Thieme

Ultrasound Anatomy of the accessory anterior saphenous vein

Oksana Riabinska, Erika Mendoza

The anterior accessory saphenous vein (AASV) often bothers the patients due to its meandering appearance on the ventral aspect of the thigh. Anatomic variations of the normal vein influence the hemodynamic of varicose disease, as well as the clinics and should be known and considered when treating a patient. This is exposed in two clinical cases.

ABREVIATIONS

CHIVA	ambulatory conservative hemodynamic treatment of venous insufficiency
CVI	chronic venous insufficiency
SFJ	sapheno femoral junction
UPMT	upper postero-medial Tributary
CFV	common femoral vein
AASV	anterior accessory saphenous vein
PASV	posterior accessory saphenous vein
GSV	great saphenous vein

Introduction

The anterior accessory saphenous vein (AASV) is one of the tributaries of the sapheno-femoral junction region. It is present in approximately 50 % of the cases [1]. In Phlebology, the interest of this vein used to be thanks to its specially meandering course on the anterolateral aspect of the leg (▶ **Fig. 1**).

In times of High Ligation and Stripping, this vein was regularly interrupted during the surgical treatment of saphenous vein insufficiency, independently of its condition of competent or refluxive. Since duplex ultrasound became the gold standard in investigation of veins and a refinement of techniques (foam sclerotherapy, endoluminal heat treatments) and strategies (saphenous ablating or saphenous sparing) was possible, the AASV gained interest, especially as it can be the source of recurrent varicose veins after ablation. On the other hand, in case of isolated reflux in the AASV the patient tailored options allowing to treat this vein as an own entity.

▶ **Fig. 1** **a** Typical clinical appearance of isolated AASV incompetence of the left leg. Source: Arrien GmbH. **b** Graphical representation (Quelle: Schünke M, Schulte E, Schumacher U, Prometheus LernAtlas der Anatomie. Allgemeine Anatomie und Bewegungssystem. Illustrationen von Voll M und Wesker K. 5., vollständig überarbeitete Auflage. Stuttgart: Thieme; 2018). 1: AASV, 2: GSV, 3: PASV.

Thus, during a duplex investigation of superficial veins of the lower extremities in patients with chronic venous insufficiency (CVI) the evaluation of the AASV has become

▶ **Table 1** Frequency of reflux sources and reflux pathways into different veins at the groin in patients scheduled for intervention adapted from [4]. Type B means: Reflux source from the deep vein and the tributaries. Type C means: Reflux from tributaries, terminal valve competent. Type 0: Reflux in GSV at the thigh, with competent terminal and preterminal Valve (e. g. Perforating vein or distal tributaries as source). PASV: Posterior accessory saphenous vein. Cases with reflux into the AASV are highlighted.

N/%	sum	refkux into GSV	reflux into AASV	reflux into PASV	reflux into GSV + AASV	reflux into GSV + PASV	GSV + AASV + PASV
type A axial reflux	1348 66.8 %	1067 52.8 %	122 6.0 %	2 0.1 %	154 7.6 %	2 0.1 %	1 < 0.1 %
type B “both”	170 8.4 %	117 5.8 %	22 1.1 %	0 –	31 1.5 %	0 –	0 –
type C cranial reflux	430 21.3 %	314 15.6 %	74 3.7 %	2 0.1 %	39 1.9 %	1 < 0.1 %	0 –
type 0	71 3.5 %	63 3.1 %	3 0.1 %	0 –	5 0.2 %	0 –	0 –
sum	2019 100 %	1561 77.3 %	221 10.9 %	4 0.2 %	229 11.3 %	3 0.1 %	1 < 0.1 %

a “Must”, especially in the context of the growing amount of ablative operations in patients with varicose disease of great saphenous vein (GSV) territory. As a result, nowadays it is well known, that AASV incompetence can cause both primary and recurrent varicosity. Moreover, AASV insufficiency can “mimic” great saphenous vein disease. So, precise anatomic distinction between the GSV and the AASV is needed for correct diagnostics, for planning of adequate treatment and for assessing the treatment outcomes.

Regular anatomy of AASV

Description of the course of the vein, types of tributary territories, interfascial and extrafascial options, frequency of occurrence

Anterior accessory saphenous vein (AASV) is one of the SFJ distal tributaries. According to the cadaveric study performed by Muhlberger et al. AASV is present in 51 % of cases [1]. Isolated reflux in AASV is noted in 10,9 % – 14 % of legs with primary varicosity [2–4], whereas reflux in both AASV and GSV is observed in 1,6 %–11,5 % of cases [4, 5]. In recurrent varicosity, incompetent AASV tends to be the most common US defined pattern either after GSV surgery (up to 43 %) [6] or after endovenous thermal ablation of GSV (8–35 %) [7] (see ▶ **Table 1**).

The segment of AASV adjacent to the saphenofemoral junction is mostly interfascial (N2), the origin of the vein is formed by extrafascial tributaries (N3). Thus, the AASV is one of the seldom veins that has interfascial and extrafascial portions. This refers to the subdivision of venous networks in the leg into three nets: N1 for deep veins, N2 for interfascial veins and N3 for epifascial veins (tribiutaries) [19].

It runs laterally and parallel to the great saphenous vein (GSV) on the upper thigh and joins the saphenofemoral junction, more often between terminal and preterminal valves. At this level, it runs nearly always as an interfascial vein, so it has similar features as GSV: mostly straight course, lack of externally visible manifestations in case of isolated truncal incompetence and dilatation. Its total interfascial length ranges from 5 to 20 cm [7], but in anecdotal cases it reaches the upper knee level (personal data). The epifascial segment of the AASV can take its origin at the ventral and/or lateral aspect of the leg and thigh, it also can take the origin in more than one tributary. It pierces the fascia to continue as the described interfascial part. Rarely AASV joins GSV trunk at mid-thigh.

Being competent AASV tributaries are almost always invisible except for very thin persons. Being involved in varicose disease they can form few varicose patterns depending on tributaries location:

- Antero-lateral aspect of the thigh and lateral aspect of the leg with lateral bypassing of the patella (very frequently);
- Antero-medial aspect of the thigh and leg crossing over the patella (frequently);
- Medial location in below knee region in cases when AASV merges GSV without leaving fascial compartment (rarely) [8].

