



The Effects of Enhanced External Counterpulsation on Cardiac Electrophysiologic Properties of Patients with Ischemic Heart Disease and Refractory Angina at Function Class II-III

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ABSTRACT

Introduction: Enhanced external counterpulsation (EECP) is a noninvasive circulatory assist device that has been recently emerged as a treatment option for refractory angina or left ventricular (LV) dysfunction. The aims of this study were to examine the effects of EECP on the electrocardiographic parameters and the heart rate variability indices of patients with the coronary heart disease and function class II-III angina resistant to medication. **Methods:** In a descriptive study, the patients who presented with severe angina at function class II-III were studied. Those meeting the inclusion criteria were invited to participate and provided informed consent. The standard enhanced external counterpulsation treatment (35 one-hour procedures 5-6 times a week) was done. Thirty minute ambulatory electrocardiographic monitoring and electrocardiogram before starting and at the end of treatment sessions were done. Data entry and analysis of data was done finally. **Results:** Twenty five patients with mean age 68 ± 9 year including 21 (84%) men and 4 (16%) women were enrolled in this study. Electrocardiographic parameters before and after treatment by EECP were not different statistically. Time domain indices of heart rate variability according to ambulatory monitoring findings were not changed significantly. **Conclusion:** Results of this study revealed that EECP did not improve the electrocardiographic and heart rate variability parameters of ischemic heart disease patients with refractory angina at function class II or III.

Introduction

Enhanced external counterpulsation (EECP) is one of the therapeutic options for improving the patient's chest pain and quality of life. Studies showed that EECP can increase patient's level of physical activity and decrease ischemia during exercise.¹⁻³ EECP usually is the last therapeutic choice for ischemic cardiomyopathy and heart failure patients in which other therapeutic options failed to response properly.⁴ Ischemic heart disease and heart failure have multiple consequences on the

conductive tissues of the heart.⁵ The effects of EECP on the conductive systems of the heart and the heart rate variability as markers of mortality and morbidity were not evaluated thoroughly. The aim of this study was to evaluate the effects of EECP on the conductive systems and the heart rate variability of ischemic heart disease patients.

Materials and methods

With a descriptive prospective study, all ischemic heart disease patients who were candidates for EECP during year 2010 included in the study. The following patients were not admitted in the study were: patients with cardiac pacemakers, rhythm of atrial fibrillation or flutter and patients who did not want to attend in the study. Twenty five patients with ischemic heart disease and class II or III of chest pain (12 patients had history of coronary artery bypass surgery) who could finish their 35 session EECP were eligible to take part in the study. Informed consent was obtained from all patients. Medical history, physical examination, review of angiogram and medication as well as echocardiographic data of patients were evaluated thoroughly.

A twelve-lead electrocardiogram (ECG) and 30-minute ambulatory ECG monitoring were obtained before starting of EECP sessions and after the end of all sessions. Patients were followed for any possible complications of EECP. Data on QRS duration, PR interval, QT and QTc interval and indices of heart rate variability were collected. For collecting heart rate variability indices, a 30-minute holter monitoring without noise and without PACs or PVCs was selected for analysis. Data entry and analysis were done by SPSS 13 software for windows. Continuous variables showed as mean \pm SD and t-test was done to show differences. P value ≤ 0.05 considered as a significant difference.

Results

Twenty five patients (21 male) were studied. Mean age of patients was 68 ± 9 years (52 to 83 years). Mean left ventricular ejection fraction of patients was $32\% \pm 6\%$ and all patients had history of myocardial infarction. All patients had documented coronary artery disease confirmed by coronary angiography, 6 patients had one vessel disease (1VD), 5 had 2VD and others had 3VD. All patients received optimal medical treatment including ACE-I, betablockers, lipid lowering agents, digoxin, diuretics, nitrates and aspirin.

Electrocardiographic findings

Mean of QRS duration was 108 ± 18 msec (millisecond) before EECP which decreased to 105 ± 17 msec at the end of study, this difference was not statistically significant. PR interval (Figure 1) changed from 134 ± 18 msec before EECP to 139 ± 17 msec at the end of study; this difference was not statistically significant. QT and QTc interval changed from 396 ± 22 and 402 ± 22 msec before EECP to 391 ± 24 and 399 ± 22 msec respectively after EECP, differences were not statistically significant (Figure 2 and 3).

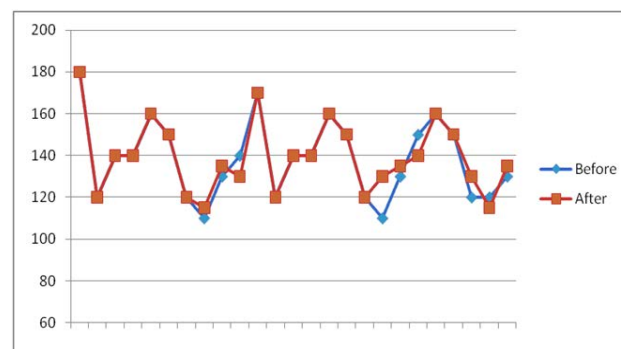


Figure 1. PR interval (millisecond) before and after EECP.

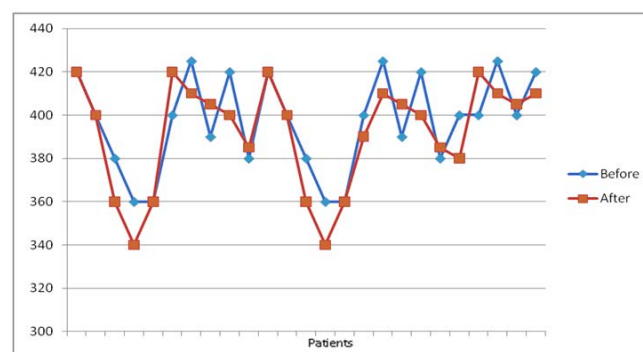


Figure 2. QT interval (milliseconds) before and after EECP.

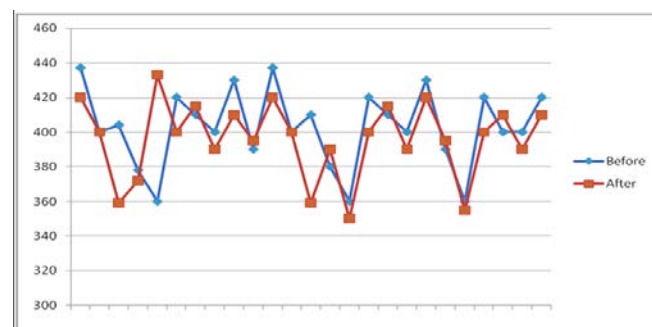


Figure 3. Corrected QT interval (millisecond) before and after EECP.

Conclusion

Findings demonstrated that EECP did not improve the electrocardiographic and heart rate variability parameters of ischemic heart disease patients with refractory angina at function class II or III.

Ethical issues: The study was approved by the Ethical Committee of the University.

Conflict of interests: No conflict of interest to be declared.

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