Relationship of Post-Operative Troponin I with Complications after CABG

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ABSTRACT

Objective: To determine the impact of serum level of Troponin-I on the outcome of elective coronary artery bypass surgery.

Study Design: Case control study

Place and Duration of Study: This study was conducted at the Department of Cardiac Surgery PAQSJ Institute of Medical Sciences from 1st July 2020 to 30th June 2021.

Materials and Methods: During the defined period 124 patients enrolled in our study divided in two groups based on serum Troponin levels collected preoperatively and 18 hours after surgery. The patients were divided into two groups, group 1 <10 ng/dl, and group 2, > 10ng/dl of Troponin-I. Both groups were statistically compared for outcome.

Results: There were 84 patients in group 1, 40 patients in group 2. Female gender and history of smoking showed significant difference among demographic characters between two groups . Intra-operative variable showed no significant differences in use of Internal memory artery usage for grafting, Aortic cross clamp time and duration of surgery, while there were significant increase in cardiopulmonary bypass time and number of grafts were observed in group 2. Post-operative variables showed no difference in LCOS, use of IABP, atrial fibrillation red blood and blood product use, ICU and ward stay and mortality. Nevertheless statistically significant differences were observed for reopening, prolong ventilations and re-intubation in group 2 with High Troponin-I levels.

Conclusion: Troponin levels were raised in all patients after CABG. Raised Troponin-I not related with complications including short term mortality. But the association of reopening for bleeding, prolong invasive ventilations and re-intubation is observed in patients with high Troponin-I levels. Further study is warranted.

Key Words: CABG (Coronary Artery Bypass Graft), Troponin I, LCOS(Low Cardiac output Syndrome), Bleeding

INTRODUCTION

Coronary artery bypass surgery is the commonest cardiac operation in the word[1]. At present in Pakistan about 21000coronary artery bypass surgery performed per year[2]. Although coronary artery bypass grafting (CABG) is a surgery of choice for selected group of patients in need of myocardial reperfusion for survival or life style benefits. It may nonetheless be associated with perioperative myocardial damage and necrosis.

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CABG surgery is often considered a high-risk procedure, associated with a 30-day morbidity and mortality rate up to 14% and 1.3% with regional variability, respectively[3]. Despite of the improvement in surgical, anesthesia and perfusion techniques the complication still present after CABG[4]. Myocardial injury is prone to happen during the perioperative period due to patient factor as well intervention related factors[5]. It is not easy to classify the severity of myocardial injury after cardiac surgery, new ECG changes, raised cardiac enzymes level ;Troponin T, Troponin I and CKMB, angiographic evidences of graft occlusion, evidence of new loss of viable myocardium/newly diagnosed regional wall motion abnormalities are the available evidences for the severity of perioperative myocardial injury[6].

Troponin I and Troponin T are used to consider as a standard test for myocardial injury. Isolated high Troponin I is mentioned an independent predictor of adverse outcome in post CABG patients[7–9].

In the present study our primary objective was to evaluate the relationship with the serum level of Troponin I with postoperative complications after CABG. We are also interested to find out any

relationship with other preoperative and intra- operative factors like diabetes, hypertension, left ventricular function, bypass time and cross clamp time with the outcome of patients operated for elective coronary artery bypass surgery.

MATERIALS AND METHODS

After the approval of study we had prospective collected data of 124 consecutive patients who underwent for surgery from 1st July 2020 to 30th June 2021 at PAQSJIMS Gambat. Our inclusion and exclusion criteria are given below.

Inclusion criteria:

- Consecutive patients operated during the study period
- Operated for coronary artery bypass surgery
- Operated by two surgeons
- Exclusion criteria
- Preoperative raised Troponin I level beyond the refence level
- Emergency coronary artery bypass surgery
- Patients requiring concomitant additional procedures along with Coronary artery bypass grafting

The measurement of Troponin I levels was done at the morning of planned day of surgery as a standard and once only18 hours after Chest Closure. The quantitative serum levels of Troponin I was measured in our lab using ADVIA Centaur XP, immunoassay system, Siemens. It measures highly sensitive Troponin I in 18 minutes and reported in nanogram per dl (ng/dl). The patients were followed till their discharge from the hospital. Major morbidities and mortality observed were recorded during stay in hospital. Patients were divided into two groups. Group 1 Troponin I level less than 10 ng/dl and group 2, Troponin I reading more than 10 ng/dl in the sample collected at the 18th hour of chest closure.