Prominent tortuous varicosities on the antero-lateral aspect of the thigh and lateral aspect of the knee and the leg are typical for AASV incompetence (▶ **Fig. 1**).

Level of joining into the GSV with variants (e. g. distally into GSV draining directly into the CFV)

AASV usually joins GSV in the region of SFJ at an average distance of 2 cm from the ostium [1]. In the vast majority of cases, this point corresponds to the segment between the terminal and preterminal valves, or, in other words, to saphenous arch, where other SFJ tributaries join as well (s. ▶ **Table 2**, Variant 1). This termination is the key to understanding of the origin of isolated AASV incompetence with no reflux into distal GSV. It happens, for example, when the terminal valve of the GSV is incompetent and reflux comes into AASV from common femoral vein (CFV). The preterminal valve of the saphenous arch is competent, saving GSV from reflux spreading.

In 90 % of cases AASV joins saphenous arch as a common trunk with inguinal tributaries: superficial epigastric or superficial circumflex iliac vein, or both [1]. Thus reflux can come into AASV not only from the CFV through the SFJ but also from pelvic veins through inguinal (proximal) tributaries.

Rarely AASV has a separate junction with CFV. In such cases AASV and GSV function independently (▶ **Fig. 2**).

Communicating veins between AASV and GSV

SFJ is not the single point where AASV is connecting to GSV. One or more communicating veins can link AASV and GSV in the mid-thigh [8]. These veins can be located either epifascial or interfascial. Communicating veins can deliver reflux from AASV to GSV and vice versa in the case, when initially reflux is only present in one of the mentioned saphenous trunks. For example, AASV is incompetent due to reflux coming from CFV through the incompetent terminal valve. Preterminal valve is competent, so GSV is competent in the proximal thigh. In this case AASV can "share" reflux to the distal segment of GSV through the communicating vein.

Similarly, when only GSV is affected by reflux in the upper thigh, the communicating vein can deliver reflux to the mid-thigh part of AASV.

AASV in Ultrasound

How to differentiate AASV from GSV

The AASV examination is usually started from the SFJ region. The transducer is placed horizontally immediately below the inguinal fold to look for transverse scan of the CFV, the common femoral artery (CFA) and the SFJ as a "Mickey Mouse sign". The SFJ forms Mickey's medial ear.

If the AASV joins the GSV very close to the junction (ostium), it can be seen as a "double ear" (▶ **Fig. 3**). In this case, lateral part of the "double ear" corresponds to the AASV, and medial – to the GSV [7].

Moving slightly down (mostly at the level when the femoral artery (FA) starts to run above the femoral vein (FV)) the AASV and the GSV can be seen below the saphenous fascia as two "saphenous eyes" (▶ **Fig. 4**).

At about the same level two lymph nodes (LN) surrounding the AASV (▶ **Fig. 5**) or at least one lymph node between the AASV and the GSV can be typically seen [9]. So if we find LN between the saphenous trunks in the groin area, the lateral trunk will be the AASV, and medial the GSV.

As a rule, there are no difficulties in US identification of the AASV, as well as its differentiation from the GSV or epifascial tributaries. One can trace the AASV course on the anterior aspect of the upper thigh, within fascial compartment, laterally to the GSV. Moreover, the AASV lies on the same axis as the femoral artery and the femoral vein, forming so-called "alignment sign" (▶ **Fig. 6**) [10]. The GSV is lying medially to the femoral vein and artery axis and commonly has not only thigh portion but also leg portion (▶ **Fig. 7**).

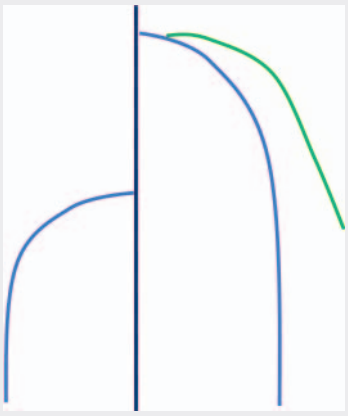
Due to interfascial laying of the AASV it is easy to distinguish it from the anterior thigh circumflex vein. This GSV tributary can also be identified in the anterior aspect of the thigh, similar to the AASV, but it almost does not have interfascial part. It reaches the SFJ area epifascially from the lateral aspect of the thigh, just piercing saphenous and muscular fascia to join the SFJ.

In case of identification of two veins in the fascial compartment of the upper thigh it can be difficult to differ the segmental duplication of the GSV from the AASV which can run close to the GSV (▶ **Fig. 8**).

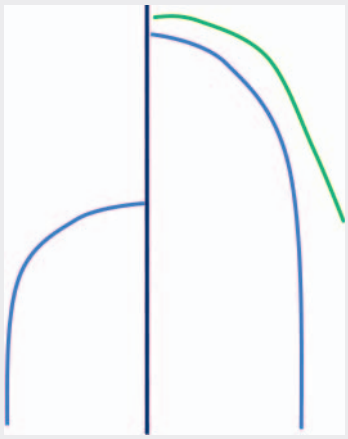
Here it is necessary to remember that the AASV will rather leave fascial compartment in its distal part while duplicated GSV will be identified between fascia layers throughout its course [11, 12]. Besides, the duplicated GSVs will lay closer to each other, and will be often bound together by an echogenic ligament (▶ **Fig. 9**).

In the distal half or distal one-third of the thigh the AASV is almost always absent in the fascial compartment.

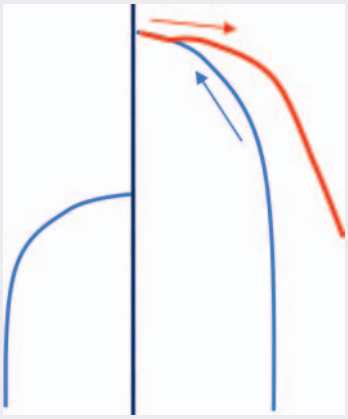
▶ **Table 2** Variations of accessory anterior saphenous vein.



