Endovenous Laser Ablation under General Anesthesia for Day Surgery: Feasibility and Outcomes of the 300 Patients

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Purpose: Endovenous laser ablation (EVLA) for superficial venous insufficiency is traditionally performed under tumescent local anesthesia as day case surgery. The aim of this study is to evaluate the feasibility of general anesthesia in addition to tumescent anesthesia in patients undergoing EVLA.

Methods: The anesthesia and clinical registration records of 341 extremities of 300 adult patients were reviewed and analyzed retrospectively. Demographic and clinical data, preoperative anesthetic evaluation data (ASA physical status, preoperative airway assessment, Mallampati score), type of supraglottic device, duration of anesthesia and surgery, any surgical and/or anesthetic complication, timing of mobilization and discharge, and postoperative course were evaluated.

Results: Mean duration of operation and anesthesia was 28 (12–55) and 40 (20–65) minutes, respectively. Mobilization and discharge timing was 25 (11–45) and 139 (110–200) minutes, respectively. All patients were discharged the same day of surgery.

Conclusion: The combination technique of administering general anesthesia with supraglottic device and tumescent anesthesia is a safe and effective method to reduce the patients’ pain and discomfort during the EVLT procedure within the scope of day case surgery.

Keywords: endovenous laser ablation, general anesthesia, supraglottic airway device

Introduction

The term chronic venous insufficiency (CVI) describes a condition that affects the venous system of the lower extremities with venous hypertension causing various pathologies including pain, swelling, edema, skin changes, and ulcerations.1) Although the term CVI is often used to exclude uncomplicated varicose veins, varicose veins have incompetent valves with increased venous pressure leading to progressive dilation and tortuosity.1) CVI of the lower extremities is a common disorder, which varies from 1% to 40% in females and 1% to 17% in males.2) The prevalence of CVI seems to be somewhat higher when compared with western population.3) Superficial venous insufficiency associated with varicose veins is usually asymptomatic, but may affect quality of life significantly.

There are several modalities available in the treatment of varicose veins. Although the conventional treatment includes open surgical techniques such as ligation and stripping,2) less-invasive endoluminal methods such as radiofrequency ablation (RFA), endovenous laser ablation (EVLA) and ultrasound guided foam sclerotherapy (UGFS) have been developed as alternatives to open surgery, with the purpose of decreased pain and morbidity,
better cosmetic results, and enhanced recovery.\textsuperscript{5–7)} Since EVLA was introduced by Navarro, et al. in 2001 as an alternative to conventional therapies,\textsuperscript{6)} it is becoming increasingly popular in the treatment of superficial venous disease. Due to the advantages of being performed under local anesthesia and short duration, it is performed as day case surgery.

Tumescent anesthesia (TA) is a local anesthetic technique that can be used within safe limits for anesthesia of large areas with the injection of large volumes of dilute local anesthetic and epinephrine into subcutaneous fat. Tumescent infiltration has gained widespread popularity and is used more frequently during the EVLA procedure. Although this technique has some specific advantages such as anesthetization of large areas of body surface, low incidence of bleeding, and prolonged post-operative analgesia, multiple needle punctures and, particularly, injection of the local anesthetic solution along the veins may induce considerable pain during TA.\textsuperscript{8)} To avoid pain and discomfort and to increase patient satisfaction, regional and general anesthesia techniques can be considered in addition to tumescent anesthesia.

The aim of this retrospective study is to evaluate the feasibility of general anesthesia with spontaneous breathing through a supraglottic airway (SGA) device in addition to TA in 300 patients undergoing EVLA as a day case surgery.

Materials and Methods

After obtaining institutional local ethical committee approval, the anesthesia and clinical registration records of 341 extremities of 300 adult patients who underwent EVLA were retrospectively reviewed and analyzed. Operations were done by the same surgical team and patients follow-up was done by the same nurse. All patients had symptomatic varicose veins with documented great saphenous vein (GSV) incompetence which were classified according to the clinical, etiologic, anatomic, pathophysiologic (CEAP) classification.\textsuperscript{9)} The patency of the deep venous system and severity and extent of reflux in the superficial venous system were evaluated preoperatively with duplex ultrasonography scanning. All duplex scans were performed with a color duplex system in the radiology department.

