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EFFECTS OF PROPOFOL INFUSION VERSUS SEVOFLURANE ON HEMODYNAMIC RESPONSE DURING CARDIOPULMONARY BYPASS IN PATIENTS UNDERGOING CORONARY ARTERY BYPASS GRAFT SURGERY

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ABSTRACT

Objective: The aim of this study was to compare hemodynamic effects of propofol with that of sevoflurane during cardiopulmonary bypass time in patients undergoing coronary artery bypass surgery to avoid high lactate level which is an indicator of poor prognosis.

Study Design: Randomized control trial.

Place and Duration of Study: Armed Forces Institute of Cardiology/National Institute of Heart Diseases, from Jan 2017 to Aug 2017.

Material and Methods: Hemodynamic of 120 patients during CPB were studied after either propofol or Sevoflurane was applied with initiation of a Standard cardiopulmonary bypass technique, applying cross clamp, administering cardioplegia and allow time to develop stable perfusion pressure. Base line lactate level from initial arterial blood gases was recorded, total bypass time, cross clamp time, Noradrenalin dose, flow rate, mean arterial pressure during CPB and post rewarming lactate level were recorded for all patients.

Results: There was no significant difference in lactate level and noradrenalin dose that given in two groups when rewarming was established. Propofol group showed a significant lower MAP 63.1 ± 2.6 mmHg in comparison to sevoflurane group 69.5 ± 5.3 mmHg and significant higher flow rate *p*-value <0.001.

Conclusion: Patients in both groups remained hemodynamically stable with lower MAP in propofol group requiring higher flow rate.

Keywords: Cardiopulmonary bypass, Propofol, Sevoflurane, Noradrenaline, MAP, lactate level.

INTRODUCTION

Propofol (2,6 Di-isopropylphenol) is one of the most widely and frequently used intravenous anesthetic[1,2]. It has high lipid solubility. The kinetics of Propofol allows rapid induction of anesthesia, adequate maintenance, and rapid return of consciousness[2]. Sevoflurane is fluorinated methyl isopropyl ether, a newer halogenated volatile anesthetic, has some chemical advantages, lower blood gas solubility resulting in a faster onset and rapid emergence, pleasant to inhale, offers good hemodynamic stability, Moreover, there appears to be an opinion among cardiac anesthesiologists that sevoflurane is superior to Isoflurane[3,4]. It has vasodilator effect on systemic vascular resistance during CBP[5] due to its direct relaxant action on vascular smooth muscle, reduction in sympathetic output and ineffective ness of other stimuli on the vascular smooth[6]. There are still many controversies on the impact of sevoflurane versus propofol on cardiovascular stability. Some authorshave not found any differences betweensevoflurane and propofol[7].

It is an established fact that tissue hypo-perfusion is associated with lactic acidosis secondary to anaerobic metabolism, hence measurement of blood lactate levels can be used as a marker to assess the adequacy of tissue perfusion[8], which is at risk during CPB and in the immediate postoperative period. lactate level is affected by many potential factors such as pump flow rate that affect Oxygen delivery, the duration of CPB, degree of hypothermia, rewarming, the hematocrit value and intra-

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operative hemodynamic effects of maintenance anesthetics might contribute to high lactatelevel[9,10].

High lactate level after cardiac surgery is common, it is regarded as predictors of major complications, patients may require prolonged inotropic and ventilatory support[11,12] and it associated with morbidity and mortality[13], some studies regard CPB lactate level one of the factors that could significantly affect ICU free survival days[14] but the implications of raised levels remainmultifactorial and controversial. According to what previously mentioned and to Barolia et al study published in May 2017 coronary heart disease (CAD) is one of the top leading cause of death in Pakistan[15] and the conventional CABG surgery with CPB is still the gold standard treatment method for treatment of CAD and CPB has been considered a useful model for studying the isolated effect of drugs on the systemic vasculature as cardiac effects are excluded during aortic cross clamp[18], this study was conducted with objective to correlate hemodynamics effects of Propofol and sevoflurane that may affect perfusion pressure and hence blood lactate level and allow intervention in a suitable time to reduce patient complication.

MATERIAL AND METHODS

One hundred and twenty consecutive patients were included (88 male and 32 female), under-went elective CABG surgery at Armed Forces Institue of Cardiology/National Institute of Cardiology (AFIC/NIHD), from January to August 2017, after approval from ethical committee of the institute. All patients had a standard anesthesia technique as per our cardiac anesthesia unit protocol, were induced with tit rated dose of fentanyl (5-15µg/kg), midazolam (0.05-1 mg/kg), propofol (1-1.5mg/kg), atracurium (0.5 mg/Kg) and maintainedwith inhalation of Isoflurane (1-2%) and incremental doses of fentanyl and Atracurium till initiation of CPB. Patients selected randomly using card drawing system and divided into two groups'A' and 'B', in group-A Propofol infusion with HUAXI medical infusion pump was applied for maintenance of anesthesia during standard CPB technique, in a dose range of 75 to 125µg/kg/min[17]. In group-B inspired concentration of sevoflurane was kept between 1 to 2% using Dragger vaporizer connected to CPB oxygenator gas supply system with constant gas flow of 3 liters/min.