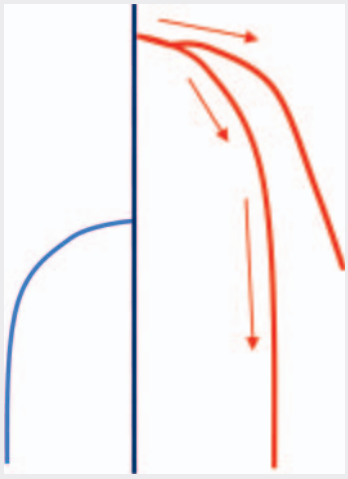
Variant 1: Typical anatomy of AASV with drainage of AASV into GSV next to
the sapheno-femoral junction. Source: Arrien GmbH.



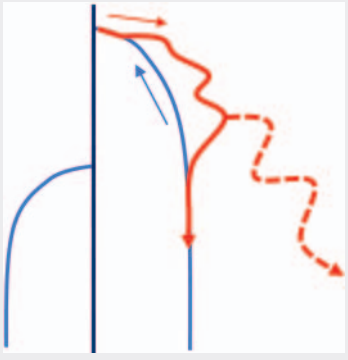
Variant 2: Separate junction of AASV into the deep venous system, independently from GSV. Source: Arrien GmbH.



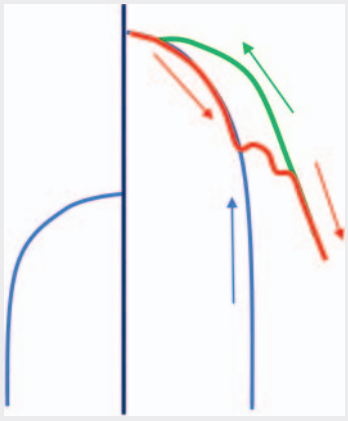
Variant 3: Reflux from common femoral vein through incompetent terminal valve into the AASV (red). The preterminal valve in GSV is competent. Source: Arrien GmbH.



Variant 4: Axial reflux into both, GSV and AASV. Source: Arrien GmbH.



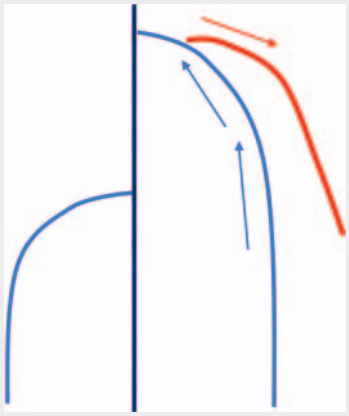
Variant 5: Reflux into AASV as depicted in3 with later filling of GSV V. communicans at the thigh. Source: Arrien GmbH.



Variant 6: Axial reflux in GSV till mid-thigh with filling of ASSV via communicating vein. Proximal AASV is competent or aplastic. Source: Arrien GmbH.

▶ **Table 2** (Continuation)

Variant 7: Reflux from groin tributaries feeding the AASV without participation of GSV. Source: Arrien GmbH.



Variant 8: Reflux from orthograde GSV into AASV. Source: Arrien GmbH.

Legends:

- AASV = accessory anterior saphenous vein (green)
- GSV = Great saphenous vein, Blue
- SSV = Small saphenous vein, light blue
- Deep venous system = dark blue
- Refluxive vein: Red

Complementary markers: E-point, first (upper) postero-medial tributary (UPMT) distance

Sometimes there are difficulties with identification of the saphenous trunk. This can occur if:

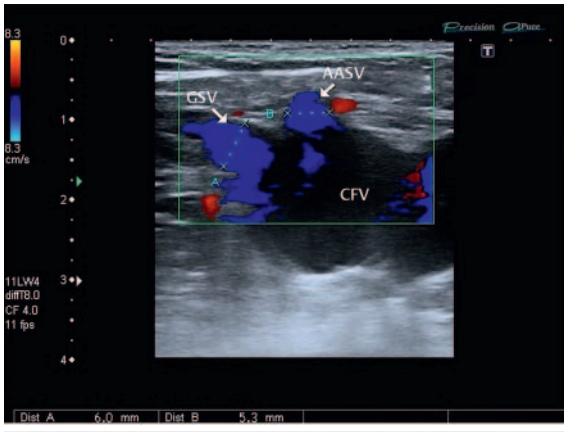
- the only one clearly visible saphenous vein joining the SFJ runs laterally to the usual path of the GSV on the thigh. This could be called single saphenous trunk, SST;
- the only saphenous vein at the thigh has short inter-fascial part (for example, proximal thigh only);
- especially, if this saphenous vein has in – between course (neither AASV nor GSV).

E-Point

Here so called complementary markers can be needed.

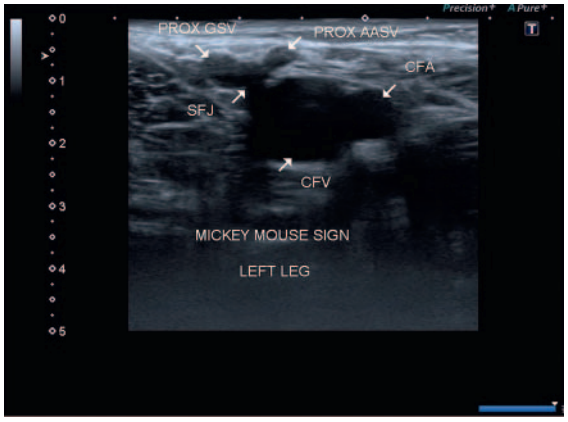
One of them is identification of the saphenous trunk in so-called E-point.

