Anesthesiology **Original Research**

International Journal of Clinical And Diagnostic Research **ISSN 2395-3403**

Volume 4, Issue 3, May-June 2016.

A COMPARATIVE STUDY BETWEEN INTRA VENOUS DEXMEDETOMIDINE AND MAGNESIUM SULFATE IN ATTENUATION OF CARDIOVASCULAR RESPONSE TO LARYNGOSCOPY AND ENDOTRACHEAL INTUBATION – A RANDOMIZED CLINICAL TRIAL

Chhaya Joshi[1*], Anilkumar Ganeshnavar[2], Shilpa Masur[3]

ABSTRACT:

Background and objective: The inappropriate response of hemodynamic parameters to endotracheal intubation (ETI) can increase perioperative and postoperative morbidity and mortality. Various pharmacological methods have been aimed to suppress this pressor response but the search for the ideal drug for attenuation of cardiovascular response during laryngoscopy and tracheal intubation continues. Dexmedetomidine is a highly selective α2 adrenoreceptor agonist and Magnesium sulfate (MgSO4) inhibits catecholamine release from adrenal glands and reduces levels of serum epinephrine and cause a decrease in the atrial contraction, bradycardia, and vasodilatation. The aim of this prospective randomised study is to compare effectiveness of Dexmedetomidine 1µg/kg and Magnesium sulfate 50mg/kg in attenuating cardiovascular response during laryngoscopy and intubation.

Methodology: One hundred and two normotensive patients aged between 18-65 years, scheduled for elective surgical procedures belonging to ASA class I and II were included in study and randomly allocated into two groups. Group D (n=51): received Dexmedetomidine 1µg/kg diluted to 10 ml normal saline, intravenously over 10 minutes, 10 minutes before intubation. Group M (n=51) received Magnesium sulfate 50mg/Kg diluted to 10ml with normal saline, intravenously over 10 minutes, 10 minutes before intubation. After premedication, study drug was administered, anesthesia was induced with propofol till loss of verbal response followed by inj vecuronium 0.1mg/kg. 3min later, laryngoscopy and intubation were done with appropriate sized Mac Intosh blade and endotracheal tube. Hemodynamic parameters of patients including systolic BP (SBP), diastolic BP (DBP), mean arterial pressure (MAP), and heart rate (HR) were recorded immediately before anesthesia induction, before endotracheal intubation(ETI), immediately after ETI, and at second and fifth minutes after ETI.

Results: It was noted that in group D the mean fall in HR, SBP,DBP and MAP at 2 and 5 minutes after intubation in Group D was statistically highly significant compared to the respective parameters in group M.

Conclusion: Injection. Dexmedetomidine at 1µg/kg significantly attenuates hemodynamic response compared to magnesium sulfate 50mg/kg.

Author Affiliations: [1,2 &3] Department of Anesthesiology, S. Nijalingappa Medical College, Bagalkot.

Keywords: *Laryngoscopy; Intubation; Cardiovascular Response; Dexmedetomidine; Magnesium sulfate*

***Corresponding Author: Dr.** Chhaya Joshi, Associate Professor, Department of Anesthesiology, S.Nijalingappa Medical College, Bagalkot. Email:drchhayajoshi1@gmail.com, Contact No: +91-9743320105.

INTRODUCTION:

In 1940, Reid and Brace first described hemodynamic response to laryngoscopy and intubation. Laryngoscopy and intubation are known to cause sympathoadrenal stimulation. This manifests as hypertension and tachycardia. Usually these transient changes have no deleterious consequences in healthy individual, but in some patients they can provoke left ventricular failure, myocardial ischemia and cerebral hemorrhage [1].

These changes are maximum at 1 min after intubation and last for 5-10 min. The factors which influence the magnitude of hemodynamic changes are the duration of laryngoscopy and intubation, the type of blades, the anesthetic agent used and the depth of anesthesia. A number of pharmacological drugs like lidocaine, esmolol, nitroglycerine, magnesium sulphate, verapamil, nicardipine and diltiazem, opioids, β-blockers, gabapentin have been used to attenuate this response [2]. The present study was conducted to study the efficacy of intravenous infusions of dexmedetomidne and magnesium sulfate in attenuating these responses. α2 agonists have been used for attenuating sympathetic response. Both clonidine and dexmedetomidine act on α1 and α2 receptors, dexmedetomidine is highly specific and selective α2 agonist with α2: α1 binding ratio of 1620:1 as compared to clonidine with 220:1[3]. Magnesium sulfate ($MgSO_4$) inhibits catecholamine release from adrenal glands and reduces levels of serum epinephrine and cause a decrease in the atrial contraction, bradycardia, and vasodilatation[4]. As the hemodynamic changes occur due to increased sympathetic activity on heart we aimed to compare an α2 adrenergic agonist Dexmedetomidine with Magnesium sulfate in attenuating cardiovascular stress response to laryngoscopy and intubation.

