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ORIGINAL ARTICLE

EFFECT OF CARDIOPULMONARY BYPASS ON LIVER FUNCTION IN PATIENTS UNDERGOING CORONARY ARTERY BYPASS GRAFTING

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ABSTRACT

Objective: To see the effects of CPB and aortic cross clamp time on postoperative liver function after coronary artery bypass grafting.

Methodology: A non randomized prospective study of 100 patients, selected for CABG with normal liver function, was carried out. A questionnaire was used as a research tool. Demographic factors, pre-operative, intra operative and post operative variables were evaluated. Patients were divided into two groups according to aortic cross clamp time (patient with aortic cross clamp time < 50 minutes and patients with aortic cross clamp time ≥ 50 minutes). SPSS v.16.0 was used to analyze the data. p-value ≤ 0.05 was considered as significant.

Results: Mean age of our patients was 55.6 ± 8.1 years and there was an overall male predominance (78% males and 22% females). There was significant difference between pre and post-operative bilirubin and alkaline phosphatase (ALP) levels as p-value was < 0.05. While no significant differences in pre and post-operative levels of liver enzymes were found with respect to aortic cross clamp time in both groups.

Conclusion: Our study showed that there is no significant effect of aortic cross clamp time on post-operative liver enzyme (AST & ALT) levels. However there were significant differences between pre and post operative values of bilirubin and ALP.

Keywords: Heart lung machine, Cardiopulmonary bypass, Hepatic dysfunction, Liver enzymes.

INTRODUCTION

Coronary artery bypass, is a surgical procedure performed to relieve anginal symptoms and reduce the death risk from coronary artery disease.[1] CABG along with cardiopulmonary bypass is a frequently used cardiovascular revascularization method to treat coronary artery disease.[2] During cardiopulmonary bypass (CPB), various changes take place in the different organs of the body because of the effect of bypass, pumps and hemodilution.[3] The liver is one of the most vital organs and is highly prone to damage while on CPB and the possibility of liver damage increases owing to the non pulsatile perfusion, low – flow state, free radicals formation and increased levels of catecholamines.[4] Literature shows that CPB usually induces mild hepatocellular damage. Liver asparate transaminases AST (SGOT) and alanine transaminase ALT (SGPT) are useful biomarkers of liver injury.[5] Hepatic ischemia is detected after cardiac surgery with CPB, which is usually marked with an increase in alanine aminotransferase (ALT) enzyme levels.[6] The rationale of study was to see the effect of CPB and aortic cross clamp time on liver function so as to guide our planning to reduce this complication if proved in this study.

MATERIALS AND METHODS

Design and Setting: It was a prospective longitudenal study of 100 patients undergoing CABG in Punjab institute of cardiology with three days follow-up after surgery. Study was completed in six months.

Sampling Technique: We used non-probability (purposive) sampling.

Sample Selection Criteria: Patients with pre-operative normal liver function, undergoing on pump CABG surgery were included in the study. All patients with pre-operative liver dysfunction and off pump CABG surgery were excluded from the study.

Data Collection Methods: A questionnaire was used as data collecting tool. Pre-operative and post-operative laboratory findings were recorded in which serum bilirubin, alaninine transaminase (ALT) and alkaline phosphatase (ALP) were recorded as indicators of liver function. Demographic parameters and other related parameters such as duration of aortic cross cla-

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mp time were also recorded on the same.

Statistical Techniques: Patients were divided into two groups i.e; those with aortic cross clamp time < 50 min and those with aortic cross clamp time ≥ 50 min. Both descriptive and inferential statistical analyses were done in Statistical Package for Social Sciences (SPSS) version 16.0. Categorical data were presented as percentages and in form of graphs while descriptive and frequency distribution was used for quantitative analyses. Independent sample t-test was used to compare the means of two groups in pre and post-operative conditions for two groups. Paired sample t-test was used to compare the averages of pre and post-operative liver enzymes' levels. p-value ≤ 0.05 was considered as significant.

RESULTS

The mean age of our patients was 55.6 ± 8.1 years and there was male predominance (78% males and 22% females). Mean CPB time was 101.3 ± 20.2 min. All cases were carried out at a mean perfusion pressures of 62 ± 8.4 mmHg. Out of 100 patients, 36 were diabetics, 56 were hypertensive, 34 were smokers and 20 were presented with a strong family history of ischemic heart disease.

Table 1 shows the comparison between bilirubin and liver enzymes (ALT, AST) levels between the two groups i.e. patients with aortic cross clamp time < 50 min and patients with aortic cross clamp time ≥ 50 min, for successive three postoperative days. No significant difference was found between post operative liver enzyme levels (Bilirubin, ALT, ALP) and aortic cross clamp time (< 50 and ≥ 50) as p values were > 0.005 which were insignificant.