Demographic and clinical data, CEAP scores, preoperative anesthetic evaluation data (American Society of Anesthesiologists [ASA] physical status, preoperative airway assessment, Mallampati score), type of supraglottic device, duration of anesthesia and surgery, any surgical and/or anesthetic complication, timing of mobilization and discharge, and postoperative course were recorded and analyzed (Table 1).

Anesthetic management

The procedures were performed in the operating room under general anesthesia supplemented with local TA. None of the patients was premedicated with any drug. Standard monitors, including ECG (lead II), noninvasive blood pressure, and peripheral oxygen saturation (SpO\textsubscript{2}) measurements were attached. A 20-gauge cannula was inserted into a vein in the dorsum of the hand and 0.9%NaCl solution was infused at a rate of 5 to 7 mL/kg/hr. After preoxygenation for 2–3 minutes, anesthesia was induced according to our standard clinical protocol with propofol 2.5 mg/kg. After loss of consciousness, fentanyl 1.0 \textmu}g/kg was injected intravenously (iv), and either LMA Classic (The Laryngeal Mask Co., Ltd., Victoria, Mahe, Seychelles) or I-Gel\textsuperscript{®} (Intersurgical Ltd., Wokingham, Berkshire, UK) of the appropriate size was inserted for management of the airway. If placement of supraglottic device failed after three attempts, the airway was maintained through endotracheal tube after proper muscle relaxation was gained and this case was considered as a failed attempt. Anesthesia was maintained with sevoflurane in a mixture of 50% oxygen and 50% nitrous oxide. Ventilation was adjusted to maintain the end-tidal CO\textsubscript{2} at 35–45 mmHg. The local anesthetic solution for tumescent anesthesia included 500 ml 0.9% NaCl, 10 ml 0.5% bupivacaine, 20 ml 8.4% sodium bicarbonate and 1 ml adrenaline. After the saphenous veins were punctured and the laser fibers were inserted to the proper location, tumescent anesthesia solution was administered under US guidelines by the surgeon. On completion of the surgery supraglottic device was removed when the patient regained consciousness.

Any recorded complication during the operation such as regurgitation, hemodynamic instability, nausea and vomiting, blood staining following removal, laryngospasm, and desaturation to SpO\textsubscript{2} 90% was examined. Patients were transferred to the ambulatory surgical unit (ASU) and evaluated for sore throat, nausea and vomiting, dysphonia, dizziness and extremity movement capacity as soon as possible in the immediate postoperative period.

Surgical technique

Before surgery, lower extremity varicosities were marked in the standing position preparation for stab avulsions.
Patients were placed in the supine position, and under duplex ultrasound guidance, the GSV was punctured with an 18-gauge needle or, rarely, accessed by cut down at the knee level. The catheter was advanced over a wire and its position confirmed to be distal to the saphenofemoral junction (SFJ), 1 cm below the confluence of the inferior epigastric vein. The saphenous subcompartment along the GSV was infiltrated with tumescent anesthesia under ultrasound guidance from knee to groin around the catheter. After the GSV was cannulated with a 45-cm-long 5F angio sheath over a J-tip guide wire, an 810-nm diode laser fiber (Diomed, Andover, Mass.) was inserted and advanced proximally. The veins were treated by delivering 14 W of continuous energy and withdrawing the laser fiber at a speed of 3 mm/s, until a distance of 2 cm above the knee access site was reached.

The linear energy density (LEED) values were used to calculate the laser energy based on the GSV diameter, 1.5–2.0 cm distal to SFJ. For GSV diameters between 4.5 and 6.9 mm, 60–70 J/cm of energy was used; for GSV diameters between 7 and 10 mm, 80–90 J/cm of energy was used. Laser energy was delivered endovenously in a continuous fashion.

After confirmation of successful obliteration and absence of common femoral vein (CFV) thrombus by intraoperative ultrasound scans, the fiber and the sheath catheter were removed and the puncture area was covered with sterile tape. An elastic bandage was then wrapped around the leg from toes to groin to be maintained for the following 2 days. Patients were discharged from ASU the same day upon recovery from anesthesia according to the post-anesthesia discharge scoring system (PADS), first designed by Chung, et al., which contains major criteria about vital signs, ambulation, pain, postoperative nausea and vomiting (PONV), and surgical bleeding (Table 2). Before discharge, patients were instructed regarding activity level, pain control, the use of compressing stockings and follow-up. At the discharge time, all patients were prescribed a standard dose of analgesics (Paracetamol 1g TD po). Postoperative pain was described as excessive when an additional analgesic was required or significant limitation of activities of everyday living was occurred.

