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RECOMMENDATIONS
Thermal ablation of the saphenous veins

Update of the SFMV (French society of vascular medicine) guidelines on the conditions and safety measures necessary for thermal ablation of the saphenous veins and proposals for unresolved issues

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Abbreviations: AM, *Assurance Maladie* (French National Health Insurance); ASA classification, American Society of Anesthesiologists physical status classification; CEAP classification, classification according to Clinical findings, Etiological findings, Anatomical cause and Pathophysiological cause; CNPMV, French National Professional Council of Vascular Medicine; DVT, Deep Venous Thrombosis; EHIT, Endovenous Heat-Induced Thrombosis; EVL, EndoVenous Laser; EVLA, EndoVenous Laser Ablation; EVTT, EndoVenous Thermal Treatment; FDA, United States Food and Drug Administration; GA, General Anaesthesia; GHM, GHS, *Groupe homogène de malades* (homogenous patient group), *Groupe homogène de séjour* (homogeneous hospitalization group): medico-economic classification principles defined by the French National Health Insurance system for health care establishments and used for determining treatment tariffs and reimbursement levels; GSV, Great Saphenous Vein; HAS, *Haute Autorité de Santé* (French National Authority for Health); LA, Local Anaesthesia; LTA, Local Tumescent Anaesthesia; MEOPA (EMONO), Equimolar mixture of oxygen and nitrous oxide (*mélange équimolaire d'oxygène et de protoxyde d'azote*); NHS, United Kingdom National Health Service; NICE, United Kingdom National Institute for Health and Care Excellence; PASTE, Post-Ablation Superficial Thrombus Extension; RF, Radiofrequency; SSV, Small Saphenous Vein; TA, Thermal Ablation; UFS, Ultrasound-guided Foam Sclerotherapy.

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Update

Summary Venous insufficiency is a very common disease affecting about 25% of the French population (if we combine all stages of its progression). It is a complex disease and its aetiology has not yet been fully elucidated. Some of its causes are well known, such as valvular dysfunction, vein wall defect, and the suctioning effect common to all varicose veins. These factors are generally associated and together lead to dysfunction of one or more of the saphenous veins. Saphenous vein dysfunction is revealed by ultrasound scan, a reflux lasting more than 0.5 seconds indicating venous incompetence. The potential consequences of saphenous vein dysfunction over time include: symptoms (heaviness, swellings, restlessness, cramps, itching of the lower limbs), acute complications (superficial venous thrombosis, varicose bleeding), chronic complications (changes in skin texture and colour, stasis dermatitis, eczema, vein atresia, leg ulcer), and appearance of unaesthetic varicose veins. It is not possible to repair an incompetent saphenous vein. The only therapeutic options at present are ultrasound-guided foam sclerotherapy, physical removal of the vein (saphenous stripping), or its thermal ablation (by laser or radiofrequency treatment), the latter strategy having now become the gold standard as recommended by international guidelines. Recommendations concerning thermal ablation of saphenous veins were published in 2014 by the *Société française de médecine vasculaire*. Our society has now decided to update these recommendations, taking this opportunity to discuss unresolved issues and issues not addressed in the original guidelines. Thermal ablation of an incompetent saphenous vein consists in destroying this by means of a heating element introduced via ultrasound-guided venous puncture. The heating element comprises either a laser fibre or a radiofrequency catheter. The practitioner must provide the patient with full information about the procedure and obtain his/her consent prior to its implementation. The checklist concerning the interventional procedure issued by the HAS should be validated for each patient (see the appended document).

The recommendations are divided into seven sections, corresponding to the successive steps of the procedure in chronological order:

- description of the standard sequence of a saphenous vein thermal ablation procedure;
- patient information;
- environment;
- anaesthesia;
- complementary treatment of tributaries;
- undesirable effects and immediate complications;
- follow-up: compression, anticoagulation, secondary adverse events, sick leave.

Description of the standard sequence of a saphenous vein thermal ablation procedure

The standard procedure comprises the following steps:

- ultrasound-guided marking of the skin to indicate the location of the incompetent vein and the optimal puncture site;
- surgical hand scrub for disinfection of the operator's hands and donning of surgical attire (sterile gown and gloves);
- comfortable positioning of the patient for an operation lasting 30—60 min (in dorsal decubitus for the treatment

of a great saphenous vein [GSV] and in ventral decubitus for that of a small saphenous vein [SSV]);
- extensive application of an antiseptic around the puncture site;
- placement of surgical drapes so as to expose only the zone to be treated, layout of sterile single-use materials and sterile protective sheaths;
- ultrasound-guided identification of the vein puncture site;
- local anaesthesia of the vein puncture site;
- puncture of the vein and insertion of an introducer into the vein according to Seldinger's technique or direct puncture of the vein and introduction of the fibre via the catheter used for puncture (for certain so-called ''slim'' fibres);
- insertion of the catheter containing the heating element (laser fibre or radiofrequency probe) into the vein and positioning of its extremity up to 2 cm upstream of the saphenofemoral junction (SFJ) for GSV ablation, or upstream of the saphenopopliteal junction (SPJ) for SSV ablation;
- ultrasound-guided local tumescent anaesthesia (LTA) extending over the entire length of the vein segment to be treated;
- verification that the anaesthetic has fully diffused around the vein, that the heating element is correctly positioned and that the vein wall fits tightly around this element;
- destruction of the vein by the heating element (during continuous pull-back of the laser fibre or either sequential or continuous pull-back of the radiofrequency probe). Withdrawal of the heating element via the percutaneous vein puncture used for its introduction;
- verification of the patency of the common femoral vein or the popliteal vein (according to whether a GSV or a SSV has been treated);
- application of a sterile absorbant dressing to the puncture site;
- the patient should stand up and walk immediately or very soon after completion of the procedure.

Patient information

During the preoperative consultation, the practitioner must provide the patient with an honest, appropriate and comprehensible description of the procedure envisaged. This will include a clear presentation of the advantages and drawbacks of the treatment proposed as well as the likely development of the disease in the absence of treatment. Information about alternative therapeutic strategies, whether applicable or not, must also be provided. The practitioner must ensure that the patient has fully understood the information given.

The French Public Health Code does not impose a specific interval between provision of this information to the patient and implementation of the procedure. However, as thermal ablation of a saphenous vein is not an emergency procedure, it seems reasonable to allow the patient several days for reflection between the preoperative consultation and the operation itself.

Printed information sheets can also be given to the patient to complement the information provided orally. Three patient information sheets have been issued jointly by the French Society for Vascular Medicine and the French Society of Phlebology:

- endovenous thermal treatment of varicose veins (by laser or radiofrequency);
- endovenous radiofrequency treatment of varicose veins;
- endovenous laser treatment of varicose veins.