During CPB, the following conditions were continuously monitored and maintained; a mild hypothermia of 32°C using hemotherm stockertand monitored by nasal probe, perfusion pressure of 60–70 mmHg using invasive blood pressure monitoring,through pre-determined non pulsatile flow rate according to body surface area and cardiac index at 2.4 L/min/m^2 with titrating and recording Noradrenaline dose and/or increasing perfusion flow to maintain stable hemodynamics if needed. Hemoglobin was monitored by frequent arterial blood gases (ABGs) and maintained between 8 and 9 gm%, base line lactate level was recorded from initial ABG using blood gas analyzer ABL800 and after heart isolation by applying cross clamp, intermittent antegrade or retrograde cold blood cardioplegia was used, final blood lactate level was recorded from last ABG after established rewarming. Total bypass time, cross clamp time, were recorded for all patients.

Data Analysis

Descriptive statistics were performed for frequency and percentage. Pearson Chi Square test was applied for comparison of categorical variables and independent t-test was applied for continuous variables.

RESULTS

The patients in this study were in the age group of 40-65 years, 88 were males and 32 were females. There were no significant differences between groups in the mean age or weight as shown in table-I & II. The results are given as Mean ± SD. A p-value<0.05 values is significant with equal variances assumed.

DISCUSSION

Hemodynamic stability is important requirement of modern anesthesia generally and maintenance of appropriate hemodynamic goals is essential to improve outcomes after cardiac surgery and determine prognosis. As it is well-known that circulatory insufficiency due to CPB and hemodynamic in stability caused by anesthesia synergistically may lead to high lactate which is considered as a prognostic factor intra operatively. Anesthesia is considered as one of the factors that may determine lactate level and hemodynamic stability, our study confirms the lack of significant change in mean lactate levels (*p*-value was 0.9) in patients whose anesthesia was maintained by Propofol, and those whose anesthesia maintained by sevoflurane during CPB period and have shown insignificant differences in parameters that may determine lactate production between the study groups; in regards of CPB duration (*p*-value was 0.3). Ranucci et al and Shinde et al[18,19] indicated that the relation between CPB time and spike lactate level was not linear and the cut off value for CPB time was 96 minutes. Our mean CPB time in Propofol group was 108.74 ± 4.708 minutes and 114.52 ± 4.25 minutes in sevoflurane group and both results were not confirming these studies. Temperature was maintained at moderate hypothermia (32°C) in both groups as it helps an easier management of temperature after completion of CPB[20]. Hemodilution and using catecholamines have a well-known effect on lactate level, in our study total Noradrenaline dose that given to maintain the MAP was insignificant between the two groups (*p*-value 0.3) and hemoglobin maintained between 8-9 g/dl to maintain oxygen delivery because many Previous studies has indicated that increase lactate level is considered as an indicator of inadequate perfusion and tissue oxygen delivery together with CPB effect and its related factors[21-23]. Knowing the body surface area (BSA) of the patient, the required pump flow is as follows; pump flow rate=BSA × cardiac index (CI) cardiac index of a 70 kg adult with normal metabolism at 37°C is 2.2–2.4 L/m²/min. For each 1°C decrease in temperature, the required cardiac output reduces by 7%, and the pump flow can be reduced by an equivalent factor[24,25]. A main potential intervention that may alter organ perfusion and tissue oxygen delivery during CPB is manipulation of perfusion pressure and flow rates[26,27]. Flow rates in our

Table-I: Demography of Patients of both groups.

Parameters	Group-I Mean ± SD	Group-II Mean ± SD
Mean Age (years)	51.90 ±10.47	55.31± 8.838
Mean Weight (kgs)	68.09±13.864	71.16 ± 16.15
No. of Male Patients	41	47
No. of Female Patients	19	13

Table-II: Hemodynamic parameters of both groups.

Parameters	Group-I Mean ± SD	Group-II Mean ± SD	*p*-value
Pre-cross clamp lactate level (mmol /L)	1.78 ± 127	1.935 ± 0.134	0.418
Post- rewarming lactate (mmol /L)	4.734 ± 2218	4.761 ± 0.2157	0.93
Total Noradrenaline dose µg/kg	0.00833	0.00616	0.31
MAP during CPB mmHg	63.1 ± 2.6	69.5 ± 5.3	0.04
Flow rate L/min = (CI×BSA)	5.089 ± .087	4.683 ± 0.066	<0.001
Total bypass time (min)	108.74 ± 4.708	114.52 ± 4.250	0.36
Cross clamp time (min)	67.76 ± 3.409	69.15 ± 3.272	0.77

study were significantly higher in propofol group, (*p*-value <0.001) which may off set the vasodilatory effects of Propofol and the fact that fall in systemic vascular resistance may decrease organ perfusion.

CONCLUSION

To conclude, patients who were undergoing CABG under CPB, choice of Propofol infusion or Sevoflurane has no significant effect in lactate level during CPB period but MAP decreased more in Propofol group which may influence the decision of which anesthetic to use in special cases. Large randomized trials are indicated to support this study.

CONFLICT OF INTEREST

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

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