

Comparison between haemodynamic changes during induction with different muscle relaxant's in patients of mitral stenosis undergoing mitral valve replacement

Pradeep Dhumane^{*} and Nilofar Shakir

Department of Anesthesia, Government Medical College and Hospital, Nagpur, Maharashtra, India- 440001

***Correspondence Info:**

Dr. Pradeep Dhumane
Department of Anesthesia,
Government Medical College and Hospital,
Nagpur, Maharashtra, India- 440001
E-mail: sachinhiradeve@gmail.com

Abstract

Aim and Objectives: Aim of the present study was to evaluate different haemodynamic changes between the muscle relaxant's (vecuronium and atracurium) and to compare them for their better haemodynamic stability in patients of mitral stenosis undergoing mitral valve replacement.

Methods: The study enrolling 60 patients of either sex, age between 18-60 years belonging to ASA Grade I, II and III was undergoing elective mitral valve replacement who were randomly assigned into two groups of 30 patients each. Group V received 0.16 mg/kg vecuronium and group A received 0.75 mg/kg atracurium as muscle relaxants at the time of induction with thiopentone (5 mg/kg). Haemodynamic parameters monitored for comparison include HR, SBP, DBP, MAP, CVP, SPO2 and ETO2.

Result: There was significant increase in HR after administration of atracurium when compared to vecuronium. In both the groups, there was fall in blood pressure but fall was more with atracurium than vecuronium. We found no change in SPO2 after induction in both the groups. There was fall in CVP and ETCO2 from baseline but difference was not statistically significant.

Conclusion: Vecuronium is better neuromuscular relaxant for haemodynamic stability than atracurium in higher doses in patients of mitral stenosis undergoing mitral valve replacement.

Keywords: Haemodynamics, Vecuronium, Atracurium, Mitral stenosis, Mitral valve replacement.

1. Introduction

Mitral stenosis is the most common valvular lesion in India, which requires cardiac surgery and hence the role of specialized cardiac anaesthesia is significant, as various haemodynamic changes occur at the time of induction, intubation, intraoperatively and postoperatively. Mitral stenosis is the condition where the normal valvular cross sectional area is decreased, the severity of mitral stenosis is assessed by cross sectional area of the valve leads to various haemodynamic changes in patient's intra and postoperatively. The various haemodynamic changes that complicate mitral stenosis includes: atrial fibrillation, pulmonary edema, decrease cardiovascular compliance. Hence in such patients following complications are to be avoided:

1. Bradycardia because of relatively fixed stroke volume
2. Tachycardia because this causes decrease diastolic filling time and cause large increase in left atrial pressure and precipitate pulmonary edema.

3. Vasodilation leading to hypovolemia.

To achieve these goals, a balance between the premedication, relaxants and inducing agents, intraoperatively is to be maintained to minimize the complications caused by drugs and disease itself and maintain the haemodynamic stability of patients with mitral stenosis under going mitral valve replacement.

In muscle relaxants haemodynamic changes are common due to histamine release and vasodilatation leading to hypotension. Hence, the haemodynamic effects of the drug is an important criteria used by clinicians while selecting a particular neuromuscular blocking agent. The older generation neuromuscular blocking agents like tubocurarine, alcuronium and pancuronium are well known for their profound haemodynamic effects produced either by autonomic changes or by histamine release. Particularly, pancuronium has been widely used and is

associated with significant increase in heart rate and mean arterial pressure due to its sympathomimetic and vagolytic effect [1]. A need of ideal neuromuscular blocking agents with rapid onset, brief duration and favorable recovery associated with haemodynamic stability led to development of great number of non depolarising muscle relaxants.

Introduction of vecuronium in 1979 [2], atracurium in 1981 [3] considerably improved flexibility in clinical administration of muscle relaxants due to their intermediate duration of action, favorable recovery and good haemodynamic stability. However, there have been reports of bradycardia with vecuronium and histamine release causing hypotension with atracurium [4,5]. Taking in to consideration the availability and ease of administration study was undertaken to compare the haemodynamic effects of both drugs i.e. vecuronium and atracurium.

2. Materials and Methods

Sixty patients of either sex, age between 18-60 years belonging to ASA grade I, II and III undergoing elective mitral valve replacement surgery were prospectively studied after obtaining approval from the hospital ethics committee. Informed consent was obtained from each patient. Patients were randomized into two groups of 30 patients each. Group V received 0.16 mg/kg vecuronium bromide and group A received 0.75 mg/kg atracurium as muscle relaxants. Patients having moderate mitral regurgitation and moderate pulmonary hypertension were included in the study. Patients with ASA grade IV, age less than 18 years and more than 60 years, patients with severe mitral regurgitation, severe pulmonary hypertension and systemic hypertension were excluded from the study. A detailed pre-anaesthetic evaluation including history and a thorough general and systemic examination and all relevant investigations were done for all the patients. All patents were fasted for at least 6 hours and received ranitidine 150 mg and diazepam 10 mg a night before surgery.

