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Termination of the great saphenous vein at variable levels

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Abstract

The assessment of the saphenofemoral junction (SFJ) is important in the diagnosis and treatment of venous reflux of the great saphenous vein (GSV). In the clinical practice of venous medicine, the SFJ is used to represent the region at which the saphenous arch connects with the common femoral vein (CFV). A number of notable variations of the SFJ have been documented, and rare variable courses of the GSV have been described recently. Our case study reports two unusual GSV terminations. In both cases, the SFJ was located below the confluence of the profunda femoris vein (PFV) with the femoral vein (FV). Case 1 showed the SFJ was formed by the GSV and FV; whereas case 2 showed the PFV was joined by the GSV after a transposition with the FV. Anatomical variations of the SFJ are rare; however, they are increasingly diagnosed with the use of duplex ultrasound. The identification of SFJ variants warrants a safe endovenous procedure and prevents surgical complications.

Introduction

The saphenofemoral junction (SFJ) is anatomically defined as the saphenous opening where the great saphenous vein (GSV) joins with the common femoral vein (CFV). In clinical settings, it is widely used to represent the saphenous arch, encompassing several anatomical structures (*e.g.*, terminal valves and pre-terminal valves) and branch veins (*i.e.*, anterior accessory saphenous vein, posterior accessory saphenous vein, superficial circumflex iliac vein, superficial epigastric vein, and superficial external pudendal vein).[1] There is great variability at the level of the SFJ as to how its tributary veins communicate with the saphenous arch.[2] In addition, variable courses of the GSV in relation to the femoral vessels have also been sporadically reported in the literature.[3-5]

In this paper, we present two cases of unusual termination of the GSV and their treatment. The ultrasound images and clinical data were from a study approved by our institution.

Case 1

A 44-years-old Indian-origin male patient with varicosities on the right leg underwent venous insufficiency ultrasound examination. During the initial duplex ultrasound assessment, axial reflux was observed throughout the entire course of the GSV which was also found to have two aneurysmal dilatations at the lower thigh (diameters of 19.6 mm and 14.6 mm respectively). In the first instance, the SFJ anatomy was noted to be unusual. Meticulous evaluation of the SFJ confirmed that the GSV joined with the femoral vein (FV), and the profunda femoris vein (PFV) and FV merged above the SFJ, as illustrated in Figure 1. The patient subsequently underwent endovenous laser ablation (EVLA) for the elimination of GSV reflux. Post-operative scan performed on day 4 showed successful occlusion of the GSV with a type II endovenous heat induced thrombosis (EHIT).

Case 2

A 63-years-old Chinese female patient with lipodermatosclerosis and pigmentation over the gaiter region presented to vascular laboratory for venous insufficiency ultrasound examination on her left leg. The scan revealed SFJ incompetence with reflux flow travelling down the GSV to mid-calf. The scan also found an aberrant SFJ formed by the GSV and PFV with the confluence of the FV and PFV located above the SFJ, as illustrated in Figure 2. The patient underwent high ligation of the SFJ and stripping of the incompetent GSV with no surgical complications.

Discussion

Prior to the wider use of ultrasound in phlebology, Nabatoff (1978) identified a number of SFJ anomalies during surgical exploration of 5050 limbs, including a saphenous arch without tributary branches (0.04%), transposition of femoral artery and vein (0.02%) and a great saphenous artery as a rare branch of the femoral artery running along the GSV (0.02%).[6] Since the 1980s, the advent of duplex ultrasound has made a revolutionary change to the diagnosis and treatment of chronic venous disease. Venous anatomy and its variations are more easily appreciated using high-resolution transducers. Although the incidence of venous reflux in the small saphenous vein (SSV) is known to be less than in the GSV, the termination of the SSV has been comprehensively studied in the past, predominantly due to its variable connections imposing increased risks of surgical complications.[7] Compared to saphenopopliteal junction (SPJ) variants, there is a paucity of studies reporting anatomical variations of the GSV at the level of SFJ, with most describing an unusual course of the GSV before joining the deep veins.

