

### Atrial Fibrillation Does Not Degrade the Clinical Benefits From Enhanced External Counterpulsation Therapy in Patients With Chronic Angina: Results From the International EECF Patient Registry

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**Background:** EECF is a non-invasive analog of the intra-aortic balloon pump, and is effective in treating chronic refractory angina pectoris. Frequent triggering interference caused by the irregular rhythm of atrial fibrillation (AF) may diminish the clinical benefits of EECF. **Methods:** The International EECF Patient Registry enrolls consecutive patients undergoing EECF for chronic angina. We analyzed demographic and clinical outcome data from 1485 patients from > 90 international sites. 213 had AF, and 1272 did not have atrial fibrillation (NAF). EECF was given 1-2 hrs daily to all patients and each group had similar total treatment hours (mean $\pm$ SD, 33  $\pm$  10hrs) and completion rates (80% vs 83%). **Results:** Patients with AF were older (70  $\pm$  10 vs 66  $\pm$  10 yrs), and had a higher incidence of prior MI (78% vs 69%) and history of congestive heart failure (54% vs 31%); all  $p < 0.005$ . A similar decrease in the frequency of nitroglycerine use (mean $\pm$ SD, -7.4  $\pm$  9.1 vs -6.9  $\pm$  10.3 tabs/wk), anginal episodes per week (-8.3  $\pm$  12 vs -7.7  $\pm$  10.3), and decrease  $\geq 1$  angina class (76% vs 74%) occurred in both groups (all  $p = NS$ ). Diastolic augmentation was the same in both groups as assessed by peak-to-peak and area under the curve pressure ratios (Table 1). Adverse cardiac events and bleeding complications occurred infrequently in both groups ( $p = NS$ ). **Conclusions:** Patients with AF receive the same clinical benefits from EECF as patients without AF, and EECF is well tolerated in AF patients. AF does not affect diastolic augmentation during EECF.

Table 1. Effects of AF on Diastolic Augmentation With EECF

	1 <sup>st</sup> Hour of EECF		Last Hour of EECF	
	NAF	AF	NAF	AF
peak to peak	0.78 $\pm$ 0.5	0.78 $\pm$ 0.7	1.00 $\pm$ 0.6	0.97 $\pm$ 0.8
area	0.95 $\pm$ 0.6	0.86 $\pm$ 0.6	1.23 $\pm$ 0.7	1.12 $\pm$ 0.7

$p = NS$  for all

### Enhanced External Counterpulsation for the Relief of Angina in Patients With Diabetes: A One-Year Clinical Outcome Study

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**Background:** Diabetic patients (D) have less success with revascularization when compared with nondiabetic individuals (ND). Enhanced external counterpulsation (EECP) is a noninvasive analogue of the intra-aortic balloon pump designed to increase myocardial perfusion pressure and decrease cardiac workload. EECF has been demonstrated to be safe and effective for treating angina in diabetic patients; however, the long-term effectiveness of EECF for the treatment of angina in this group of patients is unknown.

**Methods:** The International EECF Patient Registry enrolls consecutive patients undergoing EECF for chronic angina. We analyzed data from 1532 patients who were followed for one year after completion of treatment. Patients were divided into D (665) and ND (867). EECF was administered with similar total treatment hours (mean, 32 hours) and completion rates.

**Results:** D differed significantly from ND in female gender (35% vs 21%,  $p < 0.001$ ), history of congestive heart failure (40% vs 25%,  $p < 0.001$ ) and non-cardiac vascular disease (35% vs 22%,  $p < 0.001$ ). There were no differences between the groups in age (66 years), race (91% white), prior revascularization (86%), prior myocardial infarction (69%), or multivessel disease (81%). Most patients were not considered candidates for further revascularization. Upon completion of treatment, 69% of D and 72% of ND ( $p = NS$ ) had their Canadian Cardiovascular Society angina class reduced by 1 class. This response was maintained at one year with 71.5% of D and 72.7% of ND ( $p = NS$ ) reporting maintenance of angina reduction. During the follow-up period, the rates of myocardial infarction and unstable angina were comparable in both groups; however, D had higher rates of congestive heart failure (13% vs 6%,  $p < 0.001$ ), death (7.5% vs 3.9%,  $p < 0.01$ ) and cardiac hospitalization (33% vs 26%,  $p < 0.01$ ).

**Conclusion:** EECF is an effective treatment option for the relief of angina in patients with diabetes mellitus. Angina relief was sustained at one-year follow-up in a population where the majority of patients are not candidates for further revascularization.

### Two-Year Outcomes After Enhanced External Counterpulsation: Data From the International EECF Patient Registry

**Andrew D. Michaels**, Georgiann Linnemeier, Ozlem Soran, Elizabeth D. Kennard, University of California, San Francisco, San Francisco, CA, University of Pittsburgh, Pittsburgh, PA

**Background:** The International Enhanced External Counterpulsation (EECP) Patient Registry (IEPR) enrolls consecutive patients undergoing EECF for chronic angina. The IEPR began in January 1998, and patients have been enrolled from 72 centers.

