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Overview On Enhanced External Counterpulsation Therapy

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Abstract:-

Angina remains a significant health problem all over the world. There are a various pharmacological and interventional therapies to treat angina, many patients are not adequately helped by these treatments. In this review we discussed the very effective therapy that is Enhanced external counter pulsation (EECP) for angina, Congestive Heart Failure, Hypertension etc. EECP is an effective, noninvasive technique designed to decrease the frequency and duration of anginal episodes, as well as increase exercise duration in patients with acute angina. Since the early 1960s, the technology of EECP has been developed. There are a number of important clinical trials have provided evidence for its effectiveness. Continuing research is needed to determine the best patients for EECP and its appropriate clinical application.

Key word: - Angina; Enhanced external counter pulsation (EECP), Heart failure.

Introduction

About every 25 seconds, an American will have a coronary event, and about every minute someone will die from one. Coronary heart disease (CHD) caused about 1 of every 5 deaths in the United States in 2005. Final 2005 coronary heart disease mortality in 2005 was 445,687 (232,115 males and 213,572 females). On the basis of 2005 mortality rate data, nearly 2,400 Americans die of cardiovascular disease (CVD) each day—an average of 1 death every 37 seconds.^[1,2]

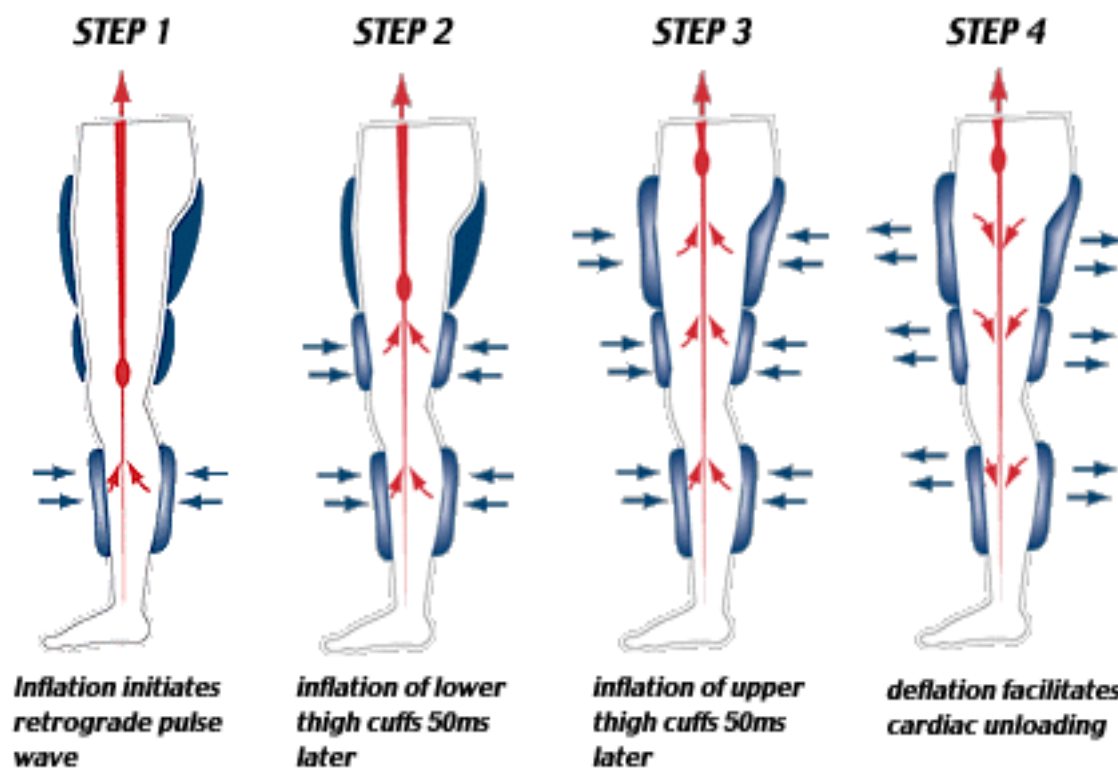
In the United States, 10.2 million are estimated to experience angina with approximately 500,000 new cases occurring each year.^[3,4]

Even when patients undergo conventional or interventional therapies, many continue to have angina. The Bypass Angioplasty Revascularization Investigation (BARI) trial demonstrated significant clinical and functional status impairment 5 years after bypass surgery and angioplasty in patients with multivessel coronary disease. Following coronary revascularization, 30% of patients were unable to return to work due to their angina. Among the subjects in the trial, 15 to 20% rated their health as fair to poor following revascularization. There are a variety of treatment options for symptomatic coronary artery disease. Pharmacologic options include beta blockers, calcium blockers, and long-acting nitrates. Interventional techniques are percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG). Some patients may not be candidates for some of these options, while other patients may have tried them all and still have angina. It is these patients for whom new therapeutic options are needed. One of these new options is a class of drugs known as FOX inhibitors. These are antianginal drugs designed to alter metabolic pathways within the myocardium. Another developed treatment is transmyocardial revascularization with laser. However, one of the most exciting, noninvasive approaches is enhanced external counterpulsation (EECP).^[5]