In an ultrasound study of 2552 limbs of 1564 patients, Igari *et al.* (2013) observed six limbs (0.24%) with SFJ variants, in which three had a GSV crossing posterior to

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the common femoral artery (CFA), two passed in between the superficial femoral artery (SFA) and the profunda femoral artery (PFA), and one took a lateral deviated course along the SFA.[3] Quickert and Alagha (2018) reported a case study of SFJ variant in which the GSV was sandwiched by the SFA and PFA resulting in a 50% diameter reduction.[4]

The SFJ formed by the GSV and CFV is recognised as the classic configuration in Scarpa's triangle. The use of 'Mickey Mouse' sign confirms normal anatomical layout among the CFA, CFV and GSV.[8] As demonstrated in Figure 3, the two cases we reported here represent two distinct configurations when the GSV joins the FV (case 1) or the PFV (case 2) instead of the CFV.

In the last two decades, minimally invasive endovenous procedures have become increasingly popular for the correction of truncal venous reflux with the GSV frequently targeted. During the EVLA or radiofrequency ablation (RFA) procedure, ultrasound guidance facilitates the insertion of fibre/catheter and administration of tumescence anaesthesia. Generally, the procedure can be safely performed by an experienced operator with ablation beginning at 2 cm below the CFV. The anatomical variant we encountered in case 1 posed an exceptional challenge for the surgeon and sonographer as extra care needed to be taken to precisely locate the laser fibre in relation to the true SFJ (GSV-FV). Failure to recognise the SFJ would result in a disastrous incidence, should a FV-PFV pseudojunction be misinterpreted as the SFJ, and the laser fibre advanced into the FV after passing the true SFJ. Although the patient developed EHIT post-operatively with thrombi of length 0.41 cm extending into the FV and causing a <50% diameter reduction, the thrombi completely dissolved after two weeks of anti-coagulation therapy. We attributed his EHIT to the established risk factors which include male sex and large GSV diameter (11 mm) near the SFJ.[9]

Despite the rate of recurrence and side effects associated with varicose veins surgery, the traditional technique still has a role if the patient is appropriately selected and operated on by experienced surgeons, especially when thermal ablation equipment is not available, or the target vein is unsuitable for ablation. The patient in case 2 was offered conventional surgery; however, the anatomical variant necessitated modification to the surgical technique. First, preoperative ultrasound marking of the SFJ was performed, ensuring precision of incision placement and localisation of the SFJ (GSV-PFV). During the procedure, a lower position than normal was chosen for the incision to allow for optimal visualisation of the GSV trunk and SFJ. The superficialisation of the PFV was appreciated, and flush ligation was performed with care taken to avoid narrowing of the PFV and iatrogenic injury to the adjacent SFA. Lastly, the diseased GSV was stripped to the level just above the patella for prevention of saphenous nerve injury. Two weeks post operation, repeat ultrasound examination showed no deep vein thrombosis, absence of the GSV stump at the site of former SFJ (GSV-PFV) and successful removal of the GSV thigh segment. It is unclear whether the transposition of the PFV with the FV is more prominent in certain ethnic groups, namely Asian populations. Kim *et al*. (2017) reported 12 out of 2093 patients (0.57%) who underwent the GSV stripping surgery had femoral artery and vein transposition, and 71% of the SFJ variants were discovered in their pre-operative scans.[10]

