



Level and modalities of origin of the small saphenous vein: toward codification of the proximal approach level

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Received: 15 December 2018 / Accepted: 30 August 2019 / Published online: 9 September 2019
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Abstract

Purpose The proximal approach to the small saphenous vein (SSV) must be performed according to precise anatomical landmarks to respect the esthetic profile of venous insufficiency surgery. In this work, we propose the tip of the lateral malleolus and the lateral edge of the calcaneal tendon as palpable landmarks from which to easily identify the situation of this vein.

Methods This was a cadaveric dissection study involving 62 members of fresh and embalmed anatomical subjects. We used a horizontal line passing through the tip of the lateral malleolus and the lateral edge of the calcaneal tendon as reference marks. Once the origin of the SSV was dissected, the distances between the saphenous vein and the landmarks were measured.

Results We found that the small saphenous vein was often unique. The origin of this small saphenous vein projected, on average, to 4.40 cm from the horizontal passing through the tip of the lateral malleolus and 1.2 cm from the lateral edge of the calcaneal tendon.

Conclusion These two measurements constitute the orthogonal coordinates for the situation of the small saphenous vein origin.

Keywords Small saphenous vein · Origin · Codification · Proximal approach

Introduction

The identification and approach to the small vein is a fundamental step in its surgical management. Several authors have proposed anatomical landmarks and recommendations for this approach [3, 4, 7, 8]. These are difficult to practice because of their complexities. The approach remains

imprecise and often leads to multiple or unsightly incisions in search of the small saphenous vein trunk.

Therefore, the identification of precise landmarks makes it possible to accurately map the small saphenous vein to improve the approach. Therefore, we propose a more accurate two-coordinate tracking system that will undoubtedly improve the efficiency of identifying the small saphenous vein trunk.

Materials and methods

To perform this work, we dissected 62 pelvic limbs, 32 on the right side and 30 on the left side, of 34 fresh and embalmed adult anatomical subjects. There were 23 men and 11 women, aged from 71 to 101 years. Members with macroscopic lesions were excluded. The dissection involved two pelvic members in 28 subjects and one pelvic limb in 6 subjects. This study was carried out concomitantly in the services of Pathological Anatomy of the Aristide Le Dantec Hospital, the General Hospital of Grand-Yoff, and the Anatomy Laboratory of the Faculty of Medicine of Marseille.

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The materials used were a current dissection box, a tape measure, a millimetric compass, a metal pin, a camera, and image processing software (Adobe Photoshop).

The small saphenous was identified at its termination. Therefore, with the subject in the prone position, we made two transverse incisions on both sides of the popliteal fold, and then a median incision connecting the two incisions allowing the separation of the two skin flaps similar to opening a book. After locating the vein, we continued down the median incision until reaching the calcaneal insertion of the calcaneal tendon, and then, we prolonged the incision to 5 cm from the external edge of the foot.

We noted, as parameters to be studied, the number of small saphenous veins, the number of branches of origin, and the distance in centimeters of the level of the origin of the SSV to a horizontal line passing by the tip of the lateral malleolus.

Results

Number of small saphenous veins

We noted only a single small saphenous vein in 60 cases. In two cases (3.2%), the SSV was duplicated.

Number of branches of origin

The number of branches of origin was 2 on average, with extremes ranging from 1 to 5 branches.

The small saphenous vein had only 1 branch of origin in 10 cases (16.12%), 2 branches of origin in 35 cases (56.45%), 3 branches of origin in 14 cases (22.58%), and 4 branches of origin in 2 cases (3.22%).

One (1.61%) SSV had 5 branches of origin (Table 1).

Premalleolar branches

The number of premalleolar branches varied between 0 and 2, with an average of one branch. We found 18 limbs (29%) without a premalleolar branch.

Table 1 Number of branches of origin

Number of branches	Number of limbs	Percentage (%)
1	10	16.12
2	35	56.45
3	14	22.58
4	2	3.22
5	1	1.61
Total	62	100

Forty limbs (64.5%) had a premalleolar branch, and four other limbs (6.5%) had two premalleolar branches (Table 2).

Retromalleolar branches

The number of retromalleolar branches ranged from 1 to 4, with an average of one branch. We found a retromalleolar branch in 41 limbs (66.1%), 2 retromalleolar branches in 18 limbs (29%), and 3 retromalleolar branches in 2 limbs (3.2%). One limb (1.6%) had 4 retromalleolar branches (Table 3).

Origin of the small saphenous vein

The SSV was 4.40 ± 3.2 cm from the horizontal lateral tip of the lateral malleolus and 1.2 ± 0.9 cm from the lateral edge of the calcaneal tendon (Figs. 1 and 2).

The diameter of the small saphenous vein

The average diameter of the small saphenous vein at its origin was 2.93 ± 0.6 mm. The diameter most frequently encountered was 3 mm.