### Table 1  Demographic and clinical data

<table>
<thead>
<tr>
<th></th>
<th>Number of patients</th>
<th>Age (year) (mean; min–max)</th>
<th>Sex (M/W)</th>
<th>Weight (kg) (mean)</th>
<th>Height (cm) (mean)</th>
<th>BMI (kg m⁻²) (mean; min–max)</th>
<th>Clinical classification (CEAP) in 341 legs</th>
<th>ASA score (n)</th>
<th>Mallampati score (n)</th>
<th>Supraglottic device</th>
<th>Fail attempt</th>
<th>Complication</th>
<th>Duration of operation/ anesthesia (min) (mean; min–max)</th>
<th>Mobilization/discharge timing (min) (mean; min–max)</th>
</tr>
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</table>
|                                | 300 patients, 341 legs (bilateral in 41 patients) | 44 (21–66) | 192 (64%)/108 (36%) | 77.92 (54–110) | 164.48 (152–185) | 27.51 (19.86–40.44) | C1 6  
  C2 140  
  C3 88  
  C4 105  
  C5 2  
  C6 0 | I 168 (56%)  
  II 120 (40%)  
  III 12 (4%) | 1 114 (38%)  
  2 156 (52%)  
  3 30 (10%) | LMA classic 36 (12%)  
  i-Gel 264 (88%) | LMA classic 0  
  i-Gel 36 (12%) | Laryngospasm 5 (1.6%)  
  Sore throat 9 (3%)  
  Dysphonia 1 (0.4%)  
  Nausea 11 (3.6%) | 28 (12–55)/40 (20–65)  
  25 (11–45)/139 (110–200) |

BMI: body mass index; CEAP: clinical, etiologic, anatomic, pathophysiologic; ASA: American Society of Anesthesiologists
Thrombophlebitis was designated as the presence of an indurated cord at the site of the treated GSV associated with localized hyperemia, edema, and tenderness requiring treatment with anti-inflammatory agents. Edema was defined as the new onset of swelling in the treated lower extremity that was exacerbated by ambulation and relieved by leg elevation. According to these definitions telephone review was done by the same nurse for patients’ follow up care at the 1st and 7th postoperative days. Routine postoperative control was done at 1 month after surgery with duplex scanning at our institution’s radiology department.

Results

Anesthesia and surgery records of 300 consecutive patients (341 limbs) were investigated in this study. Demographic and clinical data of the patients are presented in Table 1. One hundred and ninety two patients were women (64%) and 108 were men (36%), with a median age of 44 years (range: 21–66 years). Three hundred and thirty three limbs had symptomatic varicose veins, with or without skin changes (C2–C4), and two had a history of venous ulcers (C5–C6). In all patients and limbs, etiology was primary valvular incompetence. The mean GSV diameter, measured in an upright position at 2 cm below the saphenofemoral junction, was 6.82–1.22 mm. The mean length of GSV was 29.93–6.36 mm.

I-Gel (Intersurgical Ltd., UK) was the preferred supraglottic device in all patients but in 36 of 300 patients successful placement could not achieved after three attempts and classic LMA (The Laryngeal Mask Co., Ltd., Seychelles) was inserted. There was no need for tracheal intubation. Mean duration of operation and anesthesia was 28 (12–55) and 40 (20–65) minutes, respectively. Mobilization and discharge timing was 25 (11–45) and 139 (110–200) minutes, respectively. Both LMA (The Laryngeal Mask Co., Ltd., Seychelles) and I-Gel (Intersurgical Ltd., UK) did not cause any significant alteration in the hemodynamic status of the patients, end tidal CO$_2$, and SPO$_2$. Nine patients suffered from mild sore throat and 1 patient had transient dysphonia. Eleven patients were complaint of nausea in the early postoperative period and they were treated with 8 mg of iv ondansetron.

There were total of 3 cases with recanalization identified in thrombus during the post-EVLA follow-up period. All of these patients were symptomatic and required recanalization with the same surgical technique.