These information sheets are provided as an appendix to this document and can also be downloaded in Word or PDF format from the sites of the societies concerned.

The patient's written and signed consent must be obtained prior to the procedure.

Table 1 The ASA Physical Status Classification System.

The ASA Physical Status Classification System
ASA 1: normal healthy patient
ASA 2: patient with mild systemic disease
ASA 3: patient with severe systemic disease
ASA 4: patient with severe systemic disease that is a constant threat to life
ASA 5: moribund patient who is not expected to survive without the operation

American Society of Anesthesiologists (https://www.asahq.org/standards-and-guidelines/asa-physical-status-classification-system).

Environment

The appropriate setting for endovenous thermal treatment (EVTT) procedures

In 2008, the French National Authority for Health (HAS) stated that procedures involving the use of radiofrequency should be performed in a dedicated operating suite [1] conforming to the organizational, functional and technical criteria defined in the decree dated January 7th 1993 [2]. The update of the report concerning endovenous laser (EVL) procedures, issued in December 2016 [1] confirmed this point.

The different levels of environment

In 2010, the HAS differentiated various technical environment levels for the implementation of operations performed on an outpatient basis [3]. Three different levels are described and criteria for selecting one or the other level are proposed according to patient characteristics (ASA score, see Table 1 below), type of anaesthesia, and groups of procedures. Detailed description of the environment required for each procedure is left to the learned societies concerned.

Level 1 requires minimal equipment and materials. It is appropriate for interventional procedures and the basic management of cardiorespiratory complications using fundamental equipment. This includes a supply of oxygen [O_2] and a vacuum source, an oxygen [O_2] mask or nasal cannula for oxygen supply, and possibly also other items such as an aspirator, oropharyngeal cannulae, a defibrillator, a pulse oximeter or oxygen saturation monitor, and materials

for venous access. The availability of this equipment differentiates the level 1 environment from a consulting room. This level also includes a standard ''emergency pharmacy'' containing adrenaline, atropine, a corticosteroid, an antihistaminic, a bronchodilator, volume expansion solutions, and an anticonvulsant.

The staff is also limited, comprising the operator and possibly an assistant.

The discriminatory criteria for orientation towards this level comprise:

- type of anaesthesia: topical or local anaesthesia, digital or local blocks;
- type of surgery: minor;
- patient characteristics: ASA class 1, 2 or 3.

Level 2 is distinguished by a superior level of equipment enabling more intensive and complex patient care than level 1, notably including resuscitation measures. It necessitates the availability of a post-intervention recovery room and a system enabling continuous oxygen administration. The pharmacy is completed by medicinal products for the treatment of malignant hyperthermia, cardiac rhythm disorders, acute pulmonary oedema, etc. The staff is reinforced, both numerically and in terms of competence, including an assistant dedicated to monitoring sedated patients. The availability of an on-site anaesthetist, while not compulsory, could be a component of the level 2 environment.

The discriminatory criteria for orientation towards this level comprise:

- type of anaesthesia: LTA, sedation + local anaesthesia, sedation + analgesia;
- type of surgery: minor or major;
- patient characteristics: ASA class 1, 2, 3 or 4, accompanied patient.

Level 3 corresponds to a dedicated operating suite comprising an operating room, a recovery room and a decontamination/disinfection room. The level 3 environment includes the presence of a physician-anaesthetist.

The discriminatory criteria for orientation towards this level comprise:

- type of anaesthesia: regional, general, sedation/deep analgesia;
- type of surgery: minor or major;
- patient characteristics: ASA class 1, 2, 3 or 4.

Based on a single Canadian recommendation [4], a level 2 environment is proposed for operations involving LTA, as well as for operations involving local anaesthesia + sedation. However, the HAS proposes the distinction of two sub-levels in this context:

- level 2 A approaches the least stringent level of environment (level 1), but necessitates reinforced conditions of asepsis and/or the presence of a third person for performance of the operation. As it does not require the presence of an anaesthetist, this level would be compatible with the use of a technical facility not located within a health care establishment;
- level 2 B, more closely approaching the most stringent level of environment (level 3), notably owing to the required presence of an on-site anaesthetist, is compatible with the use of a technical facility located within a health care establishment.

An analysis of the clinical practice of French vascular physicians published in 2009 already revealed the performance of numerous endovenous laser (EVL) procedures in settings other than an operating suite [5]. The French National Professional Council Of Vascular Surgery (CNPMV), in the report on EVL treatment issued by the HAS in 2016, emphasized that in its opinion ''this issue should be debated by hospital authorities, government authorities, notably ministerial, and representatives of professional bodies, in order to identify, as in other European countries, a more appropriate setting for the treatment of varicose veins that could lead to this being transferred out of the operating suite.''

Parameters determining the choice of environment

Safety. The setting chosen should be adapted to the operation and to the patient in order to reduce potential complications of the procedure to a minimum. Most of the risks involved are nevertheless principally related to inadequate experience of the operator, the nature of the environment not playing a major role. In particular, air treatment does not guarantee a reduced level of risk (see section 6-2).

Concomitant phlebectomy. In the case of extensive phlebectomies, a setting corresponding to an operating suite may be preferred (owing to the increased risk of infection). These procedures can nevertheless be performed by trained operators, under LTA alone, in a level 2 facility.

The choice of a practitioner operating within a health care establishment, taking into account organizational and/or contractual constraints. Only procedures performed within a health care establishment are reimbursed by the French national health system (*Assurance maladie* [AM] on the basis of defined ''*Groupe homogène de malades* [GHM]'' or ''*Groupe homogène de séjours* [GHS]'' tarification principles (flat rate related to implementation of the procedure on an outpatient basis). At present, there is no flat rate reimbursement for such interventions if they are performed outside a health care establishment.

Choice of setting in practice

Neither advanced age, nor anticoagulant or antiplatelet treatment is a key criterion for modifying the choice of setting required for the operation (Table 2).

In contrast, an ASA class of 3 or more, cardiac, renal or hepatic insufficiency, a BMI above 35 or, in general, any perception on the part of the operator that the patient is at risk (e.g. in a state of extreme anxiety) may lead to the choice of performing the procedure with complementary sedation and in an operating suite.

Table 2 Choice of setting in practice.

