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Efficacy of foam sclerotherapy accompanied by near infrared light and duplex ultrasonography in treatment of symptomatic recurrent varicose veins: A retrospective cohort study

Semptomatik rekürren variköz venlerin tedavisinde near infrared ışık ve dubleks ultrasonografi eşliğinde köpük skleroterapinin etkinliği: Retrospektif kohort çalışma

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Abstract

Aim: The recurrence of Great Saphenous Vein (GSV) and that of Small Saphenous Vein (SSV) is a common, costly and complex challenge which is related with technically insufficient surgery or insufficient endovenous ablation and neovascularization. The purpose of this study is to assess the efficacy and the reliability of the foam sclerotherapy with Near Infrared (NIR) Light and/or Duplex Ultrasonography (DUS) in the treatment of the symptomatic Recurrent Varicose Veins (RVV).

Methods: One hundred sixty four patients (181 legs) who had been treated between April 2014 and May 2017 have been studied retrospectively. The demographic data of the patients, DUS findings, Clinical, Etiologic, Anatomic and Pathophysiologic (CEAP) classification, peri-operative data and follow-up examinations were recorded.

Results: The mean age our patients were 44.79±12.57 and 76 of them were females. It was detected that RVV in 145 extremities were developed after the open surgery (GSV ligation, GSVstripping, SSV ligation and phlebectomy) and that RVV in 36 extremities were developed after endovenous ablation (Radiofrequency ablation, Laser ablation). The reflux pathologies which led to RVV were evaluated in four groups such as incompetent saphenofemoral junction (SFJ) ±neovascularization in 114 patients, reflux from incompetent perforator / reflux from pelvic vein in 17 patients, incompetent SFJ ±neovascularization in 15 patients and combined causes in 35 patients. The stages of the patients were detected as C2 for 24 patients, as C3 for 91 patients, as C4 for 45 patients, as C5 for 16 patients and C6 for five extremities. Total occlusion was developed occurred in 172 extremities in the sixth-month control following the treatment. No major complication was seen during the follow-up.

Conclusions: Tactical and technical errors, the progression of the diseases, neovascularization may lead to RVV. The redo open surgery is more difficult compared to primary surgery. Besides, the neurovascular injury and the infection incidence of the redo surgery may be higher compared to primary surgery. Nowadays, open surgery, endovenous ablation, sclerotherapy, mechanochemical ablation (N-butyl-cyanoacrylate) may be performed in the treatment of the RVV. According to our experiences, we suggest that when foam sclerotherapy is applied in companion with NIR light and/or DUS it is a reliable, effective and cheaper treatment option that may be considered an alternative to other treatments in the convenient patients for the treatment of RVV.

Keywords: Recurrent varicose vein, Near infrared light, Foam sclerotherapy, Duplex ultrasonography

Öz

Amaç: Büyük safen ven (GSV) ve Small Safen ven (SSV) rekürrensi teknik olarak yetersiz cerrahi ya da yetersiz endovenöz ablasyon ve neovaskülarizasyona bağlı olarak yaygın, maliyetli ve karmaşık bir sorundur. Bu çalışmanın amacı semptomatik rekürren variköz venlerin (RVV) tedavisinde Near Infrared light (NIR) ve/veya Dublex Ultrasonografi (DUS) eşliğinde köpük skleroterapinin etkinliğini ve güvenliğini değerlendirmektir.

Yöntemler: Kliniğimizde nisan 2014- Mayıs 2017 yılları arasında semptomatik RVV nedeniyle köpük skleroterapi ile tedavi edilen 164 hasta (181 bacak) retrospektif olarak incelendi. Hastaların demografik verileri, DUS tarama bulguları, CEAP sınıflaması, perioperatif veriler ve takip muayeneleri kaydedildi.

