

Syncope (fainting on standing from squatting) due to massive venous reflux into lower limb varicose veins – Case report

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Abstract

A 42-year-old man presented with very large lower limb varicose veins bilaterally and an 8-month history of fainting when standing up from a squatting position. He had been investigated for syncope by a cardiologist with no abnormality found on electrocardiogram, echocardiogram, 24-h electrocardiogram or 48-h blood pressure monitoring. Venous duplex ultrasonography showed bilaterally great saphenous vein reflux, with each vein having a diameter of 23.5 and 24.0 mm at the groin, and a similar dilation along the whole vein to ankle. These veins were successfully ablated with endovenous laser ablation, immediately following which the syncope disappeared and has not returned. We calculate that before treatment, the patient had approximately 500 ml of blood refluxing passively with gravity from his deep venous system on standing into his incompetent great saphenous veins and associated varicosities, which would account for his postural syncope.

Keywords

Syncope, fainting, venous reflux, varicose veins

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Introduction

Varicose veins due to incompetent superficial truncal veins is thought to affect approximately a third of the adult population.¹ The great saphenous vein (GSV) is the more commonly affected truncal vein in the leg.² As it terminates proximally by entering the deep system at the sapheno-femoral junction (SFJ) in the groin, and although there can be valves above this point,^{3–5} in those without functioning valves, SFJ and GSV incompetence allows venous blood to reflux passively by gravity from the iliac veins and inferior vena cava on standing. In addition, in those who have competent valves above the SFJ, passive reflux down the GSV arises from the blood flowing up the deep veins of the leg by a siphon effect, acutely reducing the venous return to the heart from the legs. In haemodynamic venous surgery, this ‘passive’ or gravitational reflux is often termed ‘diastolic’ reflux.⁶

When standing from a squatting position, this reflux reduces the cardiac return to the right heart. However, the amount of passive reflux is rarely sufficient for such a reduction to be significant. Hence, we have been unable to find any previous reports of syncope caused by incompetence of lower limb varicose veins.

Case

In June 2022, a 42-year-old male presented with a long history of bilateral lower limb varicose veins (Figure 1). He had first noticed bulging veins in his legs at age 8. Since then, they had slowly increased in size and extent. Over the last 4 years, he had started noticing bilateral aching, itching and ankle swelling. More recently, he had started noticing the skin darkening at the inner ankles, giving clinical grade of C4 in the CEAP classification.⁷ Over the last 8 months, he had also started fainting whenever standing up from a squatting position and occasionally when running. These faints were described as ‘almost blackouts’ although the patient said he did not completely lose consciousness.

The only medication that he took was tamsulosin, and he had no known allergies.

The patient had previously seen a cardiologist to investigate his syncope, thought to be due to postural hypotension.

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An electrocardiogram (ECG), echocardiogram, 24-h ECG and 48-h blood pressure monitoring were all normal. The cardiologist did not use a tilt table during testing. No cause was found for the syncopal episodes.

Clinical examination showed very large varicosities bilaterally (Figure 1) and a venous duplex ultrasound reported bilateral incompetence of the GSVs from groin to ankle, with a diameter of 24 mm on the right and 23.5 mm on the left in the standing position (Figure 2). There were two



Figure 1. Photograph of right leg massive varicosities pre-operatively.

incompetent perforator veins (IPVs) on the left and one on the right. There was no significant deep vein reflux, with only borderline reflux being found in both popliteal veins that was clinically irrelevant.

A treatment plan was suggested to treat his varicose veins under local anaesthetic (tumescence) as an ambulatory case. It is noteworthy that the treatment was planned as a cure for his varicose veins and not to treat his syncope. In view of the large volume and hence high dose of local anaesthetic needed for such large and extensive varicose veins, as well as the time needed to perform the procedure, it was decided to treat his legs on separate occasions. Hence, on his first visit, he underwent endovenous laser ablation of the right incompetent GSV and TRansLuminal Occlusion of Perforator (TRLOP) closure⁸ of the IPVs, with extensive phlebectomies above and below knee. A 1940-nm diode laser (Metrיום Cryoflex Twist, Łomianki/Warsaw, Poland) was used with a single ring radial tip. The GSV was treated at 10W with a total of 5041J over 52 cm of vein, providing an overall Linear Endovenous Energy Density (LEED)^{9,10} of 96.9 J/cm. The IPV was treated at 10W with a total dose of 118J. Overall, the procedure took 1 h and 35 min.

