Section: Anaesthesiology

Original Research Article

A COMPARATIVE ANALYSIS OF THE EFFECTIVENESS OF DEXMEDETOMIDINE AND MAGNESIUM SULPHATE GIVEN INTRAVENOUSLY TO REDUCE THE HEMODYNAMIC PRESSOR RESPONSE AFTER DIRECT LARYNGOSCOPY AND INTUBATION

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ABSTRACT

Background: Both tracheal intubation and laryngoscopy elicit a sympathetic and parasympathetic reaction, which may vary depending on the degree of anesthetic, duration of laryngoscopy, and characteristics of the individual patient.

Material and Methods: A randomized, design was used for this investigation. Ninety participants who provided their consent were divided into three groups of thirty people each at random.

Results: Among the ninety patients, the distribution of genders was steady and equal. Gender, age, weight, ASA, and type of surgery did not significantly differ between the groups. Between the three groups, there was no statistically significant difference in the baseline hemodynamic measurements.

Conclusion: Magnesium sulphate and dexmedetomidine both effectively reduced the physiological stress response to laryngoscopy and intubation; however, dexmedetomidine was more effective at reducing the sympathetic response.

Keywords: Haemodynamic response, laryngoscopy, endotracheal, Dexmedetomidine, magnesium.

INTRODUCTION

Intubation and direct laryngoscopy are unpleasant stimuli that might cause brief and unpredictable hemodynamic alterations. The stimulation of the laryngopharynx and trachea, which are innervated by sympathetic via the superior cervical ganglion and parasympathetic via the vagus and glossopharyngeal nerves, is what causes this reflex sympathetic discharge. Premedication, the force and length of the laryngoscopy and intubation, the level of anesthesia, and the use of any medications or techniques all affect these alterations in the pressure response. While the side effects of laryngoscopy and intubation are generally not dangerous for ASA I and II patients who are otherwise healthy, they can cause ischemia, arrhythmias, CV stroke, pulmonary oedema, and elevated intracranial pressure in patients with low cardiac compliance. Premedication stands as one of the most important components of anesthesia.[1-3] A well-planned premedication regimen can alleviate anxiety and emesis, induce drowsiness, hypnosis, analgesia, antisialagogue effect, and sympatholysis, among other pleasant preoperative psychological circumstances. Each of these is helpful in achieving a deep state of anesthesia and creating ideal conditions for direct laryngoscopy and intubation. Numerous substances and medications, including IV lignocaine, beta blockers, opioids, vasodilators, Ca+2 channel blockers, topical sprays, and volatile agents, have been tried to reduce the stress response to date, but none have shown to be the most effective. Dexmedetomidine is a powerful and highly selective θ-adrenergic agonist that also increases cardiac, respiratory, and neurological stability. Its other effects include sedation, hypnosis, anxiolysis,

analgesia, and sympatholysis. Furthermore, it reduces the release of catecholamines during surgery. Thus, the purpose of this study was to assess the safety and usefulness of IV Dexmedetomidine 1µg/kg given prior to general anesthesia operations in order to reduce hemodynamic reactions to laryngoscopy and endotracheal intubation.[4-6]

MATERIAL AND METHODS

This prospective, randomised, double-blind, placebo-controlled comparative study was conducted at Department of Anaesthesiology, Guntur Medical College, Guntur, Andhra Pradesh, India over period of May 2023 to April 2024 on 90 individuals. Prior to induction, Group A was administered intravenous normal saline as a placebo. Group B was administered 1 microgram per kilogram intravenous dexmedetomidine prior to induction, whereas Group C was given 30 milligrams per kilogram intravenous 50% magnesium sulphate before induction.

Inclusion Criteria

1. Subjects aged 18-60 years,
2. Weight 45-65 kg
3. ASA grades I and II,
4. Subjects who provided voluntary informed consent were included.

Exclusion Criteria

1. Encompassed patients with hypertension (controlled and uncontrolled),
2. Systolic blood pressure < 90 mm Hg,
3. Heart rate < 60 beats/min,
4. Coronary artery disease
5. Chronic obstructive pulmonary disease (COPD)
6. Morbid obesity
7. Renal compromise
8. Pregnant and lactating women.

RESULTS

Table 1: Demographic data between groups

	Group -A (n=30)	Group - B (n=30)	Group - C (n=30)
Gender Male	15 (50%)	13 (43.3%)	15 (50%)
Female	15 (50%)	17 (56.7%)	15 (50%)
20-30	3 (12.5%)	3 (10%)	1 (2.5%)
Age (in years) 30-40	13 (42.5%)	12 (40%)	22 (55%)
40-50	13 (42.5%)	14(46.7%)	16 (40%)
50-60 Mean weight	1 (2.5%) 58.39 ± 4.64 kg	1(3.4%) 56.96 ± 6.78 kg	1 (2.5%) 58.69 ± 6.74 kg
ASA Grading 1	15 (50%)	20 (66.7%)	15 (50%)
2	15 (50%)	10 (33.4%)	15 (50%)

