

Enhanced External Counterpulsation As A Natural By-Pass Remedy Of Heart Surgery

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1. Abstract:

It has been demonstrated that EECP therapy, also known as Natural Bypass, improves nearby new blood arteries without the need for stents or bypass surgery. Therefore, it is unnecessary to remove the blockages since fresh blood may flow naturally around this clogged artery, rendering it unimportant.

2. Keywords:

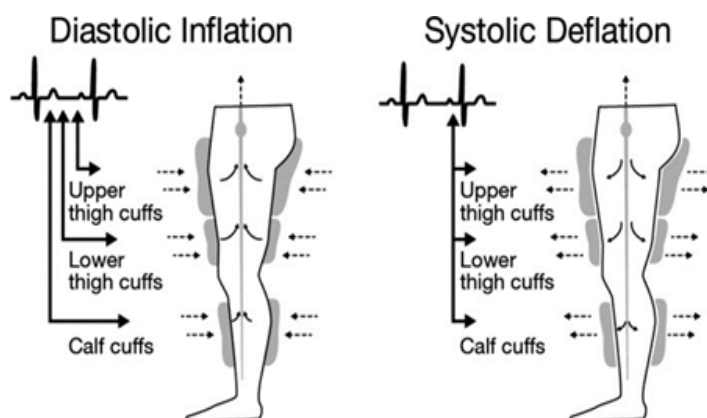
Heart Blockage, Natural Bypass, Blood Flow, Rhythmic Inflation, Cardiac Systole, Cardiac Diastole, Angina

3. Introduction:

It is an advanced treatment used to treat heart blockages, especially for those who don't wish to undergo surgery. Also, known as Natural Bypass Treatment. During the treatment low-voltage, electrical shocks are used in this form of cardiac treatment to increase the heart's blood flow and oxygenation. Enhanced external counterpulsation (EECP) treatment is an FDA-approved outpatient therapy that can improve blood flow to your heart. External counterpulsation or ECP involves three pairs of pneumatic

cuffs around calves, lower thighs, and upper thighs triggering a distal-to-proximal rhythmic inflation during cardiac diastole and releasing pressure during cardiac systole, therefore increasing the venous return and augmenting cerebral perfusion. It has been demonstrated that EECP therapy, also known as Natural Bypass, improves nearby new blood arteries without the need for stents or bypass surgery. Therefore, it is unnecessary to remove the blockages since fresh blood may flow naturally around this clogged artery, rendering it unimportant. EECP is a non-invasive therapy helps to reduce blood pressure. It works by increasing circulation in the body which helps to reduce the workload of the heart, which in turn can lower blood pressure.[1] (Figure 1)

Figure 1: Diastolic & Systolic Inflation



Enhanced External Counterpulsation (EECP) Enhanced external counterpulsation (EECP) treatment is an FDA-approved outpatient therapy for chronic stable angina. It uses pressure on the lower limbs to improve blood flow in people with long-term symptoms of heart disease, such as chest pain and pressure.

Risks of EECP Therapy:

- Fatigue.
- Muscle aches.
- Bruises.
- Edema (swelling)
- Numbness or tingling.
- Blisters or skin irritation.

Oftentimes, it has been indicated that there is no difference between EECP an ECP, as they both refer to a counter pulsation treatment. Procedure wise, they are the same. But what differs is the machinery design. EECP is the most advanced and enhanced way of delivering the counter pulsation treatment. Patients who should not undergo EECP include those with: Hypertrophic cardiomyopathy. Congenital heart disease. The cost of

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EECP treatment in India varies depending on the location, the hospital, and the doctor. However, the average cost of EECP treatment in India ranges from Rs 1,05,000 to Rs 1,57,000. This is much lower than the cost of EECP treatment in other countries like the USA, which can cost up to \$15,000 [Rs. 1250183]. However, the development of collateral circulation is a gradual process and not everyone has the same ability to develop these networks at the rate that will relieve angina (Figure 2).