Bulgular: Hastalarımızın yaş ortalaması 44.79±12.57 ve 76 (%46.3) 'i kadındı. 145 ektremitedeki RVV'ler açık cerrahi (GSV ligasyon, GSV striping, SSV ligasyon ve flebektomi) sonrası, 36 ekstremiteki RVV'lerin endovenöz ablasyon (Radyofreakans ablasyon, Lazer ablasyon) sonrası geliştiği tespit edilmiştir. RVV sebeb olan reflü patolojilerini incompetent safenofemoral junction (SFJ) ± neovascularizasyon 114 hasta, reflux from incompetent perforator / reflux from pelvic vein 17 hasta, Incompetent safeno popliteal junction (SPJ) ± neovascularizasyon 15 hasta ve combine sebebler 35 hasta olmak üzere 4 grupta değerlendirildi. Hastaların CEAP evreleri C2: 24 ekstremite, C3: 91 ekstremite, C4: 45 ekstremite, C5: 16 ekstremite, C6: 5 ekstremite olarak tespit edildi. Tedavi sonrası 6. ay kontrolünde total oklüzyon 172 (95.02 %) ekstremitede gerçekleşti. Takip süresi boyunca majör komplikasyon görülmedi.

Sonuçlar: RVV'lere taktiksel ve tekniksel hatalar, hastalığın ilerlemesi, neovaskülarizasyon sebeb olabilir. Yeniden açık ameliyatı primer cerrahiye göre daha zordur. Ayrıca redo cerrahinin nörovasküler yaralanma ve enfeksiyon insidansı da primer cerrahiye göre daha yüksek olabilir. Günümüzde RVV tedavisinde açık cerrahi, endovenöz ablasyon, skleroterapi, mekanokimyasal ablasyon(N-Butil Siyanoakrilat) yapılabilir. Deneyimlerimize göre köpük skleroterapi NIR light ve/veya DUS eşliğinde uygulandığında RVV'lerin tedavisi için uygun hastalarda diğer tedavilere alternatif olarak düşünülebilecek güvenli, etkili ve ucuz bir tedavi seçeneneği olduğunu düşünüyoruz.

Anahtar kelimeler: Recurrent varis, Near infrared ışık, Köpük skleroterapi, Duplex ultrason

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Introduction

The recurrence of the varicose veins following the varicose vein surgery is a sophisticated and costly challenge which is commonly seen. Despite the improvements in the pre-operative assessment and in the treatment methods, the recurrence following the varicose vein surgery takes place in 15% to 65% of the cases [1]. The causes such as neovascularization, technical errors done in the varice treatment and the progression of the diseases may count for the emergence of the RVV [2].

Although new endovascular treatment techniques are used, the repetition of the varices after the treatment persists to be a challenge. The advocates of the endovascular intervention claim that while neovascularization reveals commonly following the open surgery, the appearance of the neovascularization is rare following the endovascular treatments [3,4]. Regardless of which method is used in varicose vein treatment, it is a known fact that recurrent varices occur in many patients. This situation is disturbing the patients either in terms of quality of life or due to the cosmetic reasons. Many medical and surgical methods are used in the treatment of the RVV. RVV treatment is more difficult compared to technically primarily performed varice treatment procedure [5]. Thus, we used foam sclerotherapy method with 1% to 2% polidocanol which is less invasive compared to surgery in the companion NIR light (Accuavein® AV400, USA) and/or Duplex ultrasonography (DUS) in the symptomatic RVV treatment. The main purpose of our study is to assess the efficacy and the results of the method that we used in the RVV treatment.

Materials and methods

This study was performed in the Varice Treatment Center of the Cardiovascular Surgery Department of the Bursa High Specialized Hospital between April 2014 and May 2017. After the approval of the Ethics Committee from the local committee, work started. Varice treatment procedures were established in the outpatient clinic conditions by a single surgeon. The study is retrospective cohort study

The study is retrospective and monocentric and is performed in a single center. 164 patients (181 legs) who were treated by means of foam sclerotherapy due to the symptomatic RVV were investigated retrospectively. The demographic data of the patient DUS Scanning Findings, CEAP (Clinic, Etiologic, Anatomic, and Patophysiologic) classification, peri-operative data and follow-up examinations were recorded.

