COMPARISON OF EFFECTS OF PROPOFOL AND DEXMEDETOMIDINE ON PATIENT HEMODYNAMICS DURING CORONARY ARTERY BYPASS GRAFT SURGERY

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ABSTRACT

Objective: To compare the effects of dexmedetomidine and propofol on hemodynamics of patients undergoing coronary artery bypass graft surgery (CABG).

Study Design: Comparative cross-sectional study.

Place and Duration of Study: Cardiac Anesthesia department, Army Cardiac Centre, Lahore, from Aug 2020 to Feb 2021.

Methodology: Seventy patients who were selected for open heart surgery were enrolled and divided into two groups (D and P) by lottery method. Group D patients were given intravenous dexmedetomidine and group P patients were given propofol only. Changes in hemodynamics (heart rate, mean arterial pressure) was the outcome variables of study. SPSS-24 was used for data analysis.

Results: The mean arterial pressure of dexmedetomidine group during and after induction of anesthesia at 15 min, 30 min, 45min and 60 min was 73.3 mmHg ± 2.65, 70.5 mmHg ± 3.54, 70.1 mmHg ± 4.52 and 69.5mmHG ± 4.12 respectively. The mean arterial pressure of propofol group during and after induction of anesthesia at 15 min, 30 min, 45 min and 60 min was 82.5 mmHg ± 2.86, 77.8 mmHg ± 4.54, 78.9mmHg ± 3.52 and 79.4mmHg ± 4.52, respectively.

Conclusion: Changes in mean arterial pressure and heart rate are relatively low in dexmedetomidine group as compared to propofol group. There was a significant difference in hemodynamic effects of both drugs in patients undergoing CABG

Keywords: Cardiac surgery, Cardiac anaesthesia, Dexmedetomidine, Hemodynamics, Propofol.

INTRODUCTION

Dexmedetomidine as a sedative is on the top these days as several publications were made on its successful use in cardiac surgery that reveals its hemodynamic stability in perioperatively[1]. Its ability of being good sedative, analgesic, sympatholytic and anxiolytic made it is more useful in induction of anaesthesia[2]. Dexmedetomidine reduces the hypertensive response to endotracheal intubation in CABG and other cardiac surgery procedures and provides more hemodynamic stability at the time of incision, sternotomy and aortic cannulation[3].

Along with reduction of hypertensive response it also reduces the requirements of other intravenous anaesthetics[4]. Because of its added cardio-protective properties, it also has been used in trans-aortic valve implantation(TAVI)[5]. Literature also available on its advantages associated in reduction of mechanical ventilation time, ventricular tachycardia, incidence of delirium and mild diuresis in cardiac surgery patients. Main disadvantage of its use is the risk of bradycardia[6].

Propofol is a short acting intravenous anesthetic agent which is in practice for long times. In cardiac surgery induction and maintenance of anesthesia are main uses of propofol[7,8]. But now its use as an anesthetic agent is limited because of its hypotensive effect[9,10].

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METHODOLOGY

This randomized control trial study was conducted at anesthesia department of Army Cardiac Centre Lahore, from August 2020 to December 2021. Ethics permission was obtained from hospital ethics board before start of collection of patient's data. Informed written consent was taken from patients after detail discussions of study. Non probability consecutive sampling technique was used. Patients of age 40-65 years, both gender, ASA status I, II, III and planned for elective CABG heart surgery were included in the study. Patients of severe systemic disease like renal failure, respiratory illness and deranged liver function, having psychological disorders, left ventricular ejection fraction <40%, fractional shortening of LV <20%, allergic to study drugs (propofol, dexmedetomidine) and patients on infusion of vasodilators and inotropes were excluded from the study. Thirty patients in each group were on preoperative beta blockers which were continued till morning of surgery, whereas 22 patients in each group were on ACE inhibitors/ARBs which were discontinued 24 hours before surgery as per protocol of the institute. The haemodynamic stability was defined as systolic blood pressure of >90mmHg with the heart

rate of <115 per minute.

This randomized control trial was consisting of 70 patients which are divided into two groups (group P and D) by lottery method. Thirty five patients were included in each group. All patients were given 0.05 mg/kg midazolam intravenous half hour before surgery. Two large bore intravenous cannulas were inserted on dorsal sides of both hand and patients were shifted in Operation Theater. Routine monitoring of non invasive blood pressure, pulse oximeter, electrocardiography, temperature, urine output and BIS was started. Depth of anaesthesia was maintained with in halational agents to keep BIS score between 45-60 to prevent awareness in both groups. Baseline hemodynamics (arterial systolic and diastolic blood pressure and heart rate) were measured. Monitoring and measurements were done by another anaesthesiologist to overcome bias of study. In group P patients were induced with propofol 1-2.5 mg/kg and fentanyl 4-5 mics/kg. Isoflurane was used for maintenances of anesthesia. After complete loss of eyelid reflex muscle relaxant vecuronium (0.1-0.2 mg/kg) was given to ease the tracheal intubation. At the end propofol infusion was started at the rate of 0.25-1 mg/kg/hour.