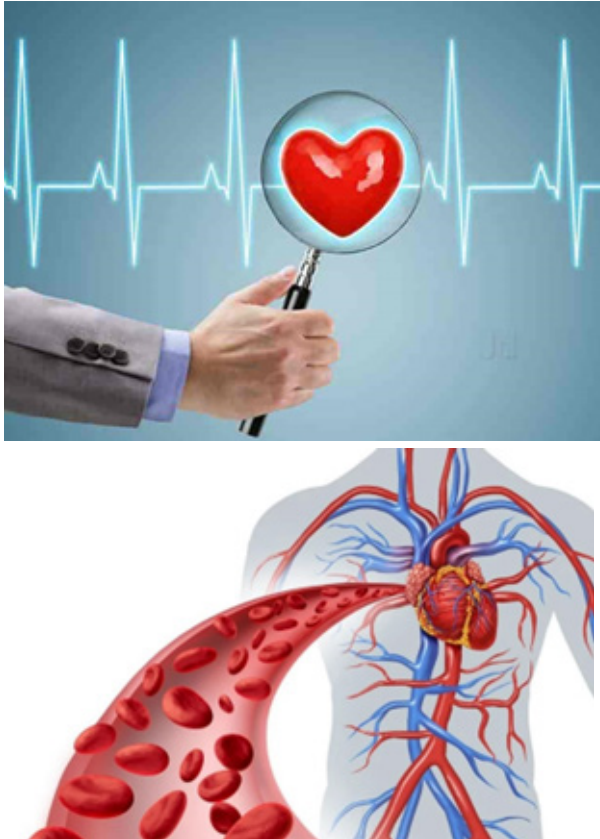


Figure 2: ECG with Blood Flow

EECP treatment triggers and accelerates this collateral circulation and makes it permanent. No, there are no age restrictions for EECP treatment. It can be beneficial for older individuals facing heart blockage issues. Potential EECP or ECP Patients are those with documented Coronary Artery Disease (CAD) that results in a variety of symptoms upon physical exertion. Electroconvulsive therapy (ECT for short) is a treatment that involves sending an electric current through your brain. This causes a brief surge of electrical activity within your brain (also known as a seizure). The aim is to relieve severe symptoms of some mental health problems. Potential patients of the symptoms include: Chest Pain. Shortness of Breath. There is time for patient assessments before treatment, receiving treatment (20 minutes), resting in the recovery area (20 minutes), and getting transferred back to a unit (inpatient) or to the driver's vehicle (outpatient). Generally, ECT is given three times a week for a total of eight to twelve sessions. This non-invasive procedure is believed to help stimulate the growth of new blood vessels in the heart and, in some cases, improves the flow of existing blood vessels. Often, ECP is used when

physicians have exhausted.[2]

The History of External Counter Pulsation & Sterling Heart Care: Dr. Clifford Birtwell first began to explore the effects of increasing blood flow during the diastolic phase of the heartbeat. The theories behind ECP therapy are based on his work. External counterpulsation (ecp) is a generic term for a circulatory assist technique first introduced by Drs. Harken, Dr. Kirstin Birtwell and Soroff in the 1960's using a hydraulic (water) driven system with a single bladder encasing the lower extremities to produce diastolic augmentation and systolic unloading. Dwight Emory Harken (1910–1993) was an American surgeon. He was an innovator in heart surgery and introduced the concept of the intensive care unit (Figure 3).

Figure 3: Inventors of EECP



Other therapies. ECP (External Counter Pulsation) is an alternative treatment for heart diseases such as angina or any other cardiac issues. It uses pressure to perform a “natural bypass” to our hearts. ECP helps reroute blood around narrowed or blocked arteries that are not supplying sufficient blood flow to the heart. Enhanced external counterpulsation (EECP Treatment in India) treatment is a therapy for chest pain that has been approved by the Food and Drug Administration (FDA). The FDA approved the CardiAssist™ ECP system for the treatment of angina, acute myocardial infarction and cardiogenic shock under a 510(k) submission in 1980. Since then, additional ECP devices have been cleared by the FDA for use in treating stable or unstable angina pectoris, acute myocardial infarction, cardiogenic shock, and congestive heart failure. Studies have found EECP to be beneficial for patients with erectile dysfunction and some COPD patients. Additionally, improvements in exercise endurance in the non-diseased patient has been found in research studies. Some reviews did not find sufficient evidence that it was useful for either angina or heart failure. Other reviews found tentative benefit in those with angina that does not improve with medications. For stroke due to lack of blood flow a 2012 Cochrane review found insufficient evidence to make conclusions. Significantly improved the exercise endurance of normal adults, low endurance adults, and COPD patients (Figure 4).

Figure 4: Cardiac cycle

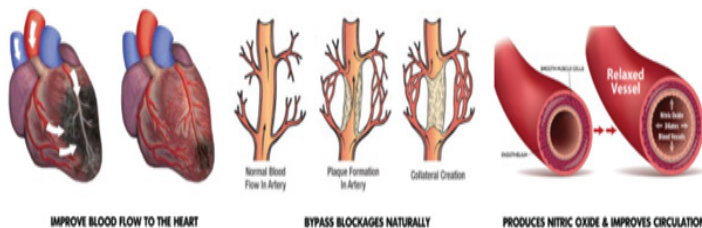
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4. Method:

