Effect of Diameter of Saphenous Vein on Stump Length after Radiofrequency Ablation for Varicose Vein

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INTRODUCTION

Varicose veins are a common vascular disease. The reported incidence of varicose vein ranges from 1% to 73% for females and 2% to 56% in males [1]. It is part of chronic venous disease, which is reported to have a substantial negative impact on health-related quality of life [2]. Before the worldwide spread of endovenous therapy, high ligation and stripping of the saphenous vein has been the standard treatment for patients with varicose vein.

Since late 1990s, endovenous treatment of varicose veins such as radiofrequency ablation (RFA) and endovenous laser ablation (EVLA) became available. Recent randomized controlled trials revealed that endovenous treatment showed better results than traditional high ligation and stripping in terms of reduced pain, better quality of life.
faster recovery, and lower rate of recurrence [3,4]. Although RFA and EVLA showed similar truncal vein occlusion, RFA was associated with less periprocedural pain, analgesic requirement, and bruising [5].

The ClosureFast™ (Covidien, Mansfield, MA, USA) catheter, which is used to perform RFA, treats a 7-cm vein segment in a 20-second energy cycle. The vein wall is heated conductively by a 7-cm coil at the distal end of the catheter. The diameter of the saphenous vein should be considered before RFA since a venous diameter >12 mm has been considered controversial when RFA was performed with the previously used ClosurePlus™ (VNUS Medical Technologies, San Jose, CA, USA) catheter. However, the 12-mm size limitation was no longer an issue in studies with the ClosureFast catheter. In the study from the ClosureFast Europe Group, exclusion criteria did not consider the venous diameter. The evaluation of occlusion status of the saphenous vein and the stump length of the remaining saphenofemoral or saphenopopliteal junction dependent on saphenous vein diameter may give us a clue for the proper indications of RFA in terms of the saphenous venous diameter.

Until now, however, there have been few data about the correlation between the diameter of the saphenous vein and the stump length after RFA. The purpose of our study was to investigate its correlation.

MATERIALS AND METHODS

A retrospective review was performed from prospectively collected data of varicose vein patients who underwent RFA between March 2009 and December 2011 in Kyung Hee University Hospital at Gangdong (Seoul, Korea). On the initial encounter at the outpatient office, we performed a history taking and physical examination.

Ultrasound examination was done with a colorized duplex scan (Vivid E9 Ultrasound system; GE Healthcare, Waukesha, WI, USA). The diameters of the great saphenous vein (GSV) and the small saphenous vein (SSV) were measured in supine position. With B-mode imaging, the inner anechoic diameter of the GSV was measured from the saphenofemoral junction (SFJ) to 5 cm distal to the junction. The SSV diameter was measured in the same manner from the saphenopopliteal junction (SPJ) to 5 cm distal to the junction. The largest diameter was chosen to analyze the relationship between diameter and stump length. After evaluation of the diameter, SFJ, SPJ, and truncal vein reflux in response to a Valsalva’s maneuver and/or manual distal compression followed by release with upper body elevation or with standing position were identified with duplex scanning. The saphenous reflux was defined as a reflux time ≥0.5 second.

Indications for RFA were clinical grade C2-C6 and patients with symptoms or cosmetic concerns. The RFA procedure was performed with general, spinal or tumescent anesthesia in the operating room in all patients. The detailed RFA procedure was performed as described in a previous report by us and according to the manufacturer’s instructions [6]. A concomitant phlebectomy around and below the knee joint was performed simultaneously. At the completion of the procedure, all wounds were dressed with steri-strips and legs were placed in full-length with Cohesive elastic bandage (Karl Otto Braun GmbH & Co, Wolfstein, Germany). The bandage was exchanged for thigh-length compression stockings after 24 hours. This was then worn for a minimum of one week. Patients were discharged on postoperative one day with stockings. They were advised to use analgesics only when required and to return to work when comfortable.

Patients were followed up at 1 week and 6 months after surgery. At all subsequent visits, the patients were examined clinically and with duplex scanning. At 1 week,

Fig. 1. Measurement of stump length after radiofrequency ablation. (A) For great saphenous vein, the length from the saphenofemoral junction to the leading point of occlusion was measured. (B) For small saphenous vein, the length from the saphenopopliteal junction to the leading point of occlusion was measured.

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duplex scanning was performed to confirm saphenous vein occlusion and to evaluate any complications such as deep vein thrombosis, hematoma, endovenous heat-induced thrombosis (EHIT), or any complications related with surgery. For the analysis of relationship between diameter and stump length, length was measured as in Fig. 1. After 2 years, we measured the length from the SFJ to the leading point of occlusion for GSV, and length from the SPJ to the leading point of occlusion for SSV.

The paired t-test, independent t-test, and correlation analysis using IBM SPSS Statistics ver. 22.0 (IBM, Armonk, NY, USA) was used for statistical analysis. P-value <0.05 was considered statistically significant.