In the group D, the induction was done with bolus of dexmedetomidine (1 microgram/kg) diluted in 100 ml normal saline over 10 minutes and then dexmedetomidine infusion was started at the rate 0.2-0.6 microgram/kg/hour. Meanwhile fentanyl was given at 4-5 mics/kg as well for analgesia and perioperative analgesia was maintained with 100 mics Fentanyl after every 2 hours in both groups. Similarly, both the groups were maintained on Isofluraneup to 1 MAC. Standard mechanical ventilation of intermittent positive pressure with tidal volume of 6-8 ml/kg was maintained. Patient's heart rate and arterial pressures were noted at interval of 15, 30 and 60 minutes after induction (pre-bypass), 15, 30, 60 and 90 minutes after start of cardiopulmonary bypass (during bypass) and at the end of surgery(post-bypass). Data was recorded and compared between the groups.

RESULTS

Seventy patients of both genders were included in this study. Demographic characteristics represented in table-I. The mean arterial pressures of dexmedetomidine group were less than the mean arterial pressure of propofol group, (p=0.000) (table-I).

The mean heart rate after induction at time interval of 15, 30, 45 and 60 minutes in propofol group was greater than the mean heart rate after induction time interval 15, 30, 45 and 60 minutes of dexmedetomidine group. The differences were statistically significant, (p=0.000). The mean heart rate after the end of cardiopulmonary bypass at time interval 15, 30 and 60 minutes of propofol group was greater than the mean heart rate after the end of cardiopulmonary bypass at time interval 15, 30 and 60 minutes of dexmedetomidine group. The differences were statistically significant, (p≤0.050). The mean difference of end of surgery was also significant, (p=0.000) (table-II).

Table-I: Demographic characteristics of both the groups.

Characteristics	Dexmedetomidine Group n=35 (50%)	Propofol Group n=35 (50%)	*p*-value
Age (years)	33.61 ± 7.31	33.51 ± 7.11	0.960
Gender			
Male	19 (54.3%)	23 (65.7%)	0.329
Female	16 (45.7%)	12 (34.3%)	
Weight (kg)	60.42 ± 3.55	60.05 ± 4.59	0.706
Baseline mean arterial Pressure (mm Hg)	90.17 ± 8.54	93.24 ± 10.21	0.125
Baseline Heart Rate (bpm)	75.35 ± 3.16	77.74 ± 3.45	0.004
Hypertension	13 (37.1%)	16 (45.7%)	0.547
Cardiopulmonary bypass time (minutes)	125.92 ± 7.64	125.02 ± 6.63	0.606

Table-II: Comparison of heart rate at various time intervals after induction and cardiopulmonary bypass in both the groups.

Interval of Time (minutes)	Dexmedetomidine Group n=35 (50%)	Propofol Group n=35 (50%)	*p*-value
Pre-Bypass +15	77.07 ± 2.66	87.54 ± 6.43	0.000
+30	78.44 ± 1.96	85.51 ± 7.74	0.000
+45	74.34 ± 3.44	86.12 ± 6.11	0.000
+60	75.21 ± 3.71	84.46 ± 6.08	0.000
Bypass+15	83.57 ± 3.29	91.66 ± 5.32	0.000
Bypass+30	81.41 ± 4.09	91.13 ± 4.31	0.000
Bypass+60	81.16 ± 5.38	84.46 ± 5.71	0.019
End of Surgery (Post-bypass)	77.59 ± 7.55	86.58 ± 3.98	0.000

The mean arterial pressure of dexmedetomidine group for induction of anesthesia at 15 min, 30, 45 and 60 min was 73.3mmHg ± 2.65, 70.5 ± 3.54, 70.1 ± 4.52 and 69.5 ± 4.12, respectively. The mean arterial pressure of propofol group for induction of anesthesia 15 min, 30, 45 and 60 min was 82.5mmHg ± 2.86, 77.8 ± 4.54, 78.9 ± 3.52 and 79.4 ± 4.52, respectively. The differences were statistically significant, (p=0.000). The mean arterial pressure of dexmedetomidine group

after start and end of cardiopulmonary bypass at 15 min, 30, 45 and 60 of 55.8 ± 2.14, 56.4 ± 3.21, 57.8 ± 3.21, 56.7 ± 2.38, and at the end of CPB 70.4 ± 2.25, 75.6 ± 2.41 and 71.6 ± 3.24 respectively. The mean arterial pressure of propofol group after start and end of cardiopulmonary bypass at 15 min, 30, 45 and 60 min was 50.8 ± 3.24, 56.7 ± 4.51, 58.5 ± 2.51, and at the of CPB 74.5 ± 3.18, 78.4 ± 1.55 and 85.4 ± 3.41 respectively. The difference was statistically insignificant, (p=0.146). The mean heart rate at end of surgery in dexmedetomidine and propofol group was 74.5 ± 3.65 and 89.7 ± 5.24, respectively. The difference was statistically significant, (p=0.000) (figure).