Preoperative DUS assessment

The deep and superficial venous system of the patients who had complaints due to the recurrent varices were evaluated with detail preoperatively by means of DUS (SonoSite Titan, SonoSite Ltd, Hitchin, UK) and the venous pathologies causing the recurrence were marked with a permanent pen on the patient. The DUS assessment was begun with GSV. The existence of flow for more than one second in the GSV and SSV segment causing recurrence was considered as significant in terms of reflux. Furthermore, GSV which was important in terms of recurrence was studied in the collateral vessels to which it was flowing. The perforating veins which had diameter greater than 3.5 centimeters and which had demonstrated retrograde flow longer than 0.5 seconds were considered as pathological perforating veins. It was recorded in terms of venous variations by performing detailed DUS.

Evaluation via preoperative NIR light

The examination was done while the patient was standing and while NIR light was in the hand of the surgeon. NIR instrument presents the instantaneous image of the venous vessels one to three millimeters below the skin. The varices with deeper localization cannot be shown through this device. RVV were scanned by moving the NIR device in fashion that it will be in a fifteen to thirty-centimeter distance to the patient on the extremity (Figure 1A, 1B). Prior knowledge was obtained about the prevalence of RVV, about the diameter of RVV and its progression in the extremity.

Sclerotherapy procedure

1% to 2% Polidocanol (Aetoxysclerol®; Kreussler, Wiesbaden, Germany) was used as the sclerosing agent in the sclerotherapy. The foam was prepared by mixing the air and the sclerosing agent foam kit in one fourth ratios. Ten millimeter foam in average was used in each session. All interventions were established by the same surgeon while the legs of the patients were in forty five-degree elevation. The injection of the sclerosing agent was done by means of 25 gauge scalp vein set and in the companion of the NIR light (Accuavein® AV400, USA) inserted on a portable carrier (Figure 2A). Punction was done to varicose vein with the image provided by the NIR light device (Figure 2 B). The progression of the sclerosing drug along the varicose vein was followed while it was being injected (Figure 2C, 2D). Moreover, if the drug was extravased during the injection with NIR light, it was attempted to preclude the complications by terminating the procedure. In varicose veins with deeper localization in which NIR light device with deeper localization could not ensure venous image, foam sclerotherapy was in the companion of DUS. Compression bandage, calcium dobecilate (Modet® tablet, Berksam Pharmaceuticals A. S., Turkey), hirudin (Hirudoid® cream, Santa Farma, Turkey) form thrombophlebitis prophylaxis were administrated for two days following the procedure.

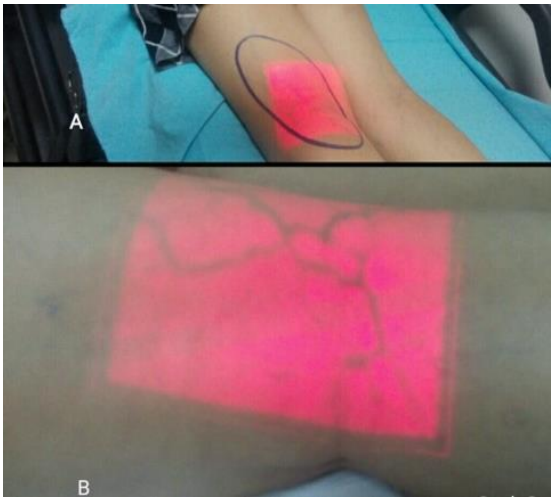

Figure 1: A: Evaluation of the patient with NIR light before sclerotherapy, B: NIR light appearance of varicose veins

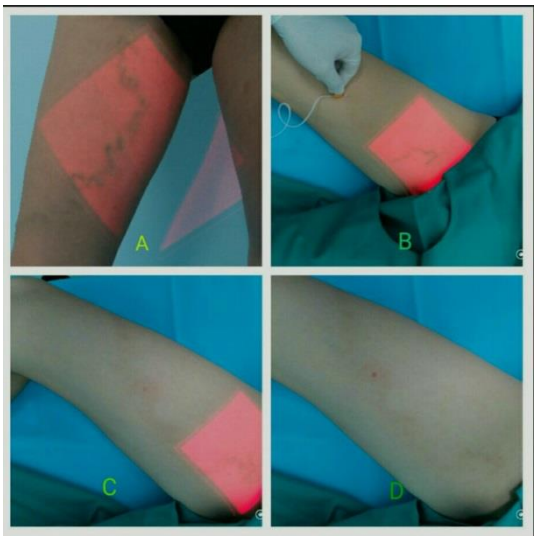

Figure 2: A: View of RVV with NIR light while patient standing, B: Foam sclerotherapy injection with NIR light in RVV, C: RVV disappeared as foam progresses in RVV, D: View of the leg treated with naked eye after foam sclerotherapy

