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COMPARISON OF IV DEXMEDETOMIDINE AND IV MAGNESIUM SULPHATE IN ATTENUATING HAEMODYNAMIC EXTUBATION RESPONSE AFTER GENERAL ANAESTHESIA

Medical Education

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ABSTRACT

Dexmedetomidine is a highly selective alpha 2 adrenoceptor and an imidazole derivative. The study aims to evaluate and compare the efficacy of intravenous dexmedetomidine and intravenous magnesium sulphate to attenuate the hemodynamic response after general anaesthesia & also the side effect of both. This is prospective, randomised, double-blind comparative study. About 60 eligible study subjects participate were enrolled and divided randomly into two groups, with 30 in each group (Group D & Group M). Decrease in heart rates in Groups D was more significant than Group M ($p<0.015$). The fall in systolic BP, Diastolic BP & MAP in Groups D was not statistically significant than Group M ($p > 0.05$). Sedation score was comparable between both groups statistically insignificant till before extubation. At the time of extubation, 1 minute and 3 minutes after extubation sedation score was significantly increased in group D as compared to group M ($p <0.0001$). In present study we observed better haemodynamic stability with Magnesium sulphate and there was no postoperative sedation, and Dexmedetomidine group showed significant fall in HR (more than 20% of baseline), SBP, DBP, MAP. Dexmedetomidine showed more sedation as compared to magnesium sulphate and sedation persisted in post-operative period also. we conclude that better haemodynamic stability was maintained by Magnesium sulphate without adverse effects, whereas Dexmedetomidine group showed fall in HR, SBP more than 20% of baseline and more post-operative sedation.

KEYWORDS

Dexmedetomidine, Magnesium sulphate, Extubation,

INTRODUCTION

Laryngoscopy and tracheal intubation have become essential components of anaesthesia management and critical care since their introduction in 1921. They trigger a momentary yet significant sympathetic response. [1,2]

Laryngeal, tracheal and bronchial receptors are stimulated by mechanical and chemical irritants during laryngoscopy, intubation and extubation. The reflex increase in sympatho-adrenergic activity caused by this manipulation leads to catecholamine release, increase arterial blood pressure and heart rate. This response may lead to increased morbidity and life threatening complications.[3,4] While the exact mechanism behind this stress response remains unclear, it is widely accepted that it involves both sympathetic and parasympathetic elements. These transient effect typically occurs approximately 30 seconds after intubation and subsides within less than 10 minutes. Tracheal extubation has always received less emphasis than intubation; same precautions are seldom carried out for extubation.[5]

Approximately 5-10% of patients experience various cardiac dysrhythmias besides sinus bradycardia and tachycardia. However, most of these dysrhythmias are harmless and temporary.[6] Medical professionals have employed several approaches to mitigate these responses, including topical lignocaine spray, deep plane anaesthesia maintenance, intravenous (IV) opioids, calcium channel blockers, beta-blockers, alpha 2 agonists, and vasodilators. Despite using these methods, none have proven flawless, and the search for the ideal agent to manage the sympathetic response continues.[6,7]

There is relative lack of guidance and research regarding this key aspect of anaesthesia care. A reliable technique for rapid and smooth extubation is still not fully evolved. Several strategies are adopted to blunt the haemodynamic response to extubation like extubation under deeper plane of anaesthesia, administration of various drugs like lignocaine, esmolol, propofol, labetalol, fentanyl, calcium channel blockers and Nitroglycerine[3,4,8-13]. But all such strategies had their own limitations. For example, with opioids respiratory depression and chest wall rigidity are potential problems, calcium channel blockers produce reflex tachycardia.

