Challenges in the management of primary lower extremity varicose veins: what is the best treatment option?

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Background Varicose vein is considered as one of the commonly practiced venous problems for decades not only by vascular surgeons but also by general surgeons.

Aim The purpose of the current study was to compare the results of management of lower limb superficial varicosities using conventional surgery versus endovenous laser ablation (EVLA) therapy.

Patients and methods A retrospective study took place in the period of three years from January 2015 until December 2017. Patients were selected for having reflux of the great saphenous vein (GSV) with primary varicosities of the lower limb presenting to the vascular surgery clinic. Patients were divided into two groups: group I included those who were treated with GSV short stripping and saphenofemoral junction disconnection, whereas group II involved patients who underwent EVLA.

Results The study included 80 patients. There were 50 females and 30 males, with a female to male ratio of 5 : 3. Patients' age ranged from 22 to 44 years, with a median age of 34 years. There was a significantly higher initial technical success rate of 95% (n=38) in the group treated with EVLA versus 90% (n=36) in the group treated surgically (P=0 · 006). Operative outcome was statistically significantly higher in the group treated with EVLA compared with the surgically treated group (P=0.002). A significant difference between operative procedures versus operative outcome was seen (P=0.002). Recurrent varicosities were observed in 10% and 5% in group I and group II, respectively. Heat-induced deep vein thrombosis was reported in 2.5% of cases.

Conclusion Treatment of superficial varicosities with EVLA had a lower incidence recurrence rate than traditional surgery in the short-term follow-up. Moreover, the minimally invasive EVLA therapy, especially, in female patients seems to be a highly effective and safe modality for treatment of primary GSV varicosities.

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Introduction

Varicose veins are dilated, elongated, tortuous veins of the lower limb. Superficial varicosities of the lower limb were considered as one of the chronic common venous problems affecting women more than men. Patients with varicose veins may present with ankle edema, disfigurement, chronic eczema, disability, ulceration, bleeding, foot deformities, and impairment in quality of life [1–3]. Pathology and treatment of primary varicosities are reported in the surgical literature for more than 300 years. Yet, there is no solid agreement about the best and most convenient line of its treatment. Treatment of lower limb superficial varicosities is aimed at correction of both anatomical and hemodynamic disorders caused by its development, thus improving the patients' well-being and life quality [4]. Conventional surgery was considered an ordinary tool for its management. The usual surgical treatment option for the great saphenous vein (GSV) varicosities included saphenofemoral junction (SFJ) disconnection and GSV stripping, as well as multiple hook phlebectomies to completely remove the diseased vein. Although it seems to be a successful operation, yet it is considered as an invasive procedure and usually accompanied by a high morbidity rate [5–10]. The minimally invasive endovenous laser ablation (EVLA) has been adopted with the aim of having equal or better results than standard surgical technique. This less invasive procedure was accompanied by an early postoperative recovery with a less postoperative morbidity [11–13]. Based on the current guidelines [14–17], short- and/or mid-term follow-up was recommended for patients treated with EVLT of the GSV reflux. The aim of the current study was to report our local experience with conventional surgical treatment of primary GSV varicosities versus the recently adopted EVLA technique.

Patients and methods

A 3-year retrospective study took place from January 2015 to December 2017 reporting the data of patients

who presented with primary GSV varicosities who presented with primary GSV varicosities. Patients' underwent a thorough review for data retrieval after approval of our institutes' research board (IRB) ethical committee. Patients were fully aware and informed about the therapeutic effects, advantages, disadvantages, expectations, and complications of each used technique. Moreover, when obtaining patients' formal consent (to have their medical records used in future studies) in performing the interventional procedures, we followed the ethical standards of the Helsinki Declaration (1975–2000).

Patients were enrolled in the study if they had primary GSV varicosities (dilatation >5 mm in diameter) associated with reflux. In addition, they were eligible for the study if they had GSV varicosities plus SFJ incompetence. Furthermore, patients were excluded if they had short saphenous vein varicosities with saphenopopliteal junction (SPJ) incompetence, isolated SFJ incompetence without GSV varicosities, coexisting disease or disability that would preclude surgical treatment, and below-the-knee varicosities owing to leg perforator incompetence. Moreover, it excluded those patients with telangiectatic or spider varicosities that required compression sclerotherapy, recurrent varicosities, history of peripheral arterial disease, active thrombophlebitis, and those with deep venous system insufficiency/deep vein thrombosis (DVT) as documented by color duplex ultrasonography (CDUS).