Anesthesia and cardiopulmonary bypass technique were standardized. The Bypass circuit used hollow fiber membrane oxygenator and non pulsatile flow was generated by roller pump and a 38 micro millimeter arterial line filter, flow was 2.4 liters per minute per meter square at 37 degree centigrade falling to 1.8 liter per min, per meter square at 32 degree centigrade, arterial pressure was maintain from 50-70 mm of Hg and hematocrit to 0.20 to 0.25. Myocardial protection was achieved with smooth induction followed by hypothermic cardiopulmonary bypass with temperature drop to 28c. We use cold blood cardioplegia for chemical arrest and myocardial protection repeated in every twenty minutes or earlier if new anastomosis is started.

Statistical Analysis

The data was entered into SPSS(STATISTICAL PACKAGE FOR THE SOCIAL SCIENCES) version 16 for the statistical analysis. Data presented as mean with standard deviation, the discrete variables were presented as frequencies. Comparison of the two groups was performed by the independent sample t-Test for continuous variable with 95% confidence level.

RESULTS

Out of 124 consecutive patients operated for CABG as per our selection criteria, group 1, have 84 patients and group 2, 40 patients respectively. The preoperative characters of two groups with the significance shown in table 1. The mean age of all patients was 54.7 ±9.07 and there were no significant different in two groups in age there were higher number of female in group 2 with significant difference. Higher numbers of smokers were present in group1so as the observed diffuse disease of coronary arteries.

Table No. 1: Preoperative characteristic between the two groups

Variables	Group 1 (n=84)	Group 2 (n=40)	P value
No. of Patient	84	40	
Age	54.25±8.9	55.7±9.3	NS
Male	82 (97.6 %)	34 (85%)	NS
Female	2 (2.38 %)	6 (7.14 %)	0.008
Smoking	41(48.8 %)	11(27.5 %)	0.025
DM	58 (69.04 %)	21 (52.5 %)	NS (0.074)
Hypertension	62 (73.8 %)	25 (62.5%)	NS
Stroke	5 (5.95%)	1 (2.5 %)	NS
Renal Impairment	8 (9.52%)	2 (5 %)	NS
LM	34 (40.48 %)	15 (37.5%)	NS
Diffuse Disease	25 (29.76 %)	18 (45%)	NS (0.09)
HBA1C	7.2±1.9	7.10±1.7	NS
EF	46.5±10.7	47.8±8.9	NS

Abbreviations DM, Diabetes Mellitus, LM , Left Main, EF, Ejection Fraction, SD, Standard Deviation, NS, Not Significant, HBA1C

Table No. 2: Preioperative characteristic between the two groups

Variables	Group 1 (n=84)	Group 2 (n=40)	P-value
IMA	65 (77.38%)	30 (74%)	NS
Retrograde	5 (5.95%)	6 (15 %)	NS (0.09)
Hot shot	58 (69.04 %)	28 (70 %)	NS
CPB	100.5±18.6	111.8±18.9	0.002
X Clamp	75.06±15.2	79.0±14.1	NS
No of Grafts	3.07±4.3	3.28±0.5	0.025
Duration of Surgery	4.7±1.4	4.5±1.0	NS

Abbreviations IMA, Internal mammary Artery, CPB, Cardio Pulmonary Bypass Time, X Clamp Aortic Cross clamp, SD, Standard Deviation, NS, Not Significant,

Operative data showed no statistical significant difference in use of internal memory artery (IMA), cross clamp time and duration of surgery. There were significant differences of higher number of grafts and CPB time in group 2 as shown in Table No. 2,

Post operative data showed no significant difference in IABP usage, post op Atrial Fibrillation, use of blood and blood product, LCOS, total ICU and ward stay, stroke and mortality. There were significant difference in intubation time, re-intubation, reopening and number of inotropes. Post operative outcomes are shown in Table No. 3.

Table No. 3: Post operative characteristic between the two groups

Variables	Group 1 (n=84)	Group 2 (n=40)	P-value
Intubation Time	10.6±7.2	21.6±28.8	0.001
Re- Intubation	5 (5.95%)	8 (20%)	0.017
IABP	6 (7.14%)	7 (17.5%)	NS (0.084)
Post op AF	13 (15.4%)	10 (25%)	NS
Post op Stroke	2 (2.38%)	2 (5%)	NS
Reopen	4 (4.76%)	7 (17.5)	0.020
No of Inotrop	21 (25%)	17 (42.5%)	0.012
LCOS	22(26.19 %)	16(40 %)	NS
Blood Product	62 (73.8%)	30 (75%)	NS
Blood Used	1.68±1.6	2.2±2.1	NS
Post Op Trop I	4.83±2.37	20.5±5.7	0.0001
Total ICU Stay	2.96±1.4	3.28±1.4	NS
Total Ward Stay	4.9±2.2	5.21±2.3	NS
Mortality	2 (2.38%)	4 (10%)	0.099

Abbreviations, IABP Intra Aortic Balloon Pump, LCOS, Low Cardiac output Syndrome, SD, Standard Deviation, NS, Not Significant.

