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EECP procedure used for first time to treat diabetic patient
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TRIVANDRUM - A doctor in Kerala has successfully tried a non-surgical procedure called enhanced external counter pulsation (EECP) for treating a diabetic patient with liver and renal failure.
The EECP therapy is usually used for treating heart patients in India. But it was used first time in the country at the Medilinks Cardiocare Centre in Trivandrum for treating a patient who was on optimal medical treatment for six years.
Dr Ajith Joy K. tried the method on Joseph Thomas, a Non-Resident Indian from Abu Dhabi, as there was no scope for immediate renal transplant and Hemodialysis. The 57-year-old patient was referred to India after he was diagnosed of renal failure with diabetic retinopathy.
"Thomas had a serum Creatinine level of 7.5 mg/deci litre (normal 1.5mg/dl), gross swelling of feet and face, Serum Potassium level of 5.9 mg/dl (normal: 5.5 mg/dl) and markedly decreased urine output. His doctors had advised him renal transplant and Hemodialysis as his only options forward and was referred to India for placement of Atreriovenous Fistula," Dr Ajith said.
He said he had chosen the EECP treatment for Thomas on a first time trial on the basis of an earlier published study from Germany which had noticed improvement of renal function in patients with both liver and renal failure awaiting transplantation.
"After 35 days of one hour a day EECP therapy, Thomas remarkably improved both clinically and biochemical parameters. Post EECP therapy he lost about 6kg weight, his swelling had disappeared, urine output had doubled at half the dose of diuretic medication, his blood pressure had normalised at half his medication strength," said Dr Ajith.
He said EECP is an effective procedure to augment renal excretory function in healthy volunteers as well as in patients with diabetic renal failure. In such patients, GFR (glomerular Filteration rate) and renal plasma flow increased during EECP.
EECP improves diuresis, and therefore can be look at as a non invasive option of treatment in patients with renal failure and can be an effective method in prolonging the time to start dialysis or transplant.
EECP procedure, approved by US Food and Drug Administration (FDA) in 1995, became available in India only in 2006. The procedure is used for treating heart patients in 20 hospitals in the country at present.

Improvement of Renal Perfusion and Function by Pneumatic External Counterpulsation. D. Werner et al European Heart Journal 1998;19(Abstract Supplement) P3660(655).

How does EECP effect the kidneys? Will EECP improve or compromise blood flow to the kidneys? What happens to kidney function? These are important questions, as many of our patients with recurrent coronary disease also have impaired kidney function. In these patients, the X-ray dye that we use during angiography and angioplasty can sludge

up in the kidneys, compromising kidney function further; full blown kidney failure can rarely occur. In this group, we might turn to EECP as a safer means of reducing angina, but we need to be sure that EECP also won't harm the kidneys. Intuitively, one would predict that EECP would have a beneficial effect on kidney function. The American studies discussed above show that EECP increases blood flow to the heart and improves heart function. Blood flows through native arteries, vein grafts, and arterial grafts increases, and heart function, as measured by treadmill time, nuclear scanning, and angina frequency, also improves. Chinese studies tell us that blood flow to the brain increases with EECP, leading to an improvement in brain function in certain patients. Werner and colleagues set out to study the effect EECP has on blood flow to the kidneys and how this might affect kidney function.
Using a non-invasive ultrasound technique, Werner measured blood flow to the kidneys before and during EECP in 9 healthy volunteers. Parameters of kidney function were assessed in 12 others. Their findings are summarized in the table and discussed below:

Parameter	Pre-EECP	During EECP	% Change
Kidney Blood Flow	522 ml/min	676 ml/min	+ by 21%
Sodium Excretion	0.18 mmol/min	0.35 mmol/min	+ by 94%
Chloride Excretion	0.1 mmol/min	0.22 mmol/min	+ by 120%
Urine Production	3.3 ml/min	5.3 ml/min	+ by 60%
Renin	4.4 pg/ml	3.2 pg/ml	- by 37%
Endothelin	9.5 pg/ml	7.5 pg/ml	- by 27%

A. Blood flow to the kidneys increased by 21%, from 522 to 676 ml/min. This is a positive finding. The more blood presented to the kidney per minute, the better it can do its job of filtering waste products and controlling body water and salt levels.

B. One of the jobs of the kidney is to remove salt from the body, so excretion of the components of salt, sodium and chloride, serve as a measure of kidney function. During EECP, sodium excretion nearly doubled, from 0.18 to 0.35 mmol/min; chloride removal increased likewise from 0.1 to 0.22 mmol/min.

C. Urine is composed of body wastes, byproducts of metabolism that have toxic effects if allowed to remain in the body. The kidney filters these waste and excretes them in the urine, so urine production rate serves as a good measure of overall kidney function. Werner found that urine production increased by 60% during EECP, from 3.3 to 5.3 ml/min. This is why you feel the need to empty your bladder during EECP - because your kidneys are working better.

D. Renin is a kidney produced hormone that plays a key role in salt and fluid balance and blood pressure control. When renin levels are high, sodium and water are retained, and blood pressure rises. When renin levels are low, sodium and water are excreted, and blood pressure falls. When blood flow to the kidneys is impaired, the kidneys will produce more renin. Salt retention will occur, expanding the blood volume. Blood pressure will rise, increasing blood flow to the kidneys. Blood flow to the kidneys and kidney function will improve, but the rest of the body pays a price. The elevation in blood pressure strains the heart and increases the patient's risk of stroke. The salt and water

retention may lead to edema formation or an aggravation of congestive heart failure. When it comes to renin production, the kidney "cares only about itself". This is why patients with poor kidney function or impaired blood flow to the kidneys as a result of cardiovascular disease typically have elevated renin levels, high blood pressure, and a tendency towards fluid retention, edema, and congestive heart failure. On the other hand, when the kidneys are receiving an adequate blood flow, they begin to produce less renin, and good things follow. Blood pressure falls, decreasing stroke risk and the heart's workload. With less fluid retention comes an improvement in edema and a decreased tendency towards CHF. For the cardiac patient, an elevated renin level is bad, and any intervention that lowers renin is to their benefit. During EECP, renin levels fell by 37%, from 4.4 to 3.2 pg/ml.

E. Endothelin is nasty stuff. It constricts arteries. It constricts the coronary arteries, compromising blood flow to the heart. It constricts peripheral arteries, raising blood pressure, increasing the heart's workload. We want a low endothelin level, especially if we have coronary artery disease. Werner found that endothelin levels fell by 27% during EECP, from 9.5 to 7.5 pg/ml.

To summarize, in healthy volunteers (and presumably in patients), EECP:

1. Increases blood flow to the kidney
2. Improves the ability of the kidney to produce urine
3. Promotes excretion of sodium and chloride
4. Lowers levels of the harmful hormones renin and endothelin