

Relationship of Off-Pump Coronary Artery Bypass Surgery with the Cardiac Enzyme Troponin T, LVEF, TAPSE and Post-Operative Recovery

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Abstract

Introduction: Cardiovascular diseases (CVD) makes a large part of NCDs.¹ In National Health Policy 2017, India aims to reduce premature deaths from CVDs, especially ischaemic heart disease to 25% by 2025. Our country with 1.3 billion people with significant cultural and lifestyle diversities is going through a varied epidemiological transition regarding the trend of ischaemic heart disease among its different states from 1990 to 2016.

Materials and methods: From September 2020 to August 2021 (1 year), patients who underwent OPCAB in Department of Cardiothoracic surgery, Government General Hospital, Guntur, Andhra Pradesh, India were studied. Patients were selected depending upon the specific selection criteria. Among all the studied patients, 44 patients were found to meet the below-mentioned selection criteria and enrolled in this retrospective study. As this is a retrospective record-based study, has granted our request for waiver of the written informed consent for the study.

Results: Among 44 pts, 17 (38.63%) pts, were positive with Trop T sensitivity test post operatively and the rest 27 pts, (61.36%) were negative for the same. There were 8 patients (18.18%) with LVEF <35% in Trop T (+ve) group and 5 patients (10.22%) in Trop T (-ve) group. TAPSE were <14 in 6 patients (7.95%) in Trop T (+ve) group and 3 patients (6.81%) in Trop T (-ve) group. Table 1 compares the preoperative characteristics of patients belonging to two groups with postoperative Trop T (+ve) and Trop T (-ve) results. Age, height, renal function, nutritional status along with left ventricular function and TAPSE were not significantly different between these two groups. Body wt, BMI, Blood pressure status were also not different.

Conclusion: In post OPCAB patients, elevation of cardiac enzyme Trop T is used as a prognostic guide especially when preoperative Trop T value is normal. LVEF is another well-known parameter in immediate and in early post-operative period of such patients for guiding postoperative recovery. In triple vessel disease with inferior wall ischaemia and/or infarction, there remains a heterogeneity using LVEF alone as a prognostic guide. A RV parameter TAPSE, signifying a global RV function, when added to Trop T and LVEF, they increase the cumulative prognostic value to a greater degree in such patients.

Key words: Cardiovascular diseases, BMI, Blood pressure, heterogeneity.

INTRODUCTION

Cardiovascular diseases (CVD) makes a large part of NCDs.¹ In National Health Policy 2017, India aims to reduce premature deaths from CVDs, especially ischaemic heart disease to 25% by 2025.² Our country with 1.3 billion people with significant cultural and lifestyle diversities is going through a varied epidemiological transition regarding the trend of ischaemic heart disease among its different states from 1990 to 2016.³ Cardiovascular disease prevalence has increased in India from 25.7 million in 1990 to 54.5 million in 2016 and there is nearly 46%

rise in deaths due to CVDs especially with ischaemic heart disease. This trend is highest in Kerala, Punjab, Tamilnadu and followed by Andhra Pradesh, Himachal Pradesh, Maharashtra, Goa and West Bengal.⁴

It is observed that there is a very sharp rise in number of patients with triple vessel coronary artery disease, admitted for coronary artery bypass grafting surgery (CABG) in past few years. As in other centres in India, in our centre also off pump coronary artery bypass surgery (OPCAB) highly outnumbers on pump coronary artery bypass surgeries (ONCAB).⁵

Our centre has a wide drainage area spanning different states of south India. Study has been done on post OP recovery of OPCAB patients of this demographic area combining estimation of three parameters Trop-T, LVEF and TAPSE for prognostic value.

MATERIALS AND METHODS

Study design: A retrospective record-based study

Study location: Department of Cardiothoracic surgery, Government General Hospital, Guntur, Andhra Pradesh, India.

Study duration: September 2020 to August 2021 (1 year).

Sample size: 44 patients.

From September 2020 to August 2021 (1 year), patients who underwent OPCAB in Department of Cardiothoracic surgery, Government General Hospital, Guntur, Andhra Pradesh, India were studied. Patients were selected depending upon the specific selection criteria. Among all the studied patients, 44 patients were found to meet the below-mentioned selection criteria and enrolled in this retrospective study. As this is a retrospective record-based study, has granted our request for waiver of the written informed consent for the study.