A week later, the patient returned for Endovenous Laser Ablation (EVLA) of the left GSV, TRLOP closure of two IPVs on the left leg and extensive phlebectomies. The left GSV was treated with 10W and a total of 5060J to treat 50 cm, resulting in an overall LEED of 101.2 J/cm. The two IPVs were treated with 239 and 127J; the whole procedure took 59 min.

After each treatment, all wounds were closed with SteriStrips[®] (3M, Bracknell, UK) and the legs bound overnight with absorbent bandages covered by support stockings.

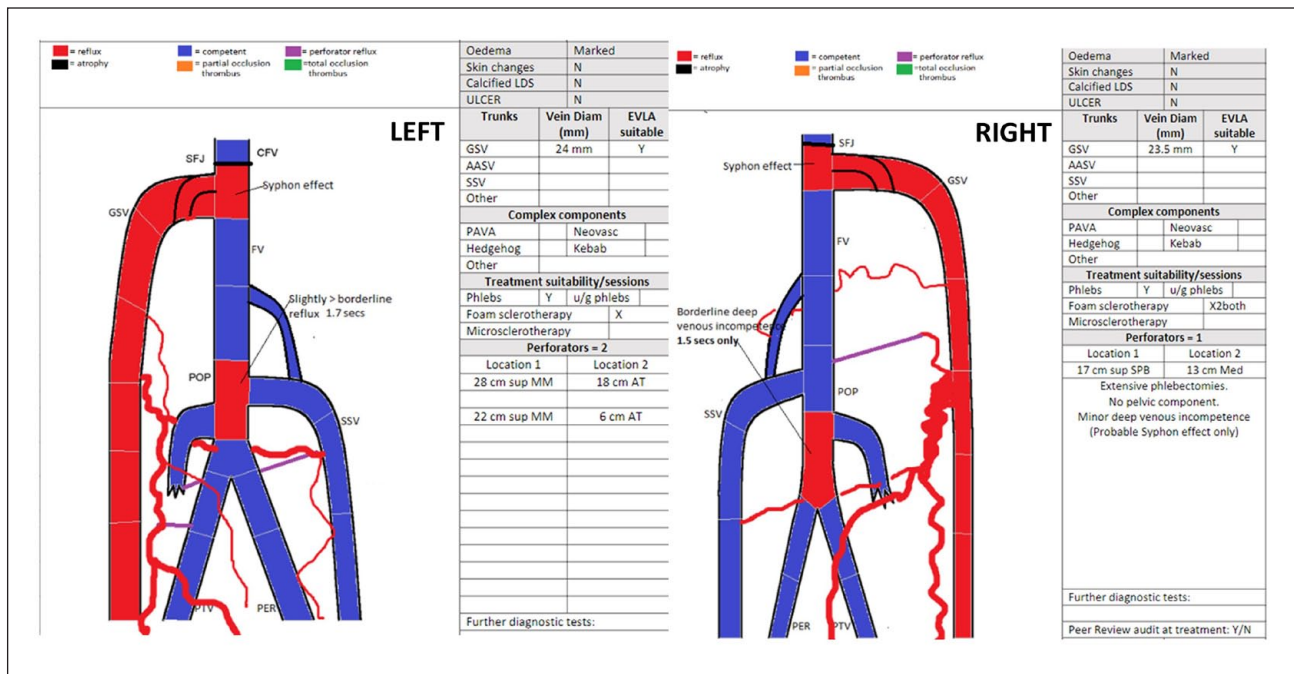


Figure 2. Duplex ultrasound reports of both legs pre-operatively (see key on diagram).

The bandages were removed the following morning and stockings and Steristrips® removed on the third post-operative day.

Four weeks later, the patient returned for a follow-up, which showed a good result, with a few residual varicosities, particularly around the ankles. A session of foam sclerotherapy was recommended for completion of his treatment. During this follow-up, the patient stated that he had not had any further fainting episodes, and it appeared that the venous surgery had cured him of these symptoms.

The patient underwent the recommended foam sclerotherapy and visited the clinic for the final time 6 months after his endovenous surgery. Duplex confirmed closure of the treated GSVs and IPVs. He reiterated that he had not had any further symptoms of faintness or dizziness when moving from crouching to standing, and also said that this change had significantly increased the quality of his life.

