
Brief Report

Global and Regional Left Ventricular Function Improvement Following Successful Percutaneous Coronary Intervention in Patients with Ischemic Left Ventricular Dysfunction

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This study assessed changes in global and regional systolic left ventricular function after successful percutaneous recanalization of coronary artery occlusions.

A consecutive series of 110 patients with mean \pm SD age of 53.6 ± 9.1 years, in whom a complete angiographic evaluation was available before angioplasty, underwent successful percutaneous recanalization of significant occlusions of coronary arteries. Left ventricular ejection fraction and wall motion score index were assessed by echocardiography at baseline, and 1, and 6 months after recanalization.

Left ventricular ejection fraction increased from a mean \pm SD of $40.7 \pm 4.52\%$ at baseline to $50 \pm 8.3\%$ after one month ($P < 0.001$) and to $50.9 \pm 8.5\%$ after 6 months. There was no significant difference between left ventricular ejection fraction at the end of the first and the sixth month of treatment ($P = NS$). The wall motion score index decreased from 1.3 ± 0.2 at baseline to 1.1 ± 0.2 after one month ($P < 0.01$). There was no significant difference between 1 and 6 months results. Six-month follow-up of all patients showed significant improvement in both angina severity and NYHA class.

The restoration of coronary potency of occluded coronary arteries by successful percutaneous recanalization is associated with significant improvement in regional and global left ventricular function and clinical outcome.

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Introduction

Left ventricular (LV) function is an important predictor of outcome in patients with coronary artery disease. Extensive myocardial ischemia can cause decreased LV contractility and function. Several studies have demonstrated the clinical benefits of revascularization in patients with ischemic LV dysfunction.^{1 - 8} However, the magnitude and consistency of improvement in this setting are not well-characterized in our patients. This study

assessed changes in global and regional systolic LV function after successful percutaneous recanalization of coronary artery occlusions (PCI).

Patients and Methods

A total of 110 consecutive patients who had depressed ($\leq 45\%$) LV ejection fraction (LVEF) due to coronary artery disease, were studied. All patients underwent a complete angiographic evaluation and were candidates for PCI. The study protocol was as follows: before PCI, all patients underwent 2-dimensional echocardiography to assess global LVEF and regional contractile function (wall motion score index). One and six months after PCI, global and regional LV contractility were reassessed. Patients with unsuccessful PCI were not included in the study.

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The Hospital Ethics Committee approved the protocol. All patients gave informed consent before enrolling into this study.

Assessment of LVEF and regional contractile dysfunction

For 2-dimensional echocardiography, a vivid 3 system with phase array probe was used. All echocardiographic assessments were done by an experienced echocardiologist. LV global EF evaluated by Simpson method, and regional contractile function by regional wall motion analysis according to the standard 16-segment model suggested by the American Society of Echocardiography.

Statistical analysis

All continuous data are expressed as mean±SD. Continuous variables were compared using the Student's *t*-test for unpaired samples. Differences between proportions were compared using the χ^2 test. ANOVA test (Bonferroni correction) was used for *post hoc* comparison of means. SPSS version 9.05 (SPSS Inc., Chicago, IL) was used for the statistical analyses. A $P < 0.05$ was considered statistically significant.

Results

Baseline characteristics of the patient's are presented in Table 1.

The mean ± SD LVEF was $40.7 \pm 4.52\%$ at baseline (range: 25 – 45%). The mean ± SD wall motion score index was 1.3 ± 0.2 at baseline.

Overall, the mean ± SD LVEF improved from $40.7 \pm 4.52\%$ before PCI to $50 \pm 8.3\%$ one month after PCI ($P < 0.001$) and to $50.9 \pm 8.5\%$ after six months. There was no significant difference between LVEF at the end of the first and the sixth month of treatment ($P = \text{NS}$).

Improvement of global function after PCI was related to baseline LVEF (Figure 1). Significant improvement in LVEF after PCI was more often observed in patients with an LVEF $\leq 40\%$ at baseline.

Wall motion score index showed a significant improvement from 1.3 ± 0.2 at baseline to 1.1 ± 0.2 after one month ($P < 0.01$). There was no significant difference between the results observed one and six months after PCI.

Six-month follow-up of the whole study population showed a significant improvement of both angina severity and NYHA class particularly

Table 1. Baseline characteristics of patients.

Baseline characteristics (n = 110)	
Mean ± SD age (yrs)	53.6 ± 9.1
Gender	
Men	78 (71%)
Women	32 (29%)
Previous myocardial infarction	47 (42.7%)
Angiographic results:	
1.SVD	52 (47.3%)
2.VD	44 (40%)
3.VD	14 (12.7%)
LVEF $\leq 40\%$	70 (63.6%)
LVEF $> 40\%$	40 (36.4%)
PCI (number of vessels treated)	
One vessel	65 (59%)
Two vessels	45 (41%)

in the subgroup of patients with more severe LV dysfunction.

Discussion

Myocardial revascularization using PCI is widely used and improves clinical outcome particularly in postinfarction patients with markedly reduced LVEF.⁶

In the present study, our results suggest that PCI is associated with a significant improvement in global and regional LV function and favorable clinical outcome as shown by functional improvement in NYHA class and angina severity. This improvement of LV contractility was significant one month post-PCI whereas it did not show further significant improvement when measured six months after PCI. The LVEF improvement was nonetheless more pronounced in patients with baseline LVEF $\leq 40\%$ (Figure 1).