While an individual is undergoing ECP, they have pneumatic cuffs on their legs and is connected to telemetry monitors that monitor heart rate and rhythm. The most common type in use involves three cuffs placed on each leg (on the calves, the lower thighs, and the upper thighs (or buttocks)). The cuffs are timed to inflate and deflate based on the individual's electrocardiogram. The cuffs should ideally inflate at the beginning of diastole and deflate at the beginning of systole. During the inflation portion of the cycle, the calf cuffs inflate first, then the lower thigh cuffs, and finally the upper thigh cuffs. Inflation is controlled by a pressure monitor, and the cuffs are inflated to about 200 mmHg. Of note, therapies are tailored on an individual basis but beginning regimens tend to include daily one-hour treatments that occur 5 days of the week and last 6–8 weeks with an average overall of 35 hours.[3] (Figure 5)

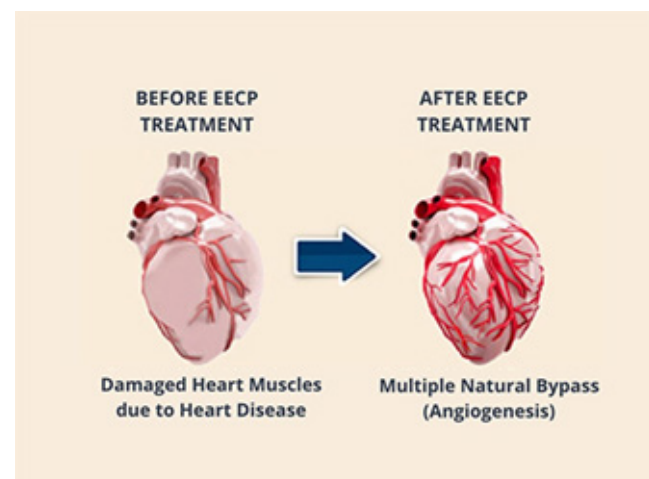
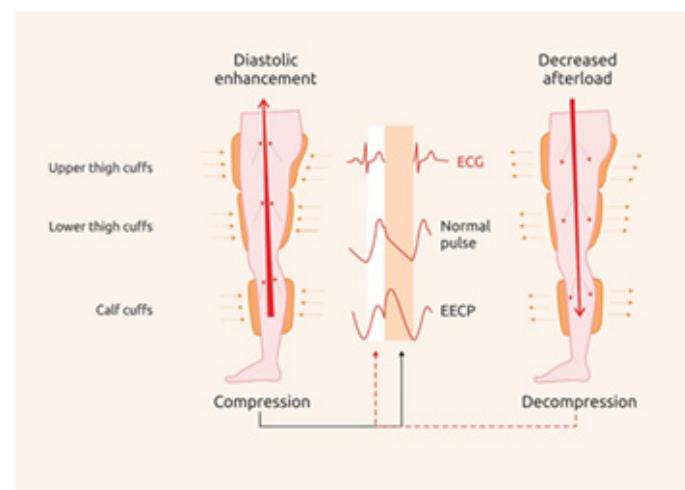
Figure 5: Heart anatomy



5. Physiological Considerations:

One theory is that ECP exposes the coronary circulation to increased shear stress, and that this results in the production of a cascade of growth factors that result in new blood vessel formation in the heart (arteriogenesis and angiogenesis). Arteriogenesis describes the remodeling of pre-existing arterio-arteriolar anastomoses to completely developed and functional arteries. In both growth processes, enlargement of vascular wall structures was proposed to be covered by proliferation of existing wall cells. Angiogenesis is the formation of new blood vessels. This process involves the migration, growth, and differentiation of endothelial cells, which line the inside wall of blood vessels. To best understand the

pathophysiology of the therapy it is easiest to understand what each step does. To begin with, as the cuffs on each leg inflate, starting at the calf and working up to the upper thighs, blood is propelled back to the heart thereby increasing the venous return or preload. This increase in preload occurs simultaneously with diastole which happens to be the time during the cardiac cycle in which coronary perfusion occurs. So, by increasing the coronary perfusion, you allow more oxygen to perfuse the heart and ultimately generate more collateral circulation without actually increasing the work of the heart. Additionally, cardiac output is increased via the Frank-Starling mechanism secondary to the increased venous return. As the cardiac cycle progresses to systole, the cuffs on the extremities deflate, allowing for the increased cardiac output to adequately perfuse all tissues including the extremities. By improving blood circulation, boosting metabolism, and targeting visceral fat deposits, EECP treatment provides a holistic and effective approach to weight loss. Not only does it help shed pounds, but it also enhances cardiovascular health, increases energy levels, and improves overall well-being. If the rate of repeat EECP is compared with the revascularization rate of stents, then the 18% repeat EECP rate is significantly higher than the 4% rate of revascularization with drug-eluting stents observed in other interventional trials. This treatment is regarded as a miracle for patients who are living their lives after a HEART ATTACK, regardless of whether they underwent Angioplasty or Bypass Surgery.[4-6] (Figure 6)



