

Variations in Circulatory Responses to Laryngoscopy - Dexmedetomidine vs. Magnesium Sulphate.

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ABSTRACT

Background: The haemodynamic stress response to laryngoscopy is momentary, generally of small duration and of little significance in healthy individuals but it is lethal to those with systemic hypertension, coronary heart diseases and cerebrovascular diseases. The aim of the study is to compare the effects of Dexmedetomidine and Magnesium Sulphate on haemodynamic parameters in patients undergoing laryngoscopy and intubation in elective surgery. **Methods:** This study is the prospective, comparative study conducted on 100 patients aged between 20-50 years, with Mallampati class I or II which were randomly selected. The subjects were divided into two equal groups, A & B which received Dexmedetomidine and Magnesium Sulphate respectively. Heart rate, systolic blood pressure and diastolic blood pressure were noted at 0, 5, 10 and 15 minutes after intubation. The values of the two groups were compared and expressed as mean \pm SD. Statistical analysis was done by using Student's paired t-test for quantitative and Chi-square test for qualitative parameters. The p value of <0.05 was considered as statistically significant. **Results:** Out of the three haemodynamic parameters (Heart rate, systolic and diastolic blood pressure) dexmedetomidine and magnesium sulphate are equally effective in diminishing the blood pressure in response to laryngoscopy and intubation but, dexmedetomidine is more effective in controlling the heart rate. **Conclusion:** Both drugs lead to good haemodynamic stability both in intra and post-operative periods and may also be advantageous for governing postoperative pain.

Keywords: Dexmedetomidine, Haemodynamic, Laryngoscopy, Magnesium Sulphate.

INTRODUCTION

Laryngoscopy is endoscopy of the larynx. It is a technique that is used to acquire a vision of the vocal folds and the glottis. Laryngoscopy may be executed to enable tracheal intubation during general-anaesthesia or cardiopulmonary-resuscitation or for surgical procedures on the larynx or other parts of the upper tracheobronchial tree.^[1,2]

Hemodynamic is the dynamics of blood flow. The circulatory system is organised by homeostatic mechanisms, much as hydraulic circuits are controlled by control systems. Hemodynamic reaction continuously monitors and amends the conditions in the body and its environment. Thus hemodynamic clarifies the physical laws that govern the flow of blood in the blood vessels. The sympathetic haemodynamic stress response of cardiovascular system occurs as increase in the heart rate and the mean arterial pressure.^[3-7]

Although, this haemodynamic stress response to laryngoscopy is momentary, generally of small duration and of little significance in healthy individuals. It is lethal to those with systemic hypertension, coronary heart diseases,

cerebrovascular diseases and the complications like tachycardia, hypertension, myocardial ischemia, left ventricular failure, cardiac dysrhythmias and cerebral haemorrhage can occur.^[5,8,9]

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Many prophylactic drugs have been used to lighten the cardiovascular response to laryngoscopy and intubation including the topical and intravenous use of lignocaine, providing deep anaesthesia, use of ganglionic blockers and antihypertensive agents like beta blockers, phentolamine, sodium nitroprusside, nitroglycerine and calcium channel blockers.^[10-13] Intravenous magnesium sulphate inhibits catecholamine release associated with tracheal intubation and produces vasodilation by directly acting on blood vessels. Dexmedetomidine is a more specific and selective alpha-2 adrenergic agonist than clonidine and has a shorter duration of action. Alpha-2 adrenergic agonist stimulate alpha-2 receptors in the lateral reticular nucleus resulting in reduced central sympathetic outflow and blunting of

the haemodynamic responses to unpleasant stimulation and hence preventing the overall haemodynamic variability.^[14-19]

The present study is done to compare the effects of Dexmedetomidine and Magnesium Sulphate on haemodynamic parameters in patients undergoing laryngoscopy and intubation in elective surgery.