Studied populations were divided into two groups. Group I included those patients who underwent short stripping of the GSV and SFJ disconnection operations. Short stripping procedure was accompanied by stab avulsion technique if the varicosities extended below the knee, provided that the leg perforators were competent. Moreover, all groin tributaries were ligated back to the secondary division, and inversion stripping of the GSV took place around the knee level. The inversion stripping was preceded by high ligation of the SFJ. On the contrary, group II incorporated patients who were treated with minimally invasive EVLA therapy. This technique was performed as described previously [18]. Typically, management with laser took place by firing of its wave (10–14 W) ~4 cm below the SFJ and stopped either at the level of the knee or not exceeding 10 cm below it [19]. Laser-induced thermal damage acts through indirect heating of the venous wall by the formation of steam bubbles intraluminally, leading to thrombotic blockage of the vein. In addition, and as a consequence of contact closure between the tip of the laser fiber and the venous wall itself, direct damage of the venous wall is the aftermath [20–22]. As a result, the collagen of the venous walls undergoes the heating process, with the resultant contraction and endothelial destruction. Moreover, venous fibrosis developed as a result of increased thickening of the venous wall [23]. Moreover, all patients initially underwent clinical evaluation entailing a thorough history taking, with a special emphasis on fertility potential, history of intake of oral contraceptive pills, patient's occupation, and predisposing factors. In addition, a local clinical examination of the affected limb took place to assess the type, degree, and any possible complications of varicosities as well as CDUS scanning before any intervention and within the follow-up visits for flow, reflux, as well as venous occlusion. Disease severity was stratified by clinical assessment, CDUS results, and according to the Committee of the American Venous Forum (Clinical, Etiology, Anatomy, and Pathophysiology) classification [24]. To confirm a significant comparison between the two studied groups, all patients underwent routine stab phlebectomy for significant branch varicosities. Following interventions, all patients were evaluated and followed in the first postoperative week. A subsequent examination was performed after 1 month, 3 months, 6 months, and 12 months, correspondingly. The median follow-up period was 5.6±3.6 month. They were followed up clinically, as well as by CDUS for exclusion of clinically evident varicosities recurrence, which can be defined as recurrent varicosities that may be presented within six weeks after operation. Initial technical success may be defined as effective anatomical ablation of the treated vein. In group I, it included disconnection of all tributaries drained into upper part of the GSV at the groin, high ligation of the GSV, and ablated GSV in the thigh. In contrast, in group II the treated segment of GSV should be occluded, thrombosed, and showed noncompressibility with complete absence of venous flow. Postoperative recurrence was diagnosed by the presence of reflux in the previously ablated vein. Reflux may be explained by the presence of a reversal of flow in the saphenous trunk (>0.5 s) detected by CDUS in the standing position with venous augmentation. Moreover, reflux may be stratified into grades according to the length of affected segment. Grade I attributed to reflux limited to a short vein segment, grade II was responsible for reflux in a segment greater than 10 cm, whereas grade III ascribed to reflux involving the whole saphenous trunk [22]. Special considerations should be given to the development of signs of neovascularization at the groin with particular attention to recanalization GSV that has been previously occluded. Neovascularization

was defined as superficial tortuous veins radiating from the SFJ that was not apparently observed on CDUS imaging during the previous 6 weeks of follow-up.

Statistical analysis

All statistical analyses was performed using IBM statistical package for the social sciences (SPSS) program version 23 (IBM Corporation, Armonk, New York, USA). Descriptive analysis reported number and percentage for categorical variables and mean±SD for continuous variables. The results interpreted in details the characteristics of the study population and the association between sociodemographic characteristics versus operative procedure to which it addressed the study objectives using χ^2-test, and paired samples *t*-test to compare categorical variables. The factors that influenced operative procedures for the two groups were estimated by the logistic regression analysis method. A *P* value of less than 0.05 was considered to have a statistical significance. Unadjusted hazard ratios with 95% confidence intervals were further used to evaluate the association between the risk factors of interest and their association with the development of lower limb varicosities.