DISCUSSION

People with multi-vessel and diffuse obstructive Coronary artery disease require CABG procedure to improve blood flow to the ischemic parts of the heart previously supplied by diseased arteries and it is one of the most effective treatment against ischemia caused by blocked coronary arteries and prevention of the complications associated with coronary artery diseases may cause like life style restriction and nonfatal and fatal arrythmias. In this procedure an artery used as pedicle or free graft or vein from the body is used to bypass the blocked coronary artery and reestablish blood flow to ischemic myocardium .

Myocardial damage is inevitable after cardiac surgery due to many factors. Myocardial cells may be damaged due to manipulation of heart, global ischemia of myocardium related with Aortic cross clamp, use of heart lung machine and its associated complements and cytokinesis activation[9]. As a result cardiac enzymes may be released into the blood stream. These enzymes include creatine kinase, CK-MB and various troponins. Extent of the release of these enzymes depend on the variety of factors like patient condition at the time of surgery , urgency of surgery , type of surgery and duration of surgery. In general extensive and complicated surgeries are more prone to higher level of release of enzymes . Myocardial injury still possible with the optimum dose of cardioplegia or avoidance of heart lung machine and the careful manipulation of heart, Coronary embolism of air and debris in venous graft and occlusion of grafts[10] and ischemia reperfusion injury[11]are few more factors responsible for myocardial cell injuries and leakage of cardiac enzymes in blood stream. Nevertheless elevated level may indicate potential risk of adverse prognosis. Troponin I & T are highly specific to heart muscles. Elevated level of these enzymes in blood indicates severity of damage of myocardial cells as seen after myocardial infarction. These enzymes level rise in few hours after event and remain elevated for several days . Therefor different timing of collection of sample for enzymes had been reported in literature .Troponin I levels in patients are better collected between 12 to 24 hours[12,13]of procedure as recommended in few studies . Therefore, we collected our single sample 18 hours after surgery for better result. It's important to note that the specific use of cardiac enzymes and their thresholds may vary depending on clinical protocols, individual patient characteristics, and advancements in medical practice. Healthcare professionals are best equipped to interpret and evaluate cardiac enzyme results in the context of a patient's overall condition. Several studies are conducted to show relationship of serum level of cardiac enzymes and post-operative complication[14-22] with variable outcomes .

Costa et al. observed elevated postoperative CKMB levels being associated with increased 30-day and 1-year mortality and repeat MI in almost two-third of CABG patients.[15] in another study a signification association of new myocardial necrosis demonstrated by MRI was found with the raised cardiac enzymes level[23]. Lurati Buse and colleagues in their meta-analysis for the prognostic value of troponin release after adult cardiac surgery supports the association between postoperative Troponin release and mid- and short-term all-cause mortality after adult cardiac surgery[24]. Nevertheless due to , differences in the populations, timing of the sample collection and Troponin subunit and Troponin assays and outcome definitions , making a standardized conclusion

regarding outcome , and cut-off values very debatable for consensus.

Our study showed no significant differences in most of the morbidities and mortality suggested with high Troponin I levels except prolong invasive ventilation time, re-intubation and mediastinal bleeding requiring reopening.

Nevertheless these adverse out comes were significantly inter related as those patients who bleed they were re-intubated and ultimately have the prolong invasive ventilation time. The patients who bleed also needed high inotropic support for the short period of time;therefore most of these factors were interrelated. There are also some studies which show no difference in operative mortality and short term complication[25] with raised cardiac biomarkers supporting our outcome . Thus, perioperative biomarker elevations are more difficult to interpret than one might have expected. In any case, the direct association of biomarker release with poor short- or long-term outcome may be questioned

Our limitation of study are we collected only single sample as few studies showed series of samples of Troponin I are more related with morbidity and mortality. Long term follow up was not done in this study.

CONCLUSION

Troponin I raised in every patient after cardiac surgery in different levels. Higher levels itself not related with early complications including mortality. Bleeding, intubation time and re-intubation related with high Troponin I levels. Further studies are warranted. The Troponin level itself does not indicate the adverse outcome.

Author's Contribution:

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