Echocardiographic Evaluation of Left Ventricular Function After Coronary Artery Angioplasty

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Abstract

Objectives: Coronary angioplasty has revolutionized the management of coronary artery disease. It has not ceased to develop to become the reference method of myocardial revascularization. The aim of our study is to evaluate the ultrasound parameters of left ventricular function after coronary angioplasty.

Patients and methods: This is a prospective analytical study including patients with stable coronary artery disease with a known coronary artery anatomy programmed for coronary angioplasty. Transthoracic echocardiography was performed four hours before and seven days after myocardial revascularization.

Results: 56 patients were collected, 38 of them were male (67.9% of the cases). The mean age was 60.11±7.92 years. Modifiable cardiovascular risk factors were dominated by diabetes in 64.3% of cases, followed by hypertension in 57.1% of cases. The clinical symptoms were dominated by a typical stable angina in 53.6% of cases. At the ECG, the antero-septo-apical territory was the most affected in 52% of the cases followed by the posterior territory in 46% of the cases; the depression of the ST segment was noted in 46% and negative T waves in 32% of cases. . The left anterior descending artery was affected in 66% of cases followed by right coronary artery in 13% of cases. Echocardiography was performed in all our patients 4 hours before and 7 days after angioplasty, the EF mean was 49.68% ±12 vs 55.32±12 (p=0.0001). The early mitral diastolic velocity was improved after angioplasty 66.55±16 vs 69.7±18cm/s (p=0.02). As well as the tissue doppler, the E' wave significantly improved 9.48±2.29 vs 10.02±3.38cm/s (p=0.02) whereas the left ventricular end diastolic diameter and end diastolic volume did not change after angioplasty.

Conclusion: This work emphasizes the value of revascularization in stable coronary arteries not only to improve clinical symptomatology but also to improve left ventricular diastolic function.

Keywords: Coronary angioplasty; Diastolic dysfunction; Pulsed doppler; Tissular doppler

Introduction

Diastolic dysfunction is the first consequence of myocardial ischemia in patients with severe coronary lesions. In the absence of early management, it progresses to global dysfunction. Transluminal coronary angioplasty has revolutionized the management of coronary heart disease. It has continued to develop to become the gold standard for myocardial revascularization. To evaluate improvement in left ventricular function after coronary revascularization, we conducted a study comparing ultrasound parameters of left ventricular function before and after coronary angioplasty.

Patients and Methods

This is a prospective analytic study including 56 patients suffering of chronic stable angina who are candidates for percutaneous coronary intervention (PCI) for coronary stenosis >75% of diameter. We excluded from our study all patients with atrial fibrillation, cardiomyopathy, systemic hypertension, valvular or congenital disease and patients with multi-truncal coronary lesions without complete revascularization or previous coronary revascularization. Once selected, all our patients have had a transthoracic echocardiography examination 4 hours before and 7 days after successful coronary angioplasty. We collected all the data of the diastolic and systolic left ventricular function: In TM and 2D mode (left ventricular end-systolic diameter LVES-D, left ventricular end-diastolic diameter LVED-D, the left ventricular end-systolic volume LVES-V and left ventricular end-diastolic volume LVED-V, regional wale motion abnormality- and LV biplane ejection fraction LVEF).In pulsed Doppler mode (the peak of the E-wave , A-wave , the ratio E/A, TDE, IVRT and the ITV of the aortic flow). In tissue Doppler mode (the peak of the E '-wave, A' and the S 'wave of

the left ventricle. All data were analyzed using an SPSS version 17 and expressed as mean on ±SD. For all analyses a p value <0.05 was considered significant.

Results

Fifty-six patients were collected and evaluated in our study. Table 1 summarizes their main clinical characterestics. The average age was 60.11±7.92 years (40-80 years). 86% of patients had at least three cardiovascular risk factors dominated by diabetes in 64.3% of cases followed by hypertension (57.1%), The history of myocardial infarction was noted in 10% of patients. The clinical history was dominated by stable angina in 53.6% of cases. In Electrocardiogram, the anterior-septo-apical territory was the most affected in 52% of cases followed by the inferior territory (46%), the depression of the ST segment was noted in 46% and negative T waves in 32% of cases. Coronary angiography showed a single vessel disease in 82% of cases dominated by left anterior descending artery's stenosis in 66% of cases followed by right coronary (13%), marginal artery (12%), and circumflex (9%) (Figure 1). Echocardiography was performed in all our patients four hours before and 7 days after angioplasty. In TM and 2D mode, the mean left ventricular ejection fraction (LVEF) was 49.68%±12 vs 55.32±12 (p=0.0001). Analysis of regional wale motion showed severe hypokinesia in 57.1% of cases vs 41.1% after angioplasty (p=0.0035), while LVED diameters and volume did not change after angioplasty 43.9±7.22mm vs 42.68± 9mm (p=0.1) 114.6±18.8ml vs 110.16±23.85ml (p=0.06) respectively (Table 2). In pulsed Doppler, the early diastolic velocity of mitral flow (E) was improved after angioplasty 66.55±16 vs 69.7±18cm/s (p=0.02). The tissue Doppler showed an improvement of E ' wave significantly after PCI 9.48±2.29 vs 10.02 ±3.38cm/s (p=0.02). However, there was no significant difference of systolic wave (S') of Left ventricle (Table 3).