Results

Consecutive 80 patients with primary GSV varicosities were enrolled in this study. There were 50 females and 30 males, with the female to male ratio of 5 : 3. Patient's age ranged from 22 to 44 years, with a mean of 32.8 ±06.2 years. The sociodemographic data of the studied patients and the risk factors associated with the development of varicose veins are shown in Table 1. The initial clinical presentation for all patients were gross varicosities along the affected lower limb (Clinical, Etiology, Anatomy, and Pathophysiology clinical grades C_2 or beyond). CDUS findings revealed that 70% (*n*=56) of patient presented with both SFJ incompetence and above-knee communicator incompetence. On the contrary, 30% (*n*=24) were diagnosed as having GSV varicosities along the whole limb in addition to SFJ incompetence (Table 2). Moreover, most of the studied patients (70%, *n*=56) had markedly incompetent grade 3 SFJ, as it measures about 10.7 mm in diameter as documented by CDUS (Fig. 1), whereas the remaining 30% (*n*=24) were diagnosed as having SFJ incompetence, as well as above- and below-knee varicosities with communicator incompetence (Fig. 2). In group I, 75% of patients (*n*=30) underwent conventional surgery in the form of SFJ disconnection and GSV short stripping. This technique was adopted for those patients who have had above-knee varicosities. While the remaining 25% (*n*=10) underwent the previously mentioned procedure in addition to multiple hook phlebectomies. Furthermore, the other 50% (*n*=40) included in group II were treated by minimally invasive EVLA procedure. Moreover, short stripping inversion technique was adopted in 75% who had above-knee varicosities. The concern was that below-knee stripping may result in unwanted neurological complications. On the contrary, 25% of patients who had extended below-knee GSV varicosities underwent ambulatory phlebectomy (i.e. stab avulsion technique). The initial technical success was significantly higher following EVLA, reported in 95% of cases (*n*=38/40) versus 90% (*n*=36/40) for the surgically treated group (*P*=0 · 006).

Furthermore, the relation between sociodemographic data and the operative procedures showed no statistically significant difference between different age groups in relation to the operative procedures (*P*=0.595). In contrast, there was a highly significant association between sex in relation to the operative procedure (*P*=0.001), as depicted in Table 3.

Table 1 Patients' sociodemographic data and risk factors for superficial varicosities (*n*=80)

Factors	Result
Age in years	32.8±06.2
Median (minimum–maximum)	34 (22–44)
Age group	
<40 years old	66 (82.5)
≥40 years old	14 (17.5)
Sex	
Female	50 (62.5)
Male	30 (37.5)
Risk factors	
Hereditary	37 (46.3)
Pregnancy	28 (35.0)
Long Standing	15 (18.8)

Results are expressed as mean±SD, number and percentage.

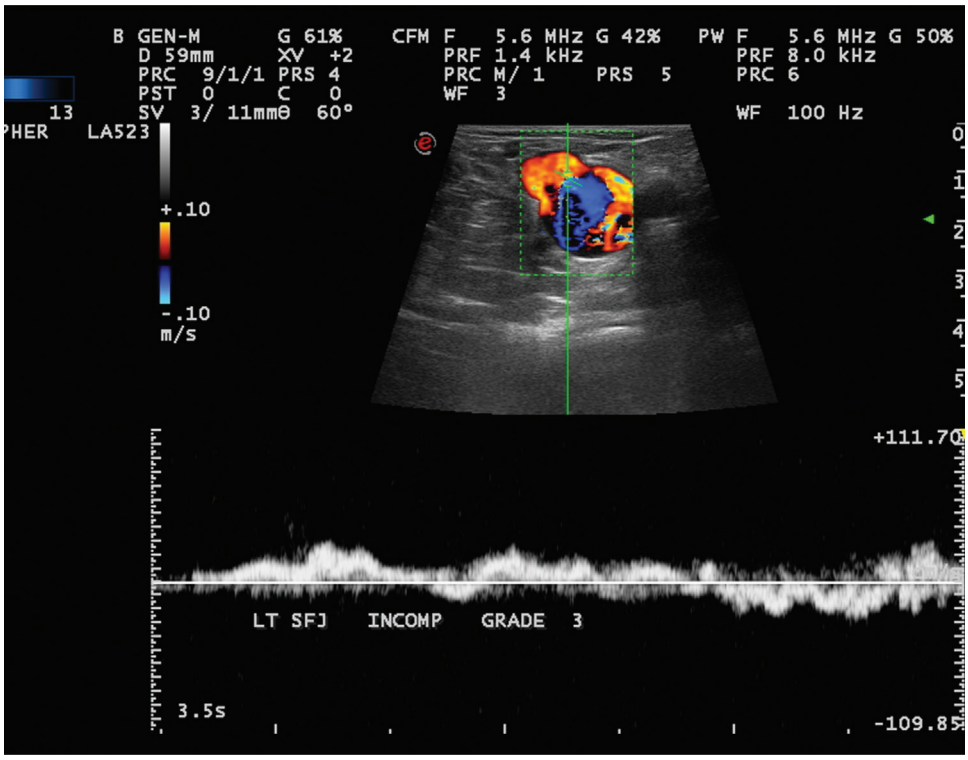
Table 2 Clinical presentation and color duplex ultrasonography findings (*n*=80)

ACP, American College of Phlebology; CDUS, color duplex ultrasound.