Patient Selection Criteria

1. Only male patients with diagnosed triple vessel disease involving left, right coronary arteries and circumflex artery were included as causal factors and disease prognosis are different in male and female genders in ischemic heart disease.
2. Age limit- 45-65 years, the most common age group affected by ischemic heart disease in the demographic zone under study.
3. All patients selected were diabetic.
4. All patients were on atorvastatin, aspirin, clopidogrel and metoprolol tablets preoperatively and clopidogrel and aspirin were stopped five to seven days before operation.
5. All patients were normotensive before operation, as uncontrolled hypertension affects recovery significantly, may cause encephalopathy or stroke postoperatively.
6. All patients were Troponin T negative preoperatively.
7. Left ventricular ejection fraction was more than 45% and with such ejection fraction hemodynamic stability during operation would be better maintained.
8. Patients with TAPSE more than 16 mm were included (as 16 mm is the consensus cut-off value for coronary artery disease).
9. Patients with stents in RCA were excluded as this can affect preoperative TAPSE level.
10. Patients were screened for serum Thyroid Stimulating Hormone (TSH) and free T4 level. Only those patients with normal thyroid profile were selected as disturbance in thyroid function affects postoperative recovery.
11. No patient had other associated co morbidities like chronic kidney, lung diseases, liver and peripheral arterial diseases.
12. All patients had 4 grafts – as number of grafting is the function of time and may influence ischemic time.
13. The preop NYHA (New York Heart Association classification for heart failure) class was either III or IV in all patients.

All patients had preoperative (preop) Trop T sensitivity test and routine echo evaluation was done including LVEF and TAPSE level measured, the day before surgery. Trop T sensitivity test was again done on post-operative day (POD)- 1 morning i.e., after 14-16 hours after surgery. All patients were postoperatively evaluated with 2D Echocardiography and colour Doppler study on POD 5. We use to discharge our post op OPCAB patients with uneventful and smooth recovery on POD 5. By protocol routine echo assessment was done along with LVEF and TAPSE measurement in the postoperative second visit in day -30. All patients (pts) underwent operation, with general anaesthesia, intubation and midline sternotomy under same anaesthetic and surgical team. All patients received LIMA to LAD grafting, RSVG to one diagonal artery (sequential), one obtuse marginal (sequential) and one PDA/distal RCA grafting (end anastomosis). Suction stabiliser, deep pericardial stays and gauge packing were used in all patients. All patients received infusion nitroglycerin and/or dobutamine, low dose of noradrenaline and diuretic therapy peroperative and postoperatively. Reopening was done in two patients in ICU due to bleeding issues. Postoperatively 12 patients had signs and symptoms of heart failure, mild to moderate in presentation, with variable incidence of increased heart rate, pedal oedema, rales at the base of the lungs, night cough, distress on lying down, anorexia but all of them were treated successfully. Respiratory complications included postop prolonged mechanical ventilation (more than 36 hours) and one patient needed tracheostomy and recovered late, one patient had CVA of ischaemic variety involving area supplied by posterior cerebral artery, recovered and discharged from hospital after six weeks post operatively. Wound infection, superficial soft-tissue infection, occurred in 6 pts, 3 of them needed sternal wire removal after two months of surgery.

Statistical Analysis: data were entered into a Microsoft excel spreadsheet and then analyzed by SPSS. Data had been summarized as mean and standard deviation for numerical variables and count and percentages for categorical variables. Two-sample t-tests for a difference in mean involved independent samples or unpaired samples. p-value ≤ 0.05 was considered for statistical significance.

RESULTS

Among 44 pts, 17 (38.63%) patients were positive with Trop T sensitivity test post operatively and the rest 27 pts, (61.36%) were negative for the same. There were 8 patients (18.18%) with LVEF <35% in Trop T (+ve) group and 5 patients (10.22%) in Trop T (-ve) group. TAPSE were <14 in 6 patients (7.95%) in Trop T (+ve) group and 3 patients (6.81%) in Trop T (-ve) group. Table 1 compares the preoperative characteristics of patients belonging to two groups with postoperative Trop T (+ve) and Trop T (-ve) results. Age, height, renal function, nutritional status along with left ventricular function and TAPSE were not significantly different between these two groups. Body wt, BMI, Blood pressure status were also not different.

