Sources of Reflux in Patients Diagnosed with Varicose Veins of Great Saphenous Vein Subjected for Radiofrequency Ablation: A Cross Sectional Study

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Abstract

Background

Varicose veins result from defective valves in the venous system, particularly at the junctions between the superficial and deep veins. Understanding the reflux sites in the great saphenous vein (GSV) is crucial for planning surgical procedures, such as Radiofrequency Ablation (RFA), and preventing recurrence.

Methods

This cross-sectional study analyzed patients who underwent RFA for GSV varicosities from July 1 to June 30, 2023. GSV mapping was conducted to identify reflux in the saphenofemoral junction (SFJ) and perforators, classified by location (mid-thigh, above knee, below knee, mid-calf, above ankle). Reflux was defined by a reflux time >500 ms and/or peak velocity >30 cm/s.

Results

Among 211 patients, 27.5% had only right lower limb involvement, 39.8% had only left, and 32.7% had both limbs affected. SFJ incompetence was found in 100% of right limbs and 96.7% of left limbs. Perforator incompetence was observed in 63 sites on the right and 82 on the left, with the mid-calf perforator being most common.

Conclusion

Reflux in the SFJ is predominant in GSV varicosities, but perforator reflux is also significant. Identifying reflux sites is essential for effective surgical planning to prevent recurrence.

Varicose veins are caused due to defective valves between the superficial and deep venous systems. These defects can occur at the level of the main junction between superficial and deep systems or at the level of various perforators. Understanding of these systems help in the surgical procedures for varicose veins and will help prevent their recurrence. This study is aimed to identify the reflux sites in great saphenous veins (GSV) in patients diagnosed as varicose veins of GSV and subjected for RFA with or without adjunct procedure.

Keywords: *Lower Extremity Varicosities, Superficial veins, Perforating veins, Reflux, Sapheno femoral junction*

Introduction

Varicose veins are dilated superficial veins, commonly in the lower limbs, and are associated with pain, pigmentation, and ulceration[1]. They result from valve incompetence, particularly at junctions between superficial and deep veins, and affect 15–25% of the population[2–4]. These junctions include the saphenofemoral and saphenopopliteal junctions, as well as anatomically classified perforators (e.g., mid-thigh, mid-calf)[5]. Perforators may be direct (connecting superficial to deep veins) or indirect (connecting to muscular veins)[6]. Surgical treatment like RFA requires accurate identification of reflux sites, as missed incompetent perforators are a common cause of recurrence[7]. The CHIVA protocol emphasizes targeting escape points, making reflux mapping essential[1,8,9]. Persistent perforator incompetence increases the risk of recurrent ulcers[10]. While both GSV and SSV are involved, GSV has longer courses and more reflux points, necessitating detailed mapping. Intraoperative Doppler helps identify sites not reached by RFA, such as mid-calf perforators[11]. This study aims to identify GSV reflux sites in patients undergoing RFA.

Methods

This retrospective study included all patients who underwent radiofrequency ablation (RFA) for great saphenous vein (GSV) varicosities at Dhulikhel Hospital between July 1, 2023, and June 30, 2024. Cases with recurrent varicose veins were excluded. Ethical approval was obtained from the Institutional Review Committee of Kathmandu University School of Medical Sciences, and written informed consent was taken.

Bilateral procedures were analyzed as separate cases. Preoperative mapping of the GSV was performed by a consultant vascular surgeon with patients standing in Doppler stands. A portable ultrasound machine (Acuson P300, Siemens Medical Solutions USA, Inc.) with a 5–10 MHz linear probe was used[12,13]. Reflux at the saphenofemoral junction (SFJ) or perforators was defined as reflux time >500 ms and/or peak velocity >30 cm/s. Perforators were classified anatomically: mid-thigh, above-knee, below-knee, mid-calf, and above-ankle.

RFA cannulation was done at a site with GSV diameter >5 mm, straight segment ≥5 cm, and depth <5 mm[14], usually proximal to the distal insufficiency point. In cases of distal GSV dilation, cannulation was performed at the mid-calf to avoid saphenous nerve injury[15]. The VNUS ClosureFast RF generator was used, targeting 120°C within 3 seconds and maintaining it for 20 seconds at 10–20 W output. After ablation, distal GSV segments were scanned for residual reflux and managed as needed, often with perforator ligation.

Data was entered in Microsoft Excel and analyzed using SPSS v19. Scalar variables were expressed as mean ± standard deviation; categorical variables as percentages. Independent t-test was used for comparisons, with $p < 0.05$ considered significant.

Results

There were a total of 211 patients, 110 male patients (52.1%) and 101 female patients (47.9%). Mean age was 44.23 years (range 18-78, standard deviation 13.9). The mean age in male patient was 43.80 years and that in the female patient was 44.69 (p=0.643).

