Effect of Coronary Artery Bypass Grafting on Right Ventricular Function, A Tissue Doppler study

Thesis

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Abstract

Background:

Right ventricular function is known to be depressed after cardiac surgery, but the extent and mechanism is not known.

Aim of study:

To assess the effect of coronary artery bypass grafting surgery on the right ventricle.

Methods

RV function was studied pre and postoperatively in 20 patients scheduled for CABG (group 1) and in age and gender matched controls (group 2).Patients were followed up for 1 month after CABG. We prospectively evaluated right ventricular function by Tissue Doppler imaging of the tricuspid annulus, and the basal septum, Tricuspid annular plane systolic excursion (TAPSE), and right ventricular dimensions .We also measured left ventricular dimensions, left atrium and aortic root before and after coronary artery bypass grafting (CABG).

Results

Right ventricular function as evaluated by pulse wave Doppler tissue imaging in tricuspid annulus it significantly reduced after CABG pre & post operative values (systolic velocity0.124 vs 0.091 m/s; $p<0.014$, early diastolic 0.111 vs 0.079 m/s; $p<0.001$, and late diastolic 0.160 vs 0.096 $p<0.000$).Likewise RV function as measured by tissue Doppler in basal septum was significantly reduced after CABG (systolic velocity 0.081 vs 0.071; $p<0.046$, early diastolic 0.085 vs 0.070;$p<0.017$ and late diastolic 0.099 vs 0.083 $p<0.044$). A significant reduction of the TAPSE occured after CABG (2.386 vs 1.82; $p <0.000$).There was **no** significant difference in right ventricular dimensions. LVEDD significantly decreased after CABG (5.5 vs 5.2 $p<0.037$).

Comparison of the baseline data of group 1 patients with that of healthy controls(group 2) showed significantly lower LVESD in controls (3.79 vs 3.05 cm; $p<0.001$), LVEDD(5.5 vs 4.8 $p<0.008$), lower the LA (4.04 vs 3.6 cm; $p<0.049$), AOR (3.33 vs 3

cm p<0.024).When comparing right ventricular dimensions only the base to apex right ventricular dimension was significantly less in the patients group (4.98 vs 5.9 cm p<0.001). Pulse wave Doppler tissue imaging showed lower systolic velocity of the basal septum (0.0819 vs 0.098 m/s p<0.031).

Conclusions:

The cardiothoracic surgery is not a benign event to the RV regarding the systolic func on, RV func on remained depressed a er 1 month a er CABG. The CABG surgery does not produce significantly gross remodeling of the RV.

Key word:

-Tissues Doppler imaging in free wall of RV and basal of septum.

-RV Dimensions.

-TAPSE.

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Dedication

To my family, especially my parents, for their encouragement, patience and assistance over the years. I am forever indebted to my parents, who have always kept me in their prayers.

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List of Abbreviations

RV	Right ventricle
LV	Left ventricle
AOR	Aortic root
LA	Left atrium
RA	Right atrium
MI	Myocardial infraction
STEMI	ST segment elevation myocardial infraction
CABG	Coronary artery bypass grafting
RCA	Right coronary artery
LAD	Left anterior descending artery
LCx	Circumflex artery
PDA	Posterior descending artery
PVR	Pulmonary vascular resistance
NO	Nitric oxide
SMC	Smooth muscle cell
DM	Diabetes mellitus
PLAX	Left parasternal long axis
A4C	Apical four chamber
PSAX	Parasternal short axis
RVSP	Right ventricular systolic pressure
RVD1	Basal right ventricular dimension
RVD2	Mid right ventricular dimension
RVD3	Base to- apex right ventricular dimension
RVOT	Right ventricular outflow tract
RVH	Right ventricular hypertrophy

TAPSE	Tricuspid annuluar plane systolic excursion
SPAP	Systolic pulmonary artery pressure
PADP	Pulmonary artery diastolic pressure
TDI	Tissue Doppler imaging
PW TDI	Pulse wave Doppler tissue imaging
TDIAS	Tissue Doppler image of tricuspid annular systolic velocity
TDIAE	Tissue Doppler image of tricuspid annular early diastolic velocity
TDIAA	Tissue Doppler image of tricuspid annular late diastolic velocity
TDISS	Tissue Doppler image of basal septal systolic velocity
TDISE	Tissue Doppler image of basal septal early diastolic velocity
TDISA	Tissue Doppler image of basal septal late diastolic velocity

Introduction

Right ventricular infarction may cause sufficient myocardial damage to result in heart failure, shock, arrthymias, and death in the absence of any superimposed volume or pressure overload and unrelated to extent of left ventricle damage.[1]

RV dysfunction in left heart failure may occur in both ischemic and non ischemic cardiomyopathy. The right ventricular dysfunction in heart failure is secondary to pulmonary venous hypertension, intrinsic myocardial involvement, and ventricular interdependence. [2]

Bypass surgery improves the blood flow to the heart with new route or 'bypass' around a section of clogged or diseases artery. The surgery involves sewing a section of vein from the leg or artery from the chest or another part of the body to bypass apart of the diseases coronary artery.[3]

Coronary artery bypass grafting operation is classified into two categories: emergency and elective. The emergency coronary artery bypass grafting and reoperation on patients with prior bypass surgery are associated with higher operative mortality. [4]

It was found that right ventricular function is significantly reduced after coronary artery bypass grafting and remains so after one month. The underlying mechanisms leading to right ventricular dysfunction are still unknown. [5]

Other authors found that right ventricular function remained depressed for as long as 1 year after coronary artery bypass grafting.[6] A decrease in right ventricular function is an event know to occur after coronary

artery bypass grafting. Right ventricular dysfunction can be seen during and immediately after cardiac surgery although the mechanisms of this phenomenon are not understood.

Causes may include:

-Cardiopulmonary bypass

-Preoperative myocardial ischemia

-Intraoperative myocardial damage. [7]

Echocardiographic follow up after one year showed that RV function remained depressed. In comparison to the preoperative status, paradoxical septal motion was found in 90%of the patients. Exercise capacity improved significantly 3 months after CABG. [8]

These findings were independent of the state of the right coronary artery or the graft. [6]

About 90% of patients experience significant improvement after coronary artery bypass grafting and relief from chest pain .About 70% of cases resume their normal activities. [9]

Aim of work

The aim of this study was to assess the effect of coronary artery bypass grafting surgery on the right ventricular function using Tissue Doppler imaging.