

## COMPARISON OF HEMODYNAMIC STABILITY WITH CISATRACURIUM AND ATRACURIUM IN PATIENTS WITH LOW EJECTION FRACTION UNDERGOING CORONARY ARTERY BYPASS GRAFTING

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### ABSTRACT

**Objective:** To compare the hemodynamic stability with cisatracurium and atracurium in patients with low ejection fraction undergoing coronary artery bypass grafting.

**Study Design:** Randomized controlled trial.

**Place and Duration of Study:** Department of Anesthesiology, Army Cardiac Center, Lahore, from Jan 2018 to Nov 2018.

**Methodology:** A total of 80 adult patients were recruited or invited to participate in this study. Further the cohort was divided in to two groups with respect to their treatment by draw method. Group I contained a total of 40 patients, which were given Cisatracurium 0.2mg/kg at induction of anesthesia. The group II patients constitute the same number but the treatment medication given was 0.5mg/kg Atracurium at induction.

**Results:** Before anesthesia induction, pulse rate was  $84.10 \pm 5.54$  bpm and  $83.01 \pm 5.72$  bpm in group A and B, respectively ( $p=0.385$ ). At 4 minutes after anesthesia induction, pulse rate was  $83.05 \pm 5.58$  bpm and  $86.37 \pm 6.62$  bpm in group A and B, respectively ( $p=0.017$ ). Before anesthesia induction, mean arterial pressure was  $71.07 \pm 7.62$  mmHg and  $69.22 \pm 10.77$  mmHg in group A and B, respectively ( $p=0.378$ ). At 4 minutes after anesthesia induction, mean arterial pressure was  $68.22 \pm 8.17$  mmHg and  $72.20 \pm 8.09$  mmHg in group A and B, respectively ( $p=0.032$ ) table-II.

**Conclusion:** We may conclude from our study that although there is significant difference of the change in arterial blood pressure due to the both drugs. The group A was having more stable hemodynamic indexes where the drug administrated was Cisatracurium.

**Keywords:** Atracurium, Cisatracurium, Coronary artery bypass grafting, Ejection fraction, Hemodynamic.

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### INTRODUCTION

During induction of anesthesia many depolarizing and non depolarizing agents are used in order to ease the tracheal intubation and also to ascertain optimum muscular relaxation when patients are undergoing surgery. With the aim to create a muscle relaxant which had no renal or hepatic effects, atracurium was developed as it is a non depolarizing agent with minimal adverse effects and intermediate duration of action. Even though atracurium is an ideal drug with intermediate duration of action it also has limited histamine releasing characteristics, therefore, large and rapid boluses of atracurium cannot be administered<sup>1</sup>.

Use of muscle relaxants is widely common

in many surgeries including general surgery for induction as well as maintenance of muscle relaxation<sup>2,3</sup>. The first and foremost use of muscle relaxants was done in 1942 and afterwards it was made necessary for all the surgical procedure undergoing in general anesthesia<sup>3,4</sup>. Muscle relaxants results in hemodynamic changes via the mechanism of releasing of histamine and ganglion blocks which in turn results in antimuscarine effects. Atracurium is a popular muscle relaxant all over the world. However atracurium does have a drawback as it also results in histamine release and results in hemodynamic changes which are not desired in patients with diseases of cardiovascular system<sup>5,6</sup>.

Cisatracurium is an isomer of atracurium. Its edge over atracurium is that it causes very low amount of histamine release and therefore results

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in minimal hemodynamic changes<sup>7-9</sup>. The release of histamine by muscle relaxants can cause severe tachycardia, hypotension and erythema of face and head. The greater the dose of the given drug the greater is the adverse effects. Severity of these side effects also depends on the speed of action of certain drug<sup>9,10</sup>.

Study of the literature shows that, very few studies have been done regarding the comparison of atracurium and cisatracurium in terms of their hemodynamic effects, especially in patients with low ejection fraction and undergoing coronary bypass graft surgery. No local study could be found regarding hemodynamic comparison of atracurium and cisatracurium in coronary artery bypass graft surgery of patients with low ejection fraction. Therefore we are performing this study so that better recommendations can be made regarding muscle relaxant to be used in such patients undergoing general anesthesia.

## METHODOLOGY

It is a randomized control trial which was conducted in department of Anesthesia, Army Cardiac Center, Combined Military Hospital, Lahore, from January 2018 to November 2018. Ethical approval for this study was taken from the ethics board of the institute. Sample size was calculated using the reference study<sup>10</sup>. Non probability consecutive type of sampling technique was used to collect the sample. A total number of 80 patients were included in this study after taking informed consent from each patients or their guardian. Lottery method was used to divide the patients into two equal groups, i.e. group A and group B. Group A consisted of 40 patients in which cisatracurium at the dose of 0.2mg/kg was used at the time of induction of anesthesia. Similarly in group B 40 patients were administered with atracurium at the dose of 0.5mg/kg at the time of induction of general anesthesia. Other than that similar protocol was given to all patients for induction of general anesthesia i.e. morphine at dose of 0.2mg/kg and propofol at dose of 2mg/kg. Maintenance of anesthesia was done with isoflurane at the dose of 1.2%.

Exclusion of patients was done on the following criteria; patients with heart blocks, patients with normal ejection fraction, patients with arrhythmias, patients with intra aortic balloon pump, patients undergoing emergency surgeries and patients undergoing surgeries without the use of cardiopulmonary bypass. All patients aged 40 to 60 belonging to either gender and having LV ejection fraction of 35% or lower were included in this study. A designed performa was used to record all the demographic as well as hemodynamic changes of the patients after the administration of the drugs. All the data was measured and recorded by the researcher himself. Heart rate, mean arterial blood pressure etc were noted before the induction of general anesthesia and also at 2nd minute and 4th minute after the induction or administration of the muscle relaxant (cisatracurium/atracurium).