The right lower limb alone was involved in 58 patients (27.5%). The left lower limb alone was involved in 84 patients (39.8%). In 69 patients (32.7%) both lower limbs were involved and thus bilateral RFA was done.

In patients where the right lower limb was involved, all cases had SFJ incompetence. Table 1 shows the involved perforators. There was perforator incompetence in a total of 63 sites. The most common perforator involved in the right lower limb was the mid calf followed by the above ankle.

Table 1. Involved perforator in right lower limb varicose veins involving GSV and subjected for RFA

Involved perforator	Number	Percentage
Mid calf	27	21.3
Above ankle	19	15
Below knee	11	8.7
Above knee	6	4.7

In the left lower limb there were 148 cases with incompetent SFJ (96.7%) and five cases (3.3%) where SFJ was competent. In those five cases, they had multiple perforator incompetent causing long segment GSV dilatation requiring RFA.

Table 2 shows the number and percentage of different perforators which were incompetent in the cases. There was perforator incompetence in 82 sites. The most common incompetent perforator in the left side was also mid calf perforator followed by below knee and above knee.

Table 2. Involved perforator in left lower limb varicose veins involving GSV and subjected for RFA

Involved perforator	Number	Percentage
Mid calf	39	25.5
Below knee	21	13.7
Above knee	12	7.8
Above ankle	10	6.5

Out of 211 patients, presence of perforator incompetence was noted in 107 patients (50.7%). The number of perforator incompetence in a patient is shown in Table 3. Besides no perforator incompetence, the most common number of perforator incompetent was one (27.5%) followed by two (17%). There were a maximum of four incompetent perforators in a patient. Mean number of perforator incompetence in each patient was 0.80.

Table 3. Number of perforator incompetence

Number of perforator incompetence in patient	Number	Percentage
0	104	49.3
1	58	27.5
2	36	17.0
3	12	5.7
4	1	0.5

Discussion

Although varicose veins are generally more common in females, our study observed a higher prevalence among male patients[16]. This may reflect gender differences in health-seeking behavior in our region, where men often the primary earners, are more proactive about seeking medical care, whereas women tend to rely on traditional remedies due to limited financial autonomy[17].

Identifying the reflux site is critical for formulating an effective treatment strategy. In our study, all patients with right-sided GSV varicosities had saphenofemoral junction (SFJ) reflux. Among those with left-sided involvement, 96.7% showed SFJ reflux. A study by Carrison et al. analyzing 1027 cases of varicose veins found SFJ reflux in 82% of cases with full-length GSV involvement[18]. The higher proportion of SFJ involvement in our cohort likely reflects our inclusion criteria; patients selected for RFA typically have long-segment GSV involvement. Localized GSV varicosities, often associated with isolated perforator incompetence, were not included.

Perforator incompetence was identified in 50.7% of patients in our study. This is consistent with findings from a study by Pant et al. in Nepal, where at least one incompetent perforator was noted in 59.4% of cases[19]. Similarly, Tolu et al. reported perforator-related incompetence in 44.7% of patients[10]. The most commonly involved perforator in our study was the mid-calf perforator on both sides. On the right side, the second most common site was the above-ankle perforator, while on the left it was below the knee. Our earlier study also reported the mid-calf perforator as the most frequently involved site, followed by the above-ankle perforator[20]. This pattern was also noted in the study by Pant et al.[19] Given the frequent involvement of mid-calf perforators, they should be evaluated and treated during above-knee RFA when present.

The CHIVA (Conservative and Hemodynamic treatment of Venous Insufficiency in the Office) approach emphasizes treating only the refluxing segments while preserving normal venous anatomy[8]. For this, precise knowledge of reflux locations is essential. Our study provides valuable insight into the pattern of SFJ and perforator involvement, which may aid surgical planning.

In a study evaluating superficial reflux in patients with venous ulcers, perforator incompetence was found in 81.4% of patients with ulcers in the lateral region (44 of 54 cases), and in 91.3% of those with ulcers in the medial region (94 of 103 cases)[21]. Overall, 89% of patients in that study had perforator incompetence[21]. These findings further underscore the importance of thoroughly evaluating perforators when managing chronic venous insufficiency.

Conclusion

Identifying the site of reflux is essential for effective surgical planning and ensures that all incompetent points are addressed during intervention for varicose veins. While saphenofemoral junction (SFJ) reflux is commonly observed in GSV-related varicosities, our study highlights that a significant proportion of patients also exhibit reflux at the perforator level, underscoring the need for comprehensive preoperative evaluation.

Consent

Written informed consent was obtained from each patient ensuring anonymity.

Declaration of competing interest

There are no conflicts of interest.

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N/A

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