	Technical facility	Operating suite
Environment	(See section 6-2) Dedicated room of sufficient size to permit comfortable positioning of the patient and layout of all the necessary equipment and materials The treatment area must be separate from the administrative area Cleanable surfaces	Conforming to operating suite criteria
Equipment	Operating table, lighting, blood pressure monitor, oxygen saturation monitor, trolley bearing emergency equipment, source of oxygen	Conforming to operating suite criteria
Materials	Sterile, single-use	Sterile, single-use
Staff	At least a third trained person. Presence of an on-site anaesthetist if level 2B	Operating suite staff If anaesthesia is envisaged: an attendant anesthetist If no anaesthesia is envisaged: presence of an anesthetist within the operating suite
Monitoring	At least 30 min after the operation in an outpatient facility or equivalent	According to the mode of anesthesia chosen and the associated interventions
Interventions complementary to the ablation procedure (RF or EVL)	Foam sclerotherapy of a tributary with or without phlebectomy	Phlebectomy, foam sclerotherapy of a tributary
Associated anaesthesia	Preoperative EMLA cream MEOPA[a], hypnosis ou autohypnosis Relaxation	Preoperative EMLA cream, sedation, exceptionally spinal anaesthesia, femoral block or general anaesthesia (increased risk of neurological complications and skin burns)

[a] The use of MEOPA (EMONO), an equimolar mixture of oxygen and nitrous oxide, may necessitate ventilation of the facility. The circular DGS/3A/667 bis dated 10 October 1985 specifies a limit of 25 ppm for exposure during the maintenance phase of anaesthesia (see also the Toxicological Data Sheet INRS 267 concerning nitrous oxide).

Additional features of the setting according to the techniques employed

The use of radiofrequency systems necessitates the standard precautions described above.

For EVL procedures, it is additionally stipulated that prior to any laser emission, all persons present in the room must be wearing protective glasses specifically designed to protect against lasers of the wavelength used. A warning pictogram must be displayed on each door of the room where the operation will be performed.

Summary of environmental prerequisites

- we suggest that endovenous thermal treatment (EVTT) involving exclusively LTA (using lidocaine alone, without adrenaline) and with an expected duration of less than 60 minutes should be performed, subject to patient agreement, in a treatment facility conforming to level 2 criteria as defined by the HAS;
- in other situations, we recommend adapting the setting according to the patient's expectations and the constraints related to the therapeutic strategy envisaged.

Anaesthesia

Thermal ablation of saphenous veins (whether by laser or radiofrequency) is a treatment leading to the destruction of the vein by the endoluminal application of heat to the vein walls.

The internal wall of the vein is exposed to temperatures of at least 120 °C.

The use of LTA is indispensable to avoid diffusion of this heat to the surrounding tissues.

LTA is widely employed in other surgical indications, including dermatology and plastic surgery. It consists in injecting a large volume of a solution containing a reduced quantity of the anaesthetic agent, thereby reducing the risk of overdose.

With regard to EVTT of a saphenous vein, the objective is to surround the vein with a liquid ''sleeve''. This ''sleeve'' has three functions:

- protecting the perivenous tissues. The liquid surrounding the vein prevents damage to adjacent tissues

(subcutaneous tissues, skin, nerves, muscles) by absorbing the heat emitted by the endovenous heating element (laser fibre or radiofrequency probe) and by pushing these tissues away from the vein;
- ensuring that the vein walls fit closely round the heating element (laser fibre or radiofrequency probe), increasing the contact between the heating element and the vein endothelium and optimizing exposure of the endothelium to heat. LTA additionally induces complete evacuation of blood from the vein (exsanguination by external vein compression);
- exerting local anaesthesia, rendering the operation painless.

The use of LTA may be perceived as unpleasant by the patient, but this does not justify adding another form of anaesthesia, such as spinal anaesthesia, locoregional block or even complete sedation [6]. The practice of thermal ablation under LTA seems to us to be perfectly suited to the vast majority of procedures, being probably less likely to induce undesirable effects.

With LTA, the patient is alert and capable of reporting pain during the procedure (including the perception of pain associated with burning due to insufficient tumescence or pain resembling that of an electric shock in the case of too close proximity of a nerve).

The document ''Choosing wisely for chemical or thermal occlusion in the treatment of incompetent saphenous veins and recurrences'' published in 2018 advocates the use of LTA alone (general or locoregional anaesthesia not being considered justifiable other than in rare exceptions) [7].

It is therefore important to reduce the discomfort of LTA for the patient as far as possible while at the same time ensuring an optimal level of safety.

Thorough knowledge of the products used for LTA on the part of the practitioner ensures respect of both safety and efficacy [8—13].

Several questions concerning the optimal composition of the liquid used for TLA with regard to achieving the objective of making this form of anaesthesia less painful while maximizing safety still remain in abeyance, namely:

- What is the most appropriate solution?
- Which local anaesthetic agent should be used?
- In what amount?
- Should the solution be rendered alkaline?
- Should adrenaline be added?
- What materials are required for local tumescent anaesthesia?
- Should other complementary modes of anaesthesia be used?

What is the most appropriate solution?

In 2008, the HAS wrote in its report concerning percutaneous endovenous occlusion of saphenous veins: ''Tumescent anaesthesia may be defined as the ultrasound-guided administration of lidocaine or lidocaine plus adrenaline diluted in an isotonic crystalloid solution without additional alkalinization'' [1].

Table 3 Characteristics of local anesthetics.

Characteristics of local anaesthetics	Duration of efficacy (min)	
	Without adrenaline	With adrenaline
Amino-amides		
Lidocaine	30—120	60—400
Mepivacaine	30—120	NA
Bupivacaine	120—240	240—480
Ropivacaine	120—360	NA
Amino-esters		
Procaine	15—30	30—90

NA: not applicable.

These recommendations were reiterated by the French Society for Vascular Medicine in 2014 [14].

Two isotonic crystalloid solutions are available: 0.9% physiological saline and Ringer's lactate solution (comprising water for injection, Na+, Ca++, K+ and lactates).

The pH of physiological saline is 7.4, whereas that of Ringer's lactate solution ranges from 5 to 7.

Considering that the physiological pH of circulating blood is 7.4, Ringer's lactate solution does not seem to be the most appropriate solution for LTA.

As we shall see below, bicarbonate solutions may also be used [15].

Which local anaesthetic agent should be used?

Local anaesthetics belong to two major families: amino-amides and amino-esters.

Several studies have compared the various amino-amides suitable for local anaesthesia (bupivacaine, ropivacaine and mepivacaine). Although additional amino-amides exist, these are reserved for other uses (e.g. articaine is employed in odontostomatology, prilocaine is used in the form of a patch or cream).

There is no advantage in using an amino-amide other than lidocaine as the benefit/risk ratios of bupivacine and ropivacaine are less favourable (owing to a greater risk of convulsive complications in the event of overdose and a further risk of cardiological complications with bupivacaine), and the time to onset of their anaesthetic effect is longer. Lidocaine has a rapid onset of action and a duration of action ranging from 90 to 120 min, sufficient for accomplishment of the thermal ablation (TA) procedure. In view of these characteristics, lidocaine is the anaesthetic of choice for LTA [16] (Table 3).