On operation theatre, multipara monitors- ECG, SPO₂ probe were applied to the patient and baseline parameters like pulse rate, blood pressure, respiratory rate, Spo₂ were recorded. Intravenous access was obtained with 18 G venous canula and patient preloaded with 5 ml/kg of Ringer Lactate solution. All patients were premedicated with ranitidine 50 mg and dexamethasone 8 mg and sedated with midazolam 0.05 mg/kg and fentanyl 1 ug/kg. Anaesthesia was induced with thiopentone 5 mg/kg and muscle relaxation was given with vecuronium 0.16 mg/kg and atracurium 0.75 mg/kg. After receiving muscle relaxants patients ventilated for 5 minutes on bag and mask with oxygen. Patients were intubated with

appropriate endotracheal cuffed tube. Bilateral equal air entry confirmed on auscultation and endotracheal tube secured and maintained on O₂ + N₂O inhalation agent according to availability (isoflurane / sevoflurane). The haemodynamic parameters such as heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MBP), SPO₂, central venous pressure (CVP), ETCO₂ were measured at different intervals- preoperatively, after premedication, at induction and every minute after induction up to 5 minutes. Data was collected from both the groups, tabulated and analyzed. P<0.05 was considered as statistical significance.

3. Observations and Results

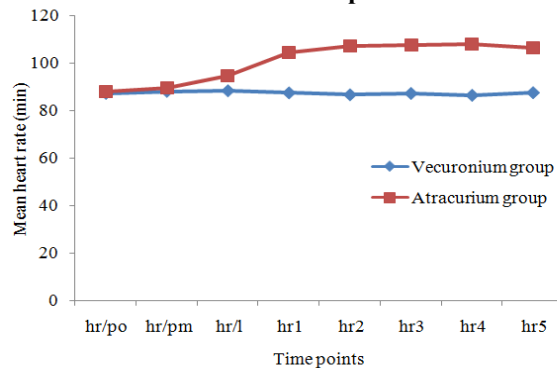
Sixty patients were selected for the study, divided into group 'V' and group 'A'. In group 'V' there was 53.33% females and 46.66% males whereas in group 'A' there were 43.33 % females and 56.66% males. The mean age of patient in Vecuronium and Atracurium group was 29.87±9.39 years and 34.16±11.32 years respectively. The mean weight of patients in group 'V' was 49.00±8.59 kg and in group 'A' was 52.23±8.74 kg. Demographic characteristics was comparable in both the groups and difference was not statistically significant (p>0.05) (Table 1).

Table- 1: Demographic Data of the Patients

Variable	Group V	Group A	P Value
Age (years)	29.87±9.39	34.16±11.32	0.11
Weight (kgs.)	49.00±8.59	52.23±8.74	0.16
Sex (Male/Female)	14/16	17/13	0.60

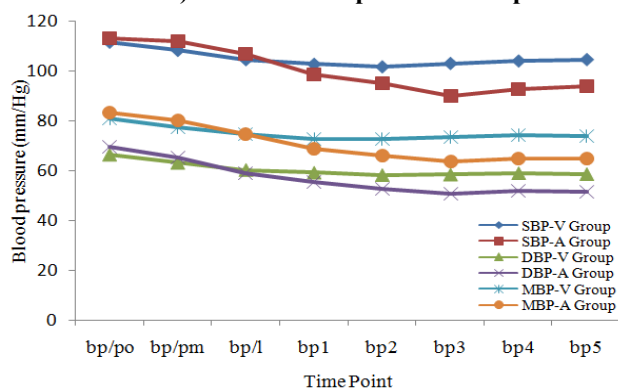
We observed fall in heart rate from baseline after administration of vecuronium but fall was not statistically significant, however after administration of atracurium there was increase in heart rate which was statistically significant. In present study 16 (53.33%) patients had tachycardia after administration of atracurium. Thus it was observed that there was significant increase in HR after administration of atracurium when compared to vecuronium in patients of mitral stenosis undergoing mitral valve replacement, (Figure 1).

Figure 1: Comparison of Heart Rate between Group V and Group A



There was fall in blood pressure (SBP, DBP and MAP) after administration of vecuronium and atracurium after induction from baseline but fall in BP was more with atracurium than vecuronium. In group A fall in SBP, DBP and MAP observed in 7(23.33%) patients after induction and which was statistically significant and required treatment (Figure 2).

Figure 2: Comparison of Blood Pressure (SBP, DBP and MAP) between Group V and Group A



We found no change in SPO2 after induction in both the groups and were statistically not significant. There was fall in CVP and ETCO2 from baseline after induction in both the groups but when compared they were not statistically significant.