## RESULTS

Mean age and weight were  $50.77 \pm 4.37$  years and  $60.01 \pm 6.68$  kg in group-A while  $50.37 \pm 5.34$  years and  $62.40 \pm 7.85$  kg in group-B ( $p$ -value= 0.715 and 0.145), respectively. History of beta blocker use was 37.5% and 32.5% in group A and B, respectively ( $p=0.639$ ). History of smoking and diabetes mellitus were present 40% and 35% of group-A patients while in 47.5% and 40% of group-B patients ( $p=0.499$  and 0.644), respectively (table-I).

Before anesthesia induction, pulse rate was  $84.10 \pm 5.54$  bpm and  $83.01 \pm 5.72$  bpm in group A and B, respectively ( $p=0.385$ ). At 2 minutes after anesthesia induction, pulse rate was  $83.25 \pm 5.95$  bpm and  $85.72 \pm 5.26$  bpm in group A and B, respectively ( $p=0.052$ ). At 4 minutes after anesthesia induction, pulse rate was  $83.05 \pm 5.58$  bpm and  $86.37 \pm 6.62$  bpm in group A and B, respectively ( $p=0.017$ ). Before anesthesia induction, mean arterial pressure was  $71.07 \pm 7.62$  mmHg and  $69.22 \pm 10.77$  mmHg in group A and B, respectively ( $p=0.378$ ). At 2 minutes after anesthesia induction, mean arterial pressure was  $69.30 \pm 6.47$  mmHg and  $66.53 \pm 7.55$  mmHg in group A and B, respectively ( $p=0.082$ ). At 4 minutes after anesthesia

induction, mean arterial pressure was  $68.22 \pm 8.17$  mmHg and  $72.20 \pm 8.09$  mmHg in group A and B, respectively ( $p=0.032$ ) (table-II).

ED95 (effective dose at which 95% patients become unresponsive) which is almost 0.3mg/kg, it does not alter the arterial blood pressure and

**Table-I: Demographic data.**

Variable	Group-A	Group-B	p-value
Age (years)	$50.77 \pm 4.37$	$50.37 \pm 5.34$	0.715
Weight (kg)	$60.01 \pm 6.68$	$62.40 \pm 7.85$	0.145
History of Beta blocker use	15 (37.5%)	13 (32.5%)	0.639
Smoking history	16 (40.0%)	19 (47.5%)	0.499
Diabetes Mellitus	14 (35.0%)	16 (40.0%)	0.644

\*Data is entered as mean  $\pm$  SD or number (Percentage)

**Table-II: Hemodynamics data.**

Variable	Group-A	Group-B	p-value
<b>Pulse Rate, Bpm</b>			
Before anesthesia induction	$84.10 \pm 5.54$	$83.01 \pm 5.72$	0.385
At 2 min after induction	$83.25 \pm 5.95$	$85.72 \pm 5.26$	0.052
At 4 min after induction	$83.05 \pm 5.58$	$86.37 \pm 6.62$	0.017
<b>Mean Arterial Pressure, mmHg</b>			
Before anesthesia induction	$71.07 \pm 7.62$	$69.22 \pm 10.77$	0.378
At 2 min after induction	$69.30 \pm 6.47$	$66.53 \pm 7.55$	0.082
At 4 min after induction	$68.22 \pm 8.17$	$72.20 \pm 8.09$	0.032

\*Data is entered as mean  $\pm$  SD

## DISCUSSION

Comparison of hemodynamic stability after the use of cisatracurium and atracurium was done in this study in patients with low ejection fraction undergoing coronary artery bypass grafting. Use of muscle relaxant is well established according to previous literature for the induction of general anesthesia by providing optimum muscle relaxation to facilitate the intubation process in patients undergoing coronary artery bypass grafting<sup>10-15</sup>.

Use of narcotic drugs in induction of general anesthesia causes bradycardia. Pancuronium is the oldest drug which was used to counter the bradycardia produced by these narcotic drugs at induction. Pancuronium is no longer used as a drug of choice for muscle relaxation because it has a long duration of action and causes tachycardia and therefore is not favorable in cases where early extubation is needed<sup>16</sup>.

Studies have shown that cisatracurium when used in patients undergoing coronary artery bypass graft surgery at the dose of six times the

heart rate<sup>16, 17</sup>.

Current study also supports the fact that cisatracurium had minimal effect on hemodynamic stability of patients undergoing coronary artery bypass grafting. In a previous study it was found that cisatracurium use was not associated with any rise of serum histamine levels. That study also reported that no significant hemodynamic changes were noted with the use of cisatracurium in 150 patients<sup>18</sup>.

In a previous study by Seluck *et al*<sup>19</sup> compared cisatracurium with atracurium in patients undergoing bypass graft surgery. The ejection fraction of these 100 patients was between 42-45% and beta blockers and calcium channel blockers were used as premedication before surgery. They reported effective hemodynamic changes after the use of premedication. In contrast to their findings the results of study showed no effect of premedication on hemodynamic stability during surgery whereas hemodynamic indices were more stable in group of patients in which cisatracurium was used at the time of induction.

## CONCLUSION

We may conclude from our study that although there is significant difference of the change in arterial blood pressure due to the both drugs. The group A was having more stable hemodynamic indexes where the drug administered was Cisatracurium.

## CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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