This term was proposed by S.Ricci to the point where GSV can be easily identified on the thigh during US examination. E-point is located 3–5 cm below SFJ, where GSV crosses over the adductor longus muscle (ALM) (▶ **Fig. 10**). Here GSV has a very superficial position, is covered with echogenic superficial fascia, and can be detected even in obese patients. So if the saphenous trunk

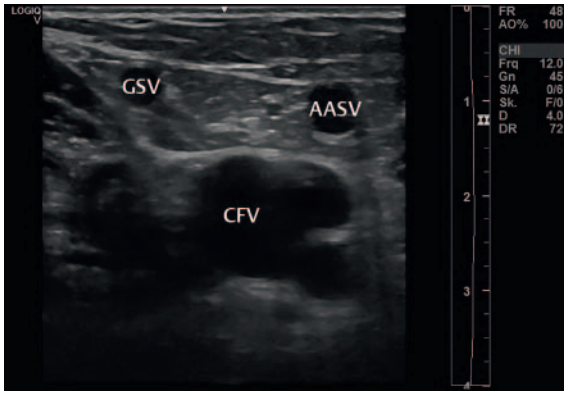


▶ **Fig. 2** Separate sapheno-femoral junctions: transverse view through the left groin. GSV **a** and AASV **b** are seen draining separately to CFV. Both junctions are competent. (CFV = Common femoral vein, GSV = great saphenous vein, AASV = accessory anterior saphenous vein). Source: Oksana Riabinska

is visible in the E-point, it can be defined as GSV. If the identified saphenous vein lies laterally to the E-point it means that it is AASV while GSV is hypoplastic in the groin area [13].



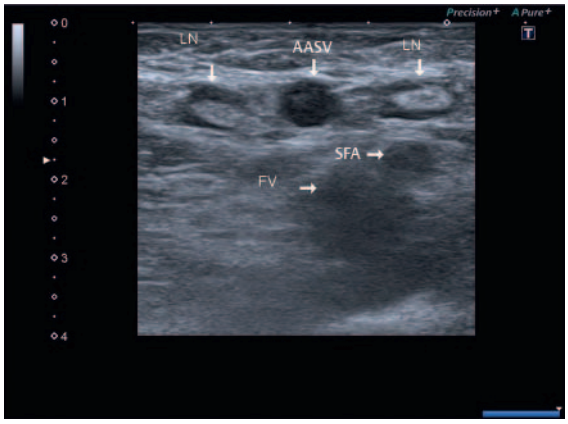
▶ **Fig. 3** Duplex ultrasound of the left sapheno-femoral junction, transverse view. "Mickey Mouse sign" in case when AASV joins GSV close to saphenous opening: Mickey's medial "ear" corresponds to GSV, lateral – to AASV. (CFV = Common femoral vein, CFA = Common femoral artery, SFJ = sapheno-femoral junction, GSV = great saphenous vein, AASV = accessory anterior saphenous vein, prox = proximal). Source: Oksana Riabinska



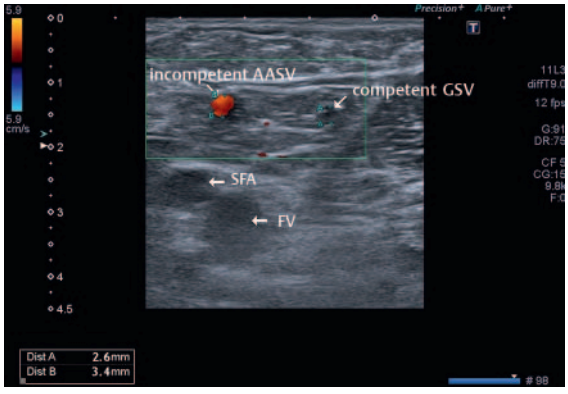
▶ **Fig. 4** The same leg, transverse view of AASV, GSV few millimeters below sapheno-femoral junction: AASV and GSV are visualized in the same fascial compartment (GSV = great saphenous vein, AASV = accessory anterior saphenous vein). Source: Oksana Riabinska

Distance between the junction and the posterior-medial tributary (UPMT)

The presence of only one saphenous vein in the thigh is not so rare. In a study published by Ricci et al., a single GSV in the thigh was found in 48 % out of 172 examined limbs, and a single AASV in 11 % [14]. In line with this study our work reports a single AASV presence in the thigh in 12 % of 978 legs [15].



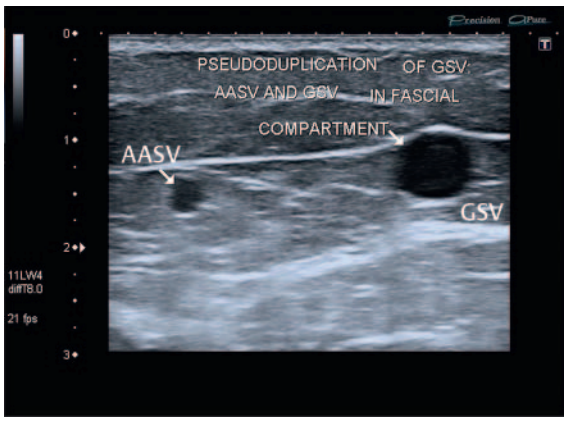
▶ **Fig. 5** Transverse view through the left groin. Lymph nodes (LN), surrounding the AASV. (FV = femoral vein, SFA = superficial femoral artery, AASV = accessory anterior saphenous vein). Source: Oksana Riabinska



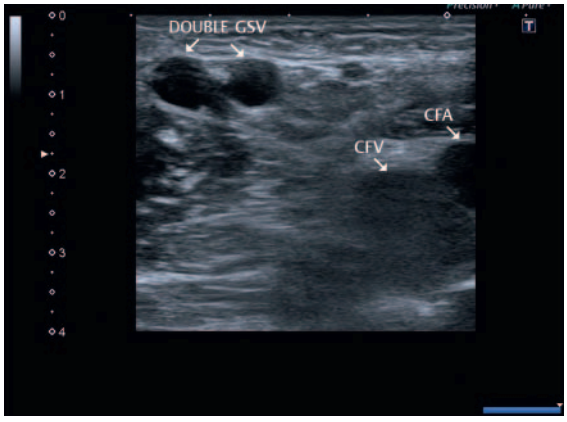
▶ **Fig. 6** Transverse view through the right groin. Incompetent AASV lies on the same axis as deep femoral vessels, forming "alignment sign", while competent GSV lies medially to the femoral vessels. (FV = femoral vein, SFA = superficial femoral artery, AASV = accessory anterior saphenous vein). Source: Oksana Riabinska

Another criterion that can be used for identifying the only one saphenous vein draining into the common femoral vein is the distance from the ostium to the first (upper) posterior-medial tributary (UPMT) of the saphenous trunk. The distance is measured in longitudinal ultrasound view, between the point, where the dorsal part of the GSV joins the common femoral vein, this means the footward margin of the ostium (▶ **Fig. 11b**). As a rule, this distance is much longer for GSV (56.9 ± 19.8 mm) in comparison to AASV (15.1 ± 7.0 mm) (▶ **Fig. 11a**). Thus, it was proposed to use the segment length between SFJ and UPMT as a differentiation criterion.

