surgical field in patients undergoing tympanoplasty. *Egypt J Hosp Med.* 2022;88:2861–70. doi:10.21608/ejhm.2022.242549.