Research Article

Hemodynamic effects of insulin cardioplegia in cases of on pump coronary artery bypass graft.

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Abstract

Background/aim: Hemodynamic changes are of great importance in on pump cardiac surgery. Insulin is a peptide hormone produced by beta cells in the pancreas , It regulates the metabolism of carbohydrates and fats by promoting the absorption of glucose from the blood to skeletal muscles. During CPB, glucose homeostasis is invariably altered with hypothermia, glucose-containing cardioplegic solutions, inflammatory response and insulin resistance, and these aspects indicate that recommendations regarding glycemic control need to be surgery specific and cannot be generalized[١]. **Materials and methods:** In our study, forty patients of both sexes allocated into two groups of ٢٠ patients each aged between ١٨ and ٦٠ years, ASA physical status II or III who underwent elective valvular cardiac surgery with cardiopulmonary bypass between April ٢٠١٥ and May ٢٠١٦. **Results:** There was no significant difference in-between the studied groups in systolic, diastolic and mean arterial blood pressure.
Conclusions: Insulin did not offer any effect on hemodynamic data.
Keywords: Bypass, hemodynamics and insulin.

Introduction

Insulin is a known vasodilator and when administered to maintain euglycemia, it may have anti-inflammatory and antithrombotic effects.[٢] In cardiac surgery, poor intraoperative glycemic control in diabetics is associated with a sevenfold increase in postoperative renal failure, whereas severe hyperglycemia during cardiopulmonary bypass (CPB) in non-diabetics is associated with acute renal failure requiring dialysis[٣]. During CPB, glucose homeostasis is affected altered with hypothermia, glucose-containing cardio-plegic solutions and insulin resistance Euglycemmia is a mainstay in on pump cardiac surgery to protect hemodynamic compromise. As expected, intraoperative glucose homeostasis was less disturbed in off Pump coronary artery by-pass (OPCAB) compared with its on-pump counterpart[٤]. Insulin reverses the harmful effects of hyperglycemia on vascular oxidative stress by increasing myocardial glucose uptake, diminishing the inflammatory response and decreasing apoptosis. Insulin enhances myocardial glucose metabolism by facilitating glucose transport into the myocyte, inhibiting the release of free fatty acids and augmenting aerobic metabolism by stimulating pyruvate dehydrogenase. It acts as an anti-inflammatory agent by suppressing the proinflammatory trans-cription factors. Insulin up regulates the L-arginine nitric oxide pathway, thus promoting vasodilatation and enhancing endothelial function, improving platelet function by decreasing PA-١ and increasing prostacyclin release and reducing apoptosis by increasing nitric oxide levels[٥].

Materials and methods

Study design: This prospective rando-mized, double blinded study was approved by local Ethical Committee of anesthesia and intensive care department, faculty of medicine, Minia university. Prior written consent was obtained from each patient.

Study participants: forty patients underwent elective coronary artery bypass cardiac surgery under CPB were enrolled between April ٢٠١٥ and May ٢٠١٦.

Exclusion criteria: The exclusion criteria for participants in this study were emergency operation, low left ventricular function (ejection fraction <٣٠ %), diabetic patients and preoperative renal dysfunction (on dialysis).

Randomization and statistical analysis:

The collected data were coded, tabulated, and statistically analyzed using SPSS program (Statistical Package for Social Sciences) software version ٢٠.

- Descriptive statistics were done for Parametric quantitative data by mean, standard deviation and minimum & maximum of the range, while they were done for categorical data by number and percentage.
- Analyses were done for parametric quantitative data between the three groups using One Way ANOVA test followed by Post Hoc Tukey correction between each two groups, and for non-parametric quantitative data between the three groups using Kruskal Wallis test followed by Mann Whitney test between each two groups.
- Analysis within each group were done for parametric quantitative data using paired sample t test and for qualitative data using Wilcoxon signed rank test. Analyses were done for qualitative data using Fisher Exact test.
- The level of significance was taken at (P value < ٠.٠٥).

Results

There was no significant difference in-between the studied groups in systolic, diastolic and mean arterial blood pressure.