Characteristics	Trop-T (+ve) (n=17)	Trop-T (-ve) (n=27)	P Value
Age (years)	54.67±9.10	56.23±4.29	0.48
Height (meters)	1.60±0.05	1.59±0.3	0.07
Body weight (Kg)	56.38±7.20	55.10±7.15	0.41
BMI (Kg/m2)	20.28±9.20	21.32±2.10	0.34
Systolic Blood Pressure (mmHg)	123.65±17.10	125.12±13.20	0.46
Diastolic Blood Pressure	84.21±4.28	79.17±9.27	0.54

(mmHg)			
Creatinine (mg/dl)	1.28±0.70	1.30±0.21	0.78
Albumin (gm/dl)	3.5±1.5	3.2±1.34	0.69
Haemoglobin (gm/dl)	11.25±1.23	10.67±1.80	0.23
ALT(units/L)	51.26±18.17	49.25±16.2	0.65
AST (units/L)	44.12±20.65	33.10±15.70	0.84
LVEF (%)	48.13±2.10	43.26±3.50	0.21
TAPSE (mm)	16.01±0.20	15.85±1.18	0.78

Table 1. Comparative Pre-Op Data for Two Groups with Post-Op Trop-T (+ve) vs Trop -T (-ve) Results

Characteristics	Trop-T (+ve) (n=17)	Trop-T (-ve) (n=27)	P Value
Haemoglobin (gm/dl)	8.30±2.40	9.42±1.52	0.007
Albumin (gm/dl)	2.63±1.5	2.71±1.56	0.56
BNP (pg/ml)	1058.70±68.13	670.2±2.28	0.001
LVEF (%)	37.69±6.85	42.16±4.17	0.06
TAPSE (mm)	13.58±1.14	14.15±1.45	0.012
PRBC Transfusion (units)	3.15±1.83	3.4±1.27	0.53
FFP Transfusion (ml)	586.8±64.12	540.56±548.10	0.72
Postop Hospital Stay (days)	7±1.32	4.8±2.5	0.0001
Ventilator Support (hours)	32.56±4.38	17.18±5.69	0.0001

Table 2. Comparative Data of Post-Op Parameters between the Two Groups with Post-Op Trop-T (+ve) vs Trop -T (-ve) Results in POD 5

Characteristics	Trop-T (+ve) (n=17)	Trop-T (-ve) (n=27)	P Value
Haemoglobin (gm/dl)	9.10±2.10	9.68±1.90	0.26
Albumin (gm/dl)	2.90±0.35	3.20±0.19	0.09
BNP (pg/ml)	544.10±270.04	626.10±300.12	0.23
LVEF (%)	43.20±0.10	46.30±3.5	0.001
TAPSE (mm)	14.09±0.28	15.21±0.15	0.001

Table 3. Comparative Data of Post-Op Parameters between the Two Groups with Post-Op Trop-T (+ve) vs Trop -T (-ve) Results in POD 30

DISCUSSION

Being a tertiary care hospital, our centre has the wide drainage area from various parts of eastern India and is experiencing very high number of OPCAB done per year. It is a known fact that OPCAB increases cardiac enzymes postoperatively, but predicting prognosis based only on this is problematic.⁷ Moreover, LVEF is affected in many cases postoperatively and also can be considered as a postoperative prognostic guide, but regarding surgical treatment in triple vessel disease where 70% of hearts are right coronary artery dominated, considering one right ventricular parameter may give a better prognostic value.⁸ Our study is considered

post-operative Trop T sensitivity test, LVEF%, TAPSE measurement as the cumulative predictors in post OPCAB patients.

In our centre TROP T Sensitive kits (Cobas –Roche) are routinely used after 12 hours of completion of OPCAB surgery and overall prognosis is assessed. The test contains two monoclonal antibodies specific for cardiac Troponin T, one gold –labelled, the other biotinylated. Both form a sandwich complex with any cTnT present in blood sample. Erythrocytes are removed from the sample and the plasma passes through the detection zone, in which the cTnT sandwich complexes gather along a line, appearing as a red streak. Excess gold- labelled antibodies gather along the control line, signalling visually that the test was valid. The positive result means that the concentration of Trop T in the sample is above the test threshold value of 0.1 ng/ml.⁹

It is an established fact that LVEF is an important parameter for assessing LV systolic function. Many patients, who are treated with aggressive revascularization therapy like OPCAB and medical therapy following MI, will have an improved LV systolic function, up to 50% of patients do not demonstrate improvement in LVEF several months after their index MI. The prognostic significance of the heterogeneity in LVEF change is not fully understood, yet may be important in terms of risk assessment and the routine management of post-MI patients.¹⁰

CONCLUSION

In post OPCAB patients, elevation of cardiac enzyme Trop T is used as a prognostic guide especially when preoperative Trop T value is normal. LVEF is another well-known parameter in immediate and in early post-operative period of such patients for guiding postoperative recovery. In triple vessel disease with inferior wall ischaemia and/or infarction, there remains a heterogeneity using LVEF alone as a prognostic guide. A RV parameter TAPSE, signifying a global RV function, when added to Trop T and LVEF, they increase the cumulative prognostic value to a greater degree in such patients.

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