Discussion

In 1890, Lejars [6] described the plantar venous pump, which is the origin of several theories on the physiology and pathophysiology of venous insufficiency and the anatomical description of the venous networks of the pelvic limbs. Indeed, since then, this anatomy remains controversial. Therefore, the small saphenous vein has several birth modalities. This vein can be born from the convergence of several

Table 2 Number of premalleolar branches

Number of branches	Number of limbs	Percentage (%)
0	18	29.0
1	40	64.5
2	4	6.5
Total	62	100

Table 3 Number of retromalleolar branches

Number of branches	Number of limbs	Percentage (%)
1	41	66.1
2	18	29.0
3	2	3.2
4	1	1.6
Total	62	100

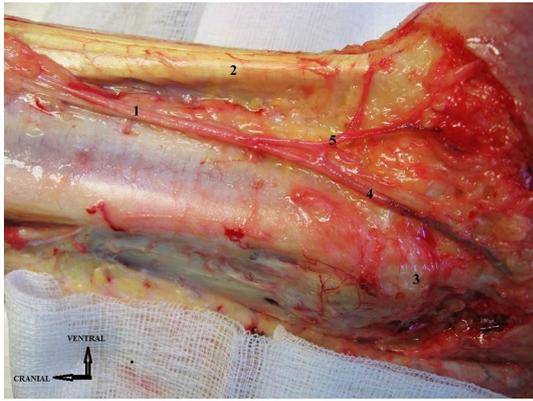


Fig. 1 Left lateral retromalleolar region, origin of the small saphenous vein. 1—small saphenous vein; 2—calcaneal tendon; 3—lateral malleolus; 4—premalleolar collateral afferent vein; 5—retromalleolar collateral afferent vein

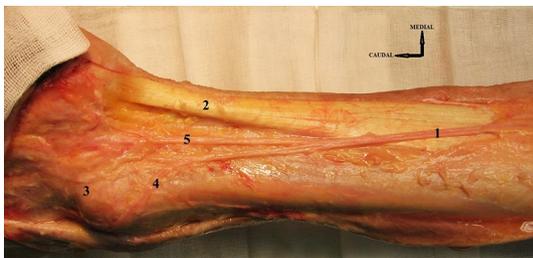


Fig. 2 Right lateral retromalleolar region, high origin of the small saphenous vein. 1—small saphenous vein; 2—calcaneal tendon; 3—lateral malleolus; 4—premalleolar collateral afferent vein; 5—retromalleolar collateral afferent vein

veins. In our study, we found that up to five branches could converge to form the trunk of the small saphenous vein. Gillot [3] found the confluence of three venous branches that he described as the malleolar, marginal, and calcaneal veins.

Uhl [10] also describes the origination of the small saphenous vein from three branches but with a different nomenclature than the previous author; he called them the marginal lateral vein, lateral venous plexus, and lateral common venous trunk perforating the foot. These veins drain the lateral part of the dorsal surface of the foot, the lateral malleolus, and the lateral and dorsal parts of the heel [4]. This difference in the nomenclature illustrates the difficulty of identifying these veins at the origin of the small saphenous vein. It should be noted that the work of Caggiati [1] on the consensus of venous terminology and that of the international federative committee on anatomical terminology [2] do not concern these veins. Thus, we propose a simpler nomenclature according to the topography of the vein compared to the lateral malleolus. Thus, we found that 49.40% of the retromalleolar branches

correspond to the marginal lateral veins and calcaneus described by Gillot [3] and that 46.90% of the premalleolar branches remained innominate in the literature.

The constitution of the small saphenous vein can occur from a venous dorsal arch of the foot. Uhl and Gillot [10] have described this possibility. We found it in 9 cases, or 11.1%, of our series.

The existence of several branches of origin of the small saphenous vein can make the systematization of varicose veins of the foot difficult. Emergence from a dorsal venous arch of the foot may increase the signs of venous insufficiency of the small saphenous vein at the foot due to the influence of the plantar sole in the venous flow. Indeed, the plantar veins drain the sole in the venous deep network and communicate with the small saphenous vein by perforators [11].

The level of origin of the trunk of the small saphenous vein according to anatomical landmarks is not sufficiently specified in the literature. Gillot [3] located the confluence of the original branches behind and opposite the neck of the lateral malleolus. Kosinski [4] placed the constitution of the small saphenous vein trunk at an average of 2 cm above the tip of the lateral malleolus. This would be symmetrical in 20% of cases. For Mercier [7] and Payen [8], the trunk was an average of 8 cm above the tip of the lateral malleolus, slightly outside the external edge of the calcaneal tendon. They recommended approaching the trunk not less than 8 cm from the tip of the lateral malleolus. They sometimes noted a low constitution level of up to 5 cm from the tip of the lateral malleolus.

Moreover, Perrin [9] proposed making the incision in the lateral retromalleolar fossa midway between the fibula and the calcaneal tendon. All in all, these results and recommendations seem imprecise to us. Indeed, to pick a point on a plane, you need at least two precise coordinates. From our study, in addition to the lateral malleolus, which is the classical reference, we propose a second fixed and easily identifiable landmark: the calcaneal tendon. Thus, these two landmarks constitute an orthogonal plane and should increase the precision of localizing the small saphenous vein origin to perform Doppler mapping and facilitate the approach. In fact, according to these two landmarks, the small saphenous vein is constituted, on average, 4.40 ± 3.2 cm from the tip of the lateral malleolus and 1.2 ± 0.9 cm from the lateral edge of the calcaneal tendon (Fig. 3). The malleolar skin incision during stripping or puncture in endovenous procedures of the small saphenous vein should be centered on these landmarks.

We tried to determine the normal size of the small saphenous vein at the origin to allow us to appreciate increases in diameter on Doppler ultrasound [5]. Thus, we found it to 3 mm on average at the origin.



Fig. 3 Landmarks of origin of the small saphenous vein

This study has some limitations, especially in relation to the description of the sural cutaneous nerve that can be damaged during the approach to the small saphenous vein.

Conclusion

This proposal for an orthogonal localization plane based on visible and palpable anatomical landmarks seems to us indispensable in view of the vagueness of previous recommendations. On the other hand, these coordinates are based on averages and normal configurations. Therefore, this study presents these limitations and should be supplemented by a prospective study on the accuracy of these landmarks in the operating room.

Compliance with ethical standards

Conflicts of interest The authors declare that they have no conflicts of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of our research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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