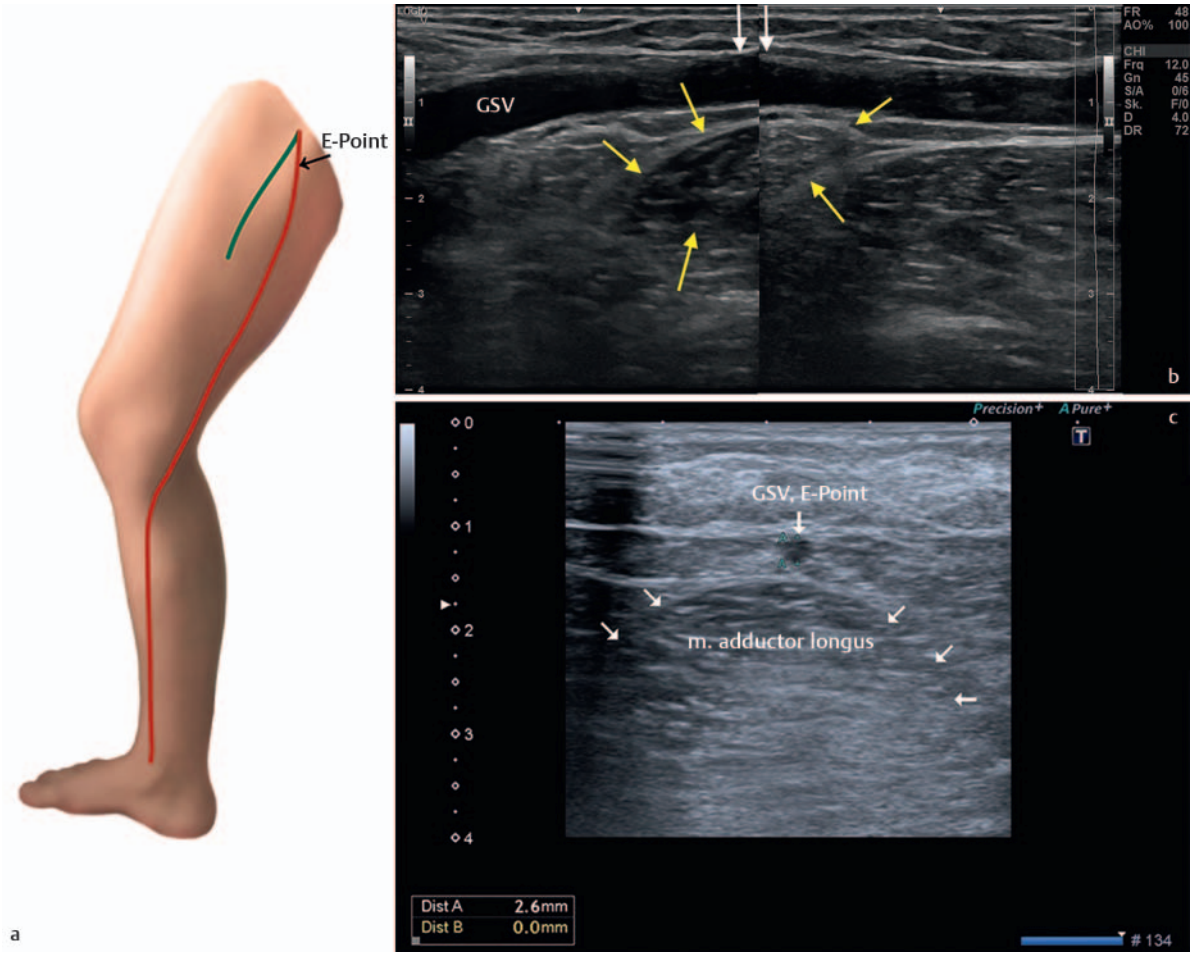
▶ **Fig. 7** Typical course of great saphenous vein and anterior accessory saphenous vein in the right leg. The anterior accessory saphenous vein lies laterally to the great saphenous vein and has a short interfascial course in the upper thigh (green), while GSV has both thigh and leg portions (red). Source: Oksana Riabinska



▶ **Fig. 8** Pseudo duplication of GSV: transverse view through the right upper thigh. Dilated GSV and normal AASV lie in the same fascial compartment at a distance about 2 cm. Few centimeters distally the AASV will leave fascial compartment.(GSV = Great saphenous vein, AASV = Accessory anterior saphenous vein). Source: Oksana Riabinska