The only amino-ester available in France in a pharmaceutical form permitting local injection (infiltration) is procaine. Recourse to this anaesthetic is unusual, but in theory possible. It could be employed in cases of allergy to amino-amides.

Allergy to lidocaine and to amino-amides in general is exceptional. If a patient reports an allergy to lidocaine, we propose the following steps:

- in the first instance, confirmation of the true existence of the allergy (consultation with a specialist);

- if the allergy to lidocaine is confirmed, verification that this allergy also applies to the other amino-amides that can be used for TLA;
- if allergy to amino-amides in general is confirmed, the following solutions may be envisaged:
  - either implementation of thermal ablation under sedation, using 0.9% physiological saline alone (LTA using physiological saline alone is too painful for use in the absence of sedation) [17],
  - or use of an amino-ester (procaine). In practice, recourse to this option is exceptional.

Symptoms suggestive of allergy to the anaesthetic agent comprise: onset of urticaria, angio-oedema or anaphylactic shock. Depending on the serious nature of the reaction, the therapeutic response will consist in the administration of an antihistaminic, a corticosteroid, oxygen, or adrenaline.

In what amount?

The recommended maximum dose of lidocaine is 200 mg, according to its Summary of Product Characteristics, corresponding to a bottle containing 20 mL of 1% lidocaïne to be diluted in 1000 mL of solution.

The FDA (United States Food and Drug Administration) recommends maximum doses of 7 mg/kg lidocaine for use in a pure form. This corresponds to 420 mg for a patient weighing 60 kg (in other words, more than two bottles of 1% lidocaine) [18].

Based on a study comparing the maximum quantities of anaesthetic for LTA in various indications, Klein & Jeske proposed in 2016 a maximum quantity of 28 mg/kg for LTA other than in the context of liposuction (corresponding to 1680 mg for a patient weighing 60 kg!) [18].

The maximum doses in the context of LTA could be well above the recommended dose of 200 mg given that lidocaine is diluted in a large volume of solution.

The study published by Klein & Jeske confirmed the absence of any risk of overdose with use of a 500 mL solution containing 100 mg of lidocaine (or 1000 mL of solution containing 200 mg of lidocaine, depending on the size of the container available for constituting the solution).

The symptoms evocative of overdose comprise:

- with regard to neurological signs: metallic taste, perioral numbness, tinnitus, sensation of ebriety, ataxia, tremor followed by convulsions potentially culminating in coma;
- with regard to cardiac signs: hypotension, cardiac arrhythmia potentially progressing to cardiac arrest.

Should the solution be rendered alkaline?

The alkalinization referred to in the report issued by the HAS consists in increasing the pH of the solution.

Lidocaine has an acidic pH (approximately 6 for 1% lidocaine without adrenaline and close to 4 for 1% lidocaine with adrenaline).

After addition of physiological saline to lidocaine (whether combined with adrenaline or not); the solution remains acidic (pH 6.4 to 6.9).

As a result of this acidity, injection of the solution during LTA is painful (the difference between the pH of the solution injected and the physiological pH being too great).

One way of making this injection less painful is to buffer the solution to bring its pH closer to the physiological pH.

In 2008, the HAS continued to debate the benefit and risks of rendering the solution used for LTA more alkaline: ''This alkalinization raises three pharmacological issues:

- inactivation of adrenaline by sodium bicarbonate owing to a potential physicochemical incompatibility;
- the possible *in vivo* effect of potentialization of lidocaine activity as a result of alkalinization;
- the actual analgesic impact of recourse to this alkalinization, bearing in mind, first, that lidocaine is most often administered as a highly diluted solution and, second, the limited degree of pain induced by injection of an isotonic crystalloid solution into the saphenous compartment.''

Concerning the first two issues, a study performed by the Pharmacy of the University Hospitals of Geneva (HUG) [19] showed that:

- the pH of a lidocaine solution without adrenaline + 8.4% sodium bicarbonate is stable;
- In reply to: it is preferable to use a 0.5 or 1% solution of lidocaine to avoid the risk of precipitation on addition of bicarbonate;
- it is preferable to use 1.4% bicarbonate to avoid any risk of precipitation of lidocaine and adrenaline.

Concerning the third issue raised by the HAS (the actual analgesic effect of alkalinizing the solution), it is worth noting that several studies have shown a significant increase in analgesia with the use of bicarbonates [15,20—27].

Consequently, the use of bicarbonates to buffer the acidity of lidocaine seems to be devoid of risk if the following rules are respected when preparing the solution:

- option 1: mixture of 0.9% physiological saline with 8.4% bicarbonate (and lidocaine) according to the formula proposed by Klein [28] by adding one 20 mL bottle of 1% lidocaine (with or without adrenaline) and 10 mL of 8.4% bicarbonate to 1000 mL of physiological saline;
- option 2: use of 1.4% bicarbonate alone (with lidocaine) instead of the preparation described above. This option has the advantage of limiting the number of steps necessary. Furthermore, it avoids the use of 8.4% bicarbonate which, if injected alone (in the event of an error in preparation, for example), induces necrotic skin lesions. Studies have shown the efficacy and innocuity of this option [29,30];
- in any case: the solution should be prepared immediately before implementation of LTA in order to maintain its stability despite alkalinization and avoid the risk of precipitation.

Should adrenaline be added?

Adrenaline (epinephrine) is present in certain lidocaine preparations (bottles containing 1 or 2% lidocaine with

adrenaline). Marketed solutions of lidocaine with adrenaline slow systemic absorption, thereby increasing the duration of anaesthesia by prolonging the effect of lidocaine. Adrenaline additionally acts as a haemostatic.

Even very low concentrations of adrenaline, such as those used in the context of LTA, are effective [25,31,32].

In view of the extremely low doses of adrenaline in solutions used for LTA, adrenaline-induced undesirable effects and potential complications are exceptional.

The characteristics of adrenaline are particularly valuable in the case of EVTT with concomitant phlebectomy [33,34].

What materials are required for local tumescent anaesthesia?

LTA must be performed under ultrasound guidance to precisely site the injection and ensure optimal diffusion of the solution around the vein (interfascially if the vein is located in the saphenous compartment or subcutaneously if it is located between the superficial fascia and the skin).

LTA should involve the least pain possible to ensure optimal comfort of the patient. The choice of the needle is important. A needle with a calibre sufficient to allow efficient injection of the solution, but small enough to avoid excessive pain on insertion should be chosen. A 22- or 23-gauge needle is appropriate. It should be as long as possible to limit the number of punctures. Needles 50 mm long with a 22-guage calibre and 80 mm long 23-gauge needles are available on the market.

A peristaltic infiltration pump should be used for LTA, replacing the syringes used in the early days of TA. This pump increases the comfort of both practitioner and patient, limiting the number of needle manipulations. The flow rate chosen should ensure a regular and gentle infiltration (permitting painless tissue hydrodissection).

