Transmyocardial Laser Revascularization

Like every other organ or tissue in your body, the heart muscle needs oxygen-rich blood to survive. The heart gets this blood from the coronary arteries. But in patients with coronary artery disease (CAD), the coronary arteries are clogged and diseased and can no longer deliver enough blood to the heart. The heart's lack of oxygen-rich blood is called ischemia.

Not getting enough oxygen to the heart muscle increases the risk of heart attack and may cause a painful condition called angina. Patients often say that angina feels like a squeezing, suffocating, or burning feeling in their chest. The pain usually occurs when the heart has an extra demand for blood, such as during exercise, after eating, or at times of stress.

Most of the time, the best treatment for angina is coronary artery bypass surgery. But for some patients with very serious heart disease or other health problems, bypass surgery may be too dangerous. Also, some patients may have had many coronary artery bypass operations and be unable to have more bypass operations.

For patients who cannot have bypass surgery, there is a procedure called transmyocardial laser revascularization, also called TMLR or TMR. TMLR cannot cure CAD, but it may reduce the pain of angina.

What Is Transmyocardial Laser Revascularization (TMLR)?

TMLR is a type of surgery that uses a laser to make tiny channels through the heart muscle and into the lower-left chamber of the heart (the left ventricle). The left ventricle is the heart's main pumping chamber.

After TMLR, when oxygen-rich blood enters the left ventricle, some of that blood can flow through the tiny channels and carry much-needed oxygen to the starving heart muscle.

No one really knows why TMLR helps reduce the pain of angina. Some doctors think that TLMR helps the growth of tiny new blood vessels in the heart muscle wall. This process is called angiogenesis. These new blood vessels bring more blood to the heart muscle, making it healthier. Others think that the TMLR laser destroys some of the pain-causing nerves in the heart muscle. Still others think that patients feel a placebo effect. This means that patients feel better because they got treatment, not because the treatment really worked.

Doctors came up with the idea for TMLR by studying the hearts of alligators and snakes, where blood to feed the heart muscle goes straight from the ventricle and into the muscle, not through coronary arteries. Doctors thought this might work in human hearts, too.

TMLR is surgery, but it can be done while the heart is still beating and full of blood. That means that a heart-lung machine is not needed. Also, surgeons do not cut open the chambers of the heart, so TMLR is not open heart surgery.

What To Expect

The operation will usually be scheduled at a time that is best for you and your surgeon, except in urgent cases. As the date of your surgery gets closer, be sure to tell your surgeon and cardiologist about any changes in your health. If you have a cold or the flu, this can lead to infections that may affect your recovery. Be aware of fever, chills, coughing, or a runny nose. Tell the doctor if you have any of these symptoms.
Also, remind your cardiologist and surgeon about all of the medicines you are taking, especially any over-the-counter medicines such as aspirin or those that might contain aspirin. You should make a list of the medicines and bring it with you to the hospital.

It is always best to get complete instructions from your cardiologist and surgeon about the procedure, but here are some basics you can expect as a TMLR patient.

**Before The Hospital Stay**

Most patients are admitted to the hospital the day before surgery or, in some cases, on the morning of surgery.

The night before surgery, you will be asked to bathe to reduce the amount of germs on your skin. After you are admitted to the hospital, the area to be operated on will be washed, scrubbed with antiseptic, and, if needed, shaved.

A medicine (anesthetic) will make you sleep during the operation. This is called "anesthesia." Because anesthesia is safest on an empty stomach, you will be asked not to eat or drink after midnight the night before surgery. If you do eat or drink anything after midnight, it is important that you tell your anesthesiologist and surgeon.

If you smoke, you should stop at least 2 weeks before your surgery. Smoking before surgery can lead to problems with blood clotting and breathing.

**Day Of Surgery**

Before surgery, you may have an electrocardiogram (ECG or EKG), blood tests, urine tests, and a chest x-ray to give your surgeon the latest information about your health. You will be given something to help you relax (a mild tranquilizer) before you are taken into the operating room.

Small metal disks called electrodes will be attached to your chest. These electrodes are connected to an electrocardiogram machine, which will monitor your heart's rhythm and electrical activity. You will receive a local anesthetic to numb the area where a plastic tube (called a line) will be inserted in an artery in your wrist. An intravenous (IV) line will be inserted in a vein. The IV line will be used to give you the anesthesia before and during the operation.

After you are completely asleep, a tube will be inserted down your windpipe and connected to a machine called a respirator, which will take over your breathing. Another tube will be inserted through your nose and down your throat, into your stomach. This tube will stop liquid and air from collecting in your stomach, so you will not feel sick and bloated when you wake up. A thin tube called a catheter will be inserted into your bladder to collect any urine produced during the operation.

The cardiovascular surgeon leads the surgical team, which includes other assisting surgeons, an anesthesiologist, and surgical nurses.

First, the surgeon makes a cut in the left side of the chest to get to the heart's left ventricle. Then the surgeon uses a special carbon dioxide laser to make 20 to 40 tiny channels in the heart muscle. These channels are about 1 mm wide, or about the size of the head of a pin. The surgeon makes the channels when the heart is in systole (pumping blood), because that is when the heart's walls are the thickest and the least likely to be damaged.

The channels may bleed for a few seconds, but the bleeding will stop when the surgeon presses lightly on the channels with a finger. The tops of the channels close over with a blood clot, but inside the heart, the channels stay open.

The TMLR procedure usually takes about 2 hours.

Sometimes, one part of the heart can be treated with bypass surgery while another part of the heart can be treated with TMLR. In these cases, TMLR and bypass surgery are done at the same time.
Recovery Time

You can expect to stay in the hospital for between 4 and 7 days after TMLR.

Recovery after TMLR may take a long time. You will have to rest and limit your activities. Your doctor may want you to begin an exercise program or to join a cardiac rehabilitation program.

If you have an office job, you can usually go back to work in 4 to 6 weeks. Those who have more physically demanding jobs may need to wait longer.

Life After TMLR

Most of the time, the symptoms of coronary artery disease and angina get better after TMLR, but it may take 3 months or more to see improvement. Patients find that after TMLR they can now do all of the activities that once caused them pain. They may also find that they do not need to take as many heart medicines, including nitroglycerin.

Because TMLR is a new type of surgery, no one knows exactly what its long-term effects may be. Studies have shown that 1 year after surgery, 80% to 90% of patients treated with TMLR still feel better than they did before they had the surgery. They also have a lower risk of heart attack.

Percutaneous Transmyocardial Revascularization (PTMR)

A cardiologist performs PTMR in the cardiac catheterization laboratory. The area around an artery in the leg (the femoral artery) is numbed with anesthesia. The cardiologist inserts a long, thin tube called a catheter into the artery. The catheter is threaded through the artery and up to the heart. The doctor feeds the laser through the catheter and uses it to create the tiny channels in the heart muscle. Because PTMR only requires a tiny incision at the site of the artery, both the surgery time and recovery time are shorter.

Not all patients can have the percutaneous form of laser revascularization. Both types of procedures, TMLR and PTMR, are a last resort for treating angina.