EECP invented in Boston in the late 1960s. The EECP was effective in treating cardiogenic shock, or severe heart failure due to heart muscle damage, a condition that was otherwise almost uniformly fatal. Researchers in mainland China during the 1980s improved the technology and effectively treated patients with heart disease, stroke, circulatory disorders and many other diseases. In 1990, physiologist named Dr. John Hui brought the technology back into the United States, and persuaded physicians at Stony Brook Hospital in New York to begin research. EECP

proved so effective in reducing angina symptoms that the FDA approved it for the treatment of angina and cardio-genic shock. EECP is also approved by the FDA to treat congestive heart failure, which is responsible for the highest number of hospitalizations in our country. [6]

EECP therapy consists of three sets of pneumatic cuffs attached to each of the patient's legs at the calf and lower and upper thigh. The inflation of the cuffs is triggered by a computer, and timing of the inflation is based on the R wave of the electrocardiogram. The EECP therapist adjusts the inflation and deflation timing to provide optimal blood movement per a finger plethysmogram wave form reading. This produces a retrograde flow of blood in the aorta (aortic counterpulsation), resulting in a diastolic augmentation of blood flow and also an increase in venous return, which leads to an improved coronary perfusion pressure during diastole. Shortly afterwards, the cuffs simultaneously deflate before the onset of systole, thereby decreasing vascular resistance, assisting with systolic unloading, and decreasing cardiac workload. [7]



The basic principle of EECP treatment involves increasing the amount of blood returning to the heart, which helps supply more oxygen to its starved areas. With more oxygen available, the heart can function much more efficiently and therefore reduce chest pain. [8]

The typical EECP course involves 35 one-hour sessions that the patient attends each week, Monday through Friday. However, two sessions can be completed per day if the patient so desires and is able to tolerate the sessions. The course of therapy can be extended for patients who do not start to develop improvement of their symptoms until late in the course of therapy. Additional treatment hours may be considered on a case-by-case basis for the patient to reach individual treatment objectives. Specifically, for patients who initially present with angina, a reduction of symptom frequency and/or intensity would be a measurement of progress. For

patients with comorbidities or physical limiting factors, the therapy may be less effective and additional hours of treatment may be warranted.^[9]

Role of EECP therapy On :-

- Angina
- Congestive Heart Failure
- Hypertension
- Acute Coronary Syndrome with Cardiogenic Shock
- Non-cardiac Conditions

Campbell et al, demonstrated the EECP therapy improves systolic blood pressure [SBP] in patients with refractory angina. EECP lowered SBP in patients with refractory angina. However, there was a differential effect on blood pressure depending on baseline SBP. The differential effect on blood pressure may represent favorable changes in cardiac output, endothelial function, and vasoreactivity that ultimately improve clinical outcomes.^[10]

Alvaro N Gurovich et al, the present study showed that EECP acutely improves endothelium-dependent vasodilation in both femoral and brachial arteries. EECP creates opposite blood flow patterns in the femoral (retrograde-turbulent) and brachial (antegrade-laminar) arteries.^[11]

XianMing Chu, in his research studied EECP therapy not only increased the number, improved functions of EPCs in peripheral blood but also enhanced the restoration of endothelial function. So, based on vascular biomechanics and remodeling of endothelial function, EECP therapy can increase blood flow shear stress, thus promote endogenous vascular endothelial repair mechanisms after emergency PCI of AMI.^[12]

R R Arora , on his research studied on the multicenter study-EECP (MUST-EECP) that randomly assigned 139 patients with chronic stable angina and positive exercise stress tests. He concluded that, Enhanced external counterpulsation reduces angina and extends time to exercise-induced ischemia in patients with symptomatic CAD. Treatment was relatively well tolerated and free of limiting side effects in most patients.^[13]

Darshak H. Karia, on his research studied concluded that Endothelial dysfunction is common in patients with Angina and Coronary Artery Disease, and worse in Hypertensive Patients. EECP may hence produce a substantial drop in Systolic and Diastolic Blood Pressure in Hypertensive patients compared to Normotensive Patients. EECP may represent an untapped nonpharmacotherapeutic option for patients with resistant HTN.^[14]

Yousef Houshyar et. Al. studied on Effect of EECP on Erectile Dysfunction in Patients with Coronary Artery Disease, on this studied they consider 12 men with coronary artery disease and erectile dysfunction. EECP therapy was conducted in 20 sessions. Every session lasted 1 hour. In his study showed that EECP can be significantly effective for ED in CAD patients.^[15]

Komal Channappa Pawar, studied the comparison of 35 sessions eecp therapy with 50 sessions of eecp therapy in patients with low ejection fraction, he show that there is significant improvement in EF at 6 weeks ($p=0.05$) and at 8 weeks ($p=0.007$).^[16]

Conculsion:-

EECP has been used in the treatment of angina for the past three decades with a record of safety and, there are, several publications which support its efficacy. Mainly it is approved by the FDA for the treatment of chronic or unstable angina and in patients with congestive heart failure. In more research additional light on the mechanism of action and verify the longterm attenuation of symptoms in patients with unstable angina pectoris and in those with congestive heart failure. Also EECP therapy helpfully in other health problem like hypertension, Endothelial dysfunction. By increasing the 50 session of EECP therapy as compared to 35 session of EECP therapy, it show significant improvement.

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