Laser and light therapy of lower extremity telangiectasias, reticular veins and small varicose veins

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INTRODUCTION — Telangiectasias and reticular veins are common venous abnormalities and are often a source of significant distress to the patient whether or not symptoms are present. The treatment of telangiectasias and reticular veins with lasers or light therapy is reviewed here. Other modalities used to treat these entities are discussed separately. (See "Overview and management of lower extremity chronic venous disease" and "Liquid and foam sclerotherapy techniques for the treatment of lower extremity veins".)

INDICATIONS — Telangiectasias, reticular veins and varicose veins are the visible signs of chronic venous disease, and can occur in the presence or absence of either symptoms or an underlying functional venous disorder (reflux) [1]. Sclerotherapy is the treatment of choice for the majority of superficial leg veins. When sclerotherapy is administered sequentially from deep to superficial and from larger to smaller veins, over 90 percent of vessels can be successfully treated [2]. Candidates for laser and light therapy are those who fail sclerotherapy or who have small superficial vessels that are too small to cannulate with a sclerotherapy needle [3]. (See "Liquid and foam sclerotherapy techniques for the treatment of lower extremity veins".)

Asymptomatic patients with telangiectasias or reticular veins often find the cosmetic appearance of their veins distressing. In the absence of signs of venous reflux, laser and light therapy can be performed after physical
examination. The clinical evaluation of the patient with chronic venous disease is discussed separately. (See "Clinical evaluation of lower extremity chronic venous disease".)

Because vein recurrence rates are increased in the presence of superficial venous reflux, reflux is managed prior to treatment. Treatment with laser and light therapy is most effective for small vessels (1 to 2 mm in diameter) although vessels up to 5 mm in diameter can be treated. Larger veins do not respond as well [4-6]. (See "Overview and management of lower extremity chronic venous disease", section on 'Diagnostic evaluation'.)

**CONTRAINDICATIONS** — Laser and light therapy should not be performed in patients who have signs of acute thrombosis/phlebitis, due to the increased risk of deep venous thrombosis. Pregnant patients should defer until after delivery.

Diabetes and peripheral arterial occlusive disease (ankle-brachial index <0.9) are also contraindications because these conditions are associated with an increased risk of nonhealing wounds.

In addition, laser and light therapy may cause hyperpigmentation, which is usually temporary but can last up to a year, and hypopigmentation, which may be permanent. Both these side effects are most common in patients with tan skin and in Fitzpatrick skin types III, IV, V, and VI. A test spot is undertaken prior to treatment (table 1). (See 'Pigmentation' below.)

**PATIENT COUNSELING** — The decision to offer laser or light therapy depends upon symptoms, extent of lower extremity disease, patient expectations, and likelihood of providing a durable benefit either with respect to appearance or improvement in symptoms.

Patients should be counseled carefully prior to treatment. The patient is informed that veins will lighten and become less noticeable, but may not completely disappear. **Multiple treatments are typically required to achieve the desired effect**, and alteration in skin pigmentation can occur.

For all patients, it is important to address patient expectations, potential complications and to document veins photographically prior to each treatment. These photographs should be reviewed with the patient periodically.

**LASER/LIGHT PRINCIPLES** — Lasers emit a single, coherent wavelength of light, while intense pulsed light (IPL) sources emit white light from 515 nm to 1200 nm that is usually filtered to certain broad wavelengths (figure 1).

Laser therapy of venous structures is based on the concept of selective photothermolysis (ie, selective thermal confinement of light-induced damage) [7-9]. Pulsed lasers and light sources heat the target tissue, inducing thermal injury with limited damage to the surrounding structures.
The wavelength of light is chosen based upon the chromophore (the part of a molecule responsible for its color) of the target structure and the depth of the vessel. The oxyhemoglobin contained within red blood cells has three major absorption peaks at 418, 542, and 577 nm, with an additional infrared absorption around 1000 nm (graph 1). Green, yellow and infrared laser and light sources are effectively absorbed by leg veins.

The selected duration of the light pulse determines the size of the vessel that will respond to treatment. Shorter pulses selectively heat smaller vessels (<2 mm) and longer pulse duration light sources are effective for slightly larger vessels [10].

Other parameters, such as fluence (energy density), spot size, and cooling are also important factors. (See "Basic principles of medical lasers", section on 'Tissue ablation'.)

**LASER AND LIGHT SOURCES** — No single laser type is used to treat the variety of vascular abnormalities seen in clinical practice. The specific laser selected for an individual patient depends upon the size and depth of the vessels to be treated (table 2) [1]. Patient skin phototype is also important (table 1) [11].

**Pulse dye laser** — Pulse dye lasers (PDLs) emit light at 585 and 595 nm at pulse durations of 0.45 to 40 msecs. The yellow wavelength matches the third oxyhemoglobin peak. PDLs are most effective for treating small lower extremity veins less than 1.5 mm in diameter in light skin type patients (table 2).