MATERIALS AND METHODS

This study is the prospective, comparative study done in the department of anaesthesia for the period of one year. The aim of the study was to compare the effect of Dexmedetomidine and Magnesium Sulphate on haemodynamic parameters in patients undergoing laryngoscopy and intubation in elective surgery. This study was conducted on 100 patients aged between 20-50 years, with Mallampati class I or II which were randomly selected. The written consent was taken from the patients. The subjects were divided into two equal groups, A & B which received Dexmedetomidine and Magnesium Sulphate respectively.

Inclusion criteria

- a) Age 20-50 years
- b) Patients with Mallampati class I or II
- c) Normal cardiovascular parameters in pre-anaesthetic check-up.

Exclusion criteria

- a) Age <20 and >40 years
- b) Pregnant females.
- c) Patients with pre-existing cardiac, cerebral, respiratory, endocrine, renal and hepatic disease.
- d) Positive history of drug allergies
- e) Patients with psychiatric diseases.
- f) Not giving consent for participation in study.

A detailed pre-anaesthetic evaluation and all relevant investigations were done. In operation theatre, the standard monitoring devices SpO₂, ECG, non-invasive blood pressure, temperature probe were attached to the patient and baseline parameters pulse rate, systolic and diastolic blood pressure were recorded. Intravenous access was setup with a wide bore 18G intravenous cannula over forearm. Each patient was preloaded with 10 mL/kg Ringer lactated solution over a period of 20 minutes prior to spinal anaesthesia. All patients were pre-medicated intravenously with Inj. Ranitidine 50 mg and Inj. Ondansetron 4 mg.

Group A received dexmedetomidine 1.0 µg/kg as slow IV infusion over a period of 10 minutes, 10 minutes before induction of anaesthesia and Group B received 60 mg/kg of 50% magnesium sulphate, 10 minutes before induction of anaesthesia.

Patients were induced with Inj. Pentothal (4-7 mg/kg) IV, Inj. Suxamethonium (2 mg/kg) IV and fentanyl (2 mcg/kg) followed by laryngoscopy and intubation. Only, one attempt of intubation lasting for not more than 20 seconds was accepted in the study.

Heart rate, systolic blood pressure and diastolic blood pressure were noted at 0, 5, 10 and 15 minutes after intubation. Anaesthesia was maintained with O₂, N₂O, isoflurane and Inj. Vecuronium. At the end of the surgery, patients were reversed with neostigmine 0.05 mg/kg and glycopyrrolate 0.01 mg/kg.

The values of the two groups were compared and expressed as mean ± SD. Statistical analysis was done by using Student’s paired t-test for quantitative and Chi-square test for qualitative parameters. The p value of <0.05 was considered as statistically significant.

RESULTS

This study was conducted on hundred patients in the age group of 20-50 years, which were divided into two groups (50 each). The Group A and Group B received Dexmedetomidine and Magnesium Sulphate respectively. The demographic profile of these patients was compared. The difference in parameters of the patients (Age, weight, height, BMI) were found to be statistically insignificant (p>0.05) [Figure 1].

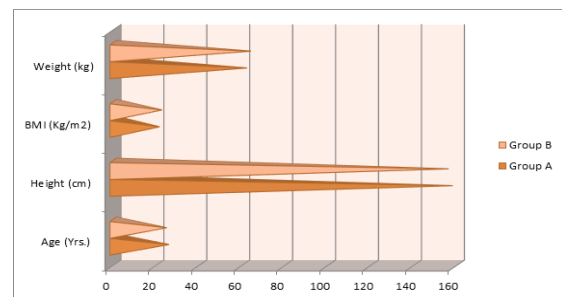


Figure 1: Comparison of demographic characteristics in two groups.

The heart rate and blood pressure were measured during laryngoscopy and intubation and after 5, 10 and 15 minutes.

Table 1: Changes in the haemodynamic parameters in both the groups.

Parameters	Group A				Group B			
	0 min	5 min	10 min	15 min	0 min	5 min	10 min	15 min
Heart rate (/min)	76.13 ±10.8	78.24 ±11.5	78.26 ±18.4	73.29 ±9.7	105.4±8.9	106.5±6.4	102.2±9.1	102.5±9.7
Systolic BP (mmHg)	116.8±9.2	120.2±9.3	120.88±8.6	116.04±14.3	122.5±14.6	124.4±15.2	122.62±15.2	120.15±8.4
Diastolic BP (mmHg)	77.6±8.7	77.1±10.5	76.8±10.2	75.8±9.5	79.5±5.6	80.4±6.5	78.22±6.3	76.32±5.5

Table 2: Statistical comparison of changes in the haemodynamic parameters in both the groups.

