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"A PROSPECTIVE STUDY COMPARING IV MAGNESIUM SULFATE AND IV DEXMEDITOMIDINE FOR ATTENUATING HAEMODYNAMIC RESPONSE TO LARYNGOSCOPY AND ENDOTRACHEAL INTUBATION"

Medical Science

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ABSTRACT

Introduction: Airway management for general anaesthesia implies two major events which starts with induction and intubation of trachea and concludes with emergence and extubation of trachea. Study aims to evaluate and compare the efficacy of intravenous dexmedetomidine and intravenous magnesium sulphate to attenuate the hemodynamic response during laryngoscopy and endotracheal intubation. **Materials & Methods:** This is prospective, randomised, double-blind comparative study was conducted at the Department of Anaesthesiology and Critical Care at tertiary care center over 18 months. Before induction, Group C received IV normal saline as a placebo. Group D received 0.7 ug/kg IV dexmedetomidine before induction, while Group M received 30 mg/kg IV magnesium sulphate before induction. **Results:** Gender distribution was consistent and equal among 90 patients. Gender & age did not differ significantly across groups. The three groups had no statistically significant difference in baseline hemodynamic parameters. When compared to the Control Group (C), there were statistically significant changes in hemodynamic parameters in the Dexmedetomidine (D) and Magnesium sulphate (M) groups. There was no hypotension, bradycardia, nausea, vomiting, dry mouth, or arrhythmias. **Conclusions:** Dexmedetomidine and magnesium sulphate efficiently reduced the hemodynamic stress response to laryngoscopy and intubation, although dexmedetomidine attenuated the sympathetic response more effectively. There were no drug related complications.

KEYWORDS

Dexmedetomidine, Magnesium sulphate, Intubation

INTRODUCTION

Airway management is fundamental to safe anaesthetic practice and in most circumstances is uncomplicated, but it has been recognized for many years that complications of airway management occur with serious consequences. Airway management for general anesthesia implies two major events which starts with induction and intubation of trachea and concludes with emergence and extubation of trachea. During general anesthesia, direct laryngoscopy and tracheal intubation, is capable of producing a rise in blood pressure and heart rate.[1] Hypertension and tachycardia are well documented events during intubation.[2] The stimulation of tracheal and laryngeal receptors results in release of catecholamines leading to increase in heart rate and blood pressure [3,4,5,6] This increase in heart rate and blood pressure are transitory, variable and unpredictable[3,4].It is well tolerated by healthy individuals but may be responsible for adverse events in others myocardial infarction, arrhythmia, congestive heart failure, cerebrovascular accidents, bleeding and other end organ damage [7] Patients with other comorbidities like cerebrovascular diseases, coronary artery disease, systemic arterial hypertension, diabetes mellitus,heart failure, previous arrythmias, geriatric population, are at greater risk for these events. [8,9] This development of hypertension warrants immediate assessment and treatment to reduce the risks of myocardial infarction, arrhythmia, congestive heart failure, cerebrovascular accidents, bleeding and other end organ damage. Respiratory complications associated with tracheal intubation are coughing and sore throat, laryngospasm, bronchospasm which leads to hypoxemia. Numerous ways exist to attenuate and nullify this stress response and the potential complications. It comprises pharmacological interventions such as Esmolol [10], Dexmeditomidine [11]. Dexmeditomidine is a novel alpha 2a agonist, which counteracts the haemodynamic fluctuations occurring at the time of intubation due to increased sympathetic stimulation and nor adrenergic activity. Magnesium is well known to block the release of catecholamine from both adrenergic nerve terminals and the adrenal gland, and intravenous magnesium sulphate inhibits catecholamine release associated with laryngoscopy. Moreover, magnesium produces vasodilator effect by acting directly on blood vessels, and high dose magnesium attenuates vasopressin-stimulated vasoconstriction. It also has a depressant effect on the central nervous system by antagonising N-methyl-Daspartate (NMDA) Here, in the study, intravenous magnesium sulphate and Dexmeditomidine used before intubation to alter the stress response and their effectiveness compared over various haemodynamic variables in the peri-intubation period. Since both drugs act over different receptors of sympathetic system, significance lies in comparing efficacy of both the drugs over different haemodynamic variables such as blood pressure and heart rate. Study aims to evaluate and compare the efficacy of intravenous dexmedetomidine and intravenous magnesium sulphate to attenuate the hemodynamic response during laryngoscopy and endotracheal intubation.