Dexmedetomidine is a highly selective alpha 2 adrenoceptor agonist (alpha1:alpha2 = 1:1620) and an imidazole derivative. Alpha 2 agonist decreases the sympathetic outflow and nor-adrenergic activity thereby counteracting haemodynamic fluctuations occurring at the time of extubation. Dexmedetomidine has been recently introduced in India and not many studies have been done using the same in order to attenuate the extubation response[8]. The role of Magnesium Sulphate in blunting the haemodynamic response to endotracheal intubation is evolving. It has been shown to inhibit catecholamine release from adrenal medulla and adrenergic nerve endings. It also causes coronary vasodilatation and blocks noxious stimuli. It has been used successfully in serious atrial and ventricular arrhythmias. Effect of MgSo4 on NMDA receptors is beneficial for alleviating post-operative pain and shivering[8,9]. The study aims to evaluate and compare the efficacy of intravenous dexmedetomidine and intravenous magnesium sulphate to attenuate the hemodynamic extubation response after general anaesthesia & also the side effect of both.

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 20-55 years, weighing 40-70 kg, with ASA 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 (ASA grade 3 or more), 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 60 eligible study subjects who willingly consented to participate were enrolled and divided randomly into two groups, with 30 patients in each group (Group D & Group M) by using computer generated randomization list with allocation ratio 1:1 following the approval of the hospital's ethical and scientific committee. Group D' were given IV dexmedetomidine (0.5 ugm/kg) infusion in 100 ml normal saline over 5 minutes started 5 minutes before extubation and 'Group M' were given IV magnesium sulphate (40 mg/kg) infusion in 100 ml normal saline over 5 minutes before extubation at the end of surgery.

Before the surgery, all patients underwent a comprehensive pre-anesthetic checkup and assessment. The patients were pre-medicated with an IV Midazolam- 0.02mg/kg IV, Pentazocin- 0.5mg/kg IV Ondensetron- 4 mg IV. After preoxygenation induction of general anaesthesia was done using IV Thiopentone sodium (2.5%) 4-6 mg/kg till the loss of eyelid reflex & Suxamethonium- 2mg/kg IV given. Anaesthesia was maintained with oxygen, nitrous oxide, Isoflurane or Sevoflurane and IV atracurium 0.5 mg/kg. Neuromuscular blockade reversed with IV neostigmine (0.05 mg/kg) and glycopyrrolate (8 µg/kg). Study vitals (SBP, DBP, MAP, RR, ECG, SPO2, sedation score) were recorded before extubation, at the time of extubation, 1min, 3mins, 5mins, 10mins, 15mins after extubation. Patients observed in post anaesthesia care unit for complications. Sedation was measured by Ramsay sedation score. (RSS)

For statistical analysis, the collected data were organised, tabulated, and analysed using "SPSS." Descriptive statistics such as mean with standard deviation or proportions were presented. Mean, median, standard deviation and variance 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 60 patients, the gender, age and ASA grading were comparable and equally distributed. There were statistically insignificant differences in gender among the two Groups ($p = 0.784$).An average age of 36.86 ± 13.23 years in Group D and 41.03 ± 15.91 years in Group M. Among the two groups, most patients were between 21-30 years. There were statistically insignificant differences in age among the two Groups ($p > 0.05$). The mean weight was 60.50 ±8.83 Kg in Group D and 60.67±7.48 Kg in Group M.Most patients were ASA grade 1 compared to grade 2 among the two groups. There were statistically insignificant differences in ASA among the Groups with a p-value of 0.748. (Table 1) There was no significant difference in types of surgery between groups, with a p-value of >0.05. (Table2)

Table 1 : Demographic Data Between Groups

Demographic Parameter		Group D N (%)	Group M N (%)	Chi square	p Value
Gender	Male	09(30%)	11(37%)	0.075	0.784
	Female	21(70%)	19(63%)		
Age Group	21-30	13(43%)	09(30%)	0.646	0.422
	31-40	05(17%)	07(23%)	0.104	0.748
	41-50	07(23%)	08(27%)	0.089	1
	51-55	05(17%)	06(20%)	0.111	1
ASA Grade	I	25(83%)	23(77%)	0.104	0.748
	II	05(17%)	07(23%)		