Therefore, it appears that patients with more severe LV dysfunction will achieve more benefits

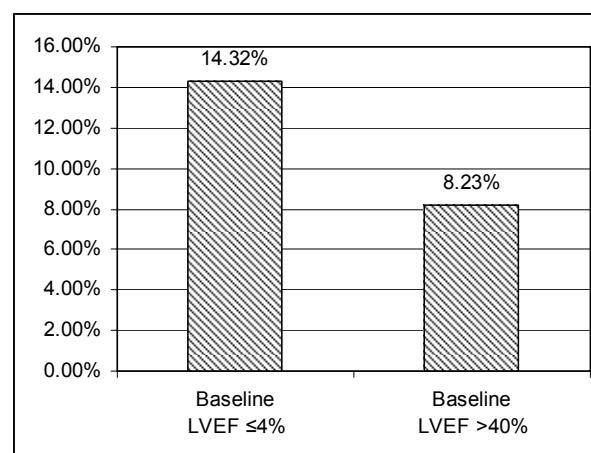


Figure 1. The mean increase in LVEF one month after PCI.

from PCI.

Previous studies have also shown an improvement in LV function after PCI. Dzavik and colleagues studied 244 patients and showed that the restoration of coronary potency of nonacute occluded coronary arteries is associated with a small but significant improvement in regional and global LV function, especially in patients with depressed LV function.⁵

Dudek et al showed improvement in LV function in patients with ischemic cardiomyopathy after PCI.³

According to the current ACC/AHA guidelines, patients with low LVEF and significant coronary stenosis should be referred for surgical revascularization.⁹

Nevertheless, both the AWESOME randomized trial and REHEAT registry concluded that PCI and CABG in such patients had similar outcome and that PCI can be an alternative approach to CABG.^{6,10} However, a randomized clinical trial comparing CABG and PCI with routine use of drug-eluting stent and new antiplatelet therapy should be carried out to prove this concept.

In conclusion, our results suggest that the restoration of coronary potency of occluded coronary arteries by successful PCI is associated with significant improvement in regional and global LV function and clinical outcome.

References

- 1 Nechvatal L, Hlinomaz O, Groch L, Hornacek I, Sitar J, Urban M, Petrikovits E. Serial echocardiographic assessment of the left ventricular function after direct PCI. *Kardiol Pol.* 2003; **59**: 397 – 401.
- 2 Chung CM, Nakamura S, Tanaka K, Tanigawa J, Kitano K, Akiyama T, et al. Effect of recanalization of chronic total occlusions on global and regional left ventricular function in patients with or without previous myocardial infarction. *Catheter Cardiovasc Interv.* 2003; **60**: 368 – 374.
- 3 Dudek D, Rzeszutko L, Turek P, Sorysz D, Dubiel JS. Clinical predictors of left ventricular function improvement after percutaneous coronary interventions in patients with ejection fraction below 45% [in Polish]. *Przegl Lek.* 2001; **58**: 751 – 754.
- 4 Danchin N, Angioi M, Cador R, Tricoche O, Dibon O, Juilliere Y, et al. Effect of late percutaneous angioplastic recanalization of total coronary artery occlusion on left ventricular remodeling, ejection fraction, and regional wall motion. *Am J Cardiol.* 1996; **78**: 729 – 735.
- 5 Dzavik V, Carere RG, Mancini GB, Cohen EA, Catellier D, Anderson TE, et al. Total Occlusion Study of Canada Investigators. Predictors of improvement in left ventricular function after percutaneous revascularization of occluded coronary arteries: a report from the Total Occlusion Study of Canada (TOSCA). *Am Heart J.* 2001; **142**: 301 – 308.
- 6 Buszman P, Szkobka I, Tendera Z. Early and late results of percutaneous revascularization in patients with ischemic cardiomyopathy and decreased left ventricular ejection fraction. *Euro Intervent.* 2005; **2**: 186 – 192.
- 7 Bolognese L, Neskovic AN, Parodi G, Cerisano G, Buonamici P, Santoro GM, Antoniucci D. Left ventricular remodeling after primary coronary angioplasty: patterns of left ventricular dilation and long-term prognostic implications. *Circulation.* 2002; **106**: 2351 – 2357.
- 8 Schinkel AF, Poldermans D, Vanoverschelde JL, Elhendy A, Boersma E, Roelandt JR, et al. Incidence of recovery of contractile function following revascularization in patients with ischemic left ventricular dysfunction. *Am J Cardiol.* 2004; **93**: 14 – 17.
- 9 Hunt SA, Baker DW, Chin MH, Cinquegrani MP, Feldman AM, Francis GS, et al. ACC/AHA Guidelines for the evaluation and management of chronic heart failure in the adult: a report of the American College of Cardiology web site. Available from: URL: http://www.acc.org/clinical/guidelines/failure/hf_index.Htm.
- 10 Sedlis SP, Ramanathan KB, Morrison DA, Sethi G, Sacks J, Henderson W. Department of Veterans Affairs Cooperative Study #385, Angina With Extremely Serious Operative Mortality Evaluation (AWESOME) Investigators. Outcome of percutaneous coronary intervention versus coronary bypass grafting for patients with low left ventricular ejection fractions, unstable angina pectoris, and risk factors for adverse outcomes with bypass (the AWESOME Randomized Trial and Registry). *Am J Cardiol.* 2004; **94**: 118 – 120.