Original Article

Evaluation of Left Ventricular Dyssynchrony after Coronary Artery Bypass Grafting in Patients with Ischemic Left Ventricular Dysfunction

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Background: Ischemic left ventricular (LV) dysfunction is one of the major causes of LV dyssynchrony. This is indicative of poor prognosis in patients with LV dysfunction and correction of ischemia by Coronary Artery Bypass Grafting (CABG) may resynchronize LV contraction. The aim of this study was to evaluate the effect of CABG on LV dyssynchrony, systolic and diastolic function.

Patients: The present study comprised 31 patients with ischemic LV dysfunction with Ejection Fraction (EF:25-50%). Echocardiography with Tissue Doppler Imaging (TDI) was performed to assess LV dyssynchrony (calculated by basal LV segment),to evaluate diastolic function by measurement of peak early diastolic mitral annular velocity (E_m) ,systolic function by measurement of peak early systolic mitral annular velocity (S_m) and Ejection Fraction (EF) by Simpson method.

Results: Mean LV dyssychrony before CABG was 30±16 ms that decreased to 22±14 ms after operation (P=0.04).There was also improved diastolic and systolic function after CABG (E_m 0.04m/s versus 0.05 m/s , P=0.01 and S_m 0.06 m/s versus 0.08 m/s P=0.01).The mean ejection fraction rose from 40±8.6% to 42±8.2% (P=0.01).

Conclusion: CABG is associated with improvement of LV dyssynchrony, systolic and diastolic function in patients with ischemic LV dysfunction.

Key words: Dyssynchrony, CABG, Tissue Doppler Echocardiography

Introduction

Intraventricular systolic dyssychrony refers to differences in the timing of contraction between the different myocardial segments which causes dyssynchronous contraction of right and left ventricle that leads to mechanical stress and hemodynamic deterioration.[1,2]

Asynchrony causes suboptimal LV filling and reduction in LV contractility with redistribution of myocardial blood flow, non-uniform regional myocardial metabolism,[2-4] development or prolongation of mitral regurgitation and paradoxical septal wall motion. These changes seem to represent a pathophysiological process that depress ventricular function causing LV remodeling and heart failure with increased risk of morbidity and mortality[4] and cardiac events.[5]

The prevalence of dyssynchrony varies and is based on the severity of LV dysfunction, QRS duration and loading condition.

The prevalence is higher in studies including patients with larger ventricles, coronary artery disease, lower ejection fraction and a wide QRS.[6]

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Chronic heart failure is one of the causes of morbidity and mortality in the western world.[7] In the majority of cases the etiology is ischemic heart disease and ischemic LV dysfunction is an important cause of LV dyssynchrony.[1,8] Several studies were done to evaluate the effect of optimal medical therapy alone versus optimal medical therapy plus Cardiac Resynchronization Thrapy (CRT) with or without Implantable Cardioverter Defibrillator (ICD). Biventricular pacing (CRT) stimulates both ventricles or septal and lateral walls of the left ventricle almost simultaneously and improves the coordination of ventricular contraction. The contraction delays of each cardiac segment can be lowered by CRT as measured by tissue Doppler imaging, along with decreased filling pressure and augmentation of systemic arterial pressure.[9]

These processes lead to reverse remodeling and increased exercise capacity.[10]

CABG as an optimal method for total revascularization in comparison with primary Percutaneous Coronary Intervention (PCI) in which revascularization is usually partial, seem to be another choice for reduction of contraction delays and improvement of asynchrony by resolving ischemia.

The aim of this study was to evaluate the effect of CABG on LV dyssychrony, diastolic and systolic function.

Patients and Methods

This study was done between march 2009 and September 2009 in Namazi hospital in shiraz Iran.

A total of 31 patients (20 males and 11females) whose mean age was 61±11 years with LV systolic dysfunction (LV EF: 25%-50%) were included in the study. These patients admitted with impression of acute coronary syndrome (19STEMI and 12 NonSTEMI / UA) and need CABG according to the result of coronary angiography (26 3VD and 5 2VD) and dipyridamol scan that revealed viability in patients with EF < 35%. QRS duration was (98 ±10 ms).

Echocardiography assessment:

Before CABG echocardiography and tissue Doppler imaging was done to assess LV dyssynchrony, systolic function as measured by EF and S_m, diastolic function by E_m and severity of mitral regurgitation. Echocardiography was then repeated one month after CABG to evaluate the effect of surgery on these parameters. The study was performed with GE- Vingmed vivid 3 system.

For measurement of LV dyssynchrony, time between the onset of QRS complex on the surface ECG and the peak of the systolic velocity wave on the TDI was recorded in each basal LV segments . Dyssynchrony calculated as the difference between the maximaum and minimum time interval in the 6 basal segments (Fig. 1). E_m and S_m by TDI were measured for evaluation of diastolic and systolic function (average of 6 basal segments). EF was calculated by simpson method.