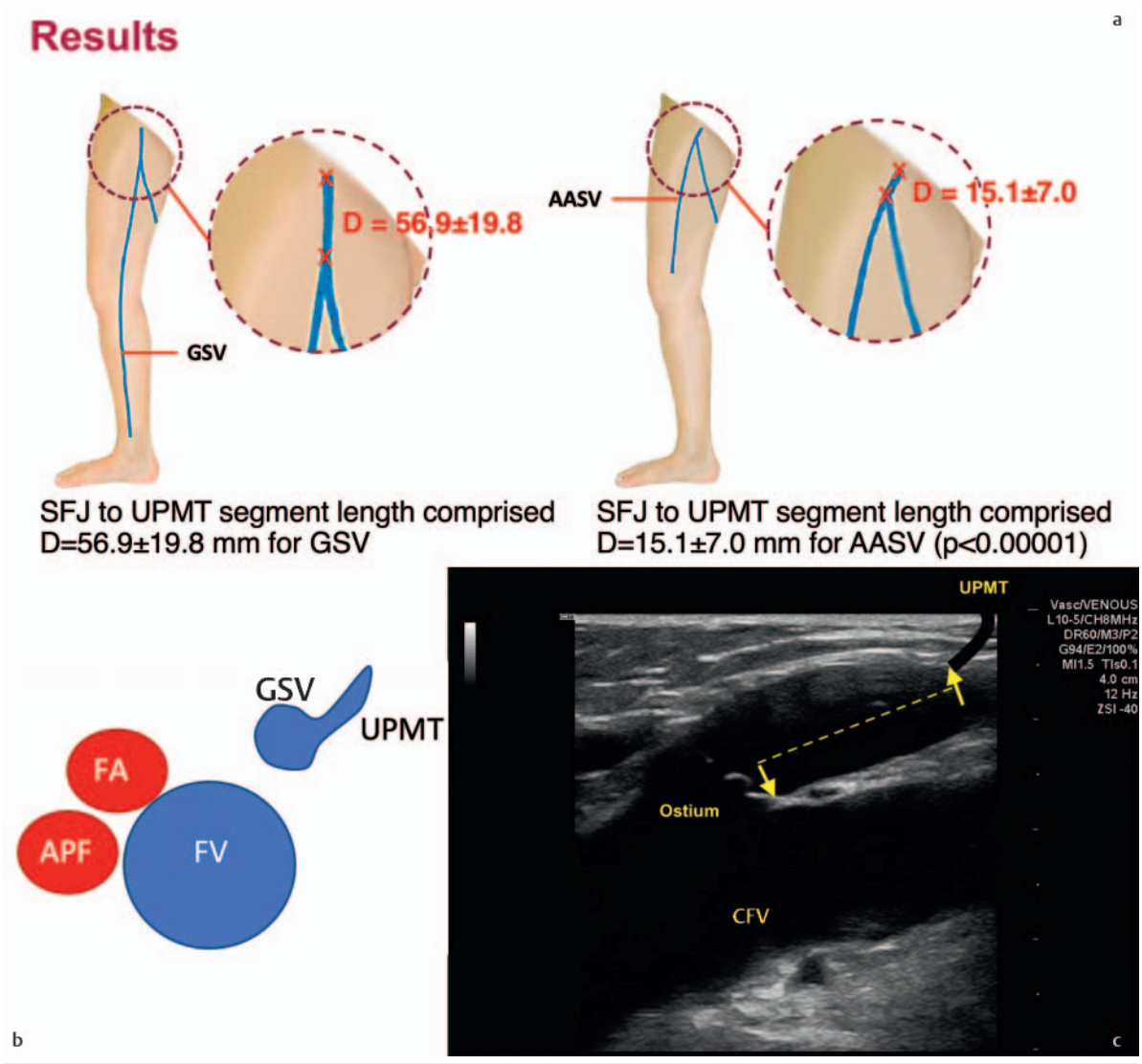
▶ **Fig. 9** True duplication of GSV. Transverse view 2 cm distally to the left groin. The duplicated dilated GSV veins lie close to each other. Laterally in the fascial compartment the unsigned AASV of small diameter is visualized. (CFV = Common femoral vein, CFA = Common femoral artery, GSV = great saphenous vein). Source: Oksana Riabinska



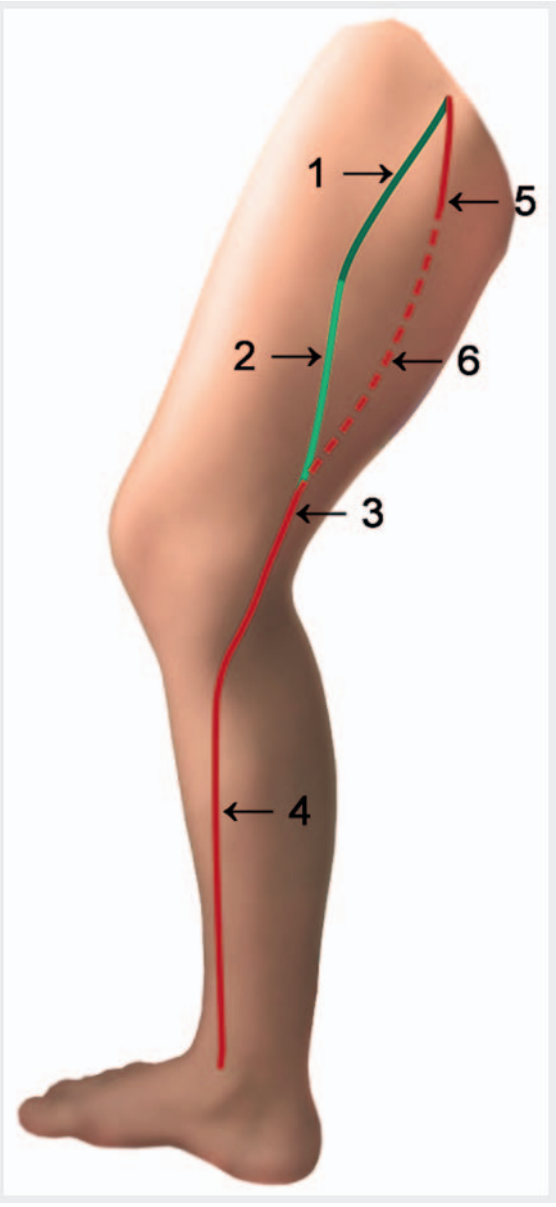
▶ **Fig. 10** **a** The location of the E-point (right leg): 3–5 cm below the sapheno-femoral junction, where the GSV crosses over a bulging adductor longus muscle, and can be easily detected by ultrasound imaging. Positive E-point corresponds to typical GSV anatomy. Source: Oksana Riabinska. **b** longitudinal view at the upper segment of the medial thigh over the course of the GSV. White arrow "E point", yellow arrow: M. adductor longus. Source: Oksana Riabinska. **c** cross section at the proximal medial thigh, GSV is very next to the skin. Source: Oksana Riabinska

The saphenous trunk would be defined as AASV at values beyond 40 mm and as GSV at larger values [16].

Interestingly, the total length of the saphenous trunk cannot be utilized to distinguish between AASV and GSV [16]. This fact has a few explanations. On the one hand, in about 15–30 % of cases researchers diagnose segmental aplasia or hypoplasia of the GSV on different levels, mostly in the lower thigh and in the knee area, so GSV visible by ultrasound could be shorter [17, 18]. On the other hand, when the AASV substitutes the hypoplastic/aplastic GSV on the upper thigh, sometimes it does not leave fascial compartment and merges GSV in the lower thigh. Distally GSV continues downwards at it's typical course in the leg (▶ **Fig. 12**). Finally, in the process of US examination the interfascial vein from the inguinal fold to the medial ankle is perceived as a single venous unit with total length much longer than AASV.