4. Discussion

Neuromuscular blocking drugs are in use since last 60 years of anaesthesia practice. Though they were introduced with intention to facilitate endotracheal intubation and provide good surgical muscle relaxations, these drugs are not devoid of side effects. These agents are well known for their haemodynamic instability which can be either due to autonomic effects or histamine release property of drugs. The autonomic effects are mediated by sympathomimetic, vagolytic actions (Pancuronium, Alcuronium). The clinical manifestations can be tachycardia, hypertension and hypotension. These autonomic effects are dose related and are added overtime if divided doses are given. Histamine release property of neuromuscular blocking drugs is more common in benzyloquinolone compounds i.e. Atracurium and Mivacurium [4,5].

In the present study atracurium and vecuronium were compared regarding their CVS effects in patients of mitral stenosis. As we require muscle relaxant with maximum haemodynamic stability. Since in use, vecuronium had been considered gold standard in view of its haemodynamic stability and is devoid of any autonomic effects or histamine release property. It can be beneficial in patients of low coronary artery reserve, cardiac valvular lesion, especially stenotic lesions [6]. Atracurium is also an intermediate acting neuromuscular blocker with

favorable recovery and clinical acceptable cardiovascular stability. It produces increase heart rate and causes hypotension with larger dose i.e. three times the ED95. The advantages of atracurium include rapid onset of action, metabolism by Hoffman's elimination, clinically acceptable cardiovascular stability. Hence considering wide clinical application availability of few studies, these drugs were selected and compared the haemodynamic effects in patients of mitral stenosis as muscle relaxant with good intubating condition and maximum haemodynamic stability was required in these patients.

The baseline HR in group V and in group A was 87.37 ± 16.49 and 88.17 ± 17.62 respectively. After administration of muscle relaxant the mean heart rate decrease from baseline in group V but was found to be not significant. Maximum fall in HR was found after 3 min of induction. In group A there was increase in heart rate 1 min after induction. The increase in heart rate was more 3 min after induction was highly significant. To summarize heart rate response after induction, it was observed that there was increase in HR with atracurium which was statistically significant than vecuronium in patients of mitral stenosis. We observed that there was increase in heart rate with larger doses of atracurium i.e. 3 times ED after induction whereas fall in heart rate up to 0.96% after induction with vecuronium which was statistically non significant. Although there was non significant fall in heart rate after inducing with vecuronium in a dose 3 times the effective dose. In the present study, it was observed that there were non significant haemodynamic changes in patients after induction with vecuronium and significant haemodynamic changes after induction with atracurium i.e. significant increase in heart rate, which correlated with increase in histamine release. Our findings compare with different studies. [4,6-10].

After administration of vecuronium there was fall in SBP, DBP and MAP from baseline with maximum fall was seen after 2 minutes of administration of drug i.e. up to 9%, 14% and 11.6% respectively, which was statistically significant but did not required any treatment. While in group A there was fall in SBP and DBP after induction, with maximum fall up to 25% and 37% respectively after 2 minutes of administration of drug while maximum fall in MAP up to 30.7% after 3 minutes of administration of drug, which was statistically significant and required treatment. When both the groups were compared the maximum fall in BP was higher in atracurium group than vecuronium group and which was statistically significant after induction in patients of mitral stenosis undergoing mitral valve replacement. These results were correlated with various studies [11-13].

Thus it was observed that there was significant increase in heart rate and fall in blood pressure after

induction with atracurium while no significant change was seen after induction with vecuronium, however cardiac index and SVR were not studied.

We found no significant change in SPO₂ after administration of drug from baseline. When both the groups were compared there was no statistically significant difference found in SPO₂. CVP was fall from baseline in both the groups but fall was not statistically significant, this result was compare with the study of Maharaj *et al* [14]. After administration of vecuronium and atracurium we observed maximum fall in ETO₂ up to 2.21% and 2.53% respectively from baseline, when comparing both the groups the difference was not statistically significant, our finding correlate with finding of Puri *et al* [15].

Postoperatively all patients were extubated on same day after returning of all reflexes and consciousness. All patients were stable postoperatively. During the study period it was observed that 16 patients had tachycardia >100/min after induction which was managed with IV fentanyl 1 µg/kg after induction of atracurium. There was hypotension in 7 patients which needed treatment with inotropic agents after induction of atracurium. We did not observe any evidence of arrhythmia in any patient.

5. Conclusion

In present study, vecuronium used as a muscle relaxant provide good intubating condition, maximum haemodynamic stability, intermediate duration of action and favorable recovery in patients of mitral stenosis undergoing mitral valve replacement. Because of these advantages make it suitable drug for many cardiac surgery. Thus vecuronium is better neuromuscular relaxant for haemodynamic stability than atracurium in higher doses in patients of mitral stenosis undergoing mitral valve replacement.

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