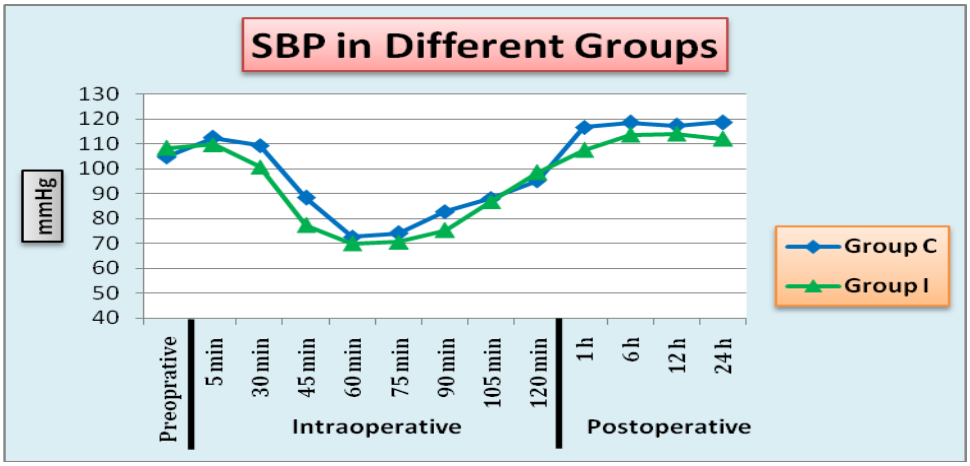

Fig. ١: Systolic bl. Pressure in the studied groups

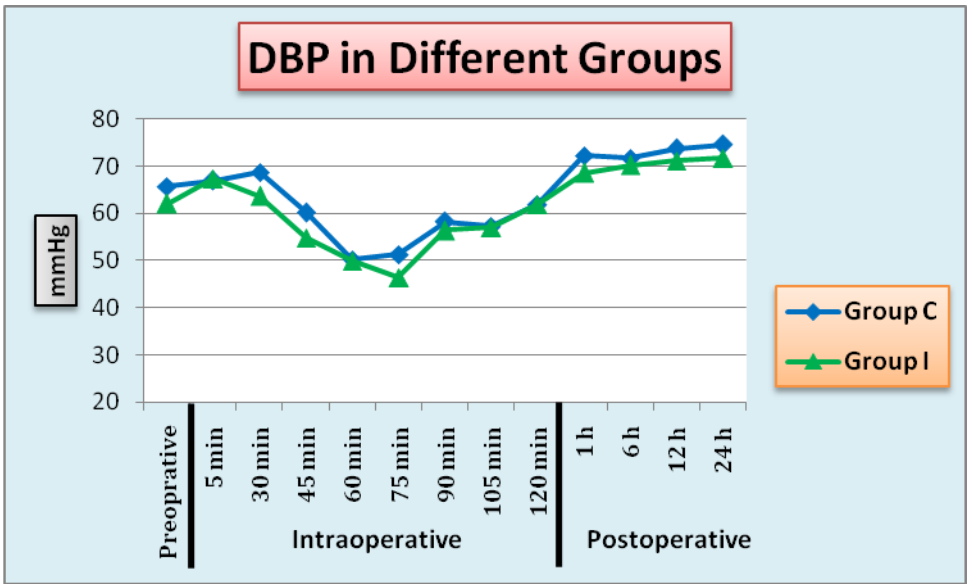

Fig. ٢: Diastolic bl. Pressure in the studied groups

(Table ١): Changes in the mean arterial blood pressure (MAP) (mmHg) in the studied groups (data presented as mean ± SD).