Factors	Yes
ACP classification	
$C_{2,S}$, E_p, A_s, P_r: varicose veins	80 (100)
$C_{3,S}$, E_p, A_s, P_r: edema	59 (74)
$C_{4,S}$, E_p, As, P_r: skin changes without ulcer	51 (64)
$C_{4,S}$, E_p, As, P_r: skin changes with healed ulcer	10 (8)
$C_{6,S}$, E_p, A_s, P_r: active ulcer	04 (5)
CDUS	
SFJ incompetence and VV limited to the knee	56 (70)
SFJ incompetence and VV involving the whole GSV	24 (30)

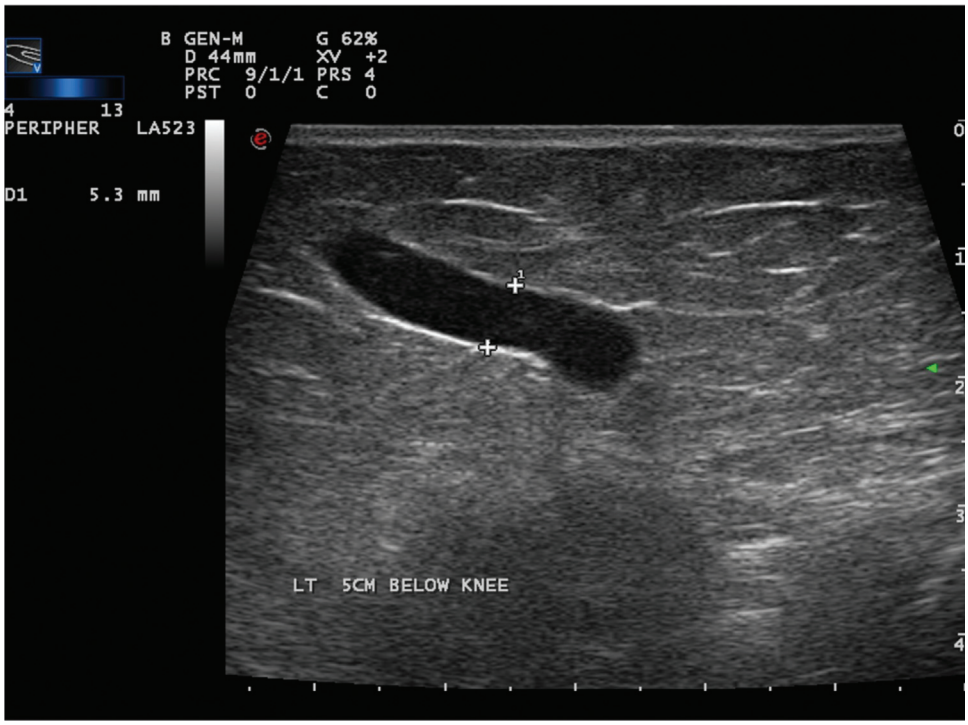
Results are expressed as number and percentage.
ACP, American College of Phlebology; CDUS, color duplex ultrasound.

Figure 1



Grade 3 saphenofemoral junction incompetence.

Figure 2



Below-knee great saphenous vein incompetence.

Furthermore, comparison between EVLA versus surgical treatment in relation to sociodemographic characteristics and operative outcome was statistically significantly higher in the group treated with EVLA compared with the surgically treated group (P=0.002). On the other hand, there were no statistical significant differences between age group regarding the operative procedure (P=0.114). In addition, there was no

Table 3 Association of operative procedure versus sociodemographic characteristics (*n*=80)

Factors	Procedure		
	EVLT	SFJ disconnection and stripping	*P* value[∞]
Age group			
<40 years old	26 (65.0)	40 (80.0)	0.595
≥40 years old	04 (35.0)	10 (20.0)	
Sex			
Male	02 (02.00)	28 (35.0)	<**0.001**[§]
Female	28 (35.0)	22 (28.0)	

EVLA, endovenous laser ablation; SFJ, saphenofemoral junction. Results are expressed as number and percentage. [∞]*P* value has been calculated using χ^2-test. [§]Significant value.

