



ENDOVENOUS LASER ABLATION (EVLA) AS CURRENT MANAGEMENT OF VARICOSE VEIN

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Abstract

Varicose veins are conditions in which the enlargement of the superficial veins is protruding and tortuous at the lower extremities. Until now, varicose vein treatment is based on medical administration, sclerotherapy, the use of stocking compression and surgery. The surgical method for varicose veins is known as vein stripping. At this time, laser-based management has been developed, namely Endovenous Laser Ablation (EVLA). EVLA technique is performed without sedation so that the patient is fully conscious. This procedure takes one to two hours and after observation the patient can immediately go home without requiring hospitalization. The benefits obtained from this laser therapy such as short post-operative treatments, do not cause scars or surgical sutures and the success rate reaches 97%. EVLA with a wavelength of 1470 nm has the side effects of postoperative inflammation and minimal bruising because the absorption coefficient of 1470 nm is 40 times greater than the laser energy of 810-980 nm, so that the wavelength of 1470 nm the heat energy is more easily absorbed and venous ablation will be more effective. The management of varicose veins continues to develop until now with the utilization of laser energy known as endovenous laser ablation (EVLA). EVLA continues to evolve from year to year by increasing laser wavelengths ranging from 610 nm, 810 nm and 940 nm to 1470 nm which have better intracellular water absorption than other wavelengths. This causes post-operative side effects such as pain, hematoma, ecchymosis, long treatment can be minimized.

Keywords: Varicose vein, endovenous laser ablation, stripping vein.

1. Introduction

Varicose veins (varicose veins) are conditions in which superficial veins are prominent and winding in the lower extremities. This event often occurs there is a venous safena magna and safena parva. The dilation of blood vessels is caused by excess pressure on the veins of the lower extremities and also causes damage to the venous valves in these vessels which serves as a one-way door to prevent back blood flow.^{1,2}

Anatomically the venous system in the lower limb is divided into three subsystems namely the superficial vein subsystem, the deep vein subsystem and the connecting subsystem. Superficial veins are located in the subcutaneous tissue of the limbs and receive back blood flow from small veins from the skin and subcutaneous tissue. The superficial vein system consists of the safena magna and safena parva veins. Safena magna vein is the longest vein in the body that runs from the maleolus to the medial region of the calf then the thigh and empties into the femoral vein. Safena magna veins function to drain blood from the antero-medial part of the calf and thigh.^{1,3}

The safva parva vein runs along the lateral side of the maleolus to the calf and ends at the knee area. The safva parva vein flows from the postero-lateral portion of the calf towards the popliteal vein. The meeting point between the venous saffene and the popliteal vein is called the safeno-popliteal junction.^{2,3}

In carrying out its function, veins, especially the lower extremities, are equipped with valves that function to prevent back blood flow. The venous valve is formed from collagen and elastic fiber tissue that integrates with the intima layer of blood vessels.¹ In normal circumstances, venous valves work in one direction in carrying venous blood up and entering. Blood will be collected in superficial vein capillaries then flowed into the larger veins, eventually passing through the venous valves to the deep veins then to the central circulation to the heart and lungs.^{2,4}

In certain conditions such as pregnancy, obesity and the use of high heels there is an increase in lower leg vein pressure which results in damage to the venous valve. Damage to this venous valve will put a high enough pressure on the deep veins which are then passed on to the superficial veins and cause blood vessel dilation.³

Management of varicose veins aims to reduce the symptoms caused to prevent complications. Until now, varicose vein treatment is based on medical administration, sclerotherapy, the use of stocking compression and surgery. In severe cases, varicose veins can no longer be treated with medical therapy, sclerosis or the use of stocking compression and surgery must be performed.^{2,3} The surgical method for varicose veins is known as vein stripping. However, side effects such as high risk of infection, long treatment time and also very contraindicated in patients with heart problems and old age due to using general anesthesia.²

At this time laser-based management of varicose veins with minimal invasive treatment has been developed with a fast recovery period without the need for hospitalization. This method is known as *Endovenous Laser Ablation (EVLA)*.

2. Discussion

Management of Varicose Veins is based on the severity of the disease. Varicose veins based on severity are divided into 4 stages, namely: ^{1,2,3}

1) Stage 1

Complaints of faint (not typical) feeling heavy, tired easily in the legs after standing or sitting for a long time. The appearance of bluish veins widening is not clear.

2) Stage 2

Venous dilation began to appear, tortuous and prominent.

3) Stage 3

Varicose veins are clear, elongated, winding on the thigh or lower leg. Can be accompanied by telangiectasis / spider vein.

4) Stage 4

Skin disorders and / or ulcers occur due to chronic venous insufficiency syndrome.

In stage 1 the selection of therapy is limited to medical administration such as NSAIDs to relieve pain and is not indicated for certain actions. However, in stage one also recommended the use of stocking compression to prevent back blood flow. In stage two, the recommended treatment for selection is the use of sclerotherapy by injecting a fluid into a dilated blood vessel to return to normal.^{2,3} In addition, administration of NSAIDs such as ibuprofen is also indicated if the patient complains of pain. In Stages 3 and 4 the choice of surgical intervention is recommended and adjusted to the patient's clinical condition in general.^{4,5}

Vein Stripping is a surgical method that is indicated. This technique uses internal stripping equipment and invagination techniques by turning blood vessels and pulling them using endovenous traction, the technique can reduce the occurrence of injury to the surrounding structures. To remove the saphena magna vein, an incision is made 2-3 cm next to the medial fold of the thigh to see the saphena femoral junction.^{5,6} Before an incision is made, the doctor will usually give an ultrasound guided signal to determine the location of the damaged vein.^{3,6}