MATERIALS AND METHODS:

One hundred and two patients, scheduled for various elective surgical procedures under general endotracheal anesthesia, belonging to ASA class I and II with Mallampatti I and II were included in the study between 18-65 years. Patients with history of allergy or contraindications to either Dexmedetomidine or Magnesium sulfate, those with predicted difficulty in intubation, pregnancy, nursing women and morbid obesity, Coronary artery disease, ischemic heart disease, heart blocks, Diabetes mellitus and Patients with heart rate < 60 bpm and systolic blood pressure < 100 mmHg were excluded.

The study population was randomly divided into two groups with 51 patients in each group using computer generated randomized table.

Group D – Dexmedetomidine (n=51): received injection dexmedetomidine (1.0µg / kg) diluted to 10 ml with normal saline intravenously over 10 min.

Group M - Magnesium sulfate group (n=51): received Inj Magnesium sulfate 50 mg/kg diluted to 10 ml with normal saline over 10 minutes.

Institutional ethics committee clearance has been obtained. Informed consent was taken from the subjects.. Pre-anesthetic evaluation was done before surgery. A routine pre-anesthetic examination was conducted assessing: General condition of the patient, airway by modified Mallampatti grading, nutritional status and body weight of the patient and a detailed examination of the cardiovascular system and Respiratory

system. The following investigations were done in all patients: Hemoglobin estimation, urine examination for albumin, sugar and microscopy, standard 12-lead electrocardiogram, X-ray chest, blood sugar, blood urea and serum creatinine.

All patients included in the study were kept nil per orally 10 pm onwards on the previous night. On arrival of the patient in the operating room, a 20-gauge intravenous cannula was secured and connected to IV fluid ringer lactate. The patients were connected to Drager multiparameter monitor which recorded heart rate, non-invasive measurements of SBP, DBP, MAP, EtCO2 and continuous ECG monitoring and oxygen saturation. The baseline systolic, diastolic blood pressure, mean arterial pressure and heart rate were recorded after 5 mins of settling in the operative room. The cardiac rate and rhythm were also monitored from a continuous visual display of electrocardiogram from lead II.

After recording the baseline reading, all patients were premedicated with intravenous (IV) glycopyrrolate (0.005mg/kg) midazolam 0.03mg/kg, IV fentanyl (2µg/kg). Patients in group D received dexmedetomidine 1µg/kg body weight diluted in 10 ml normal saline intravenously over 10 min and patients in group M received inj. Magnesium sulfate 50 mg/kg diluted to 10 ml with normal saline over 10 minutes.

Drug preparation: 100 µg of dexmedetomidine (1ml) was added to 9.0 ml of normal saline and made to 10 ml with each ml containing 10 µg of dexmedetomidine. 1000mg of Magnesium sulfate(2ml) diluted with 8.0ml of normal saline and made to 10 ml with each ml containing with each ml containing 100mg of magnesium sulfate.

The patients were preoxygenated for 3 minutes via a face mask, anesthesia was induced with propofol (titrated till loss of verbal response). Endotracheal intubation was facilitated with IV Vecuronium 0.1mg/kg three minutes prior to laryngoscopy and intubation. Laryngoscopy and oral intubation was performed using appropriate sized Macintosh blade lasting for not more than 15 seconds and after confirmation of bilateral equal air entry, the endotracheal tube was fixed. If time for laryngoscopy and intubation exceeds 15 seconds, such patients were excluded from the study. Anesthesia was maintained using 60% nitrous oxide and 40% of oxygen with isoflurane, inj vecuronium. No surgical or any other stimulus was applied during 10 minutes of study period. At the end of the procedure patients were reversed with neostigmine 0.05 mg/kg body weight and glycopyrrolate 0.02mg/kg.

Hemodynamic parameters of patients including systolic BP (SBP), diastolic BP (DBP), mean arterial pressure (MAP), and heart rate (HR) were recorded immediately before anesthesia induction, before ETI, immediately after ETI, and at second and fifth minutes after ETI.
Hypotension was defined as SBP ≤ 20% of baseline value .Tachycardia was defined as HR > 25% of baseline value .Bradycardia was defined as HR ≤ 20% of baseline value.