▶ **Fig. 11** Illustration of the procedure to differentiate between GSV and AASV. **a** Schematic representation of the study results on patients with only one saphenous trunk being present in the groin area measuring the distance from the saphenous opening to the first (upper) posterior-medial tributary (UPMT) of the saphenous trunk [15]: this distance was significantly longer for GSV (left) in comparison to AASV (right). Source: Oksana Riabinska. **b** Left Schematic representation of the upper posteromedial tributary (UPMT) in cross section. Right longitudinal view with exact measurement of the distance D between the distal margin of the Ostium and the confluence point of the tributary. Source: Oksana Riabinska.



▶ **Fig. 12** The course of AASV (Anterior accessory saphenous vein) and GSV (Great saphenous vein) in case of GSV groin hypoplasia and midthigh aplasia with AASV substitution: 1). AASV as a main saphenous trunk in the proximal thigh. It is projected over the deep femoral vessels (dark green); 2). The segment of the saphenous trunk in the midthigh that "shifts" medially from the deep vessels axis (light green; 3 and 4) segments of GSV in the distal thigh and leg with typical course (red) 5). Hypoplastic GSV in the groin area (red); 6). Absent (aplastic) GSV in the midthigh (dotted red). Source: Oksana Riabinska

CLINICAL CASE 1

A 28 years old female requested treatment of varicose veins in GSV territory. On physical examination, her lower extremity clinics included a bulging varicosity on the medial aspect of right leg (see ▶ **Fig. 13a**). Duplex sonography defined an incompetent SFJ and dilated incompetent saphenous trunk that projected over the deep vessels in the groin area and at the proximal thigh, but at the level of lower thigh and leg it had typical course of GSV. Thus, there was an aplasia or non-visualized hypoplasia of the groin GSV and a reflux via the AASV with drainage into the distal GSV (see ▶ **Fig. 12**). The total length of the refluxing saphenous trunk included thigh and proximal one third of the leg. Incompetent tributaries were identified in the medial aspect of the leg.

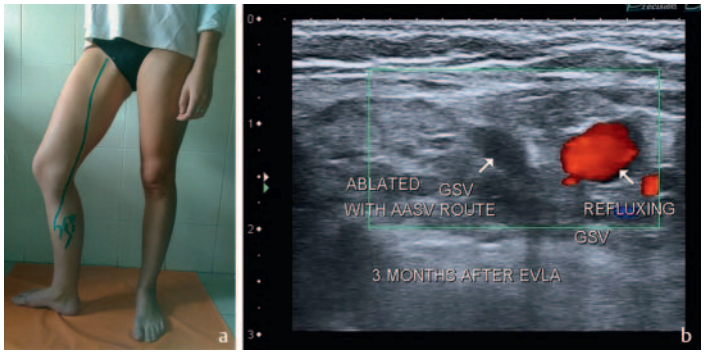
Mini-invasive surgical treatment including endovenous laser ablation of incompetent saphenous trunk (ASSV in the groin, GSV at midthigh down to below knee) and phlebectomies of varicosities led to disappearance of the visible veins.

Follow-up: At three months follow-up new dilated varicose veins were visible at the medial aspect of the leg. Ultrasound demonstrated a (new) refluxing GSV at the saphenofemoral junction, medially to the visible, closed AASV (see ▶ **Fig. 13b**). Thus, the beforehand hypoplastic GSV was dilated by a new reflux and fed new tributaries.

GSV Groin aplasia (or hypoplasia) with AASV substitution

GSV groin aplasia occurs in 6,6 % of legs with SFJ incompetence [15]. In the proximal 1/3 – ½ of the thigh single saphenous trunk (SST) projects over the deep femoral vessels (segment 1 in ▶ **Fig. 12**). Lower down it is displaced from the deep femoral vessel axis to the medio-caudal direction (segment 2 in ▶ **Fig. 12**). Starting from the inner knee joint surface down to the leg, it has the typical location of GSV (segment 3 and 4 in ▶ **Fig. 12**). Of note, in the point of the direction change, which occurs mostly in the mid-thigh one can frequently observe either a curvature in the sagittal plane (▶ **Fig. 14** left), or an interfascial varix (▶ **Fig. 14** middle), sometimes it even looks like a duplication (fig. ex ▶ **Fig. 14** right) of the saphenous trunk on the short distance (up to 20 mm).

Importantly, a hypoplastic (1–2 mm in diameter) interfascial vein is always present medially to the upper segment of SST. It has a total length of 50 to 80 mm and joins SFJ (Ex-▶ **Fig. 15**).



▶ **Fig. 13** **a** Preoperative image of the right leg, in green reflux path. Source: Oksana Riabinska. **b** Crosse section distally of the groin cease with closed AASV and refluxing GSV (red). Source: Oksana Riabinska

This hypoplastic vein has a GSV course, as far as it is seen in the E-point (see segment 5 in ▶ **Fig. 12**). In its distal part, this vein either leaves fascial compartment and follows an epifascial path or runs dorsally as posterior accessory saphenous vein (PASV), merging eventually with the Giacomini vein. Below the point where the hypoplastic vein changes its route the fascial compartment of the inner thigh is empty up to the distal third of the thigh (see segment 6 in ▶ **Fig. 12**) [15]. Probably, in terms of general terminology [19] in this case we can talk about groin hypoplasia of GSV and its segmental aplasia in the middle third of the thigh.

Patterns of reflux through AASV

In the majority of cases with AASV incompetence reflux filling AASV arises either from CFV, or from pelvic veins.

Reflux from CFV via GSV into AASV

If reflux arises from CFV, the terminal valve of GSV will be incompetent, and AASV will be refluxive from its groin portion. In this situation AASV can be extremely enlarged even with aneurism of its most cranial segment.