**Methods:** We analyzed demographic, hemodynamic, and two-year clinical outcome data

on 704 patients who underwent EECF for angina and were enrolled in the IEPR between January 1998 and July 2000.

**Results:** The mean age of patients in this cohort was 66 $\pm$ 10 years, 74% were male, 43% were diabetic, 68% had prior MI, 80% had multivessel coronary disease, 30% had CHF, 86% had prior PCI or CABG, 67% had quit smoking, and 5% were current smokers. The mean duration of coronary artery disease (CAD) was 10 $\pm$ 8 years, and 81% were no longer suitable candidates for further revascularization by PCI or CABG. The mean number of angina episodes per week was 10 $\pm$ 13. Three percent of patients had class I angina, 13% had class II, 61% had class III, and 23% had class IV. 82% patients completed at least 35 hours of EECF, 11% stopped due to a clinical event, and 7% stopped due to patient preference. 71% had a reduction by at least one angina class at the end of treatment, while 28% had no change in angina class. The following adverse cardiac events were reported at two-year follow-up: unstable angina 19%, MI 10%, death 10%, CHF exacerbation 13%, PCI 11%, CABG 6%, cardiac hospitalization 40%, and repeat EECF 19%. The angina status at two years was no angina in 30%, class I in 20%, class II in 28%, class III in 16%, and class IV in 6%. 59% of patients who reported a reduction in angina after the original EECF course had maintained that angina reduction at two years.

**Conclusion:** In a large cohort of patients with chronic CAD, EECF is associated with a significant reduction in angina that is sustained after two years of follow-up in the majority of cases.

## ORAL CONTRIBUTIONS

### 848FO Featured Oral Session...Clinical Innovations in Surgical Revascularization: Surgeons Are Not Standing Still

Tuesday, April 01, 2003, 10:30 a.m.-Noon  
McCormick Place, Room S104

10:45 a.m.

#### 848FO-2

#### Clinical Outcomes of Over 800 Radial Artery Grafts Used in Coronary Bypass Surgery

**Edward P. Chen**, Emir Veledar, Ellis L. Jones, Robert A. Guyton, William S. Weintraub, Emory University, Atlanta, GA

**Background:** Coronary artery bypass grafting (CABG) is an established treatment for ischemic heart disease and is most commonly performed using an internal mammary artery (IMA) in combination with one or more saphenous vein grafts (SVG). The radial artery (RA) has recently reemerged as a potential additional arterial conduit for CABG. However, to date, little experience exists regarding patient outcomes with the use of this vessel in myocardial revascularization. In this study, the clinical results of patients receiving a RA graft at the time of CABG were retrospectively examined.

**Methods:** From January 1997 to December 2001, all patients who underwent CABG with a RA graft combined with an IMA and/or SVG's were reviewed. Results were also compared to those who had CABG using only an IMA and SVG's during this time. The follow-up period was up to 5 years.

**Results:** During the study interval, 892 patients underwent CABG with a RA graft while 6378 patients underwent CABG using an IMA and SVG's. There was no difference in the two groups with respect to operative mortality (1.7% vs 2.1%), peri-operative myocardial infarction (1.1% vs 1.3%), intra-aortic balloon pump use (0.1% vs 0.4%), major arrhythmias (6.2% vs 7.4%), neurological events (3.9% vs 4.3%), sternal wound infections (0.7% vs 0.9%), and pulmonary complications (2.3% vs 3.4%). When compared with patients who did not receive a RA graft, a significantly larger proportion of patients in the RA group had undergone prior CABG (15.4% vs 4.4%,  $p < 0.0001$ ). In addition, survival was significantly better in patients who underwent CABG using a RA when compared to those who did not receive a RA graft (94.2% vs 91.1%,  $p < 0.0001$ ).

**Conclusions:** Use of a RA conduit at the time of CABG does not adversely affect operative morbidity and mortality when compared to CABG without a RA graft. Although a significantly higher percentage of patients in the RA group had undergone previous CABG, survival was higher when compared to patients who received only an IMA in combination with SVG's. These data suggest that the RA graft appears to be an safe and viable additional arterial conduit for myocardial revascularization, particularly in the setting of re-operative coronary surgery.

11:00 a.m.

#### 848FO-3

#### Influence of Diabetes on Coronary Graft Patency

**Mohammad Khan**, Joseph F. Sabik, III, Eugene H. Blackstone, Penny L. Houghtaling, Bruce W. Lytle, Delos M. Cosgrove, III, The Cleveland Clinic Foundation, Cleveland, OH

**Background:** Diabetes is associated with increased failure of percutaneous coronary interventions. To determine if diabetes is also associated with increased risk of coronary artery bypass graft failure, we compared graft patency in diabetics and nondiabetics.

**Methods:** From 1972 to 1999, 50,278 patients underwent primary isolated CABG, of whom 296 patients with diabetes, and 3,203 patients without, had 12,488 complete post-operative angiograms. Grafts with no stenosis greater than 50% were considered patent. A propensity score was developed to adjust analyses for differences between diabetics