Any dysrhythmia was defined as any ventricular or supra ventricular beat or any rhythm other than sinus. Incidences of all these parameters were recorded in both the groups.

Statistical analysis: The statistical software namely Microsoft excel, SPSS version 20, Open Epi version 2 were used for analysis of data and to generate graphs, tables etc.

RESULTS:

Demographic data:

Both the groups are similar in age, gender, body weight and type of surgical procedures performed.

Table-1 Comparison of mean heart rate (bpm) changes in response to laryngoscopy and intubation between group D and group M

Time	Group D	Group M	p-value	t-value
Before induction	85.78±11.85	89.64±10.54	0.085(NS)	1.7354
Immediate before intubation	71.01±11.19	75.03±8.87	0.047 (S)	2.0103
Immediate after intubation	84.03±10.83	97.76±10.40	0.000(HS)	6.5239
2min after intubation	78.07±10.53	91.09±9.26	0.000(HS)	6.6270
5min after intubation	74.52±11.04	85.98±8.91	0.000(HS)	5.7607

The mean HR decrease observed at 2 and 5 minutes after intubation in Group D was statistically highly significant compared to mean HR in group M ($p<0.000$).

Table 2: Comparison of mean systolic blood pressure (mmHg) changes in response to laryngoscopy and intubation between group D and group M

Time	Group D	Group M	p-value	t-value
Before induction	126.64±13.17	129.17±12.44	0.321(NS)	0.9968
Immediate before intubation	103.45±12.23	108.70±12.54	0.0347(S)	2.1410
Immediate after intubation	116.05±13.04	136.37±14.24	0.000(HS)	7.5104
2min after intubation	108.74±11.56	128.29±12.65	0.000(HS)	8.1431
5min after intubation	102.84±11.50	120.8±13.30	0.000(HS)	7.3085

The mean fall in SBP in group D at 2 and 5 minutes after intubation was statistically highly significant ($p=0.000$) compared to group M.

Table 3: Comparison of mean DBP (mmHg) changes in response to laryngoscopy and intubation between group D and group E

Time	Group D	Group M	p-value	t-value
Before induction	81.82±10.00	81.32±7.81	0.800(NS)	-0.2537
Immediate before intubation	72.15±11.65	73.92±7.68	0.374(NS)	0.8919
Immediate after intubation	67.76±9.61	71.13±8.11	0.053(NS)	1.9560
2min after intubation	69.86±9.47	79.68±6.88	0.000(HS)	5.9906
5min after intubation	66.92±8.99	75.70±6.78	0.000(HS)	5.5682

The fall in mean DBP values at 2 and, 5 minutes of intubation were statistically highly significant (p=0.000) in group D compared to group M.

Table 4: Comparison of mean of MAP (mmHg) changes in response to laryngoscopy and intubation between group D and group E

Time	Group D	Group M	p-value	t-value
Before induction	96.41±10.86	97.09±9.19	0.731(NS)	0.3443
Immediate before intubation	84.17±12.31	86.90±8.56	0.197(NS)	1.2977
Immediate after intubation	79.45±10.39	83.21±9.07	0.053(NS)	1.9537
2min after intubation	82.31±10.27	95.68±8.32	0.000(HS)	7.2431
5min after intubation	78.68±10.16	90.45±8.91	0.000(HS)	6.2149

The fall in mean MAP values in group D at 2 and 5 minutes of intubation were statistically highly significant (p<0.0000001) compared to group M.

Discussion:

Hypertension and tachycardia subsequent to tracheal intubation have been well documented. In susceptible patients even this short period (2-7 minutes) of hypertension and tachycardia can result in myocardial ischaemia or increased intracranial pressure. Complications resulting from these haemodynamic events after intubation include left ventricular dysfunction, hypertensive crises, pulmonary oedema, cardiac dysrhythmias, myocardial ischaemia and myocardial necrosis.

Many agents have been used to attenuate undesirable haemodynamic responses to laryngoscopy and intubation with varying success. These include intravenous opioids, vasodilators, calcium channel blockers, intravenous and topical lignocaine and adrenoceptor blocking drugs alone or in combination with other drugs [1].