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Figure 6: Mechanism of EECP

EECP therapy can help to reduce blood pressure levels by improving the function of the cardiovascular system. It has been shown to be effective in lowering both systolic and diastolic blood pressure, with the effects lasting for up to six months after the treatment. EECP therapy is not suitable for all patients with heart blockages. Patients with certain medical conditions, such as aneurysms or severe peripheral artery disease, may not be candidates for the therapy.[7-11](Figure 7)



Figure 7: EECP therapy

6. Conclusion:

When the coronary arteries that carry blood supply to the heart get blocked, it causes the following problems:

- Severe chest pain
- Shortness of breath when at rest
- Excessive Shortness of breath while walking
- Tiredness

Usually, the physicians treat the blockage of the coronary artery with the help of medicines, angioplasty, and stent or bypass surgery. There has been advancement in these therapeutic treatments. But, certain problems

still persist as far as the treatment of chest pain is concerned. Drugs and other invasive procedures may not always prove to be effective. When the blood flow that is restored in the blocked area fails it can cause angina. Thus an effective treatment therapy is required which will help to decrease the chest pain and also improve the quality of life without using any complicated invasive treatment procedures. ECEP therapy is considered to be the most natural effective alternative which is non-invasive and non-pharmaceutical treatment. Enhanced External Counter Pulsation is a treatment given to patients who suffer from poor functioning of the heart and chest pain. It as an outpatient treatment and is considered to be safe in the treatment of heart failure and angina. In this treatment, the patient is made to lie on a comfortable treatment table. Large blood pressure like cuffs is wrapped around the legs and buttocks of the patient. The cuffs deflate and inflate at specified interval of times between the patient's heartbeats. The timing between the heartbeats is set with the help of a continuous ECG or Electro Cardiogram which enables the cuffs to inflate when the heart is at rest. It helps the heart gets its normal supply of oxygen and blood. The cuffs deflate at the end of the rest period and just before the next heart beat. The oxygen level in the patient's blood is checked with the help of the special sensors which are applied to the fingers. These sensors also monitor the pressure waves that are created by the inflations and deflations of the cuff. The EECP therapy leads to expansion of the networks of the tiny blood vessels or capillaries and helps to develop new pathways around the arteries that are blocked. This results in the increase of the blood flow and also the normalization of the blood flow to the heart muscles.

6.1. Benefits of EECP Therapy:

The EECP therapy is a simple, safe and non-invasive risk free treatment. It is considered to be an effective treatment for the following reasons:

- It is very cost effective as it does not involve surgery and hospital stay
- It does not disturb the patient's daily routine life
- It makes the patient more energetic
- It enables the patient to return to work and participate in their active lifestyle
- It enables the patient to walk more distances without experiencing any chest pain
- It results in fewer or no angina in patients and also less painful episodes of angina
- It reduces the patient's anti-angina medication needs

6.2. Duration of the EECP treatment:

The EECP therapy is given for a total of 35 hours. The patient is given treatment for an hour each day. It has to be taken for five days a week. If the patient misses any treatment session, the doctor's adjust the sessions accordingly to enable the completion of the 35 hours treatment course. According to studies, a patient who completes 35 hours of the EECP therapy may experience relief which may last up to three years.

6.3. Is EECP Therapy an effective alternative to Heart Bypass Surgery?

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The doctors consider this therapy as a comfortable, non-invasive and safe treatment therapy and have named it 'natural bypass.' They are of the opinion that EECP therapy helps to boost the circulation of blood flow throughout the body and also stimulates the collateral flow of blood. Besides bypass EECP also benefits patients with other cardiovascular problems like chest pain, coronary artery blockage, hypertension and heart failure. Patients who have already undergone angioplasty or surgery and are not getting any relief can choose the EECP therapy.

6.4. What should the patient follow after EECP therapy?

EECP helps to provide new vessels and it is very important to prevent any obstructions in the vessels by following these lifestyle changes:

- Exercising regularly
- Avoid Smoking
- Follow a healthy diet
- Control Weight gain or obesity
- Regular follow up with cardiologist

After completion of EECP course, the patients will experience increase in their energy levels and also a decrease in breathlessness and angina. EECP is recognized internationally and is provided by many leading hospitals worldwide. Poona Preventive Cardiology Center offers EECP therapy in Pune as an effective natural alternative treatment to heart bypass surgery.

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