Table 2 : Types Of Surgery Among The Two Groups

Name Of Surgery	Group D N (%)	Group M N (%)	p Value
Appendectomy	3(10%)	4(13.33%)	0.162
Cholecystectomy	4(13.33%)	3(10%)	0.162
Lipoma excision	2 (6.66%	3(10%)	218
Carcinoma	6 (20%)	7(23.33%)	0.098
Exploratory Laparotomy	4(13.33%)	5(16.66%)	0.131
Hernia Repair	3(10%)	2(6.66%)	0.218
Burn Escharotomy	1(3.33%)	1(3.33%)	0
Pleomorphic Adenoma Excision	2(6.66%)	1(3.33%)	0.351
Tonsillectomy	2(6.66%)	1(3.33%)	0.351
FESS Surgery	3(10%)	3(10%)	0

All vital parameters were reduced in Dexmedetomidine group as compared to baseline in same group, fall in HR and SBP is more significant statistically and persisted till 15 min after extubation. All vital parameters were reduced in Magnesium group also but was maintained near baseline.

After extubation, changes in heart rate were observed in groups D and M. Following extubation, the mean heart rate was lower in Groups D than in Group M (P 0.018). Heart rates at 1, 3, 5,10 and 15 min after extubation were lower in Group D compared with Groups M. Extubation caused an decrease in the HR in all the groups. However, the decrease in Groups D was more significant than Group M ($p<0.015$)(Figure 1).

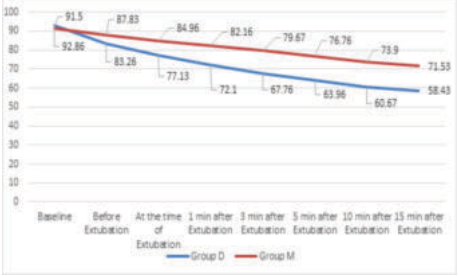

Figure 1 : Mean Heart Rate Between Group

Systolic blood pressure was lower in group D after extubation and all-time observation after extubation compared to groups M (p 0.261). The reduction in SBP in Group D was higher than in Group M. However, The fall in systolic BP in Groups D was not statistically significant than Group M ($p = 0.429$) (Figure 2).

Figure 2: Mean systolic BP Between Groups

Diastolic BP was decreased after 1 min of extubation in Group D as compared to Group M and remain to lower side all over observation period. A statistically insignificant difference among groups was observed at all the time intervals after extubation. However, The fall in diastolic BP in Groups D was not statistically significant than Group M ($p = 0.2376$) (Figure 3).

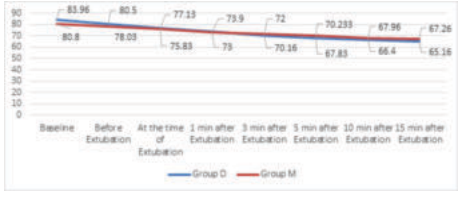

Figure 3 : Mean Diastolic BP Between Groups

All over the observation period, MAP was lower in group D as compare to Group M. A statistically insignificant difference among groups was observed at all the time intervals after extubation. (Figure 4). ($p > 0.05$)

Sedation score was comparable between both groups statistically insignificant till before extubation (Figure 5). At the time of extubation, 1 minute and 3 minutes after extubation sedation score was significantly increased in group D as compared to group M ($p < 0.0001$). We did not detect any excessive reduction in HR or BP. There was no incidence of other side effects like nausea, vomiting, dry mouth, or excessive sedation.

