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REVIEW ARTICLE

# "ENHANCED EXTERNAL COUNTER PULSATION"

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## ARTICLE INFO

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## ABSTRACT

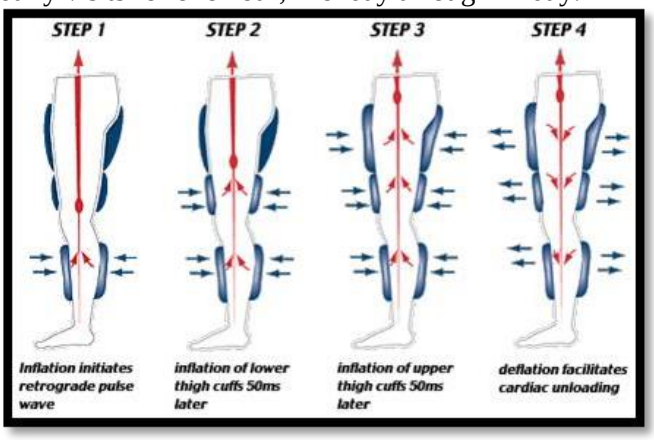
Enhanced External Counter Pulsation (EECP) is performed as a non-invasive treatment which involves increasing the amount of blood returning to the heart, which helps supply, more oxygen to its starved areas. Eligible patients are those who have had coronary artery bypass or stents placed in the coronary arteries with ongoing angina or those who are not candidates for bypass or stents but continue to suffer from angina. EECP treatment originated in China where it has been extensively used since the 1960s. In the past 10 years it has been introduced to the United States, where there are currently around 1200 machines in operation.



## Introduction:

**"The health is the greatest gift, contentment the greatest wealth, faithfulness is the best relationship" - Buddha**

Enhanced external counterpulsation (EECP) is a mechanical form of treatment for angina. While several clinical studies appear to show that this treatment can be helpful in reducing symptoms of angina in patients with coronary artery disease (CAD), EECP has yet to be accepted by most cardiologists and has not entered the mainstream of cardiology practice. Enhanced External Counter Pulsation (EECP) is performed as a non-invasive treatment to lower the number and intensity of angina episodes. Treatment is administered through three pairs of external inflatable cuffs that are applied around the lower legs, upper legs and buttocks. These cuffs continuously inflate and deflate between the resting period of the heartbeat and increase blood returned to the heart. 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. EECP has at least two potentially beneficial actions on the heart. Something like a sudden vacuum in the arteries, which reduces the work the heart muscle has to perform in Pumping blood. It is also speculated that EECP may help reduce endothelial dysfunction. The treatment schedule includes 7 weeks of continuous treatments, which require daily visits for one hour, Monday through Friday.




History of EECP Treatment: EECP treatment originated in China where it has been extensively used since the 1960s. In the past 10 years it has been introduced to the United States, where there are currently around 1200 machines in operation.

The idea for EECP stemmed from the development of the intra-aortic balloon pump (IABP). IABP resulted in increasing the amount of blood that can get pumped out of the heart by inflating a balloon in the aorta between each heartbeat. Opening up the aorta allows more blood flow and therefore decreases how hard the heart has to work. This same theory is applied to EECP but is taken one step further. EECP Increases the amount of blood going back to the heart, providing more blood for the heart to work with. This also decreases how hard the heart has to work but on a much greater scale, especially for people with damaged heart tissue.

**Eligible patients for EECP Treatment:** Individuals are eligible for treatment if they have:

- Had coronary artery bypass (CABG) or stents placed in the coronary arteries with ongoing angina.
- Had no prior bypass or stunting but continue to suffer from angina

Who Should Not Seek EECP Treatment?

Patients who should not undergo EECP includes:

- Hypertrophic cardiomyopathy
- Congenital heart disease
- Valvular disease
- Enlarged heart
- Pacemaker
- Hemorrhage
- Atrial fibrillation (Afib)
- Pulmonary hypertension
- Clot in their body
- Peripheral artery disease (PAD), also called peripheral vascular disease (PVD)
- Severe elevated blood pressure
- Heart rate greater than 120 beats per minute

What Are the Benefits of EECP Treatment?

- Increased oxygen supply for the heart
- Decrease in chest pain
- Improved EKG response to exercise
- Decrease in nitroglycerin use
- Increase in energy
- Increased exercise duration
- Long term effects up to 2 years

Patient Resources

- Angina Information Guide(link is external)
- Heart Attack-Prevention Information Guide(link is external)
- High Blood Pressure Information Guide(link is external)
- EECP Treatment Patient Story.

**Effectiveness of EECP:** Several studies suggest that EECP can be quite effective in treating chronic stable angina. A small randomized trial showed that EECP significantly improved both the symptoms of angina (a subjective measurement) and exercise tolerance (a more objective measurement) in patients with CAD. EECP also significantly improved "quality of life" measures, as compared to placebo therapy.

Other studies have shown that the improvement in symptoms following a course of EECP seems to persist for up to five years (though 1 in 5 patients may require another course of EECP to maintain their improvement).

**Mechanisms of EECP:** The mechanism for the apparent sustained benefits seen with EECP is unknown. There is some evidence suggesting that EECP can help induce the formation of collateral vessels in the coronary artery tree, by stimulating the release of nitric oxide and other growth factors in within the coronary arteries.