Table 5 Outcome of endovenous laser ablation versus surgical stripping in relation to age and sex

Factors	Odds ratio	95% CI	*P* value
Age group			
<40 years old versus ≥40 years old	0.295	0.050–1.754	0.179
Sex			
Males versus females	2.432	0.208–28.424	0.479

CI, confidence interval; OR, odds ratio.

Table 4 Endovenous laser ablation versus stripping to sociodemographic characteristics and operative outcome (*n*=40)

Factor	Procedure		
	EVLA	Stripping+SFJ disconnection	*P* value
Age group			
<40 years old	18 (90.0)	14 (70.0)	0.114[∞]
≥40 years old	2 (10.0)	6 (30.0)	
Sex			
Male	1 (05.0)	3 (15.0)	0.292
Female	19 (95.0)	17 (85.0)	
Follow-up after 6 months postoperatively***			
Complete healing of ulcer	2 (100)	1 (50.0)	**0.002**[§]
Ulcer going to heal	0	1 (50.0)	

Only 40 cases were included in this table comparing EVLA and surgical stripping; other procedures were excluded in this model. Results are expressed as number and percentage. EVLA, endovenous laser ablation; SFJ, saphenofemoral junction. [∞]*P* value has been calculated using χ^2-test. ***Only 4 cases were

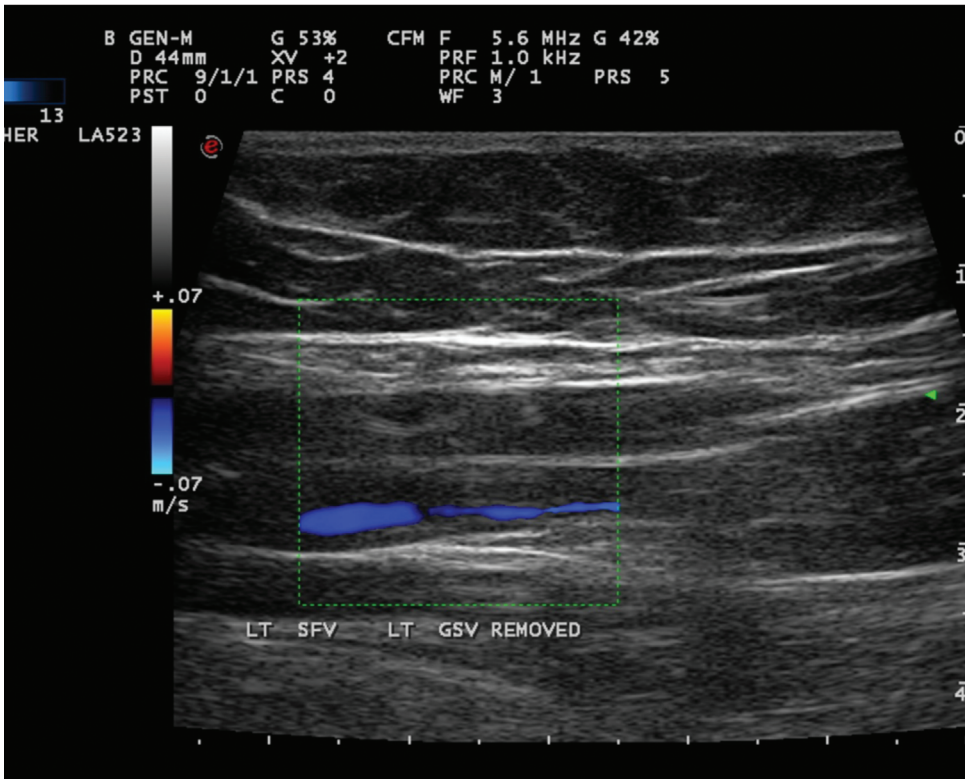
statistically significant difference between sex in relation to the operative procedure (*P*=0.292). In contrast, there was a statically significant differences between operative procedures versus operative outcome (*P*=0.002), as represented in Table 4. The correlations between EVLT versus stripping for the participants' sociodemographic characteristics revealed that there is no statistical significance of both sociodemographic characteristics such as age group and sex (*P*=0.179 and 0.479, respectively) (Table 5). Among the surgically treated group, follow-up after 12 months revealed that the GSV was completely ablated and absent in 90% (*n*=36/40) (Fig. 3). However, the remaining 10% (*n*=4/40) developed recurrent varicosities after 9 and 12 months respectively (Fig. 4). Recurrence of varicosities after surgery was observed below the knee in two (5%) patients, which was treated by compression sclerotherapy. However, in the other two (5%) patients, recurrence took place above the knee owing to the development of new incompetent perforators. Those patients were treated by EVLA therapy. On the contrary, most patients in group II (95%, *n*=38/40) were reported to have completely occluded and ablated varicosities as verified by postoperative CDUS examination (Fig. 5). Recurrence was reported only in 5% of patients (*n*=2/40) after 3–6 months of follow-up owing to above-knee partial recanalization of the treated GSV (Fig. 6). Those patients were treated by compression sclerotherapy through further sessions of local injection in the form of Alun de Chromium 0.04 g and Glycerol 3.60 g/ampoule de 5 ml Scleremo. Moreover, early postoperative complications were also reported, which included endovenous heat-induced thrombosis in two (2.5%) patients within the first week of EVLA. The heat-induced thrombus extended from the GSV into the femoral vein through the SFJ. Those patients were treated by SFJ ligation and oral anticoagulation with warfarin for 6 weeks. Furthermore, other minor postoperative complications were reported such as groin hematoma and groin wound infection in two and three patients, respectively.