Discussion

Since increasing number of surgical procedures are performed on an outpatient basis, there is an increasing demand for anesthetic agents and techniques that improve the efficiency and safety of anesthesia, with faster induction, emergence and recovery and earlier discharge of the patient. EVLA is suitable to perform as a day case surgery and in many centers it is performed under standard local TA. TA has several advantages such as protecting perivascular tissues from the thermal effects of the laser and allowing better absorption of the energy by decreasing the diameter of the vein. By this way, it decreases the intravascular blood for coagulation and serves for decreasing of DVT risk. Despite these advantages, EVLA procedure under TA is still associated with significant stress, pain and discomfort for the patient. Until recently spinal anesthesia was of little importance in day case surgery due to potential risk of prolonged nerve
EVLA under General Anesthesia

intubation, and damage to the oropharyngeal structures and causing adverse hemodynamic responses during the procedure. 

way, potential of stimulating the sympathetic nervous system and modernization of regional anesthetic techniques increase the popularity of spinal anesthesia in day case surgeries.

Peripheral nerve blocks (PNBs) of the lower extremities are effective techniques for anesthesia and postoperative pain control. In the current literature there are very few clinical investigations focusing on the nerve blocks for analgesia during EVLA. Although nerve stimulator or ultrasound guided femoral and sciatic nerve blocks were found and reported effective for limiting pain during EVLA, there may be some drawbacks to be considered. First of all, experience and technical equipment support are essential issues for both patient and surgeon satisfaction. To achieve early patient mobilization after operation and keep patients active thereafter, nerve blocks have to provide analgesia with minimal or no motor block. For this purpose, relatively high level of sensory block than motor block has to be created by using proper local anesthetic. Complications of peripheral nerve blocks such as nerve injury, bleeding problems, infectious complications, allergies and local anesthetic systemic toxicity (LAST) are rare, but can be destructive. LAST is still a major source of morbidity and mortality in the practice of regional anesthesia. To reduce the systemic toxicity risk, one of the recommendations is limiting the doses of local anesthetics to the minimal amount required for the desired outcome. Large doses of local anesthetics have been used in TA and limiting doses of local anesthetics in the combination of TA and peripheral nerve block cannot be possible, and both anesthetist and surgeon may have to face with the risk of systemic toxicity. Also in-situ toxicity of local anesthetics can induce histological damage, metabolic alteration with cell death and apoptosis, and functional dysfunction in both muscle and neuron.

In our EVLA series, we did not use regional and spinal anesthesia and/or intravenous sedation and preferred general anesthesia with a SGA device combined with tumescent anesthesia for our patients. Although an endotracheal tube (ET) is considered gold standard to maintain an airway, potential of stimulating the sympathetic nervous system and causing adverse hemodynamic responses during intubation, and damage to the oropharyngeal structures are probable disadvantages over SGA devices. The incidence of postoperative sore throat is less in patients receiving the LMA (The Laryngeal Mask Co., Ltd., Seychelles). SGAs also have some advantages when using in outpatient anesthesia. The patients with SGAs can tolerate lighter levels of anesthesia than ETs and typically do not require neuromuscular blockade and side effects of the medication or its antagonists. When compared with ET, length of stay in the post-anesthesia care unit and time to ambulation were significantly shorter in the LMA group and this can potentially increase mobilization time. The usage of SGAs is limited to some patient populations and medical conditions such as decreased lung or chest compliance and increased airway resistance, glottic or subglottic airway obstruction, oropharyngeal anatomical abnormalities, or who are at high risk for aspiration and morbidly obese patients. In present study mean BMI was 27.5 (19.86–43.44) kg m–2 and within 300 patients 83 patients have 30–35 kg m–2, 6 patients have 35–40 kg m–2, and 5 patients have >40 kg m–2. Only 7 patients had a diagnosis of asthma but any adverse event and/or complication did not occur. Laryngospasm occurred in 5 patients but any of these patients did not have any co-morbidity associated with respiratory tract. There was not any delay of discharge or need to hospitalization of our patients. Cost benefit of early mobilization and early hospital discharge is obvious. Previous studies state that great majority of day surgery patients undergoing EVLA with TA were discharged the same day but fail to provide exact information on mean discharge times. Unfortunately all our EVLA cases were performed under general anesthesia supplemented with local TA, therefore we were not able to compare the mean mobilization and discharge times of our patients with cases undergoing surgery only with TA.

Conclusion

In conclusion, the combination technique of administering general anesthesia with supraglottic device and tumescent anesthesia is a safe and effective method to reduce the patients’ pain and discomfort during the EVLT procedure within the scope of day case surgery. Further randomized controlled studies that compare general anesthesia with regional and spinal techniques are needed.

Disclosure Statement

The authors have nothing to disclose and there is no conflict of interest.

References