Conventional techniques in vein stripping are very risky due to complications such as damage to the safena nerve, which is located very close to the vein in the knee region, contraindicated in patients with heart problems and elderly patients due to using general anesthesia and is not recommended for routine patients taking blood thinning drugs such as warfarin.^{3,5}

The complications caused by vein stripping surgery make experts think of the best technique with minimal side effects and short treatment. Utilization of radiofrequency energy that is radiofrequency ablation (RF), ambulatory phlebectomy (stab avulsion) to the latest is to use laser energy namely endovenous laser ablation (EVLA) which is a technology with various advantages in it.^{6,7}

One option of minimally invasive varicose vein therapy is EVLA. The principle of laser therapy is based on the thermal process, namely the conversion of light waves to heat. Light energy in a certain direction will be surrendered by hemoglobin and water contained in the body and is transformed into heat energy.^{2,4,6}

Treatment of varicose veins with EVLA was pioneered by Dr. Robert Min from New York, United States. Dr. Robert first used a laser with a length of 910 nm. After the procedure was successful, the development of EVLA is increasingly rapid with the availability of a variety of different wavelengths. These different wavelengths aim to maximize local damage to the varicose veins or blood components in them and minimize tissue damage around veins.^{3,5}

Until now the laser wavelength has developed from 810 nm, 940 nm, 980 nm, 1320 nm and 1470 nm.⁵ The tip of the laser wire has also changed from a bare tip fiber (sharp tip), 600µ fiber with frontal emission to radial trip with circular emission. Some laser fiber designs, namely wire fibers without plastic wrap or silicone-wrapped plastic. Each design has been proven to be able to close the saphena magna vein.^{7,8}

Vein walls are formed from collagen tissue with the main composition being water. Wavelength is very influential in the transformation and absorption of laser energy, the lower the wavelength (610 nm, 810 nm and 940 nm) the shorter the amount of energy absorbed by hemoglobin and will cause side effects of bruising.^{3,6,7} Things conversely if the wavelength is longer like 1470 nm, the energy that is transformed into heat energy is more easily absorbed by the intracellular water of the venous wall or blood plasma so that it does not cause bruising.^{4,7} EVLA with a wavelength of 1470 nm has minimal side effects of postoperative inflammation and bruising because absorption coefficient 1470 nm 40 times greater than the laser energy of 810-980 nm, so that the wavelength of 1470 nm heat energy is more easily absorbed and venous ablation will be more effective.^{6,7,8}

Ablation of saphena magna using a wavelength of 1470 nm with radial fiber will reduce postoperative side effects and ecchymosis because the laser diode targets directly burn and shrink the collagen tissue of the venous wall which mostly contains water. Whereas venous

ablation uses wavelengths of 810 nm and 940 nm which is more relaxing in venous and vascular tissue. Damaged venous tissue will trigger the emergence of thrombosis as a side effect.^{7,8,9}

Veins that are usually targeted by laser therapy are the saphena magna vein, the small saphena vein, the anterior and posterior accessory saphena vein, the superficial accessory saphena vein, the anterior circumflex vein and posterior to the thigh including the Giacomini vein. EVLA has also been used in obese patients who have difficulty undergoing sclerotherapy or microphlebectomy.^{10,11}

The first step taken is to perform local perivene anesthesia with *ultrasonography* (USG) guidance. The local anesthetic that is usually used is lidocaine 2%. The *Local Tumescence Anesthetic* (TLA) technique has often been used and proven effective. The goal in addition to providing analgesia effect also gives the effect of pressure on the vein so that the venous wall is positioned with a fiber that acts as a "heat sink" to prevent damage to local tissue.^{3,6,7}

During the procedure, fibers will be inserted into the blood vessels of saphena magna or small saphena with the help of ultrasound. After the fiber sera reaches the end of the damaged vein, the laser machine is activated while the fibers are slowly pulled, so that the vein is completely titrated.^{3,4,5} EVLA therapy is carried out without sedation so that the patient is fully conscious. This procedure takes one to two hours and after observation the patient can immediately go home without requiring hospitalization. Patients will usually go home in leg condition wrapped or using stocking compression for 3 weeks.^{6,7,8}

The benefits obtained from this laser therapy such as a short postoperative treatment and directly alleviate patient complaints, patients can immediately start their normal activities with few symptoms or no symptoms, do not cause scars or surgical sutures and the success rate reaches 97%.^{2,4,5} Although EVLA has many advantages, it is not uncommon to have complications such as bruising (51%), hematoma (2%), phlebitis (7.5%), induration (47%) and shortness of breath (24.8%). More serious but rare complications such as burns (0.5%), deep vein thrombosis (0.4%), pulmonary embolism (0.1%) and nerve injuries (0.8%).

Some things must be considered during the EVLA procedure. Medical officers, patients are required to wear protective glasses. The effects of the laser can damage the retina of the eye (<1%). If the laser is activated it can cause permanent focal deficits of the "blind spot" or scotoma of the retina.^{4,7,12} Therefore the use of eyewear according to the wavelength of the laser is highly recommended. In addition, patients with thrombosis problems require stratification of the risk of post-procedure thrombosis.^{6,7} If the patient is at moderate risk, the use of EVLA will be combined with anticoagulation as prophylaxis and EVLA is contraindicated in patients with blood disorders.^{4,5,6,12}

3. Conclusions

Management of varicose veins by surgery has begun to be replaced with minimally invasive techniques such as the utilization of laser energy. Utilization of laser energy in varicose vein therapy is known as Endovenous Laser Ablation (EVLA). EVLA continues to evolve from year to year by increasing laser wavelengths ranging from 610 nm, 810 nm and 940 nm to 1470 nm which have better intracellular water absorption than other wavelengths. This causes post-operative side effects such as pain, hematoma, ecchymosis, long treatment can be minimized.

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