Follow-up

Thrombophlebitis, pain, skin pigmentations, neurologic problems and skin ulcers of the patients after the patients were recorded. Minor complications belonging to the skin and major complications such as anaphylaxis, neurologic event occurring for the first month after the procedure were evaluated. RVV segments were evaluated in terms of the success of the procedure in the sixth month after the procedure. The RVV segment in which sclerotherapy with NIR light was applied was compressed by hand and the vein was assessed by patting. We evaluated the successful sclerotherapy as the absence of the blood motion in the RVV and unsuccessful sclerotherapy was accepted as the presence of the blood motion with compression and patting. Our second evaluation was tackled in terms of total occlusion of the target vein with DUS (there was no compression), partial occlusion (semi-compressible) and in terms of being patent (compressible). Sclerotherapy was continued until the complete occlusion of RVV was ensured and more than one session.

Results

Totally, 181 extremities in 164 were included into the study. 76 (46.3%) of the patients who had RVV and in which foam sclerotherapy was applied were females. The mean age of the patients was 44.79±12.5. The demographic and clinical characteristics of the cases are summarized in Table 1. The Clinical, Etiologic, Anatomic and Pathophysiologic (CEAP) stages of the patients were detected as 24 extremities for C2, 91 extremities as C3, 45 extremities for C4, 16 extremities for C5, five extremities for C6 (Table). The intervened causes of RVV were separated into four groups such as Incompetent Saphenofemoral Junction (SFJ) ± neovascularization (Anterior Accessory Saphenous Vein (AASV), Posterior Accessory Saphenous Vein (PASV) in 114 extremities (62.9 %), Reflux from incompetent perforator / Reflux from pelvic vein in 17 extremities (9.3%), Incompetent Saphenopopliteal Junction (SPJ) ± neovascularization in 15 extremities (8.2%) and Combined causes in 35 extremities (19.3%) extremities (Table 2).

In the sixth-month control of the RVV after the treatment with foam sclerotherapy total occlusion was detected in 172 extremities (95.0%), partial occlusion was detected in six (6) extremities (3.3%) and patent recurrent varice was detected in three extremities (1.7%) (Table 3).

After the treatment temporary edema was detected in 36 extremities (19.9%), local thrombophlebitis was detected in 18 extremities (9.9%), leg pain was detected in 14 extremities (7.7%), and hyperpigmentation in skin was detected in 25 extremities (13.8%) and skin necrosis was detected in two extremities (1.1%). No major complication such as death, deep vein thrombosis, anaphylaxis, neurologic complication was seen (Table 3).

Table 1: Baseline characteristics of patients

		n (%)
Number of patients		164
Number of patients (limbs)		181
Age median±SD		44.7±12.5
Gender	Female (%)	76 (46.3%)
	Male (%)	88(53.7%)
Clinical, Etiologic, Anatomic and Pathophysiologic (CEAP)	C2 of CEAP(number of lims)	24
	C3 of CEAP(number of lims)	91
	C4 of CEAP(number of lims)	45
	C5 of CEAP(number of lims)	16
	C6 of CEAP(number of lims)	5
Previous venous surgery (number of limbs)	GSV ligation	21
	GSV striping+ ligation	73
	SSV striping+ ligation	15
	GSV striping+ligation+perforating vein ligation	36
Endovenous intervention story (number of limbs)	Endovenous Laser Ablation (EVLA)	23
	Radiofrequency (RF)	10
	unknown	3

Table 2: Causes of recurrent varicose veins

	Number of Limbs n (%)
Incompetent saphenofemoral junction (SFJ)± neovascularization (Anterior Accessory Saphenous Vein (AASV), Posterior Accessory Saphenous Vein (PASV))	114(62.9)
Reflux from incompetent perforator / Reflux from pelvic vein	17(9.4)
Incompetent Saphenopopliteal Junction (SPJ) ± neovascularization	15(8.3)
Combined Causes	35(19.3)