Discussion

This retrospective study compared the early technical success rate and complications of two different interventional procedures, namely, surgical procedure and EVLA procedure of GSV ablation carried out at a single institution in consecutive patients. EVLA therapy was adopted as one of the most commonly established minimally invasive treatment option for GSV varicosities [25].

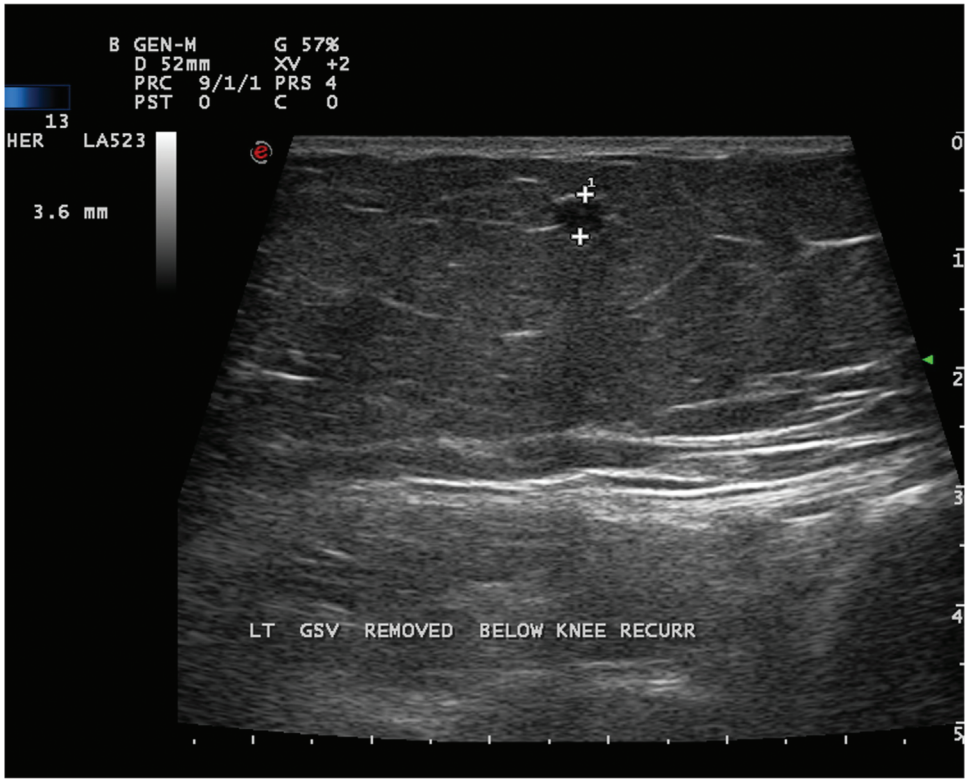
This may be attributed to its efficacy, simplicity, and safety, with fewer major postintervention complications [26–30]. Nevertheless, conventional varicose vein surgery still remains the gold standard technique in contrary to the recently developed minimally invasive interventional procedures, which need to be evaluated [31]. The technical success of EVLA approached 95% at the end of 3 months without failure (i.e., the vein get thrombosed