METHODOLOGY :

This is prospective, randomised, double-blind comparative study was conducted at the Department of Anaesthesiology and Critical Care at tertiary care center over 18 months. Inclusion criteria for the study comprised patients aged 18-60 years with MPC grades I and II, scheduled for elective surgery under general anaesthesia. Patients who provided voluntary informed consent were included. Exclusion criteria encompassed patients with uncontrolled cardiovascular disease, hepatic or renal disease, bronchospastic disease, myasthenia gravis or musculoskeletal disorder.

Sample size was calculated from mean & standard deviation of reference study with power 80%, difference in mean arterial pressure 20% of baseline value considered to be significant. About 90 eligible study subjects were enrolled and divided randomly into three groups, with 30 patients in each group (Group C, Group D & Group M) following the approval of the hospital's ethical and scientific committee. Group D' were given IV dexmedetomidine (0.7 ugm/kg), 'Group M' were given IV magnesium sulphate (30 mg/kg) & 'Group C' was control group.

Before the surgery, all patients underwent a comprehensive pre-anesthetic checkup and assessment & kept NBM atleast for 8hr. General anaesthesia was done using Inj.Fentanyl 2 ug/kg and Inj.Propofol 1.5 – 2 mg/kg. After giving Inj. Rocuronium 1 mg/kg and ventilating patient with O2 for 3 min, intubation performed with tube of appropriate size. Anaesthesia maintained with Sevoflurane MAC 1 and nitrous oxide in oxygen 50%:50% and flow rates kept at 2 lit /min. Study vitals (SBP, DBP, MAP, HR) were recorded at baseline, before giving drug, just before intubation & after intubation at 1,3,5,10 & 15 min.

For statistical analysis, the collected data were organised, tabulated, and analysed using "SPSS." Mean, median & standard deviation were calculated. T-tests were used to compare two independent groups of continuous data, while the chi-square test was utilised for comparing categorical data. The significance level was determined by comparing the calculated value with the tabulated value at a specific degree of freedom, with a p-value considered non-significant if $p > 0.05$ and significant if $p < 0.05$.

RESULTS:

Among 90 patients, the gender& age were comparable and equally

distributed. There were statistically insignificant differences in gender among the three Groups (p = 0.96). An average age of 35.03 ± 12.80 years in Group D, 29.43 ± 8.10 years in Group M and 37.8 ± 13.50 years in Group C. Among the three groups, most patients were between 18-30 and 41-50 years. There were statistically insignificant differences in age among the three Groups (p = 0.91). (Table 1)

Systolic blood pressure was statistically significantly lower in group D after induction and all-time observation after intubation compared to groups M and C (p< 0.001). The reduction in SBP in Group D was higher than in Group M. All the groups had a rise in systolic BP one minute after intubation. The increase in BP was lower in Group D and Group M compared to Group C. (Figure 1)

A statistically significant difference in DBP among groups was observed (p< 0.001) at all the time intervals after the study drug. Diastolic blood pressure was significantly lower in group D after induction and all observations after intubation compared with groups M and C (p< 0.001). The reduction in DBP in Group D was higher than in Group M. There was a rise in diastolic BP one minute after intubation in all the groups. The increase in DBP was lower in Group D and Group M compared to Group C, and the increase in DBP was much lower in Group D compared to Group M (Figure 2).