Table 3: Intraoperative and postoperative data

		n (%)
Number of sessions of foam Sclerotherapy (Inter quartile Range(IQR))		1.9 (1-4)
Six months after treatment	complete occlusion Recurrent Varicose Veins	172 (95.0)
	partial occlusion Recurrent Varicose Veins	6 (3.3)
	patent Recurrent Varicose Veins	3 (1.7)
Complications after sclerotherapy	Skin necrosis	2(1.1)
	Local Thrombophlebitis	18(9.9)
	Hyperpigmentation	25(13.8)
	Localized pain	14(7.7)
	Deep vein thrombosis	0(0)
	Anaphylactic reaction	0(0)
	Neurological complications	0 (0)
	Temporary edema	36(19.9)

Discussion

Vena saphena magna begins from the anterior of the medial malleoli, it proceeds upwards in cruris and at the medial of the thigh and it terminates at SFJ in the inguinal region. Anterior Accessory Saphenous Vein (AASV) and Posterior Accessory Saphenous Vein (PASV) which are two primary collateral veins joint to GSV at the proximal of thigh. There are bicuspid venous valves in saphenous veins. Great Saphenous Vein may be duplicated as an anatomic variation. GSV which is the longest vein in human body is the vein in which the superficial venous problems are seen most commonly. The underlying cause of the majority of the venous problems observed in this vein is the venous valves which demonstrate function impairment [6].

The varices treatment is based on the treatment of the underlying superficial venous stasis (truncal reflux, axial reflux). Dilatation in truncal vein and the existence of reflux in DUS and the existence of the symptoms related with venous stasis in the

patient constitute the treatment indication. Regression in varices is expected with the disappearance of the superficial venous stasis. In order to eliminate the symptoms related with varices and the cosmetic problem completely sclerotherapy is usually applied either simultaneously with the treatment concerning the truncal reflux or in a separate session. Since the dilatation and stasis in the perforating veins arise mainly from the superficial venous stasis, treating the insufficiency of the varices and that of the superficial venous insufficiency regress indirectly the dilated perforating veins. In general, although the results of the surgical treatment resemble to those of thermal ablation, the complication ratios, post-operative pain, recovery time and recurrence ratios are higher in surgical treatment. In the recent guidelines, it is recommended to prefer radiofrequency or Laser ablation to surgery for the truncal reflux treatment [7]. Despite its advantages, surgical treatment may be required in cases that thermal ablation is unsuccessful, in cases that truncal vein is large in advanced level or tortuous or in cases that it is located very superficially.

The recurrence after the primary open surgery may be originated from the insufficient or wrong surgery depending on the variability of the GSV progress and on the variability of valvular anatomy. The vessel may be ligated wrongly or stripping may be done to the wrong vessel. New connections may be developed between the deeper veins and superficial veins depending on the progression of the disease. Neovascularization in the surgical procedure region may also cause recurrence [2]. In redo surgery, to reveal venous anatomy depending on the adherences and to repair surgically the pathology leading to varice is more difficult compared to primary surgery. Moreover, it brings along increased surgical complications such as paresthesia, bleeding, infection, wound traces [8-10].

In many studies, neovascularization has always been in the forefront as the most common cause after the surgery [11-13]. It is demonstrated in another study done after surgery that the recurrence of varicose veins are common. Furthermore, they have stated that some recurrences which do not depend on the neovascularization and on the progression of the disease through the examination (DUS) performed to reveal better the pathology of the disease before the surgery and through the surgical procedures [2].

In our RVV patient series, there were 181 with recurrence after varice surgery (Table 1). In the DUS scanning of these our patients, Incompetent SFJ ± neovascularization (Anterior Accessory Saphenous Vein (AASV), Posterior Accessory Saphenous Vein (PASV) was detected as the causes of the RVV in 114 extremities (62.9%), Reflux from incompetent perforator / Reflux from pelvic vein was detected as the causes of the RVV in 17 extremities (9.4%), Incompetent Saphenopopliteal Junction (SPJ) ± neovascularization was detected as the causes of the RVV in 15 extremities (8.3%) and Combined Causes were detected in 35 extremities (19.3%) (Table 2).