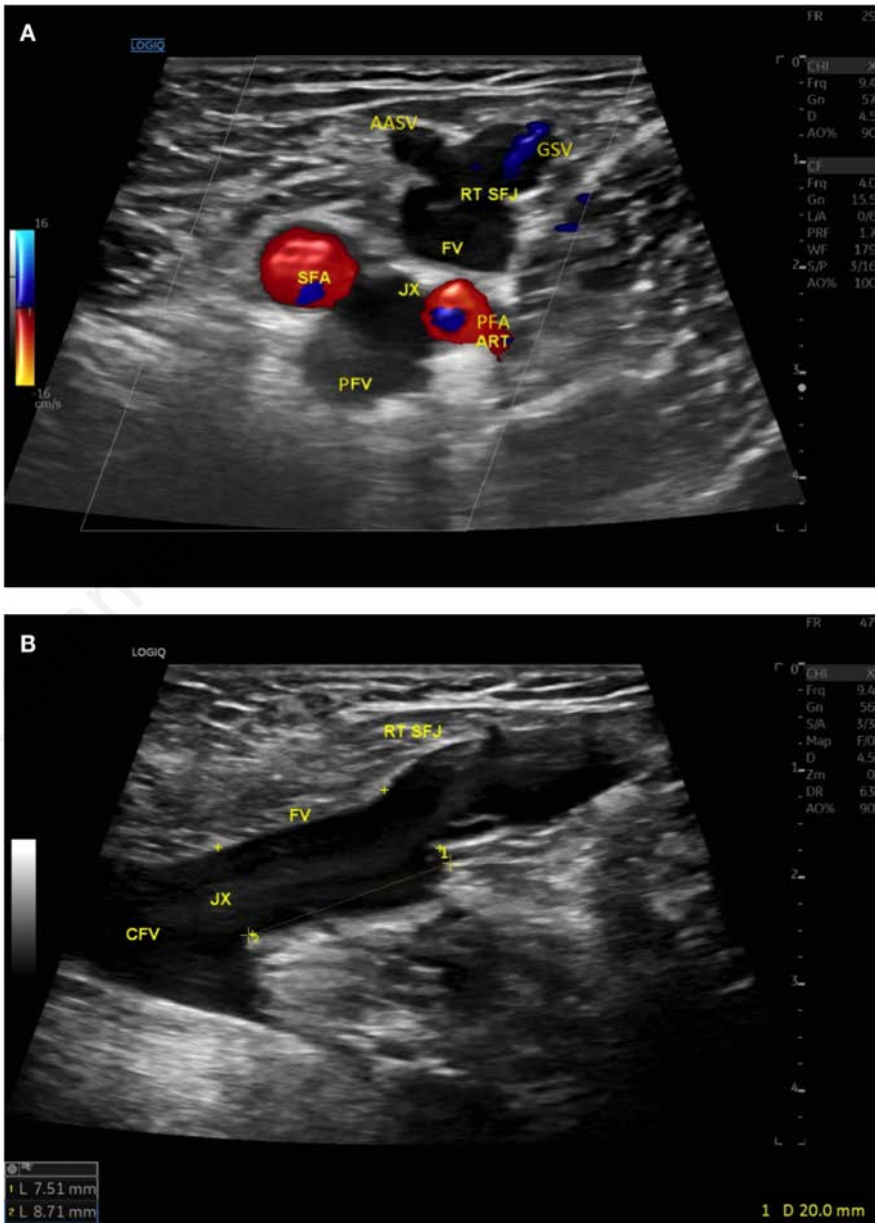

Figure 1. Case 1: Ultrasound images. (a) Transverse view of the SFJ (GSV-FV). (b) Longitudinal view of the SFJ (GSV-FV). AASV, anterior accessory saphenous vein; GSV, great saphenous vein; SFJ, saphenofemoral junction; FV, femoral vein; PFV, profunda femoris vein, JX (the confluence of FV with PFV); CFV, common femoral vein; SFA-superficial femoral artery; PFA, profunda femoris artery.