Table 2 shows the effects of cardiopulmonary bypass (CPB) on bilirubin and liver enzyme levels in terms of comparison between their average values pre and post-operatively. Result shows significant difference with respect to bilirubin and ALP levels as p values are < 0.05. No significant difference was found between pre and postoperative ALT levels, p-value 0.360 (> 0.05) which is insignificant.

Table 1: *Comparison between the two groups in different postoperative days.*

		X-Clamp Time < 50 Min.	*X-Clamp Time ≥ 50 Min.*	*P-Value*
		Mean ± S.D	*Mean ± S.D*	
Day 1	Bilirubin (mg/dl)	1.05 ± *69*	1.03 ± *0.61*	0.89
	ALT (U/L)	34.1 ± *15.1*	32.6 ± *14.5*	0.69
	ALP (U/L	68.1 ± *28.2*	69.1 ± *22.1*	0.90
Day 2	Bilirubin (mg/dl)	0.92 ± *0.59*	1.13 ± *50.61*	0.08
	ALT (U/L)	36.2 ± *28.3*	35.4 ± *20.1*	0.80
	ALP (U/L	78.2 ± *24.3*	76.3 ± *26.5*	0.63
Day 3	Bilirubin (mg/dl)	0.90 ± *0.61*	1.04 ± *0.86*	0.31
	ALT (U/L)	49.6 ± *29.7*	39.1 ± *20.4*	0.36
	ALP (U/L	92.6 ± *32.7*	90 ± *89.9*	0.70

*p-value ≤ 0.05 significant

Table 2: *Comparison between averages of pre and postoperative values.*

		Pre-OP Levels	*Post-Op Levels*	*P-Value*
		Mean ± S.D	*Mean ± S.D*	
Pair 1	Bilirubin (mg/dl)	0.72 ± *0.31*	1.03 ± *0.67*	0.003*
Pair 2	ALT (U/L)	35.1 ± *21.2*	33.3 ± *16.5*	0.360
Pair 3	ALP (U/L	84.2 ± *25.1*	69.3 ± *25.4*	0.002*

*p-value ≤ 0.05 significant

DISCUSSION

In our study the relationship of aortic cross clamp time (< 50 and ≥ 50) with post-op liver enzyme levels (bilirubin, ALT and ALP) was insignificant as p value were > 0.005. But the effect of CPB on post op bilirubin and ALP levels was found to be significant as p values were < 0.05. While insignificant effect of CPB on post-op ALT levels was found as p value was > 0.05.

Our results are in agreement with the results of Akhlagh et al[7] and Shahbazi et al[3] which also found insignificant effects between ALT and AST levels and CPB. Shahbazi et al also reported that aortic cross clamp time only showed a direct significant relationship with AST.[3]

According to Collins et al,[8] patients undergoing CPB surgery develop early postoperative post pump jaundice. Olsson et al reported that on the first postoperative day almost all of the patients showed abnormal aspartate aminotransferase (AST) activity and AST / ALT (alanine aminotransferase) > 1, and about 25% had hyperbilirubinemia, with abnormal ALT in 50%, AST / ALT < 1, and abnormal ALP and GT in 28% and 45%, respectively.[9] In another study[10] the liver enzymes were reported significantly higher in the patients with CPBT of more than 80 minutes than in the patients with shorter CPBT, also indicating moderate alterations in hepatocellular integrity. Si-

milar conflicting results were found with the study of An et al,[11] in terms of high incidence of postoperative hyperbilirubinemia (25.3%). This study showed that in patients with postoperative hyperbilirubinemia, 56.2% reached peak total bilirubin concentration on the first postoperative day, 33.5% on the second day and 10.3% on the seventh day. 18% patients with mean aortic cross clamp time 68.6 ± 2.3 had total bilirubin concentration greater than baseline level 171 μmol/L ($p < 0.01$). This study also showed that postoperative hyperbilirubinemia occurred more frequently in patients receiving valvular replacements than in patients undergoing CABG or operation for CHD ($p < 0.01$).[11] These conflicting results found between the previous investigations and our study may be due to the fact that different studies employ different markers for detecting hepatocellular injury such as alcohol dehydrogenase (AD) and alpha-glutathione S-transferase (a-GST). Moreover liver dysfunction in terms of hyperbilirubinemia is a multifactorial process and several contributing factors play an important role. It is worthy of note that we used conventional transaminases, which are, albeit a lesser indicator of hepatic damage.

It is ***concluded*** that our study showed that overall cardiopulmonary bypass (CPB) had significant effect on postoperative bilirubin and ALP levels. While there is no significant direct or indirect relationship between aortic cross clamp time and liver function in terms of deranged liver enzymes (bilirubin, ALT, AST). We recommend that future studies be conducted on a larger population of patients and with a single surgeon so as to achieve more comprehensive results.

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