There is also evidence that EECP may act as a form of "passive" exercise, leading to the same sorts of persistent beneficial changes in the autonomic nervous system that are seen with real exercise.

**Can EECP Be Harmful?**

EECP can be somewhat uncomfortable but is generally not painful. In studies, the large majority of patients have tolerated the procedure quite well.

**But not everyone can have EECP.** People probably should not have EECP if they have aortic insufficiency, or if they have had a recent cardiac catheterization, an irregular heart rhythm such as atrial fibrillation, severe hypertension, peripheral artery disease involving the legs, or a history of deep venous thrombosis. For anyone else, however, the procedure appears to be safe.

**When Is EECP Recommended?**

Based on what we know today, EECP should be considered in anybody who still has angina despite maximal medical therapy, and in whom stents or bypass surgery are deemed not to be good options. Medicare has approved coverage for EECP for patients with angina who have exhausted all their other choices. In 2014, several professional organizations (the American College of Cardiology, American Heart Association, American Association for Thoracic Surgery, Preventive Cardiovascular Nurses Association, Society for Cardiovascular Angiography and Interventions, and the Society of Thoracic Surgeons) finally agreed in a focused update that EECP ought to be considered for patients with angina refractory to other treatments.

**Why Isn't EECP Used More Often?**

In general, the cardiology community has largely chosen to ignore such an outlandish form of therapy, and many cardiologists fail to even consider offering EECP as a therapeutic option. Consequently, most patients who have angina never hear about it. Indeed, EECP is a little outlandish. It certainly does not look like cardiology. Nobody can really explain how it works. And, from a cardiologist/s viewpoint, when you compare the relative effort and relative reimbursement of EECP to something like inserting a stent (35 sessions over 7 weeks vs. a 30-minute procedure) there is no contest. To expect cardiologists to embrace EECP with any enthusiasm simply ignores human nature. Still, when a noninvasive treatment for angina exists that is safe and well tolerated, when available evidence strongly suggests

the treatment is quite effective in many patients, and when the patient being treated will be able to tell pretty definitively whether or not the treatment has helped in their own individual case (by the presence or absence of a substantial reduction in angina symptoms), it does not seem unreasonable to allow patients with stable angina to opt for a trial of that noninvasive therapy, perhaps even before they are pushed into invasive therapy.

If you are being treated for stable angina and still have symptoms despite therapy, it is entirely reasonable for you to bring up the possibility of trying EECP. Your doctor should be quite willing to discuss this possibility with you, objectively and without prejudice.

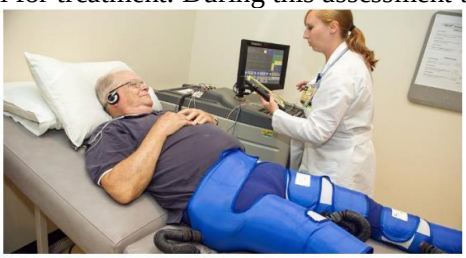
**Pre-EECP Treatment**

Before beginning EECP, you should:

Get a physician referral, Schedule your pre-treatment appointments, which include: Nursing assessment, Stress test and Orientation to procedures and equipment

***Nursing assessment:***

The nursing assessment will include a review of medical history, contraindications to treatment and clearing the individual for treatment. During this assessment they will



Michigan Medicine heart patient George Forbes receiving EECP treatment.

be given an angina diary which will be used to record frequency and duration of chest pain episodes. During the nursing assessment, the individual will receive comprehensive information about EECP treatment and procedures and will complete several questionnaires to assess severity of chest pain.

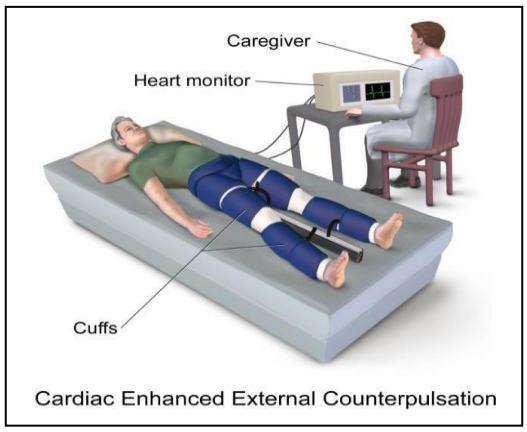
***Stress test:***

Individuals will complete a stress test prior to beginning EECP treatment. This will establish their exercise capacity and provide final clearance to begin treatment. More importantly, it will identify the severity, frequency and duration of chest pain with exercise.

After completing 35 treatment sessions, there will be another stress test measuring the same values. The two stress tests will be compared, which will indicate any changes in chest pain and exercise capacity.

***Orientation:***

The orientation is designed to give an individual the chance to experience exactly what treatments will be like. There will be an orientation to the room, a full explanation of the treatment sessions, education about the treatment process, and a 15-minute trial of the ECP machine in operation. Any questions about the treatment will also be addressed at this time. The first official treatment session will begin the next day at a specified time.




Cardiac Enhanced External Counterpulsation

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