A statistically significant difference in MAP among groups was observed (p< 0.001) at all the time intervals after the study drug. Mean arterial pressure followed the same trend as systolic and diastolic blood pressure. Mean arterial pressure was significantly lower in group D after induction and all observations after intubation compared to groups M and C (p< 0.001). The amount of reduction in MAP in Group D was higher than in Group M. All the groups had a rise in mean arterial BP one minute after intubation. The increase in MAP was lower in Group D and Group M compared to Group C. The increase in MAP was much lower in Group D compared to Group M (Figure 3)

A change in heart rate was reported between the three groups, where Group D reported an increase in heart rate with a peak heart rate of 82-83 bpm, in Group M with a peak HR 83-84 bpm, and in Group C with peak HR 91-92 bpm, respectively (Figure 1). After administration of the study drugs, changes in heart rate were observed in groups D and M (P 0.00) from the control group C. Heart rates at 1, 3, 5,10 and 15 min after intubation were lower in Group D compared with Groups C and M. The increase in Groups D and M were less than the control group (p< 0.001). Statistical evaluation between the groups showed that HR changes were significant at 1, 3, 5, 10, min and 15 minutes after intubation (p< 0.05) (Figure 4).

Not in any patients, bradycardia and hypotension was reported in studies concerning the effect of dexmedetomidine and magnesium sulphate on perioperative hemodynamics. There was no incidence of other side effects like nausea, vomiting, dry mouth, or excessive sedation.

Table 1: Demographic data between groups

Socio-demographic Parameter		Group CN(%)	Group DN(%)	Group M N(%)	p Value
Gender	Male	14 (46.7%)	15 (30%)	14(46.7%)	0.96
	Female	16 (53.3%)	15 (30%)	16 (53.3%)	
Age Group (Years)	18-30	10 (33.3%)	14(46.7%)	12 (40%)	0.91
	31-40	6 (20%)	7(23.3%)	6 (20%)	
	41-50	9 (30%)	5(16.7%)	8(26.7%)	
	50-60	5(16.7%)	4(13.3%)	4 (13.3%)	