In the present study dexmedetomidine was compared with magnesium sulphate as very few studies are available using them as infusion. The study group included group D (n= 51), who received Dexmedetomidine (1.0 mg/kg), and group M (n =51), received Magnesium sulphate (50mg/kg) diluted to 10 ml with normal saline.

Both the groups were comparable and there was no statistically significant difference with respect to mean age, weight, gender and type of surgery.

In the present study, the fall in HR was statistically highly significant in group D immediately after intubation, 2 minutes after intubation and 5 minutes after intubation compared to group M. The mean fall in SBP in group D immediately after intubation, at 2 minutes and 5 minutes after intubation was statistically highly significant (p=0.0001) compared to group M. Hence dexmedetomidine decreases the cardiac energy requirements better than magnesium sulphate at the above mentioned doses. Study by Naveed nurai et al., Magnesium sulfate is more effective than lidocaine in controlling hemodynamics, although it may increase the heart rate[5].

The fall in mean DBP values at 2 and 5 minutes of intubation were statistically highly significant (p=0.0001) in group D compared to group M. The fall in mean MAP values in group D at 2 and, 5 minutes of intubation were statistically highly significant (p<0.0000001) compared to group M. Scheinin B [6] et al., in 1992, conducted a study on 24 ASA I patients undergoing elective surgery under general endotracheal anesthesia to know the effects of dexmedetomidine in attenuating sympathoadrenal response to tracheal intubation. It is observed that during surgery arterial pressure and heart rate remained slightly less in dexmedetomidine group than control group. We have found a greater fall in the HR, SBP, and DBP than Jaakola's study due to higher dose of dexmedetomidine used.[7] Our results concur with study conducted by Keniya et a[8]who found a significant fall in HR and BP with use of 1mg/kg dexmedetomidine (p=0.000). We noticed 10% incidence of hypotension and a fall in heart rate in 6% of study group in group D which did not require any intervention.

CONCLUSION:

From our study we observed that Dexmedetomidine 1mg/kg was more effective in attenuation of cardiovascular response to laryngoscopy and intubation when compared to magnesium sulphate 50 mg/kg.

Conflict of Interest: None

REFERENCES:

1. P Gupta, B Panda, R Verma, P Ranjan, S Mathur, G Sinha. Attenuation of Haemodynamic Responses to Laryngoscopy &Intubation following Nitroglycerin and Esmolol infusion. The Internet Journal of Anesthesiology. 2009; 22(2).

2. Soniya R. Sulhyan,Anand T. Vagarali,Sharangouda S. Patil,Mahadev D. Dixit A comparative clinical study of dexmedetomidine versus placebo to attenuate hemodynamic response to endotracheal intubation in patients undergoing off pump coronary arterial bypass grafting. www.jscisociety.com on Monday, April 25, 2016, IP: 117.240.188.177]

3. Scheinin B, Lindgren L, Randell T, Scheinin H, Scheinin M. Dexmedetomidine attenuates sympathoadrenal response to tracheal intubation and reduces the need for

thiopentone and perioperative fentanyl. Br J Anaesth 1992;68:126-31.

4. Azim Honarmand, Mohammadreza Safavi, Sajad Badiei, and Neda Daftari-Fard Different doses of intravenous Magnesium sulfate on cardiovascular changes following the laryngoscopy and tracheal intubation: A double-blind randomized controlled trial
J Res Pharm Pract. 2015; 4(2): 79–84.

5. Navid Nooraei 1, Masih EbrahimiDehkordi 1, Badiozaman Radpay 2,Hooman Teimoorian 1, Seyed Amir Mohajerani 2013 NRITLD, National Research Institute of Tuberculosis and Lung Disease, IranISSN: 1735-0344 Tanaffos 2013; 12(1): 57-63

6. Scheinin B, Lindgren L, Randell T, Scheinin H, Scheinin M. Dexmedetomidine attenuates sympathoadrenal response to tracheal intubation and reduces the need for thiopentone and perioperative fentanyl. Br J Anaesth 1992;68:126-31.

7. Jaakola ML, Ali-Malkkila T, Kanto J, Kallio A, Scheinin H, Scheinin M. Dexmeditomidine reduces intraocular pressure, intubation response and anesthetic requirement in patients undergoing ophthalmic surgery. Br Journal of Anesth 1992; 68: 570-5.

8. Keniya VM, Ladi S, Naphade R. Dexmeditomidine attenuates sympathoadrenal response to tracheal intubation and reduces perioperative anesthetic requirement. Indian J Anesth 2011; 55:352-7.