Table 1: Clinical characteristics of patients: cardiovascular risk factors and history.

Characteristics	N=230
Age (ys)	60.11±7.92 (40-80)
Gender M/F	38/18
Q-wave MI	6(10%)
HT	32(57.1%)
DM	36(64.3%)
Smoking	16(28.6%)
dyslipidemia	10(17.9%)
abdominal obesity	19(33.9%)
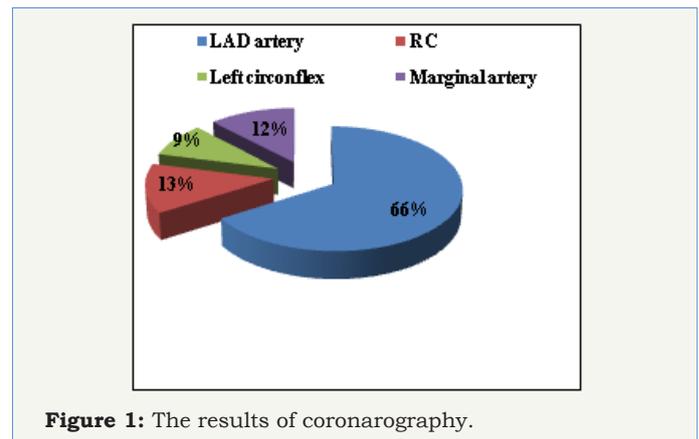
Figure 1: The results of coronarography.

Table 2: TM and 2D mode echocardiography.

	Before PCI	After PCI	P Value
LVEF (%)	49.68±11	55.32±12	0.0001
Hypokinesia	57.1%	41.1%	0.0035
LVED-D (mm)	43.9±7.22	42.68±9	0.1
LVES-D (mm)	28.89 ±5.45	28.2±4	0.2
LVED-V (ml)	114.6±18.8	110.16±23.85	0.06
LVES-V (ml)	56.34±17.75	56.07±19.78	0.12

Table 3: Pulsed and tissue doppler mode echocardiography

	Before PCI	After PCI	P Value
E (cm/s)	66.55±16	69.7±18	0.02
A (cm/s)	73.04±23.16	67.93±23.19	0.004
E/A	0.85±0.10	1.21±0.12	0.01
TDE (ms)	187.88 ±22.2	153.36±24.85	0.002
IVRT (ms)	85.88±10.25	84.73± 12.81	0.01
ITV-Ao (cm)	33.34±7.96	34.34±7.5	0.02
E' (cm/s)	9.48± 2.29	10.02±3.38	0.02
S'-LV (cm/s)	8.02±1.3	8.83±2.1	0.074

Discussion

Echocardiography is the gold standard for evaluation of left ventricular function in chronic stable angina. The study of transmitral Doppler flow velocities, TDE, IVRT and the ratio E/A coupled to the peaks of tissue Doppler velocities reported early left ventricular diastolic dysfunction before the occurrence of the systolic dysfunction [1]. Several studies report early or late improvement in LV diastolic function following PCI. Bayata et al. [1] found that Doppler derived LV diastolic abnormalities improved within 24 hours after angioplasty. Masuyama et al. [2] report an improvement of these parameters within two days after angioplasty and continued to improve up to 9 days. Leung et al. [3] concluded that left ventricular dysfunction improved on the tenth day after revascularization and significantly better after one

month. All these studies proved that the earliest echocardiographic abnormalities observed in chronic stable angina is the relaxation disorder characterized by the reduction in the E/A ratio becoming <1, the decrease in E wave, the increase in A wave and increase in TDE and IVRT [4]. In this study we noted a statistically significant difference between the E wave; A; TDE; TRIV and E 'after angioplasty showing improvement in abnormalities of left ventricular diastolic function. Leung et al. [3] showed a significant correlation between improvement in ventricular abnormalities and the severity of coronary stenosis. On the other hand, no significant correlation was found in Bayata et al. [1] study. Arbeille and al was interested by the evaluation of the myocardial wall contraction after angioplasty by Speckle tracking and showed a significant improvement of the global longitudinal Strain within 24 hours following angioplasty without significant difference in LVEF [5-7].

Conclusion

In this present study, we demonstrate that the revascularization of chronic stable angina was associated with an clinical and functional left ventricular improvement. Hence, we have to select the coronary patients who are symptomatic at the appropriate time to benefit from PCI.

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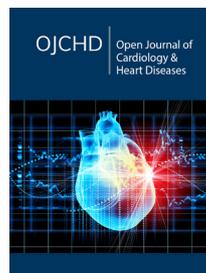
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