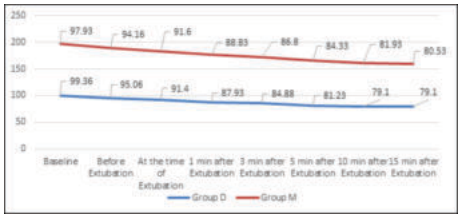

Figure 4 : Mean Arterial Pressure Between Groups

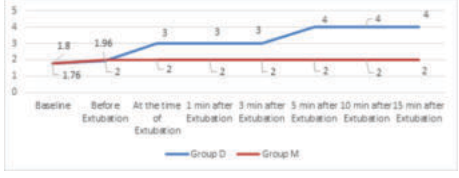

Figure 5: Change In Sedation Score In Groups

DISCUSSION

There was no significant difference in gender, age, ASA or type of surgery across groups in our study. In both group extubation induced an decrease in HR. However, fall in HR was more in Group D than Group M. Statistical analysis revealed, the heart rate was reduced more significantly in the Dexmedetomidine group till 15 minutes after extubation than in the magnesium group. The similar Finding was observed instudy conducted by Neelima Tandon et al[8] and Nirav Kotak et al.[14] According to Krishna Chaithanya et al.'s study, Dexmed and MgSO4 substantially influenced heart rate compared to the control group. These data suggest that both Dexmed and MgSO4 have a statistically significant effect on heart rate.[15] Dexmedetomidine and magnesium sulphate groups demonstrated a statistically significant

drop in HR, 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.[16] Showket Ahmad Dar et al[17] – They have observed that HR was low in Magnesium group throughout as compared to control group which was similar as reported by Suhrita Pual et al[18] , Manjushree Ray et al[19] , T O Seyhan et al[20] , Ryu JH et al[21] and Y Nakaigawa et al[22].

Mean baseline systolic blood pressure, diastolic blood pressure and mean arterial pressure was comparable between both groups. SBP was comparable till 5 minutes after extubation in study groups. At 5, 10 & 15 minutes after extubation SBP was significantly less with Dexmedetomidine as compared to Magnesium sulphate. The degree of fall in SBP was 21.15% in Dexmedetomidine group compared to 18.86% in Magnesium group. DBP and MAP in patients on Dexmedetomidine was lower than Magnesium group, though it was statistically not significant (p>0.05). Thus, DBP and MAP was comparable between both the groups during the observation period. Neelima Tandon et al [3] - Observed that SBP and DBP were remained near baseline values at the time extubation in Magnesium group (30mg/kg) and Dexmedetomidine group (0.5ug/kg) as compared to control group.[8] Similar finding was also observed in study conducted by Nooraei N et al[23] & Panda NB et al[24]

Sedation score was comparable in both groups till before extubation. At the time of extubation, 1 minute and 3 minutes after extubation sedation score was significantly increased (p= < 0.001) and 5 minutes, 10 minute and 15 minutes after extubation sedation score was very significantly increased in group D as compared to group M (p= <0.0001) which is statistically highly significant. Neelima Tandon[8] and Chitala Kishan[14] also concluded more sedation with Dexmedetomidine but Rao S G[25] did not observed sedation with dexmedetomidine, reason for this was they had used very small dose of dexmedetomidine (0.005ugm/kg).

In present study we observed better haemodynamic stability with Magnesium sulphate and there was no postoperative sedation, and Dexmedetomidine group showed significant fall in HR (more than 20% of baseline), SBP, DBP, MAP. Dexmedetomidine showed more sedation as compared to magnesium sulphate and sedation persisted in post-operative period also. Further studies in this direction are required to sketch out a role of Magnesium Sulphate, in attenuation of the Haemodynamic response after extubation.

Limitation

Due to the age range of 20-55 years in our study, the generalisation of results to patients outside this age range may not be applicable. Additionally, all patients included had ASA I & II physical status, which limits the assessment of drug effects on patients with significant comorbidities. 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. Furthermore, it's important to consider that various drugs in this study can influence hemodynamic changes, but these effects should have been specifically evaluated.

CONCLUSION

Both the drugs showed reduction in heart rate, SBP, DBP and MAP during and after extubation more with Dexmedetomidine. Sedation score was more with Dexmedetomidine as compared to magnesium sulphate. Thus we conclude that better haemodynamic stability was maintained by Magnesium sulphate without adverse effects, whereas Dexmedetomidine group showed fall in HR, SBP more than 20% of baseline and more post-operative sedation.

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