Should complementary modes of anaesthesia be used?

The use of LTA alone is recommended for TA. However, in rare cases, deeper anaesthesia (such as sedation, spinal anaesthesia or general anaesthesia) may be requested by the patient or the patient's family [35].

The patient should be warned that the risk of complications is greater in this context. In particular, the inability of the patient to react verbally during the procedure may mask insufficient LTA (increasing the risk of skin burns or neurological adverse events).

Sedation may be proposed but should remain relatively light and limited to the duration of tumescence.

Recourse to spinal anaesthesia or general anaesthesia should remain exceptional.

Perivenous anaesthetic infiltration (LTA) nevertheless remains indispensable in such cases to protect the tissues surrounding the treated vein.

Adjuvant procedures exist and are used by certain practitioners to limit the discomfort of LTA or anxiety on the part of the patient: these procedures include the use of MEOPA (EMONO), local anaesthetic cream containing lidocaine and prilocaine, hypnosis, verbal relaxation, music, and videos. If these procedures are well mastered by the practitioner, they can greatly improve the comfort of patients subject to anxiety [36—45].

Anaesthesia: summary of recommendations for clinical practice

- LTA is indispensable for thermal ablation of a saphenous vein and should be ultrasound-guided.
- In addition to its analgesic effect, LTA protects the surrounding tissues and also increases treatment efficacy by bringing the vein walls into closer contact with the heating element.
- We recommend use of a lidocaine dose not exceeding 200 mg.
- The use of lidocaine combined with adrenaline is not recommended unless TA is accompanied by phlebectomy.
- To attenuate the pain of LTA injection, we suggest adding a 1.4% solution of bicarbonate to 1% lidocaine (the dilution proposed is 100 mg de lidocaine [10 mL of 1% lidocaine] in 500 mL of 1.4% bicarbonate).
- Physiological saline or Ringer's lactate solution can also be used.
- To achieve tumescence, we suggest using a needle of appropriate length and gauge (e.g. an 80 mm long 23-gauge needle) and a peristaltic infiltration pump.
- Sedation may be proposed but should remain relatively light.
- Recourse to general anaesthesia or spinal anaesthesia should remain exceptional.
- Adjuvant techniques used by practitioners accustomed to their use and their effects (e.g. hypnosis, verbal relaxation, application of lidocaine or prilocaine cream, or MEOPA [EMONO]) may be of value in conjunction with LTA for patients subject to anxiety.

Complementary treatment of tributaries

Tributaries are veins connected to the saphenous trunks.

TA is a treatment for saphenous veins; it is not an appropriate treatment for varicose tributaries fed by the saphenous veins.

The treatment of tributaries raises numerous as yet unresolved issues:

- Should tributaries be treated during or after a TA procedure on a saphenous vein?
- Certain tributaries have been shown to regress spontaneously after the TA procedure and even disappear completely from a clinical standpoint [57]. In this case, should we refrain from superfluous treatment of tributaries that may disappear spontaneously?
- How can we identify the tributaries likely to collapse? Does that depend on their diameter prior to the TA procedure? Or on the duration of their presence? Or on their location (thigh or lower leg, proximal or distal)?

- Do tributaries that persistent (even in the absence of any symptomatic discomfort and/or aesthetic concern for the patient) nevertheless represent a risk factor for progression of the venous disease? In this case should they be systematically treated on completion of the TA procedure?
- If their treatment is deferred, when should a further operation be envisaged if necessary?
- What is the best treatment: sclerotherapy or phlebectomy? And what criteria should be used to determine the choice of therapeutic strategy?
- Should these include patient-related criteria (such as age, associated risk factors, medical history), risk of secondary adverse effects after sclerotherapy, existence of concomitant treatments, notably with antiplatelet and anticoagulant agents, patient request for an optimal aesthetic result, and/or a rapid result, or skin phototype?
- Does the choice of concomitant or deferred treatment depend on the type of treatment envisaged (phlebectomy or sclerotherapy) bearing in mind, for example, the cost of re-operation in the case of deferred phlebectomy)?
- Should the patient's preference be taken into consideration with regard to the type of treatment and the concomitant or deferred nature of the operation?
- May the choice also depend on the personal practices of the operator (i.e. whether or not he/she performs sclerotherapy and phlebectomy)?

Recommendations differ from one country to another: North-American guidelines [46] include a grade 1B recommendation that tributaries should be treated, either concomitantly or subsequently, by phlebectomy or sclerotherapy, without further details. NICE (United Kingdom) [47] recommends concomitant treatment, essentially on economic grounds. Finally, European recommendations advocate concomitant treatment in the form of phlebectomy [48].

So far, no four-arm study has been performed to compare concomitant or deferred treatment consisting in either phlebectomy or sclerotherapy.

Studies that have compared treatment of tributaries by phlebectomy at the same time as TA to their deferred treatment have shown no differences with respect to level of pain, number of complications of time to recovery of normal personal or professional activity. Similarly, no differences in quality of life scores have been observed [49—51].

The risk of thrombosis was increased when TA was accompanied by phlebectomy owing to the prolonged duration of the operation.

A single study compared sclerotherapy to phlebectomy for the treatment of tributaries [52], concluding superiority of phlebectomy. However, this study did not respect European recommendations for sclerotherapy [50] as this involved the use of a liquid rather than foam.

The two studies evaluating the rate of complications and the scores of clinical severity and quality of life associated with sclerotherapy of tributaries performed at the same time as endovenous treatment of the saphenous trunks showed similar results. Both studies concluded that this strategy was reliable and effective [53,54], resulting in a significant decrease in the rate of re-operations in comparison to TA alone [55].

However, the 30 to 80% regression of tributary varicosities, or even the clinical disappearance of certain tributaries, after TA of saphenous trunks could lead to a preference for deferred treatment [56—58].

The possibility of obliterating the saphenous axis at the junction with tributary veins also seems to provide a partial explanation for regression of the latter veins [59,60].

Recent publications concerning the use of cyanoacrylate for the treatment of saphenous trunks conclude that deferred treatment of tributaries by sclerotherapy is effective [61,62].

In view of these findings, it appears that available published data do not yet permit resolution of the question of tributary treatment.

At present there is no scientific evidence supporting the choice of either deferred or concomitant treatment of tributaries. Minimally invasive interventions that are as short as possible and involve immediate patient mobilization following the operation may reduce the risk of thrombosis [63].

Published studies frequently fail to even define the tributaries concerned as well as lacking details of their calibre, their clinical repercussions, patient demands, etc. Finally, these studies do not sufficiently take into account the venous disease as a whole and the follow-up durations are short.

Summary of tributary treatment

Based on the current state of knowledge, we suggest that the choice of concomitant or deferred treatment of tributaries in the context of TA should be made on a case-by-case basis according to the patient's expectations and the usual practices of the operator.