**Potassium titanyl phosphate laser** — Potassium titanyl phosphate (KTP) lasers emit light at 532 nm at pulse durations in the millisecond range. The green wavelength matches the second oxyhemoglobin peak overlapping the absorption peak of melanin. Veins with diameters ranging from 0.5 to 1.5 mm can be effectively treated in light skin type patients (table 2).

**Diode laser** — Diode lasers emit light at a single wavelength between 800 and 900 nm, penetrating more deeply and with less absorption by melanin than PDL and KTP lasers [12]. Veins up to 4 mm in diameter can be treated using this laser. Diode lasers with a 900 nm wavelength have been used in conjunction with radiofrequency current [13]. The combination is an effective treatment for lower extremity veins. The use of this laser should be limited to skin types I to IV (table 2) [11].

**Nd:YAG laser** — Neodymium-doped: yttrium aluminum garnet (Nd:YAG) lasers emit light at a wavelength of 1064 nm, at pulse durations in the millisecond range. This longer wavelength penetrates to deeper levels and, with long pulse durations, can be used to treat veins from 0.3 mm to 3 mm in diameter. Because of lower absorption in pigment, Nd:YAG lasers are less likely to cause pigmentary changes and are safer to use in darker skin types (table 2) [11,14].
**Alexandrite laser** — Alexandrite lasers emit light at a wavelength of 755 nm with a pulse duration in the millisecond range. The wavelength corresponds to absorption by deoxygenated hemoglobin, but also to absorption by melanin. Lower extremity veins may respond, but this laser should be limited to nontanned skin types I, II, and III (table 2) [11].

**Intense pulsed light sources** — Intense pulsed light (IPL) sources emit white light from 515 nm to 1200 nm, but it is usually filtered to certain broad wavelengths. IPL sources are most effective for superficial, red telangiectasias <1 mm in diameter in fair-skin individuals (table 2).

**TECHNIQUE** — Once the laser or light source and area to be treated have been selected, the patient is placed in a comfortable position, and protective eyewear is given to the patient and all personnel in the room. The use of eye protection is essential, and when operating class 4 lasers (includes most medical lasers), it is required in the workplace by the United States Occupational Safety and Health Administration (OSHA) [15]. Detailed treatment parameters for each of the devices listed above are beyond the scope of this topic. The parameters for treatment are entered into the laser/light control panel and treatment proceeds by first cooling the skin over the vessels and then activating the laser/light over the target vessel(s). The patient will feel anything from a very mild sting to a strong pinching and burning sensation when the laser is activated. The application of a topical anesthetic agent can be used to lessen pain. (See 'Adverse reactions' below.)

A visible clearing of the vein should be seen, but if not, the vessel can be treated again or the laser parameters adjusted to improve the effect. To avoid burns, no more than three attempts should be tried over the same area of skin.

**FOLLOW-UP CARE** — No dressings are needed. Application of compression bandages is suggested by some, but not all, practitioners. The patient may return to their normal daily activities immediately, including work. There is no evidence that avoiding exercise leads to better results. Patients should avoid sun exposure to the treated areas. Alternatively, sunscreen with a high sun protection factor (SPF 30) may be applied to the treated areas.

Vessels may need more than one treatment to achieve optimum results, and repeat therapy is generally performed within four to six weeks. There is some evidence, at least with long pulsed Nd:YAG lasers, that waiting eight weeks between treatments yields more improvement per treatment.

**ADVERSE REACTIONS** — Common local reactions associated with laser therapy include: pain, redness, swelling, bruising, and itching. These are transient and usually resolve quickly. More significant adverse reactions include: telangiectatic matting, pigmentation changes, hyperpigmentation,
hypopigmentation, ulceration, thrombophlebitis, and scarring.

**Pain** — Treatment is usually well tolerated. Pain is short lived and usually lasts only seconds to minutes after treatment. The application of a topical anesthetic (eg, EMLA® cream, EleMax®, 30% xylocaine gel, 7% lidocaine, 7% tetracaine) for 30 to 60 minutes prior to the procedure can lessen the degree of pain [16].

**Bruising** — Purpura and ecchymosis are due to vessel wall rupture resulting in leakage of blood into the surrounding tissue. These reactions are most likely to occur with short pulsed laser treatments (eg PDL), and usually occur within minutes of treatment. Post-treatment bruising is a significant drawback for the alexandrite and long PDL lasers (table 2) [8,11].

**Pigmentation** — Hyperpigmentation and hypopigmentation are common in patients with skin type III, IV, V, or VI, and usually develop within three weeks after treatment. Hyperpigmentation, which is due to hemosiderin deposition, is usually temporary but may last up to a year or can be permanent. Hypopigmentation may also be permanent.

**Telangiectatic matting** — As with sclerotherapy, telangiectatic matting consists of multiple, fine dilated vessels in the area of laser treatment (picture 1).