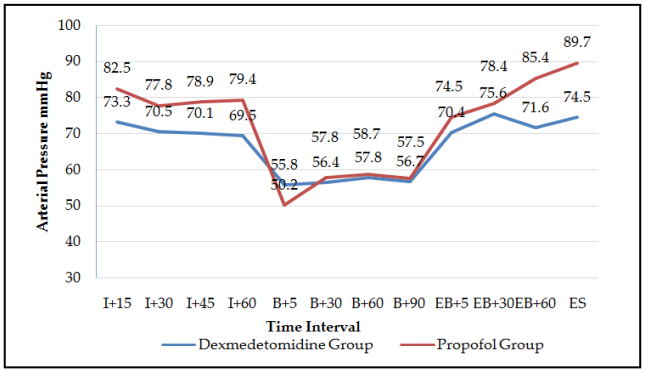

Figure: Line diagram for comparison of mean arterial pressure (mmHg) of both the groups.

DISCUSSION

Heart rate (HR) and mean arterial pressure are two main outcome variables of our study. Regarding HR and mean arterial pressure a statistically significant difference was observed between all intervals. A study was conducted by Kunisawa *et al*[11], on comparison of dexmedetomidine and control group and observed lower mean HR, systolic and diastolic values at the time of sternotomy and incision. Statistical difference was also significant between two groups in this study.

Sheikh *et al*[12], conducted a study on comparison of dexmedetomidine and propofol as sedative and its effect on hemodynamics of patients and concluded that dexmedetomidine have better hemodynamic stability as compared to dexmedetomidine. HR and mean arterial pressure were found lower indexmedetomidine group. It also reduces the risk of delirium and ICU stay. Tosun *et al*[13], also favor the dexmedetomidine group in his observational study as mean arterial pressure remains at lower margin in dexmedetomidine group when compared with control.

Use of dexmedetomidine as anesthetic adjunct was described in literature few years back and number of researches were done to approve its safe use in cardiac surgery. Jalonen *et al*[14] used dexmedetomidine as anesthetic adjunct in CABG surgery and reported its advantages. Significant reduction of HR and systolic arterial pressure by dexmedetomidine provides additional protection from tachycardia and hypertension. Martin *et al*[15] reported biphasic effect of dexmedetomidine, when given intravenously it stimulates α_2 adrenoceptors and an abrupt increase in patient's arterial pressures was observed.

Efficacy of dexmedexmedetomidine can manage heart rdetomidine also analysed in a study by Hashemian *et al*[16], who reported that ate at lower range which was concluded to be an effective anti ischemic management in cardiac surgical patients, whereas, Mean arterial pressure was almost similar in dexmedetomidine and placebo groups as p>0.05. Kamali *et al*[17], conducted a comparative study on dexmedetomidine and propofol and reported that dexmedetomidine is more effective than propofol in hemodynamic stability (HR and arterial pressure).

Menda *et al*[18], conducted a study on comparison of dexmedetomidine and propofol and reported that there no significant difference between the groups regarding hemodynamic stability in endotracheal intubation time. Incidence of hypertension, tachycardia and arterial pressures were almost same between both groups. Kabukçu *et al*[19], also compared propofol and dexmedetomidine and concluded that during CABG surgeries dexmedetomidine can be used as adjunct to anesthetic drugs or as intravenous induction agent because it delivers a safe hemodynamic status throughout the surgical procedure. Chalam *et al*[20], compared propofol and dexmedetomidine on two equal groups of 50 patients and declared hemodynamic stability is similar in both groups.

In reference to the above mentioned articles, it is prudent to mention here that the instability and confounding factors are minimised in both groups, specially dexmeditomidine group, if the drugs are given in continuous infusion and intermitent boluses are to be avoided[21]. Secondly, as both the drugs lack properties of analgesia, it is again imperative to consider a safer analgesia intermittently. Here to mention that as both drugs interfere counteractively with the ability of sympathetic nervous system and have the ability to mask some important signs of anaesthesia management (hypercapnia, pain, hypoglycemia, light plain of anaesthesia and awareness) it is important to either follow time interval method of topping up medications

or attaching monitoring devices for all end organs involved to deliver safe and legitimate cardiac anaesthesia[22].

LIMITATION OF STUDY

We did the comparison of effects of both drugs on patients hemodynamics which proved to be a significant difference between drugs. However, we did not consider the secondary outcome variables in our study which includes use of vasopressors, effects of complete and incomplete revascularisation, revascularisation with or without LITA, haemoglobin management, fluids and electrolytes balances, coagulopathies, effects on delirium, ICU stay, reopenings etc. These are some limitation of our study and further studies are suggested to further assess hemodynamic stability in reference to identical surgical and postoperative factors.

CONCLUSION

Mean arterial pressure and heart rate are relatively low in dexmedetomidine group as compared to propofol group. There is a significant difference in effects of both drugs on patients hemodynamics.

CONFLICT OF INTEREST

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

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