Undesirable effects and immediate complications

Identified as being related to the procedure: skin burns, local or locoregional infection, neurological disorders, thromboembolic complications (deep venous thrombosis [DVT] and pulmonary embolism [PE]), migration of the guide wire, rupture of the fibre, and arteriovenous fistula).

Potential adverse events related to tumescence: allergic reactions, systemic lidocaine toxicity (neurological, and subsequently cardiac), and local or locoregional infection at the sites of infiltration.

NB: bruising is not included in this list as although it is frequent (occurring at a rate of 15 to 30%), it is benign and transient.

Skin burns

Based on the 17 studies analysed by the HAS in 2008 [64] the incidence of skin burns ranges from 0 to 1.5%. These burns result from an insufficient perivenous infiltration of liquid (tumescence) and/or a very superficial (e.g. supra-fascial) location of the vein segment treated. They are no longer reported in studies published after 2008.

Prior to the application of energy, complete separation of the saphenous vein from the surrounding tissues and the skin

must be checked by ultrasound scan. The distance between the vein and the skin must be at least 1 cm.

Implementation of the procedure under spinal anaesthesia, femoral block or general anaesthesia (in exceptional circumstances) does not dispense with the need for careful LTA to avoid any risk of burns.

Risk of infection

Infectious complications are rare. The analysis reported by the HAS [64] indicates an infection rate below 0.5%, recent studies reporting even lower rates of infection (RR, 95% CI: 0.10-0.76) [1,65,66].

Infectious complications may be secondary to ultrasound-guided vein puncture for insertion of the introducer and fibre, and/or to the punctures necessary for implementation of tumescent anaesthesia [14]. A case of necrotizing fasciitis was reported recently [67], emphasizing the importance of aseptic conditions.

A direct role of the environment (notably air quality) in the occurrence of an infectious complication following TA has not been demonstrated. The most closely comparable intervention in terms of the risk of infection is the insertion of a venous catheter left in place for less than 2 hours.

The norm NF 90-351 does not specify any particular treatment of the air (e.g. a supply of controlled, filtered air) either in this specific context or for comparable interventions.

An environment corresponding to that of an operating room, including air treatment, therefore does not seem to be necessary for protecting against the risk of infection.

All the materials used should be designed for single use.

A dedicated room, with appropriate spatial organization and respect of the operating procedures by the practitioner, should enable avoidance of any errors regarding asepsis. The room used for performing the procedure should be of a sufficient size to allow comfortable positioning of the patient, installation of the ultrasound apparatus and other specific equipment necessary (generator, electric pump) and freedom of movement of the operator, this room being separated from the administrative areas. It should be equipped with surfaces that can be easily cleaned using a detergent and disinfectant agent. Access to the room during the procedure should be as highly restricted as possible.

Preparation of the patient

A shower or wash with liquid soap on the morning of the procedure is sufficient. A shower with an antiseptic cleansing agent such as Betadine® may be prescribed at the discretion of the operator to ensure the patient's body hygiene. Patient preparation should conform to the protocol in force in the establishment concerned.

Epilation using a hair clipper or depilatory cream may facilitate the procedure. Mechanical shaving is prohibited.

Skin antisepsis is analogous to that recommended for insertion of a peripheral venous catheter through healthy skin. If the skin is visually clean, application of an alcohol-based antiseptic is sufficient. If the skin is dirty, cleansing prior to antisepsis is recommended. The efficacy of antisepsis depends on leaving the antiseptic in contact with the skin for at least 30 seconds and then ensuring that the skin has had time to dry completely.

Operator and materials [14,68]

We recommend the wearing of sterile gloves, after disinfection of the hands with a hydroalcoholic disinfectant, as well as a mask.

We advise the wearing of a sterile head cover and gown.

We suggest the wearing of single-use surgical scrubs.

Although the procedure can theoretically be implemented by a single operator, the help of an assistant facilitates the intervention and limits the risk of inadequate asepsis.

All the materials used should be sterile and designed for single use. They include:

- sterile surgical drapes;
- a vein puncture kit;
- an introducer;
- a heating element (radiofrequency probe or laser fibre);
- a sterile protective sheath to cover the ultrasound probe, and sterile ultrasound gel.

Medical waste should be disposed of according to the recommended circuit. A sharps collector must be placed close to hand.

Neurological complications

Paraesthesia is a potential undesirable effect of endovenous procedures. It is characterized by an early onset and generally disappears within 6 months.

Paraesthesia occurs more frequently and persists for a longer time in the case of treatment of a GSV segment located below the middle third of the leg (11.6% at 6 months, 7.7% at 5 years) or treatment of a SSV (9.5% at 6 months) [69]. The rates of paraesthesia reported in the most recent studies [70,71] were 0.7% and 4%, respectively.

The risk of paraesthesia is increased in the case of thermal treatment of distal segments of the GSV and SSV (located in the lower third of the leg) owing to the closer proximity of nerves in this region [72].

Thorough ultrasound reconnaissance of the nerve structures close to the axis of the vein to be treated is recommended during preoperative mapping, particularly in the context of SSV treatment and treatment in zones reputed to involve a high risk of paraesthesia.

Any report by the patient of a sudden sharp pain during heat application, particularly one described as resembling an electric shock, indicates neurological irritation by the heat and necessitates immediate cessation of heat application. The use of modes of anaesthesia other than strictly local deprives the operator of this ''pain signal''. In view of the greater neurological risks associated with treatment of the SSV, thermal treatment in this context must imperatively be performed under strictly local anaesthesia by tumescence.

Thromboembolic complications (DVT and PE)

Analysis of the original studies reporting the safety of radiofrequency procedures by the HAS in 2008 and then in 2013 revealed no death [64], just like the analysis concerning the use of EVL treatment [1]. Two cases of pulmonary oedema were described, with no details concerning the outcome of the patients concerned.

Reported rates of deep venous thrombosis associated with radiofrequency procedures range from 0.09% to 0.5% [70—74].

Generally, similar rates have been reported in the context of EVL procedures (DVT: 0.4%; PE: 0.1%).

Malgor et al. [75], reported annual risks of < 1:2500 for DVT, < 1:10,000 for PE and < 1:50,000 for death (Table 4).

Systematic thromboprophylaxis is not recommended other than in particular cases. The characteristics of Post-Ablation Superficial Thrombus Extension (PASTE) and Endovenous Heat-Induced Thrombosis (EHIT) and their management are detailed in section 7.

Migration of the guide wire

Throughout the procedure, the operator must continuously monitor the material used (both visually and by ultrasound), in particular the position of the guide wire. Use of a guide wire that is sufficiently long, and above all stable positioning of the guide wire are imperative, even though migration of the guide wire has been described only exceptionally (in the form of a case report).

