A Report From the International Enhanced External Counterpulsation Registry (IEPR)

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Summary

Since 1998 the International Enhanced External Counterpulsation Patient Registry (IEPR) has collected data on baseline characteristics, safety and acute and long-term outcome of consecutively enrolled patients undergoing EECP for chronic angina. The majority of patients receiving EECP have severe angina, have had previous revascularization, and are no longer suitable for either bypass surgery or percutaneous intervention. Patients show a high rate of comorbid conditions such as diabetes, and congestive heart failure. After a mean treatment time of 34 hours, 72% of patients showed reduction in angina. Major adverse coronary events during the treatment period are infrequent. On a sample of patients followed to one year, the majority maintain their reduction in angina without occurrence of any major coronary event.

Introduction

Enhanced external counterpulsation (EECP) is a noninvasive analogue of the intra-aortic balloon pump designed to increase myocardial perfusion pressure and decrease cardiac workload. The United States Food and Drug Administration cleared EECP for the treatment of myocardial infarction, cardiogenic shock, and unstable and

stable angina in March 1995. Since then, the use of EECP for the treatment of chronic angina pectoris has continued to increase both in the United States and other countries. In 1995 the MultiCenter Study of Enhanced External Counterpulsation (MUST-EECP) (1), the first randomized trial of EECP vs. sham treatment, demonstrated that EECP resulted in a statistically significant post-treatment increase in exercise duration, increase in time to ST depression, and a reduction in the frequency of anginal episodes. In 1998 the International EECP Patient Registry (2) was started in order to document patient characteristics, safety and efficacy during the treatment period, and acute and long-term outcomes. The Registry was designed to enroll patients from a wide range of clinical treatment centers, both in the United States and other countries. This report presents the methods used in the registry and the pre-and post- results from 3309 patients enrolled in the registry who were undergoing treatment with EECP for chronic angina. In addition the results from 674 patients who reached their one-year follow-up time point are discussed.

Methods

Each clinical center using EECP as a treatment modality was contacted by the sponsor and invited to join the Registry. Clinical sites included academic and non-academic, hospital-based and free-standing treatment centers. The Registry is purely voluntary, and there are no payments to either the clinical centers or patients for participation. All clinical centers have been approved by their Institutional Review Boards for participation in the Registry (if required), and patients in the Registry are required to give informed consent.

All Registry patients were treated with EECP equipment which consists of an air compressor, a control console, a treatment table, and three pairs of pneumatic cuffs. Prior to a treatment session, these cuffs are wrapped around the patient's legs and buttocks. In early diastole, pressure is applied sequentially from the lower legs to the lower and upper thighs to propel both arterial and venous blood towards the heart. The result is an increase of diastolic blood pressure (diastolic augmentation) with retrograde aortic blood flow, as well as an increase in venous return during diastole. At end diastole, air is released simultaneously from all the cuffs to remove the external applied pressure, allowing the compressed vessels to reconform,

thereby reducing vascular impedance and decreasing cardiac workload. In general treatment is applied 1 hour daily for a total of 35 hours.

The Registry aims to collect data on as broad a range of patients as possible. The criteria for entry are only that the patient give informed consent and have at least 1 hour of EECP treatment. Every center enrolls all consecutive patients entering treatment with no exclusions due to demographics, clinical status, or outcome. Data collected prior to the first hour of treatment include demographics, medical history, disease characteristics, symptoms and medication use. At the last hour of treatment, data recorded include the length of treatment, the degree of diastolic augmentation achieved (ratio of diastolic to systolic area as measured by finger plethysmography), untoward clinical events, and current symptoms. At one year follow-up the patient is interviewed, by telephone or at a clinic visit, and data recorded concerning interim clinical events, hospitalizations and current symptomatology.

The primary outcome is exertional angina as measured by the Canadian Cardiovascular Society Classification (CCSC). Other outcome measures included frequency of anginal episodes, and use of and frequency of anti-anginal medications.

Results

The 3309 patients reported on here were enrolled from 88 clinical sites (82 in the United States, 6 in other countries). Enhanced external counterpulsation is a therapy used primarily for treatment of chronic angina pectoris in patients who either are not suitable for more conventional forms of revascularization or have been previously revascularized but have recurrent symptoms. A small minority of patients suitable for conventional revascularization chose to have EECP instead of more invasive treatment. The baseline characteristics of the patients reflect this with 80.7% of patients having severe (CCSC III/IV angina), 84.5% with previous bypass surgery (CABG) or percutaneous coronary intervention (PCI), and 79.8% judged not suitable for either CABG or PCI at the time of EECP treatment.

Overall the mean age was 66.5 years with 59% being over 65 years, 75% were male and 93.5% were of white race. Coronary disease was long-standing with a mean duration of 10 years. Multivessel disease was present in 77.5% of patients, and 65.9% had a previous

myocardial infarction. Coronary risk factors, as might be expected, were extremely prevalent; a family history of coronary artery disease was present in 76.6%, hypertension in 69.2%, hyperlipidemia in 78.2%, diabetes in 41.7% and current or past smoking in 70.8%.

Anti-anginal medication use was high with 68.2% using sublingual nitroglycerin (mean frequency of 9.4 times/week), and other coronary medication use was also frequent with 64% taking beta blockers, 46.8% calcium channel blockers, 35.8% ace inhibitors, 10.6% angiotensin receptor blockers, 73.2% long acting nitrates, 68.1% lipid lowering and 70.6% aspirin.

Treatment was completed as prescribed in 83% of patients; mean length of treatment was 33.9 hours. Treatment was discontinued because of a clinical event in 8.5% of patients, and because of patient preference in 7.5%. The mean value of diastolic augmentation (ratio of peak diastolic to peak systolic pressure) achieved was 1.1. At the end of treatment the majority of patients showed a reduction in severity of angina (72% down by at least one CCSC class), frequency of angina episodes (mean decrease of 7 episodes/week) and 54% of those using nitroglycerin has discontinued its use. Very few serious adverse events were noted during the treatment period, the combined endpoint of MACE (death/myocardial infarction/CABG/PCI) occurring in only 1.9% of patients. Other events reported included exacerbation of congestive heart failure in 1.8% and episodes of unstable angina in 2.8%. Adverse events associated with the use of EECP were also infrequent. Skin breakdown occurred in 1.4% and 1.0% complained of musculo-skeletal pain.

For the majority of patients the reduction in angina has been maintained out to one year. Of 610 patients providing one-year follow-up data (representing 90.5% of eligible patients from sites providing one-year follow-up) over 80% reported an angina class which was less than or equal to that at the conclusion of EECP. The cumulative rate of MACE up to one year was 17.4%. The combined endpoint of no MACE and maintenance of angina reduction was achieved in over 50% of the patients.

Conclusions

EECP provides both acute and longer-term effectiveness in the relief of angina in a severely symptomatic population who are at

high risk for revascularization by bypass surgery or percutaneous coronary intervention.

Serious adverse events occur infrequently and are consistent with those encountered in such populations after conventional revascularization techniques.

References

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