The Use of Endovenous Laser Treatment in Toddlers

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ABSTRACT

The use of endovenous laser ablation therapy in children is limited. Klippel-Trenaunay syndrome (KTS) is associated with persistent ectatic anomalous veins within the affected extremity, with increased risk of thromboembolism. The present report describes four toddlers (<20 kg) with KTS of the lower extremity who underwent a total of five endovenous laser procedures for treatment of ectatic anomalous marginal venous system, without complications.

ABBREVIATIONS

EVLT = endovenous laser ablation therapy, KTS = Klippel-Trenaunay syndrome, Nd:YAG = neodymium:yttrium aluminum garnet

Endovenous laser ablation therapy (EVLT) is a widely used minimally invasive procedure for treatment of varicose veins in adults. Klippel-Trenaunay syndrome (KTS) is notable for characteristic slow-flow vascular anomalies, including the presence of a complex network of dilated embryonic veins (ie, the marginal venous system). The latter predisposes to venous thromboembolism, particularly in the postoperative period. Early diagnosis and intervention such as occluding the marginal veins are paramount in reducing symptoms and preventing more morbid complications (1).

This report presents four toddlers with KTS who underwent endovenous laser treatment of the marginal venous system without complications.

CASE REPORTS

Our institution does not require approval for the publication of retrospective case reports such as this. The five procedures were performed under sterile conditions and general anesthesia with continuous monitoring of the cardiopulmonary and respiratory functions as well as core body temperature. After obtaining informed consent, diversion venography was performed to illustrate the dynamic and anatomic relationship between the deep and marginal venous systems as described in a previous report (2). The technique diverted the venous return from the anomalous veins into the deep venous system by applying tight tourniquets to occlude large perforating/communicating veins and performing ultrasound (US)-guided cannulation of the tibial and popliteal veins. The distal aspect of the dominant marginal vein was accessed percutaneously by using a micropuncture technique under US guidance. Tumescent saline solution was infused around the vein. The VenaCure EVLT endovenous 980-nm diode laser system with a 600-μm bare-tip laser fiber (AngioDynamics, Queensbury, New York) was used. The power used was 10–14 W, and the amount of energy delivered ranged from 41 to 108 J/cm. The extrafascial ectatic segments of the marginal venous system were treated with EVLT. Because of the risk of sciatic nerve injury, the deeper intrafascial anomalous channels (ie, sciatic vein) were embolized with coils (0.038-inch MReye and 0.035-inch Nester coils; Cook, Bloomington, Indiana). Following the procedure, compression bandaging was applied for 5 days. There were no immediate or delayed complications. Further clinical and technical data are detailed in the individual case reports and summarized in the **Table**.

Case 1

A 26-month-old boy with KTS of the left lower extremity and pelvis presented with a complex marginal venous system on the lateral aspect of the limb and combined lymphatic malformation, including several rectal lymphatic lesions (**Fig 1a**). The child weighed 15.5 kg. US study and diversion venography showed a large, complex marginal vein with a diameter of 9 mm and multiple enlarged tributaries (**Fig 1b**). After accessing the distal aspect of the vein, the laser sheath was then advanced over a 0.035-inch

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Table. Summary of Clinical and Technical Details of EVLT

Patient No.	Weight (kg)/Age (mo)	Vein Length (cm)	Energy (J)	Power (W)	Energy/Length (J/cm)
1	15.5/26	25	1,031	12	41
2	11.9/15	13	745	10	57
3 (EVLT 1)	12.0/13	10	797	10	80
3 (EVLT 2)	13.5/16	12	840	10	70
4	10.9/14	22	2,384	14	108

EVLT = endovenous laser ablation therapy.

guide wire into the proximal portion of the dominant marginal vein. Following instillation of tumescent fluid, the vein was treated with laser energy at 12 W, delivering a total of 1,031 J administered over a 25-cm segment. Venography and sonographic studies during the 3.5 years after the procedure demonstrated residual flow in the distal segment of the treated vein, with occlusion of the proximal segment and diversion of the venous return into the deep veins (**Fig 1c–f**).

Case 2

A 15-month-old boy with KTS of the left lower extremity and pelvis was referred to our institution. Magnetic resonance imaging showed an extensive marginal venous system extending from the dorsum of the foot via the short saphenous vein to terminate into a persistent sciatic vein in the thigh and pelvis. The child weighed 11.9 kg. The treatment plan devised included coil embolization of the sciatic vein and EVLT for the superficial segment of the marginal vein (**Fig 2**).

Following ascending venography of the left lower extremity, coil embolization of the sciatic vein was performed. After tumescent fluid was infused around the lower segment of the marginal vein, the laser fiber was used to deliver energy at 10 W over 13 cm for a total of 745 J. Following EVLT, sodium tetradecyl sulfate foam (3% Sotradecol; Bioniche, Galway, Ireland) was injected into the different segments of the veins under US guidance. Completion ascending venography revealed diversion of flow from the embolized vein into the deep veins.

A compression bandage was applied around the leg. There were no complications. Clinical and sonographic follow-up at 1 and 13 months revealed occlusion of the treated vein without complications. Because of the extensive nature of the pelvic lesions, additional treatments were planned at later stages.

Case 3

A 13-month-old girl with KTS of the left lower extremity and pelvis was referred to our institution for treatment of a predominantly subcutaneous large marginal venous system, combined with lymphatic malformation and cutaneous vesicles. Two EVLT procedures were performed at the ages of 13 and 16 months, at which times the patient's body weight was 12.0 kg and 13.5 kg, respectively. During the first procedure and after diversion venography, the marginal vein was accessed as described earlier. The entire course of the sciatic vein was embolized with Nester coils (Cook). Following administration of tumescent fluid, the extrafascial 10-cm-long segment of the marginal vein in the lateral aspect of the limb was treated with EVLT, which delivered 797 J. The cutaneous lymphatic vesicles were treated with CO_2 laser photovaporation. The ectatic short saphenous vein (12 cm long) was similarly treated 3 months later, with 840 J delivered. Completion venography revealed total occlusion of both veins. Both procedures were performed with a power of 10 W, without complications. Follow up 3.5 months after the first procedure showed occlusion of the laser-treated venous segment.

Case 4

A 14-month-old girl with KTS of the left lower extremity and pelvis presented with a capillary stain on the lateral aspect of the leg and lymphatic vesicles on the posterior aspect of the thigh. Sonographic and venographic images demonstrated the presence of a complex marginal venous system (maximal diameter of 12 mm) with tributaries terminating into the common femoral vein and intrafascial continuation as a sciatic vein. The deep venous system was visualized only after diversion venography. The proximal segment of the marginal vein in the upper thigh was embolized with 0.035-inch Nester coils (Cook). The distal extrafascial segment of the vein in the lateral aspect of the leg extending from the upper thigh to the ankle was treated with 14 W laser, delivering a total of 2,384 J administered over a 22-cm segment. Completion venography demonstrated no residual flow in the marginal vein and diversion of the venous return into the deep veins. The cutaneous lymphatic vesicles were treated with CO_2 laser photovaporation.

DISCUSSION

Endovascular treatment of varicose veins is safe and effective and offers the significant advantage of rapid recovery (3). In view of the increased risk of venous stasis, thrombosis, and pulmonary embolization, the ectatic superficial marginal venous system in KTS should be closed early in life (1,2). The risk of these outcomes typically worsens with age (4).