Rupture of the RF probe or laser fibre

Rupture of a RF probe has never been described in the literature.

In contrast, rare cases of rupture of a laser fibre have been reported. The integrity of the fibre must be systematically checked after its withdrawal.

Any dysfunction of the probe, the fibre or the generator must form the object of a materiovigilance declaration.

The application of energy when the tip of the applicator is located within the introducer may cause this to melt or lead to its segmental rupture. Guide marks on the applicator enable the operator to withdraw the introducer in order to guard against this risk.

Adverse events associated with local tumescent anaesthesia

Various adverse events may occur during LTA [77].

The most frequent is vagal malaise. This depends on the sensitivity of the subject and is related to the sometimes painful nature of tumescence. Anaphylactic shock is exceptional, but serious. Allergic incidents or accidents are more infrequent with lidocaine than with procaine and amethicaine.

Lidocaine intoxications are rare provided that the maximum dose of 35 mg/kg is not exceeded. In view of the dose recommended for EVLA, they are unlikely to be encountered [16].

Summary of undesirable effects and immediate complications: recommendations for clinical practice

To reduce the risk of skin burns, it is recommended to systematically implement ultrasound-guided LTA.

To reduce the risk of infection, it is recommended to:

- perform the operation in a room that is sufficiently large, that can be easily cleaned and that has been previously cleaned and disinfected;
- instruct the patient to take a shower on the morning of the operation (using soap or Betadine®) and to refrain from hair removal (mechanical shaving is prohibited);
- perform skin antisepsis;
- wear sterile gloves and a mask;
- wear a sterile gown and to request help in dressing, to avoid any errors in asepsis;
- use sterile single-use materials (including the protective sheath of the ultrasound probe) and have a box for sharps close to hand.

To reduce the risk of neurological complications, we recommend avoiding the application of energy to the distal segments of the saphenous veins (located below the lower third of the leg) and to perform the TA procedure in an alert patient (using LTA alone).

We recommend examining the laser fibre or the RF probe, as well as the introducer, after their withdrawal.

Although exceptional, the risk of an anaphylactic reaction to lidocaine necessitates performance of the procedure in a suitable environment and use of appropriate materials, as well as the presence of a suitably trained staff.

Follow-up: compression, anticoagulation, secondary adverse events, sick leave

Compression

There is currently no consensus concerning the type of compression (stockings or bandages) and the duration of compression applicable after EVTT [78—80].

Five recent randomized studies compared short (2 hours to 2 days) to long (3 to 15 days) periods of wearing class II compression stockings following EVTT without any associated intervention (ultrasound-guided foam sclerotherapy or phlebectomy).

Effect on pain

The wearing of compression stockings for one week seemed to have a beneficial effect in terms of pain in three studies [81—83]. However, another study published by Ayo et al. [84] showed no significant difference either at D1 or D7.

Table 4 Estimated incidence of thromboembolic events in England in the total population treated during one year in NHS trusts [76].

Treatments	*n*	Thromboembolic events		
		Deep venous thrombosis (%)	Pulmonary embolism (%)	Total (%)
Total population treated	35,374	0.36	0.15	0.51
Anatomical target				
Great saphenous vein	21,144	0.36	0.17	0.53
Small saphenous vein	1,493	0.60	0.07	0.67
Great and small saphenous veins	1,832	0.49	0.22	0.71
Unilateral treatment	28,947	0.30	0.15	0.45
Bilateral treatment	6,427	0.62	0.14	0.76
Type of treatment				
Stripping	29,435	0.37	0.17	0.54
Endovenous treatments (EVL & RF)	1,499	0.40	0.07	0.47
Endovenous treatments and phlebectomies	557	1.26	0	1.26
Sclerotherapy	3,701	0.14	0.05	0.19

Effect on bruising
Studies have not shown any significant difference in bruising between short and long duration of compression groups [83,84].

Impact on quality of life
A single study [81] showed improvement in certain quality of life parameters (in particular, physical function). In contrast, several studies reported inconvenience and discomfort during the wearing of compression stockings, particularly on the part of patients with a high BMI [85].

Effect on oedema
One study [83] showed a reduction in oedema during the first week postoperation (no longer seen at 2 weeks). Other studies did not show any significant difference in leg circumference [82] or an absence of inferiority [86] of compression limited to 4 hours versus compression for 72 hours.

Relationship between the number of complications and compression
The number of complications reported was no greater in groups wearing compression stockings for a short *versus* a long period. Krasznai [86] even observed fewer complications in the group wearing compression stockings for a short period.

No precocious repermeabilization was seen in the groups studied.

The results of these studies are consistent and show that a long period of wearing compression stockings (20 mmHg, corresponding to class II in France) does not result in any benefit in the case of EVTT alone.

Prolonged compression may result in discomfort for the patient and reduce the rate of compliance. Currently available published data therefore suggest that compression stockings should not be used for more than a week.

We do not recommend systematic venous compression following TA under TLA.

If compression is prescribed for the purpose of analgesia, it should take the form of compression at 20 mmHg, corresponding to class II in France, for a duration of less than 8 days.

Anticoagulation

Extension of a thrombus to the SFJ is a complication often described after endovenous thermal procedures [87,88]. However, its pathophysiology differs from that of a thromboembolic process, and the risk of pulmonary embolism is exceptional.

Anticoagulation following EVTT is little practised in the United States but an early ultrasound check-up is proposed [89].

Who should receive an anticoagulant?
Several authors have described factors increasing the likelihood of thrombotic extensions to the SFJ, namely age above 50 years [87], personal history of thromboembolism [90,91], and a large calibre SFJ (> 10 mm) [91—93]. Concomitant phlebectomies are also considered to be a risk factor for thrombus extension [90,92,94], but it is emphasized that such cases often concern more elderly patients with a higher CEAP score.

Current smoking, male sex [91,92,95], and a high CEAP [90,96] or Caprini [95] score are risk factors discussed. The populations treated in the various studies are not always comparable and this may affect the incidence of thrombus extensions and also modify the impact of the risk factors reported. Furthermore, thromboembolic complications (ipsilateral DVT, PE) are not always clearly distinguished from junctional thromboses.

The risk of thromboembolism is diminishing owing to the feasibility of immediate ambulation with the use of LTA.

Patients at a high risk of thromboembolism (e.g. those with a history of recurrent thromboembolic episodes, known severe thrombophilia, a state of hypercoagulability, or

Table 5 Kabnick's classification.