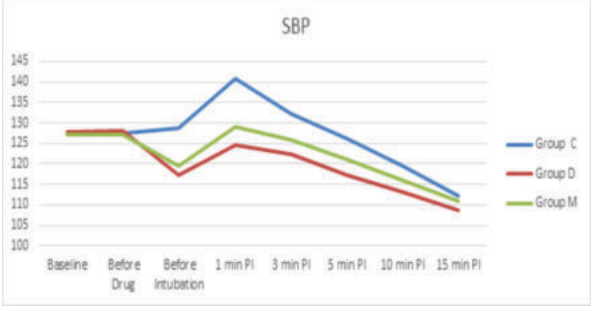

Figure 1: Mean systolic blood pressure between groups

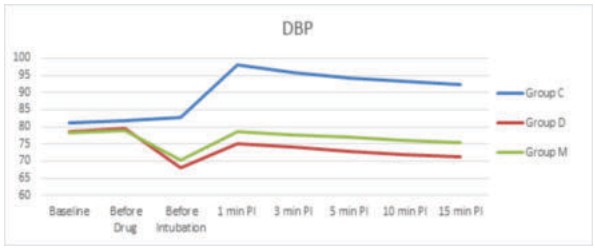

Figure 2: Mean diastolic blood pressure between groups

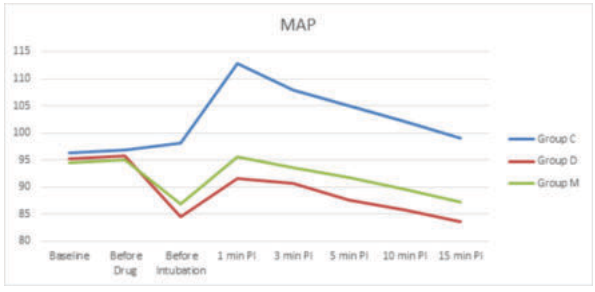

Figure 3: Mean arterial pressure between groups

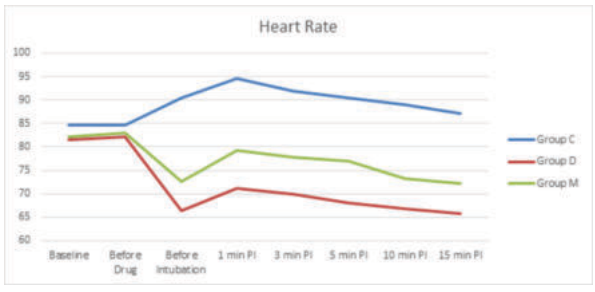

Figure 4: Mean heart rate between group

DISCUSSION –

Airway management is essential for safe anaesthetic practise and is usually straightforward, although it has long been recognised that difficulties with airway management can have catastrophic repercussions. During intubation, hypertension and tachycardia are common side effects.[1,2] There was no significant difference in gender & age. In all groups, intubation induced an increase in HR. Nonetheless, the rise in Groups D and M was smaller than in Group C. Statistical analysis revealed substantial HR increases at 1, 3, 5, 10 and 15 minutes after intubation. The change in mean HR was more in Group C, then Group M, then group D. Similar findings were observed in study conducted by Krishna Chaithanya et al.'s, the study found that Dexmedetomidine and MgSO4 substantially influenced heart rate compared to the control group. These data suggest that both Dexmedetomidine and MgSO4 have a statistically significant effect on heart rate [12] The study conducted by Chhaya Joshi et al. found that there was no significant change in heart rate before induction but a significant difference between the three groups at intubation, 2 & 5 min after intubation.[13] Dexmedetomidine and magnesium sulphate groups demonstrated a statistically significant drop in HR compared to pre-drug values up to 30 min, according to Lakshmi Mahajan et al. In contrast, the dexmedetomidine group had a statistically significant reduction in HR compared to MS for up to 9 minutes. [14]. The heart rate changes in our study were also consistent with the changes observed by Ghodki P. et al [15] & Balata et al.[16]

Group D had considerably lower systolic blood pressure after intubation than Groups M and C, with a reduced rise in SBP one minute after intubation in our research. Chhaya Joshi et al. found administering Dexmedetomidine may assist in preserving systolic blood pressure stability during intubation, but administering Magnesium sulphate may result in higher systolic blood pressure levels. [13] Similar to our findings, research by Krishna Chaithanya et al. and Chandrakala et al. found no significant variation in systolic blood pressure across groups from pre-induction to 5 minutes. [12,17]. The study conducted by to Lakshmi Mahajan et al.[14] Group D & Group M exhibited a substantial drop in mean SBP value before intubation, with Dexmedetomidine having the lowest SBP value.

Diastolic blood pressure was considerably lower in Group D during induction and all observations following intubation in our research. At the same time, Group D had a lesser rise in DBP than Group C. At any time interval (<0.05), significant variations in diastolic blood pressure between the control and Dexmedetomidine groups. However, at any interval after intubation, the group M had substantially lower diastolic blood pressure values than the control and higher than Dexmedetomidine groups. According to the study by Lakshmi Mahajan et al., Dexmedetomidine plus Magnesium sulphate had a substantial (p0.001) drop in DBP but no significant change in DBP in the control group. At all periods, the comparison of both groups was significant.[14] The study conducted by Balata A. et al found that the value of both SBP & DB were consistently below the baseline value at 10 min postintubation.[16]

Mean arterial pressure was considerably lower in Group D during induction and all observations following intubation in our research. In our research, both Dexmedetomidine and Magnesium sulfate were found to be effective in controlling the rise in heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) during laryngoscopy and intubation. However, Dexmedetomidine demonstrated superior attenuation of the sympathetic response, as the hemodynamic parameters remained below the baseline throughout the study period. Importantly, neither drug exhibited adverse effects, such as hypotension, bradycardia, nausea, vomiting, dry mouth, or arrhythmias. Even though different studies exist, the search for an ideal agent to blunt the hemodynamic response to laryngoscopy and intubation without any significant adverse effects continues. [18]

Limitation:

Due to the age range of 18-60 years in our study, the generalisation of results to patients outside this age range may not be applicable. It's essential to note that this study was conducted solely on elective surgical cases and may yield different results in emergencies. Monitoring adequate depth of anaesthesia and neuromuscular relaxation relied solely on clinical observations, which may not provide a comprehensive evaluation. We did not separately analyse hemodynamic changes associated with the two distinct stages of direct laryngoscopy and tracheal tube insertion.

CONCLUSION:

We conclude that both Magnesium sulphate and Dexmedetomidine controlled the haemodynamic response to laryngoscopy and endotracheal intubation successfully when compared with the control . Between both study drug groups, compared to group M, group D showed better attenuation of SBP, DBP, MAP and heart rate. There were no drug related complications.

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