Table 2: Type of surgery among the three groups

Surgery	Group -A	Group - B	Group – C	P value
Abdominal Hysterectomy	2 (6.7%)	3 (10%)	2 (6.7%)	0.9674
Appendicectomy	3 (10%)	2 (6.7%)	3 (10%)	0.9734
Breast Lump Excision	0.00%	2 (6.7%)	0.00%	0.1447
Excision Biopsy	3 (10%)	2 (6.7%)	3 (10%)	0.9428
Fibroadenoma Excision	1 (3.4%)	1 (3.4%)	1 (3.4%)	0.8656
Hemithyroidectomy	1 (3.4%)	1 (3.4%)	1 (3.4%)	0.9765
Humerus Plating	1 (3.4%)	1 (3.4%)	1 (3.4%)	0.7439
Implant Removal	1 (3.4%)	1 (3.4%)	1 (3.4%)	0.9564
Incisional Hernia Repair	3 (3.4%)	1 (3.4%)	2 (6.7%)	0.4221
Inguinal Hernia Repair	0.00%	0.00%	1 (3.4%)	0.3875
Laminectomy L4-L5	2 (6.7%)	2 (6.7%)	2 (6.7%)	0.9684
Laparotomy	3 (10%)	1 (3.4%)	3 (10%)	0.6355
Lipoma Back Excision	0.00%	1 (3.4%)	0.00%	0.3449
Mastectomy	2 (6.7%)	1 (3.4%)	2 (6.7%)	0.8247
Mastoidectomy	1 (3.4%)	1 (3.4%)	1 (3.4%)	0.9969
Myomectomy	0.00%	1 (3.4%)	0.00%	0.3345
Open Cholecystectomy	4 (13.4%)	5 (16.7%)	3 (13.4%)	0.9268
Pyelolithotomy	1 (3.4%)	1 (3.4%)	2 (6.7%)	0.8445
Ranula Excision	0.00%	1 (3.4%)	0.00%	0.3231
Submandibular Gland Excision	0.00%	1 (3.4%)	0.00%	0.3334
Split Skin Graft	1 (3.4%)	0.00%	1 (3.4%)	1
Thyroidectomy	1 (3.4%)	2 (6.7%)	1 (3.4%)	0.7233

DISCUSSION

There were no discernible variations in the groups' gender, age, weight, ASA status, or type of surgery, according to our investigation. All groups experienced an increase in heart rate following intubation. However, compared to Group A, the increase in Groups B and C was somewhat less significant. Significant increases in heart rate (HR) were observed at 1, 3, 5, 10, and 15 minutes following intubation, according to statistical analysis. Group A experienced the largest average change in heart rate, followed by Group C and Group B. Group A increased the most, from 83 to 96–97; Group C increased from 72 to 87–88; and Group B increased from 70 to 73–74. Therefore, Group A witnessed the most increase.

The data show that the effects of MgSO4 and Dexmed on heart rate are statistically significant. Our study's results verify that, between the groups, there was a significant difference ($p<0.001$) following one and three minutes of intubation [7-9].

Regarding the Lakshmi Mahajan et al. study, after receiving both magnesium sulphate and dexmedetomidine, both groups' heart rates (HR) significantly decreased over the course of 30 minutes in comparison to their baseline values. By comparison, the group that received MS did not see a substantial decrease in heart rate over a period of nine minutes, whereas the group that received dexmedetomidine did.

Compared to Groups A and C, Group B showed a significant drop in systolic blood pressure following intubation. One minute following intubation, Group B also showed a noteworthy decrease in the rate of systolic blood pressure increase. Chhaya Joshi and her colleagues observed significant variations in systolic blood pressure in each of the groups following the intubation procedure. The data suggest that while magnesium sulfate may raise systolic blood pressure, using dexmedetomidine may help to maintain stability in systolic blood pressure during intubation.[9,10] According to Lakshmi Mahajan et al.'s findings, the average systolic blood pressure (SBP) before intubation was significantly lower in both of the groups that received dexmedetomidine and magnesium sulphate. Dexmedetomidine showed the lowest systolic blood pressure (SBP) result between the two groups.

Based on our data, Group B showed a significant drop in diastolic blood pressure from the start of the surgery and during all follow-up evaluations after intubation. In contrast, there was no discernible change in DBP in the control group. The comparison of the two groups showed a statistically significant difference over all time periods.

During the induction phase of our experiment, Group B saw a significant fall in mean arterial pressure, which remained lower during all subsequent observations after intubation.[11,12]

One minute following intubation, Group B experienced a lesser increase in average arterial blood pressure. However, since the hemodynamic parameters continuously stayed below the starting level during the entire trial, dexmedetomidine showed a greater capacity to reduce the sympathetic response. Crucially, neither medication caused any side effects, including bradycardia, hypotension, xerostomia, nausea, vomiting, or arrhythmias.

The hunt for the perfect medication to lessen the hemodynamic response to laryngoscopy and intubation without having any appreciable side effects is still ongoing, despite the fact that many studies have been done in this area. This study focuses on the several factors that are impacted when patients receive dexmedetomidine, such as heart rate (HR), blood pressure, and intubation time. The hemodynamic stability of the anesthetized patients was also evaluated in this investigation. The research emphasizes the use of both drugs to maintain steady blood flow during laryngoscopy and intubation. This study reported the Mean Average Precision (MAP), a measure that was not often observed in most of the investigations, and carried out a thorough review of numerous factors.[13,14,15]

CONCLUSION

The results of our study show that magnesium sulphate and dexmedetomidine were useful in controlling the physiological stress response during laryngoscopy and intubation. Over the duration of the trial, dexmedetomidine was found to exhibit a more substantial decline in the sympathetic response, as evidenced by the hemodynamic parameters continuously remaining below the initial level. Interestingly, neither medication had any negative side effects during or right after the procedure.

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