Although the interventions concerning the perforating veins are rarely applied, Pathological perforating veins leading to the recurrence in varices after the treatment of the truncal reflux or being adjacent to the venous ulcers (The patients with CEAP 5 to 6) should be treated selectively. As the general rule, perforating veins with diameter greater than 3.5 millimeters demonstrating retrograde longer than 0.5 seconds and being localized in the adjacency of the ulcer were referred as pathological perforating veins. In non-complicated varice patients (CEAP 2), selective perforating vein treatment is not recommended even perforating vein demonstrates insufficiency and dilatation [7]. In the Clinical, Etiologic, Anatomic and Pathophysiologic (CEAP) classification of the patients in our study, there was C2 in 24 extremities, there was C3 in 91 extremities, there was C4 in 16 extremities and there was C6 in five extremities. The most commonly used methods in the treatment of the perforating reflux are ligation or perforating vein, thermal ablation (Radiofrequency (RF) or Laser), sclerotherapy under DUS and SEPS (subfascial endoscopic perforator surgery). In a study in which superficial venous surgery combined with SEPS and with twelve-year follow-up neovascularization has been emphasized in the cause of the RVV. In this study, it was detected that incompetent lower leg perforating veins constituted 25% of the causes of the RVV and that neovascularization constituted 45% of the causes of the RVV. Although RVV has been detected in many patients through DUS, it has been revealed that long-term general results have been favorable impressively in the investigation. Besides, they have stated that open venous surgery which had been well-performed technically has successful results [14].

Endovenous Laser ablation (EVLA) is used in order to treat the varicose veins due to the reflux in the GSV and it is usually established without the ligation of Saphenofemoral Joint (SFJ) ligation [15]. No significant difference has been detected between the technic and clinic results of EVLA and RF ablation [16]. The occlusion success in the saphenous vein has been reported as over 90% in the first year and in almost 90% in the third to fifth years in both technics [6,7]. In another performed study, it has been stated that less complication has been developed in EVLA compared to open surgery. They submitted the cause of this as the use of DUS during the procedure. Since GSV can be seen along its course, the probability of occurring of recurrence depending on the insufficient surgery is lower [17].

In the SFJ ligation, external pudendal, superficial epigastric and epigastric circumflex iliac vein branches are ligated. However, in endovenous treatments, the intervention is performed into the GSV in the guidance of the with DUS via catheter from the five centimeters below the knee and the fiber tip of the LASER or RF is inserted in a fashion that it will remain 0.5 to 1 centimeters below the Saphenofemoral Joint (SFJ). Recurrences mainly being related with remaining open of the Anterior Accessory Saphenous Vein (AASV), Posterior Accessory Saphenous Vein (PASV) branches or being related with the progression of the disease may be related due to the errors depending on the performer during this procedure. In our study, RVV has been detected in 23 extremities after EVLA, in 10 extremities after the RF ablation and in three extremities after the unknown procedure (RF or EVLA). We suggest that this is due to the endovenous ablation which the accessory saphenous veins are not ligated in due form.

Theivacumar, et al. [4] have stated that recurrence after the surgery has been developed due to the neovascularization and mid-thigh perforator reflux in a study. Again in the same study,

they have emphasized that the recurrences after EVLA have arisen in Anterior Accessory Saphenous Vein (AASV) in three patients and from the mid-thigh perforator reflux. A successful GSV ablation depends not only on LASER Power and LASER wavelength and retraction ratio but also on the influential performance of the peri-venous tumescent anesthetic infiltration, on the effective application of the compression to the vein during the ablation with LASER and on the initiation of the procedure 0.5 to 1 centimeter below the Saphenous Femoral Joint (SFJ) [18]. The situation that proximal GSV does not occlude after the EVLA and/or early re-canalization have been reported as approximately 10% [19]. In a conducted study, it has been shown that residue varices should be treated in 40% of the patients after the saphenous vein is treated [20]. In the treatment of the varices which do not regress or which demonstrate recurrence, both phlebotomy and sclerotherapy are among the accepted methods [7].