Figure 3



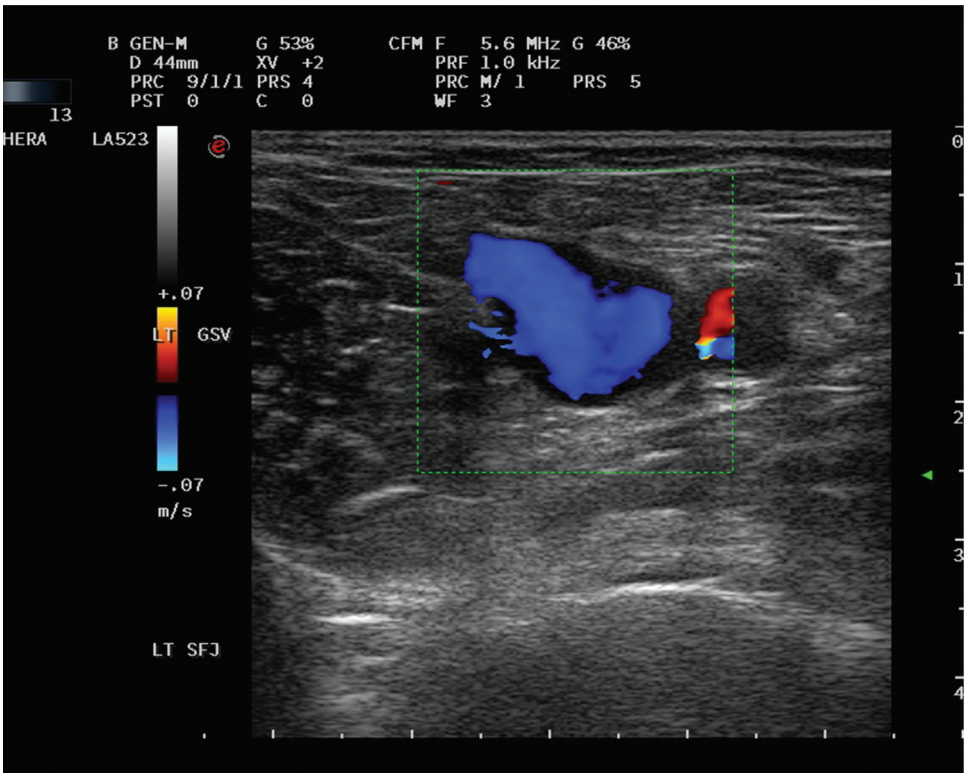
Surgical ablation of the great saphenous vein.

Figure 4



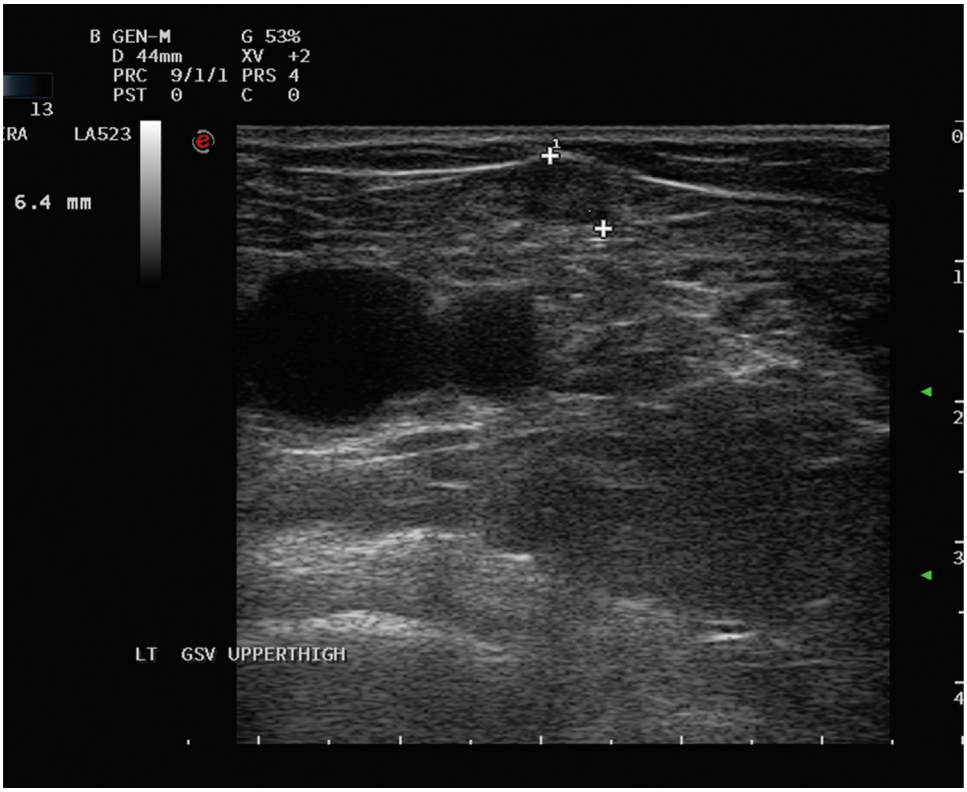
Recurrent below-knee varicosities after surgery.