Time (min).	Group C (n=٢٠)	Group I (n=٢٠)	
Before induction(basal)			
Range	(٧٠-٨٨.٣٣)	(٦٥-٩٥)	**C vs I**
Mean ± SD	٧٨.٧٨±٥.٧٥	٧٧.٤٣±٧.٣١	٠.٧٧٧
٥ min (after induction)			
Range	(٧١.٣٣-٩٨.٦٧)	(٧١.٦٧-١١٠.٦٧)	**C vs I**
Mean ± SD	٨٢.٠٨±٧.٩٧	٨١.٥٥±١٠.٣٧	٠.٩٨٢
٣٠ min			
Range	(٥٧.٦٧-٩٩.٣٣)	(٥٠-٩١.٦٧)	**C vs I**
Mean ± SD	٨٢.٢٥±١٠.٣٧	٧٦.٠٣±١١.١٢	٠.١٥٠
٤٥ min	#	#	
Range	(٥٥.٣٣-٩٥)	(٤٠-٨٠.٣٣)	**C vs I**
Mean ± SD	٦٩.٥٦±١١.٩٤	٦٢.٣٣±١٢.٥٣	٠.١٤٣
٦٠ min	#	#	
Range	(٥٠.٣٣-٨٠.٦٧)	(٤١.٦٧-٧٦)	**C vs I**
Mean ± SD	٥٧.٦٨±٦.١٢	٥٦.٦١±٨.٤٥	٠.٩٠٤
٧٥ min	#	#	
Range	(٥٠-٧٦.٦٧)	(٤٠.٦٧-٦٩.٣٣)	**C vs I**
Mean ± SD	٥٨.٩١±٥.٦٤	٥٤.٥±٧.٠٦	٠.١٢١
٩٠ min	#	#	
Range	(٤٦.٦٧-٨٦.٦٧)	(٤٠-٨٩)	**C vs I**
Mean ± SD	٦٦.٤١±١٠.٦٨	٦٢.٧٣±١٢.٢٦	٠.٥٦٦
١٠٥ min	#	#	
Range	(٥٤.٣٣-٨٢.٦٧)	(٥٣.٦٧-٨٢.٦٧)	**C vs I**
Mean ± SD	٦٧.٥٣±٩.٤٥	٦٧±٨.٩٢	٠.٩٨١
١٢٠ min	#		
Range	(٥٩.٦٧-٩٢.٣٣)	(٤٣.٣٣-٩٣.٦٧)	**C vs I**
Mean ± SD	٧٣.٠١±١٠	٧٤.١±١١.٦٩	٠.٩٣٦
١ h	#		
Range	(٧٢.٦٧-١٠٠.٣٣)	(٦٥-١١٠)	**C vs I**
Mean ± SD	٨٧.٠٦±٧.٥٣	٨١.٥٣±٩.٣١	٠.١٨٧
٦ h	#	#	
Range	(٧٧.٦٧-٩٨.٦٧)	(٧٢.٣٣-٩٦.٦٧)	**C vs I**
Mean ± SD	٨٧.٣١±٥.١٥	٨٤.٦٥±٧.٥٨	٠.٥٧٧
١٢ h	#	#	
Range	(٧٧.٦٧-١٠١.٦٧)	(٦٩.٦٧-١٠٠.٣٣)	**C vs I**
Mean ± SD	٨٨.٢٥±٧.٥٦	٨٥.٥١±١١.١٣	٠.٦٢٨
٢٤ h	#	#	
Range	(٨٠.٣٣-١٠٦.٣٣)	(٦٦.٦٧-١٠٠.٣٣)	**C vs I**
Mean ± SD	٨٩.٢٨±٦.٩٤	٨٥.٢±٩.٩٩	٠.٣٥٨

#significant difference within the group ($p<٠.٠٥$)

Disscussion

Hemodynamic changes occur due to hypothermic conditions, use of bypass machine with its vasoplegic properties. In the current study, hemodynamic monitoring was recorded continously before anesthetic induction till discharge from ICU. Systolic and diastolic blood pressure values ran parallel pre, intra and postoperatively between both the studied groups with no detectable significant difference. However, there was a mild increase in mean values of

MAP immediately after induction and prior to CPB due to sympathetic overstimulation. Marked decline in MAP values in all studied groups which can be linked to aortic cannulation with loss of systemic vascular resistence. In agreement with our results ***Marina et al.,*** ٢٠٠٧ where seventy three patients were allocated randomly into one of two groups according to the drug used during anaesthesia (before and after CPB) and in the postoperative period, into control group (propofol,**P**) and the study group (sevoflurane,**S**). Sevoflurane was administered to the patient during operation till four hours in the ICU. Primary endpoints was evaluation of myocardial biomarkers (CTnT) and pro brain natruretic peptide (BNP) while secondary endpoints were hemodynamic events and ICU stay. They also demonstrated that also there was no significant difference in mean arterial blood pressure between the two groups.

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