In sclerotherapy, as the liquid sclerosing agent may be directly injected, it can be injected in the form of foam by mixing with air. It is suggested that the application in the foam form ensures a more effective sclerotherapy by reducing the amount of drug and by increasing the contact duration. Since it will increase the success of the punction made telengiectasic and reticular veins which seem to observe, to use appropriate overhead light and illuminators during the sclerotherapy is extremely beneficial. DUS in sclerotherapy can be used during the treatment procedure in revealing the vascular pathology. The advantages of Ultrasound-guided foam sclerotherapy (UGFS) are being minimally invasive and return of the patients earlier to job. A disadvantage is the necessity for more than one session [21, 22]. The most commonly seen minor complications of sclerotherapy are pigmentations in the skin phlebitis, skin necrosis, reticular changes and recurrence. Major complications such as deep vein thrombosis, transient visual disturbance, stroke and transient ischemic attack are rarely seen [23]. In our study, sclerotherapy procedure was performed in the companion of NIR light and/or in the companion of DUS. With NIR light, varicose veins that cause subcutaneous RVV become visible. In addition the diffusion of the sclerozing drug within the vessel may be followed via NIR light. By this means, we suggest that this will be helpful in preventing the extravasation and injection into the deeper vein. When NIR light was insufficient in presenting the presence of varicose veins in overweight patients and in the presence of deep localized RVV, foam sclerotherapy was performed with DUS. Following the RVV foam sclerotherapy procedure, Skin necrosis complication was seen in two extremities (1.1%), Local Thrombophlebitis complication was seen in 18 extremities (9.9%), hyperpigmentation complication was seen in 25 extremities (13.8%), Localized pain was seen in 14 extremities (7.7%) and temporary edema complication was seen in 36 extremities (19.9%). Deep vein thrombosis, Anaphylactic reaction, Neurological complications were not developed in none of our patients (Table 3).

In a study evaluating 808 varicose patients treated with UGFS, the total occlusion of GSV was detected as 88% and the total occlusion rate of SSV was detected as 82%. As a result of this study, they stated that UGFS can be used effectively to treat varicose disease in outpatient clinic conditions without requiring for surgical intervention. Moreover, thy reported that the effectiveness ratios and the complication ratios were similar to those which were reported in other new treatments applied for varicose veins [24]. As a result of a meta-analysis in which the mean follow-up time of the patients was thirty two (32) months, the success of the UGFS total occlusion was 77% (69% to 84%) and the success of the open surgery was seventy eight percent (78%)(70% to 84%) [16]. In another study comparing surgical treatment and foam sclerotherapy, they stated that their effectivities were found similar as a result of five-year follow-up. However, they claimed that the superiority of the sclerotherapy is to be applicable several times [25]. In our study, in the sixth-month control after the treatment total occlusion was detected in 172 extremities (95.0%), partial occlusion was detected in six extremities (3.3%); patent recurrent varice was detected in three extremities (1.7%) (Table 3). We suggest that this higher success ratio is related with the performance of the procedure in the companion of the NIR light and DUS. Because we can follow with NIR light that RVV is completely filled with sclerosing agent and we can follow the course of the sclerosing agent within the RVV with a wide angle of vision. We suggest that this provides us either to apply an effective foam sclerotherapy or to protect our patient from many complications such as Deep Venous Thrombosis (DVT), skin necrosis.

This study has some limitations, including its retrospective design and small sample size.

Conclusion

Tactical and the technical errors in the management of RVV may lead to impairment of the diseases and to neovascularization. Redo open surgery is more difficult than the primary surgery. The incidence of neurovascular injury and that of the infection may also be higher compared to primary surgery. In the treatment of the RVV, open surgery, endovenous ablation (RF/EVLA), mechanochemical ablation (N-butyl-Cyanoacrilate) may be performed. The choice of RVV treatment should be tailored to each patient especially by taking into account factors such as the anatomy of the vessels, the requests of the patient, and the preferences of the surgeon. According to our experiences, we suggest that when it is applied in the companion of the NIR light and/or DUS, sclerotherapy may be considered as a safe, effective and cheaper treatment option alternatively to other treatments that can be applied in patients which are convenient for the RVV treatment.

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