Discussion

The history of syncope on standing from a squatting position, and occasionally on running, in this fit 42-year-old man was both severe enough and occurred often enough for him to be referred to a cardiologist. In turn, the cardiologist found the symptoms worth investigating. The investigations were all negative, excluding a cardiac cause for the syncope.

The complete and sudden disappearance of the syncope immediately following the treatment of his truncal venous reflux points very strongly to there being a causative link between the two.

As outlined in the introduction, there have been valves found on cadaveric studies proximal to the SFJ in the common femoral and external iliac veins.³⁻⁵ However, as these are cadaveric studies, it is not known how many of these are functional, and indeed, these studies are not selecting cadavers with a history of varicose veins during life. Hence, if the GSV is incompetent, and there are no functional valves proximal to the SFJ, venous blood can reflux under the force of gravity out of the deep system in the abdomen and pelvis and into the truncal vein. A second mechanism, and more likely in this case in view of the proximal competence noted on the duplex ultrasound (Figure 2), is the same passive reflux down the incompetent GSV 'stealing' blood acutely on standing from the venous outflow of the leg by a siphon effect. Usually, even if the GSV is incompetent and dilated, the dilatations are segmental with narrower segments of GSV between them. Hence, reflux in such veins would be turbulent, and there would be an element of resistance to the venous flow. Moreover, it is uncommon for both GSVs to be massively dilated.

We suggest that the sudden loss of a significant volume of venous blood returning from the leg veins by being siphoned into the bilateral large incompetent GSVs and associated varicosities on standing from a squatting position resulted in

a sudden reduction in right atrial filling volume and, hence, syncope.

There are factors that support this hypothesis. The first is the fact that the syncope was ongoing and regular enough to necessitate both referral to, and investigation by, a cardiologist and that it disappeared completely on abolition of the reflux. The second is that both GSVs were incompetent and very large, and unusually, the whole GSV on each side was dilated uniformly rather than just isolated segments that were massively dilated. This, combined with very large varicosities, would mean that refluxing blood in the GSVs would not undergo much turbulence or resistance to slow the flow.

The fact that the patient did not complain of syncope when standing from a sitting position can be explained by considering the height of the heart and the state of the superficial veins when sitting or squatting. When sitting, the heart is at a higher level than when squatting, increasing the hydrostatic pressure in the veins below the heart, meaning that the GSV and leg varicosities were likely to be partially filled before standing. This would result in a smaller volume of blood refluxing on standing. Conversely, when squatting, the heart is lower and the veins compressed between calf and thigh muscles, emptying the veins and giving a larger capacity to be filled on standing. The additional difference in height of the heart when squatting when compared to standing would also increase the height of the column of blood, increasing the hydrostatic pressure on the refluxing venous blood.

We can estimate the volume of venous blood that was refluxing due to gravity during the process of standing from squatting to be approximately 500 ml. We calculated this from the treated sections of both GSVs (left GSV diameter=24 mm and length treated=50 cm gives volume=226 ml and right GSV diameter=23.5 mm and length treated=52 cm gives volume=216 ml), which comes to 442 ml. Of course, the veins would not have been fully empty when squatting, but, on the other hand, we have not added the volume of the GSV below the lowest point of ablation nor the varicosities. Hence, we feel that a volume of reflux of 500 ml is a conservative estimate.

This volume equates to approximately 10% of the circulating volume of a normal human adult.¹¹ The rapid loss of such a volume from the cardiac inflow might well be expected to have profound but temporary effects on cardiac output – which is clinically observed as syncope.

Conclusion

We present a case of a man who suffered syncope when standing from squatting due to sudden and massive gravitational reflux into abnormally dilated and incompetent GSVs and associated varicose veins. We have not been able to find a description of this cause of syncope in the published literature.

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Ethics approval

Our institution does not require ethical approval for reporting individual cases or case series.

Informed consent

Written informed consent was obtained from the patient(s) for their anonymised information to be published in this article.

Written informed consent

The patient presented has provided written informed consent for his case and photographs to be published.

Pre-print available

A pre-print version of this case report is available on: <https://osf.io/preprints/coppreprints/me5c7/>

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