RESULTS

During the study period, 277 consecutive patients (346 limbs) underwent operation for varicose vein. Patient demographics are shown in Table 1. The mean age was 52.4±11.9 years with a range of 19 to 84 years. The female to male ratio was 164:113. RFA was performed in 201 patients. The conventional high ligation and stripping was done in patients whose saphenous veins were shallow (less than 10 mm from the skin) or had a junctional aneurysm of more than 20 mm. This procedure was performed in 70 patients. If the cause of varicose vein was a reflux of perforator veins only, ligation of the perforator at the level of the muscular fascia and stab phlebectomy was done (5 patients). EVLA was also done in one patient.

RFA was done simultaneously if the GSV and SSV in the same leg showed reflexes of ≥0.5 second. In one session, one truncal vein was ablated in 132 patients, 2 truncal veins in 64 patients, and 3 truncal veins in 3 patients. Four truncal veins were ablated simultaneously in 2 patients. After RFA, there were several types of complications (Table 2). The most common complication was paresthesia, which occurred in 18 patients (9.0%), followed by ecchymosis in 12 patients (6.0%), cord-like mass in 9 patients (4.5%), hyperpigmentation in 8 patients (4.0%), erythema over the ablated saphenous vein in 3 patients (1.5%), EHIT detected by postoperative duplex scanning in 3 patients (1.5%). Postoperative duplex scanning revealed class II EHIT in 2 patients and class III EHIT in one patient. All EHIT’s resolved without anticoagulation.

After 2 years (mean follow-up, 13.9±6.9 months), the stump lengths from the SFJ or SPJ to the leading point of occlusion were obtained in 74 limbs (52 patients), 56 limbs with GSV ablation and 18 limbs with SSV ablation. The mean length was 12.5±8.5 mm. The Pearson correlation coefficient for correlation analysis was −0.017 (Fig. 2). There was no correlation between the saphenous vein diameter and stump length.

DISCUSSION

In 2006, the ClosureFast catheter was introduced. This catheter allowed for segmental ablation instead of a continuous pull-back needed for the previous ClosurePlus
catheter. The manufacturer recommends that the catheter tip should be positioned 2 cm distal to the SFJ [1]. This procedure also entails two 20-second treatment cycles in the segment closest to the SFJ using external compression with the ultrasound probe. The complete occlusion of the proximal saphenous segment allows for hemodynamically effective control of truncal reflux.

The diameter of the saphenous vein was previously one of the criteria for RFA. The original device for RFA was a catheter which had extendable prongs which would make contact with the saphenous vein wall. In the fully deployed state, the larger of the 2 available devices was 12 mm in diameter. Thus, it was originally thought that the maximum diameter of a treated vein should be 12 mm [7]. The newer RFA device, ClosureFast catheter, no longer had extendable prongs making a maximum catheter contact diameter. In the study reported by Proebstle et al. [8], saphenous veins as large as 18 mm in diameter were treated with the ClosureFast catheter. There was an overall closure rate of 99.6% in their study. According to the study by García-Madrid et al. [9], the maximal venous diameter for RFA was 19 mm. The immediate occlusion rate was 100%.

However, there was no report about the relationship between saphenous vein diameter and stump length. García-Madrid et al. [9] reported that stump length was 13.9±7.7 mm (range, 0-30 mm). However, they did not reveal the relationship between the saphenous vein diameter and the stump length. In that study, the mean preoperative diameter was 6.7-6.8 mm. In our study, the mean preoperative diameter of the saphenous vein was 6.7±1.8 mm. The mean stump length was 12.5±8.5 mm. Moreover, we analyzed the relationship between the two factors. On correlation analysis, the Pearson correlation coefficient was –0.017 which means that there is no correlation between the saphenous diameter and stump length. One consensus for RFA suggests that the vein diameter for RFA could be as large as 20 mm [10].

There are several possible explanations about these results. Firstly, tumescent solution, injected around the saphenous vein, compresses the vein against the catheter, thus ensuring contact of larger veins. Manfrini et al. [11] reported the use of tumescent anesthesia during RFA. For obtaining this effect as well as anesthesia, most of trials used tumescent injection for RFA procedures [4,5,12,13]. Secondly, the delivery temperature for treatment is constant. The treatment temperature is 120°C (248°F) created by the proximal coiling 7 cm segment of the catheter [1]. If treatment were to be performed by continuous pull-back, the treatment temperature could change [14-16]. Thirdly, ablation at the proximal segment was started 2 cm distal from the SFJ or SPJ in all patients. According to the clinical practice guidelines of the Society for Vascular Surgery and the American Venous Forum, the tip of the catheter should be positioned 1 cm distal to the confluence with the superficial epigastric vein or 2 cm distal to the SFJ [17]. In our previous study, the stump had more than one branch in 85.7% of the cases.

**CONCLUSION**

In conclusion, the mean diameter of the saphenous vein was 6.7 mm. The mean length of stump after RFA was 12.5 mm. There was no correlation between saphenous vein diameter and stump length.

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