Parameters	Group A			Group B		
	5 min	10 min	15 min	5 min	10 min	15 min
Heart rate (/min)	<0.05*	>0.05	<0.05*	<0.05*	<0.05*	>0.05
Systolic BP (mmHg)	<0.05*	>0.05	<0.05*	<0.05*	<0.05*	<0.05*
Diastolic BP (mmHg)	>0.05	<0.05*	<0.05*	<0.05*	<0.05*	<0.05*

p value <0.05* : Statistically significant

DISCUSSION

Direct laryngoscopy and endotracheal intubation are the traumatic procedures during initiation of anaesthesia. They lead to a temporary, but prompt stimulation of the sympathetic system causing tachycardia and hypertension. In fit individuals, momentary hypertension and tachycardia are probably of not much significance, but the same may not hold true for patients with hypertension, coronary artery and cerebrovascular disease. Such patients need prophylaxis of lignocaine, providing deep anaesthesia, use of ganglionic blockers, antihypertensive agents and narcotics.^[20,21]

Alpha-2 adrenoceptor agonists diminish cardiovascular responses to laryngoscopy and endotracheal intubation. It also lessens MAC of inhaled anaesthetics by up to 50% and increases effects of opioids by exciting alpha-2 receptors in the spinal cord where they supplement endogenous opiate release and control the descending noradrenergic pathways involved in spinal nociceptive processing. Alpha-2 adrenoceptor agonists are also anxiolytic at low doses. Dexmedetomidine is a highly potent and selective alpha-2 adrenoceptor agonist. Dexmedetomidine causes a dose-dependent decrease in blood pressure and heart rate, dexmedetomidine decreases the plasma catecholamine concentrations and reduces the sympathetic nervous activity. A single intravenous dose of dexmedetomidine 1.0 µg/kg as slow IV infusion over a period of 10 minutes, 10 minutes before induction of anaesthesia attenuated the haemodynamic response to laryngoscopy and endotracheal intubation and decreased the requirement of thiopentone and isoflurane requirements.^[8,15,21]

Several studies have revealed calcium to perform a chief role in the discharge of catecholamines from the adrenal medulla and adrenergic nerve terminals after motivation by the sympathetic nervous system.^[1,9,13,19] Magnesium plays a role of calcium antagonist by competitively binding to membrane channels and can transform the responses that are mediated by calcium, hence blocking the release of catecholamine stores and decreasing responses to adrenergic stimulations. Magnesium also encourages smooth muscle relaxation by dipping accessibility of calcium in the smooth muscles cytoplasm sinking its receptiveness to noradrenaline stimulation.

Heart rate values [Table 1 & 2] were statistically significantly low in group A as compared to B and statistically significantly lower at 5 and 15 minutes.

The heart rate started to return to normal values at the end of 15 minutes post intubation. The systolic blood pressure was higher in group B with significant values in all the three 5, 10 and 15 minutes. Similar to systolic, diastolic values are also higher in group B. These findings are in agreement with that of Brill S et al.^[21]

Patient's circulatory parameters showed haemodynamic stability throughout the perioperative period and retrieval was smooth in both the groups. Reduction in the use of opioids, muscle relaxants and volatile anaesthetics in both the groups was observed. The benefits of using dexmedetomidine or magnesium sulphate premedication for dilution of cardiovascular responses to the laryngoscopy are calm administration, no significant side effects and accessibility. Also, both drugs have antinociceptive effects that may be advantageous for governing postoperative pain.

CONCLUSION

Out of the three haemodynamic parameters (Heart rate, systolic and diastolic blood pressure) dexmedetomidine and magnesium sulphate are equally effective in diminishing the blood pressure in response to laryngoscopy and intubation but, dexmedetomidine is more effective in controlling the heart rate.

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