Exclusion criteria

Patients with significant valvular heart disease that needed surgery, bundle branch block and AF rhythm were excluded from the study.

Statistical analysis

The statistical analysis was done with SPSS wave (version 15). Pre and post data of surgery were analyzed by paired T test . All data are presented as the mean value SD. P value less than 0.05 was considered statistically sig-

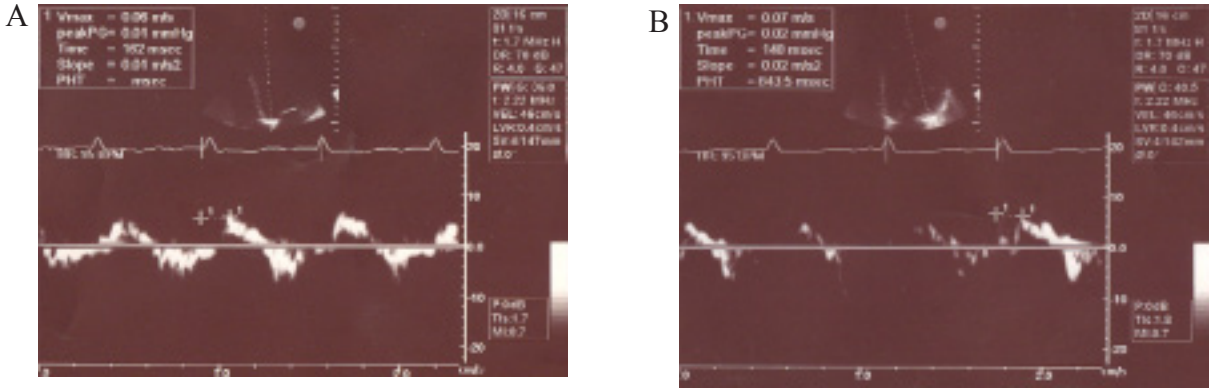

Figure 1. LV dyssynchrony, time between the onset of QRS complex on the surface ECG and the peak of the systolic velocity wave on the TDI between septal (A) and lateral wall (B).

nificant.

Result

The present study comprised 43 hospitalized patients with impression of acute coronary syndrome, but unfortunately 2 patients expired during the operation. 10 patients excluded from the study due to poor cooperation.

The remaining 31 patients were then followed with the impression of acute coronary syndrome.

Total revascularization was achieved in all of the patients. Mean LV dyssynchrony before CABG was 30 ms(14-46ms) that decreased to 22 ms(8-36ms) after operation (P =0.04).

LV dyssynchrony decreased in 24 patients (80%) and remained unchanged in 7 patients (20%). Mean EF increased from 40%±8.6 to 42%±8.2 (P =0.01).

Diastolic function by measurement of E_m with TDI also increased from 0.04±0.013m/s to 0/06±0.019m/s (P=0.01), S_m increased from 0.06±0.015 m/s to 0.08±0.018 m/s (P=0.01).

The duration of QRS after CABG did not change significantly. (Table 1)

Discussion

Ischemic LV dysfunction is a leading cause of hospitalization, because of unsatisfactory outcome of medical therapy, other therapeutic modalities such as resynchronization or revascularization are also to be considered.[11,12] Revascularization improve survival in patients with coronary artery disease.[13] The present study investigated the effect of CABG on LV dyssynchrony in 31 patients with ischemic LV dysfunction undergoing surgery. In patients with systolic LV dysfunction the prevalence of LV dyssynchrony ranges from 20.8% to 79.6% and is associated with a significantly higher risk

Table 1. Comparison of dyssynchrony, systolic and diastolic function, QRS duration before and after CABG.

	Before CABG	After CABG	P value
Dyssynchrony (ms)	30±16	22±14	0.04
EF (%)	40±8.6	42±8.2	0.01
E_m (m/s)	0.04±0.013	0.06±0.019	0.01
S_m m/s	0.06±0.015	0.08±0.018	0.01
QRS duration (ms)	98 ±10	96 ±6	0.112

of cardiac events.[12] Myocardial ischemia is one of the major causes of LV dyssynchrony and so correction of ischemia by CABG may resynchronize LV contraction. Gibson et al. reported complete improvement of LV dyssynchrony after CABG surgery in 12 of 14 patients with preserved EF.[14] Also S.A.F Tulner et al.[15] reported significant reduction in mechanical dyssynchrony after ventricular restoration (30%±4 to 26%±3). Yang and et al. demonstrated a decrease in LV dyssynchrony by 33% during systole and 20% during diastole after ventricular restoration.[16]

In this study we found that CABG can reduce LV dyssynchrony, increase EF and improve diastolic and systolic function measured by TDI.

Previous studies which demonstrated improvement of LV dyssynchrony after CABG used traditional echocardiography techniques to assess effect of CABG on LV dyssynchrony, whereas TDI was used for accurate assessment of LV dyssynchrony in our study.

CABG Leads to reduction in LV dyssynchrony and improvement of diastolic and systolic function.

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