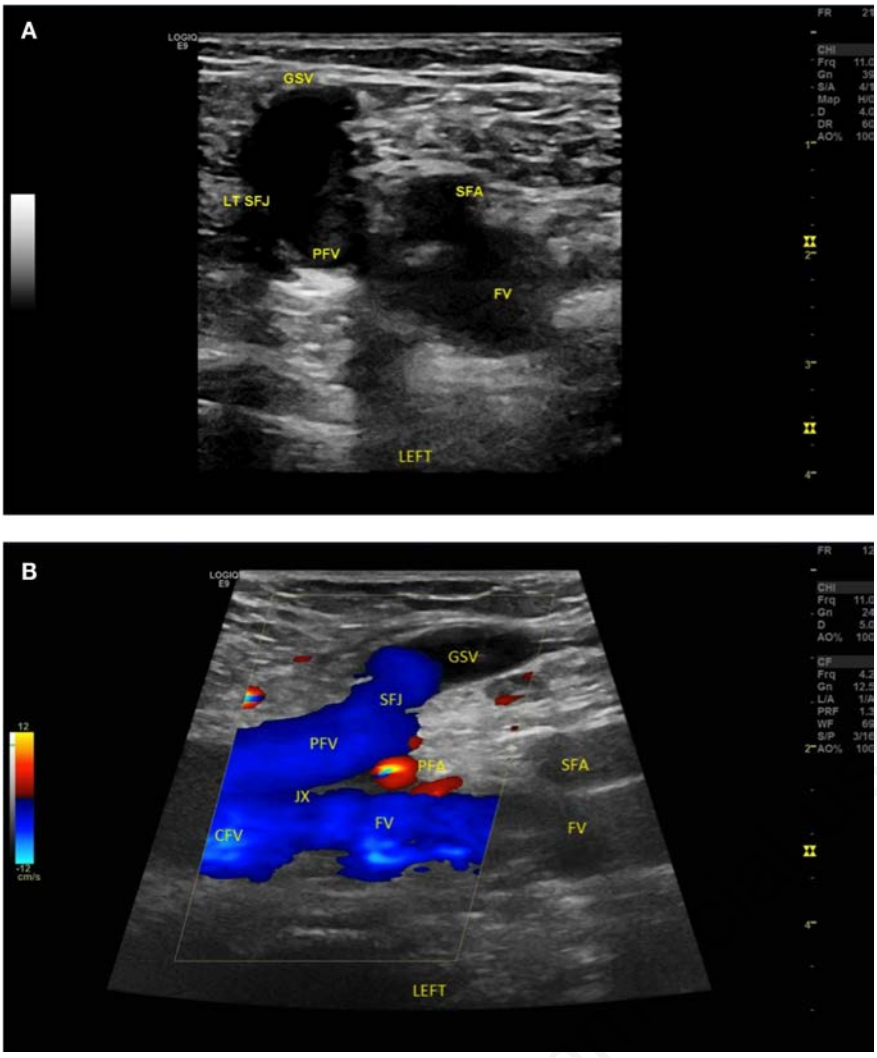

Figure 2. Case 2: Ultrasound images. (a) Transverse view of the SFJ (GSV-PFV). (b) Longitudinal view of the SFJ (GSV-PFV) [Note: transposition of PFV with FV]. GSV, great saphenous vein; SFJ, saphenofemoral junction; FV, femoral vein; PFV, profunda femoris vein, JX (the confluence of FV with PFV); CFV, common femoral vein; SFA, superficial femoral artery; PFA, profunda femoris artery.

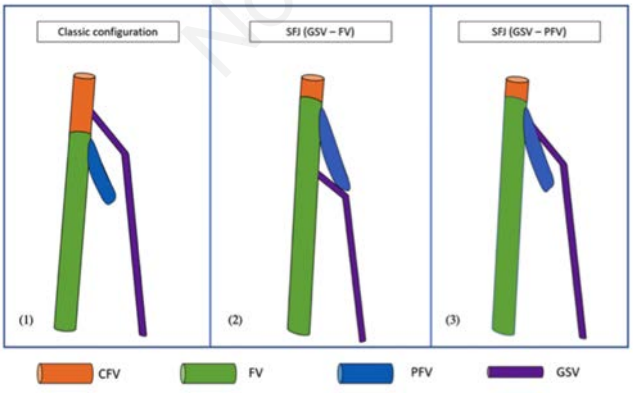

Figure 3. Schematic diagrams illustrating variable terminations of the GSV. (1) Classic configuration – GSV joins with the CFV; (2) GSV joins with FV forming a SFJ below the confluence of the FV with PFV [case 1]; (3) GSV joins with PFV forming a SFJ below the confluence of the PFV with FV [case 2]. GSV, great saphenous vein; SFJ, saphenofemoral junction; FV, femoral vein; PFV, profunda femoris vein, JX (the confluence of FV with PFV); CFV, common femoral vein; SFA, superficial femoral artery; PFA, profunda femoris artery.

Conclusions

Anatomical variations of the SFJ are rare; however, they are increasingly diagnosed with the use of duplex ultrasound during detailed venous insufficiency studies. Knowledge of SFJ and GSV variants is of paramount importance for ensuring safe treatments and preventing surgical complications.

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