Figure 5



Successful endovenous laser ablation evident by color duplex ultrasonography.

Figure 6



Dilated thrombosed great saphenous vein following endovenous laser ablation indicating recurrent varicosities.

and noncompressible with no venous flow). These results are consistent with that reported in others literature [32–35]. In the surgically treated group, our results showed an operative success rate of 90% coinciding with previously reported data in long-term prospective studies [11,36–38], although they appeared to be superior to other data reported in the literature [12,39–41]. The cause of technical failure in 10% of group I may be related to the fact that the incompetent GSV in the thigh may be snipped, which leads to difficulty or inability to be stripped easily. Furthermore, surgical failures may be attributed to failure of groin dissection as a result of a remarkable scarring in patients who admitted to previous intravenous drug injection [42]. Furthermore, above-knee inversion stripping technique was adopted in 75%. The concern was that below-knee stripping may result in unwanted neurological complications, as reported in the literature [43]. On the contrary, stab avulsion technique was adopted in 25% of group I. The overall recurrence rate was observed in 15% of our patients, which goes in accordance with that reported in some of the literature where they reported 13–29%. Moreover, recurrence in group I was reported in 10% of patients. Half of them (5%) occur as a result of below-knee GSV incompetence. Whereas the remaining 5% recurrence rate was due to the development of a recently and newly formed incompetent leg perforators which was not manifested at the initial clinical presentation. Moreover, surgical recurrence may be attributed to improperly adopted primary surgical technique, neovascularization at the groin, reflux in the accessory vein, and perforator incompetence [44–46]. These results may be coincides with that reported in the literature [47–49]. Moreover, recanalization following EVLA may be attributed to both SFJ incompetence and paratibial perforator incompetence [50]. In addition, neoreflux at the groin area, perforators, SPJ junction, as well as the nonaxial branches, represented the natural history for disease progression [42]. Following the tissue trauma of surgical dissection, neovascularization occurs as a result of angiogenesis, whereas it is hypothesized that extravascular inflammation does not occur following EVLA. It has been suggested that the preservation of groin tributaries during EVLA avoids the stimulus for angiogenesis. Some surgeons even preserve groin tributaries during saphenofemoral ligation on this basis [45,51–53]. Heat-induced DVT was reported in 2.5% of patients. These complications are similar and coincide with those reported in others literature [54]. Furthermore, practitioners of the open surgical methods attempted to prevent recurrence in their standard surgical procedures. It can be avoided by performing planned dissection of the saphenous stump and all draining tributaries. Yet, this type of dissection can't be adopted for patients treated with EVLA [33]. Even though, EVLA considered as the sole treatment modality in all the patients having an absolute contraindication to conventional surgery. It may also be very effective in small-diameter saphenous vein varicosities [55]. During the past few years, EVLA has evolved into an accepted option for eliminating venous reflux. In addition, it has become the best treatment option for GSV varicosities. Our current study was proposed to highlight the short- and mid-term follow-up results of standard surgical treatment versus EVLA therapy for treatment of primary varicosities of the GSV.

Although the study may have some limitations regarding the relatively small number of cases, it may lead to the conclusion that EVLA is superior to traditional surgery for treating primary GSV varicosities among susceptible individuals. Moreover, long-term follow-up should be adopted in the future research to detect late postprocedural complications. Endovenous laser therapy although expensive and not feasible all the time proved to be superior to conventional surgical treatment.

Conclusion

The recently adopted endovenous laser therapy for GSV ablation is an excellent and feasible minimally invasive technique. It may be an alternative to surgical stripping and high ligation of the incompetent GSV with caution to avoid postprocedural DVT. EVLA had lower recurrence rate at all reasonable situations. The demand of EVLA by both the patients' and the surgeons' has minimal side effects, early postoperative recovery, with short or even no hospital stay. in addition, it can be performed as an outpatient basis eliminating the postoperative surgical complications and the burden of hospitalization. EVLA seems to be a highly effective and safe modality for treatment of primary GSV varicosities, especially in women. Moreover, the patients can return immediately to their daily activity.

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Conflicts of interest

There are no conflicts of interest.

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