**Thrombophlebitis** — Thrombosis has been reported in the superficial veins following laser therapy. It may take up to six weeks to resolve, but rarely has sequelae. Deep vein thrombosis is exceedingly rare and is more likely related to factors not directly associated with the technique. Superficial thrombophlebitis is discussed in detail separately. (See "Superficial thrombophlebitis of the lower extremity").

**OUTCOMES** — Few trials are available comparing different types of lasers and light sources to each other for the treatment of lower extremity venous disease [11,13]. In observational studies, the long-pulsed Nd:YAG laser appears to be the best device as a single laser modality in the treatment of lower extremity telangiectasias, reticular veins, and small varicose veins [17-19]. Use of the Nd:YAG laser results in clearance of more than 75 percent of veins in the majority of sites and results are maintained for at least 12 months following treatment [11,14,19]. However, in one study, histologic specimens three months post-therapy showed recanalization, suggesting there may be a risk for vein recurrence [20]. Optimal laser settings continue to be evaluated.

The value of the Nd:YAG laser was illustrated in a prospective study of 22 patients that evaluated vessel clearance rates of the Nd:YAG compared with either the alexandrite or diode laser in the treatment of vessels ranging from 0.3 mm to 3 mm [11]. Thirty-six sets of comparable sites were treated. Greater than 75 percent improvement at three months of
follow-up was observed at 88 percent of the Nd:YAG sites, compared with
29 percent of the diode sites and 33 percent of the alexandrite sites.
Variable clearance rates are observed with other laser modalities and
depend upon the size and depth of the vessels treated. Most studies are
small and the best results are seen in groups of patients with uniform
vessel size selected specifically for the strength of a given laser type.
Clearance of >75 percent of vessels treated ranges from 10 percent of
patients using the diode laser (800 nm) [21], to 93 percent of patients with
the KTP laser [22].

**Laser versus sclerotherapy** — In spite of improved laser technology,
sclerotherapy remains the treatment of choice for lower extremity
telangiectasias, reticular veins, and small varicose veins. Sclerotherapy
clearly works better on larger veins, such as the reticular veins and larger
spider veins, while laser/light therapy is more beneficial for smaller
telangiectasias. As such, they are complimentary procedures.

Three small non-randomized studies compared laser with sclerotherapy for
the treatment of telangiectasias. One study concluded that laser therapy
was less efficacious and more expensive than sclerotherapy [3]. The
second demonstrated no differences in the clearance of veins by objective
measures; however, patients still favored sclerotherapy [23]. The third
study evaluated combined laser and sclerotherapy approaches and
determined that clearance of veins was improved with sclerotherapy
followed by laser compared with laser followed by sclerotherapy, laser
alone, or sclerotherapy alone [24].

**COST** — Laser therapy of telangiectasias, reticular veins, and small
varicose veins is generally considered a cosmetic treatment and is not
typically covered by insurance.

**SUMMARY AND RECOMMENDATIONS**

- Dilated veins can occur in the presence or absence of either symptoms or
  an underlying functional venous disorder. Telangiectasias, reticular
  veins, and small varicose veins can cause symptoms, and are often a
  source of significant distress to the patient even in the absence of
  symptoms. (See 'Introduction' above.)

- The presence of lower extremity telangiectasias, reticular veins, or small
  varicose veins in the lower extremities may indicate an underlying
  functional venous disorder, especially when associated with symptoms
  (aching, swelling, heaviness). (See "Overview and management of
  lower extremity chronic venous disease").

- Symptomatic patients with lower extremity telangiectasias, reticular
  veins, or small varicose veins should undergo further evaluation with
  venous duplex to identify the presence of superficial or deep venous
insufficiency, which alters treatment options. (See "Overview and management of lower extremity chronic venous disease", section on 'Diagnostic evaluation'.)

- Laser therapy is the only option for treatment of telangiectasias too small to access with a needle, patients allergic to sclerosing agents or afraid of needles, or those who have failed sclerotherapy. (See 'Indications' above.)
- We suggest laser therapy over sclerotherapy for treatment of telangiectatic matting resulting from either prior sclerotherapy or saphenous ablation (Grade 2C). (See 'Laser versus sclerotherapy' above.)
- We avoid laser therapy of lower extremity telangiectasias, reticular veins, or small varicose veins in patients with Fitzpatrick skin types III, IV, V, and VI due to the risk of hypopigmentation. (See 'Adverse reactions' above.)
- Common local adverse reactions to laser treatment include pain, bruising, altered skin pigmentation, and telangiectatic matting. The incidence of these reactions depends upon the laser/light modality chosen and patient skin type. (See 'Adverse reactions' above.)
- We suggest the use of the Nd:YAG laser over other laser types for the treatment of most lower extremity telangiectasias, reticular veins and small varicose veins (Grade 2C). Nd:YAG laser is effective for treatment over a wider range of vein diameters and depths with fewer adverse reactions. (See 'Outcomes' above.)

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REFERENCES
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