Class	Criteria	Treatment
1	Thrombosis of the SFJ or SPJ not extending into the deep venous system	No particular treatment or monitoring
2	Non-occlusive thrombosis of the deep venous system extending over less than 50% of the area (in transverse section)	Anticoagulant treatment at prophylactic or curative dose with ultrasound re-evaluation at 1 week
3	Non-occlusive thrombosis of the deep venous system extending to more than 50% of the area (in transverse section)	Curative anticoagulant treatment with a check-up at 2 weeks and adjustment according to the regression or absence of regression of the thrombus
4	Occlusive deep venous thrombus	Curative anticoagulant treatment for a minimum of 6 weeks with adjustment according to the benefit/risk ratio

active cancer) should receive bilateral compression and prophylactic anticoagulation.

What treatment should be given?
No study comparing different injectable treatments at prophylactic doses in the context of EVTT of varicose veins was identified.

Treatment with enoxaparin 4000 IU/day, fondaparinux 2.5 mg/day, or tinzaparin 3500 IU/day may be proposed.

Two retrospective studies evaluating the use of rivaroxaban 10 mg reported respectively:

- no significant difference between rivaroxaban 10 mg/day and fondaparinux 2.5 mg/day for 3 days in terms of thromboembolic extension or bleeding [97],
- the efficacy and reliability of rivaroxaban 10 mg/day for 5 to 10 days as an alternative therapeutic option for patients undergoing EVTT with or without associated phlebectomy [98].

As yet, no study investigating apixaban has been published.

For what duration?
The duration of thromboprophylaxis in published studies ranged from 3 to 7 days [86,91,92,96—99].

The risk factors for thrombosis are patient-related and should be managed on a case-by-case basis according to evaluation of the benefit/risk ratio.

We propose anticoagulant treatment at prophylactic dose in patients at high risk of thromboembolism, notably those with a personal history of venous thromboembolism or known major thrombophilia.

If anticoagulation is prescribed, we propose, in the absence of published data, the use of a direct oral anticoagulant (DOAC) or a low-molecular-weight heparin (LMWH) or fondaparinux at prophylactic dose for 7 days. This treatment may be combined with class 2 compression.

How should junctional thrombi arising after EVTT be managed?

Formation of a thrombus at the SFJ following EVTT, if it occurs at all, happens soon after completion of the procedure. The histological characteristics of such thrombi differ from those of a classical acute deep venous thrombus, no doubt explaining why they only exceptionally lead to the complication of PE [89,92,95]. However, these differences are not evident on an ultrasound scan. The frequency of such junctional thrombi, revealed by the follow-up ultrasound scan, ranges from 2 to 9% [100], increasing between 5 and 10 days after the operation. The persistent presence of a thrombus at the SFJ at 1 month is exceptional.

Positioning of the tip of the fibre at 2 cm from the terminal valve is designed to limit the incidence of such thrombi by maintaining a distance between the fibre tip and the femoral vein and to preserve the functional haemodynamics of the SFJ. To this end, some teams propose adjusting the position of the tip of the fibre or catheter according to the anatomical location of the tributaries of the SFJ, placing the tip 5 mm upstream of the principal tributary.

An ultrasound scan of the junction concerned, whether the SFJ or the SPJ, should be performed systematically on completion of the procedure. Early ambulation is essential.

If a thrombus is detected, we propose the use of Kabnick's classification [93] and adaptation the therapeutic strategy according to the following criteria: (Table 5).

The particular case of patients already receiving anticoagulant treatment scheduled to undergo thermal ablation
Treatment with an anti-vitamin K (AVK) or direct oral anticoagulant (DOAC) at curative dose does not constitute a contraindication to the TA procedure, which can be performed without adjustment of the anticoagulant dose.

The same applies to patients treated with an antiplatelet agent.

Sick leave

We reiterate the recommendation for early ambulation and physical activity from day 0. Clinical practice shows that

Table 6 Sick leave duration.

Sedentary work	3 days
Light physical work	5 days
Occasional lifting of loads < 10 kg	
Repeated lifting of loads < 5 kg	
Moderate physical work	5 days
Occasional lifting of loads < 25 kg	
Repeated lifting of loads < 10 kg	
Hard physical work	
Lifting of loads > 25 kg	7 days

The durations indicated include the day of the procedure.

in the case of EVTT without concomitant phlebectomy, sick leave beyond the day of the procedure is exceptional.

In France, according to the guidelines of the HAS and the national health insurance system (https://www.ameli.fr/sites/default/files/Documents/5153/document/arret-travail-varices_assurance-maladie.pdf), the criteria determining the duration of sick leave after radiofrequency EVTT (to be adapted to the situation of each patient) are as shown in the following table (Table 6).

The duration of the initial period of sick leave should be adjusted according to:

- the patient's age;
- the degree of severity of the symptoms (oedema, pain, etc.) and the extent of the venous disease;
- the comorbidities;
- any complications (haematomas, infection, venous thrombosis, etc.);
- the need for prophylactic treatment with LMWH in high-risk situations;
- the possibilities of adaptation or modification of the work station, particularly for work predominantly involving prolonged standing or sitting.

Clinical and ultrasound follow-up

The optimal scheduling of the follow-up ultrasound scan after EVTT remains controversial and varies according to clinical practices. The aim of this examination is to reveal any thrombotic extension, this event generally appearing, if at all, within the first week postoperation [88,93]. The rate of PE secondary to such thrombus extensions is below 0.01% and the effective success rate of TA of the saphenous vein during the perioperative period is close to 99% [89].

The guidelines of the American Venous Forum recommend a check-up within 24 to 72 hours post-procedure [101], in view of the very low rate of thromboprophylaxis in the United States.

The HAS advocates performing a control ultrasound scan within the 10 days following EVTT to check the efficacy of the endovascular procedure (despite the close to 100% obliteration rates achieved currently) and to verify the absence of any thrombotic phenomena.

A later ultrasound scan (at 3 to 12 months) enables verification of the occlusion of the saphenous trunk, analysis of junctional haemodynamics, and examination of any tributaries that might require complementary treatment.

We therefore propose an early clinical and ultrasound follow-up (between D8 and D10) for all patients having undergone TA [88], then the usual follow-up of varicose disease at least once a year.

Follow-up of saphenous vein thermal ablation procedures: summary of proposals for clinical practice.

After EVTT:

- We recommend early active ambulation.
- If compression is prescribed for analgesic purposes, this should comprise the use of compression stockings exerting a pressure of 20 mm Hg (corresponding to French class II) for a duration of less than 8 days.
- We recommend anticoagulant treatment at prophylactic dose for patients at high risk of thromboembolism.
- We recommend early clinical and ultrasound follow-up (between D8 and D10), then the usual follow-up of varicose disease.
- Sick leave is not systematic after TA of a saphenous vein. If necessary, the duration of sick leave can be adjusted on the basis of an individual evaluation taking into account the patient's professional activity.

Disclosure of interest

S.G: consultant for Medtronic.

The other authors declare that they have no competing interest.

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