With competent preterminal valve (only AASV is refluxive at the thigh)

The preterminal valve might be competent and the distal GSV thus without reflux in the groin region. This is a pattern called “Stücker Type 1”. It occurs in 6 % of all the legs with reflux according to Zollmann (see ▶ **Table 1**) [4]. We can distinguish three situations:

- AASV is refluxive in its inter- and extrafascial portion without feeding the GSV, which is present, normal caliber and non refluxive between ankle and preterminal valve (see ▶ **Table 2**, variant 3).
- AASV is refluxive in its inter- and extrafascial portion, proximal GSV is present, normal caliber and competent. A collateral from the AASV (inter or extrafascial path) feeds the GSV, which then becomes incompetent further down, either only at the thigh, or also at the leg (▶ **Table 2**, variant 5).
- AASV is the single visible saphenous vein in the groin portion – and it feeds the distal GSV (groin segment hypoplasia and mid-thigh aplasia) (see ▶ **Fig. 12**).

With incompetent preterminal valve (AASV and GSV are refluxive)

With reflux via terminal valve into the AASV, the preterminal valve of the GSV could be also incompetent, with reflux through both, GSV and AASV (see ▶ **Table 2**, variant 4), occurring in 7 % of patients with indication for surgery according to Zollmann [4].

Reflux from CFV into isolated junction from AASV into CFV

Pure isolated AASV incompetence without risk of GSV involvement is possible only if AASV and GSV have separate junctions. Here both veins do not have common section, so if reflux comes to AASV from CFV, it will not “harm” groin portion of GSV.

Reflux from pudendal or epigastric veins into the AASV (competent TV and PTV).

If reflux filling AASV originates from the pelvic veins, both terminal and preterminal valves will be competent. As a rule, in this situation AASV will not be enormously enlarged, except few situations, for example, in pregnant or multiparous women.

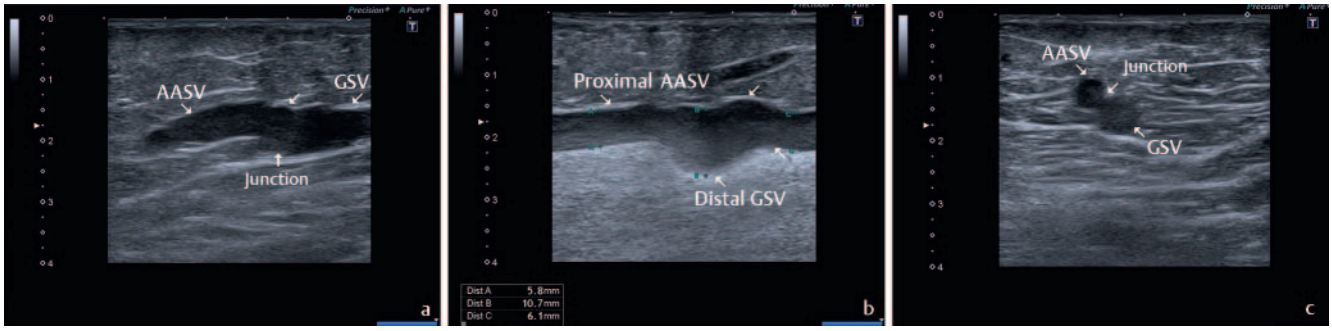
Reflux from GSV into AASV (Reflux from healthy GSV into AASV, terminal and preterminal valve competent)

Very rarely, in cases with only cosmetically bothering and not really large refluxive AASV the origin is neither a tributary of the groin nor the common femoral vein, but the healthy GSV feeding a tiny AASV with reflux.

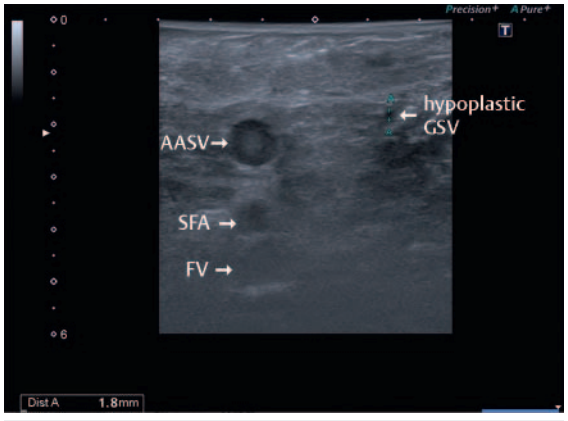
Other sources of reflux

Rarely AASV can have other sources of reflux, such as thigh perforators, or sapheno-popliteal junction, or abovementioned communicant veins, filling AASV from GSV in its distal part. In all those cases one should pay attention to sudden increase of AASV diameter distally to its groin portion with reflux occurrence, and then perform targeted search of its source.

The possibilities of reflux involving the AASV are schematically depicted in ▶ **Table 2**.



▶ **Fig. 14** Ultrasound images of the point where AASV merges GSV in the distal thigh (transition between segment 2 and 3 in ▶ **Fig. 12**). (AASV = Accessory anterior saphenous vein, GSV = Great saphenous vein, Juntion = confluence of both). Source: Oksana Riabinska



▶ **Fig. 15** Transverse view through the right groin. AASV as a main trunk and hypoplastic GSV (pay attention to small GSV diameter – 1,8 mm). Source: Oksana Riabinska

Clinical implication of findings

Treatment options of AASV in case of non-reflux

As far as AASV drains into SFJ just before saphenous opening to the deep vein (ostium), AASV and GSV often have common sources of reflux (CFV, pelvic veins). This fact can explain high amount of recurrent varicosities through AASV after open surgery or ablation of GSV [4, 6].

At the same time there are no data to prove that simultaneous treatment of non-refluxing AASV with refluxing GSV reduces the incidence of recurrences [20], even though the new results of the German investigation group (SYNCHRONOS Trial) is having different results, suggesting that competent AASV can turn refluxive after treatment of GSV [21].

So, at the moment modern ablation strategy for non-refluxing AASV in case of GSV incompetence is non treating the AASV, with postoperative follow-up. In case of occurrence of clinically significant AASV reflux or perhaps at its first ultrasound detection it can be treated with foam sclerotherapy or endoluminal thermal ablation. It is important to give informed consent on this point when performing endoluminal treatments.

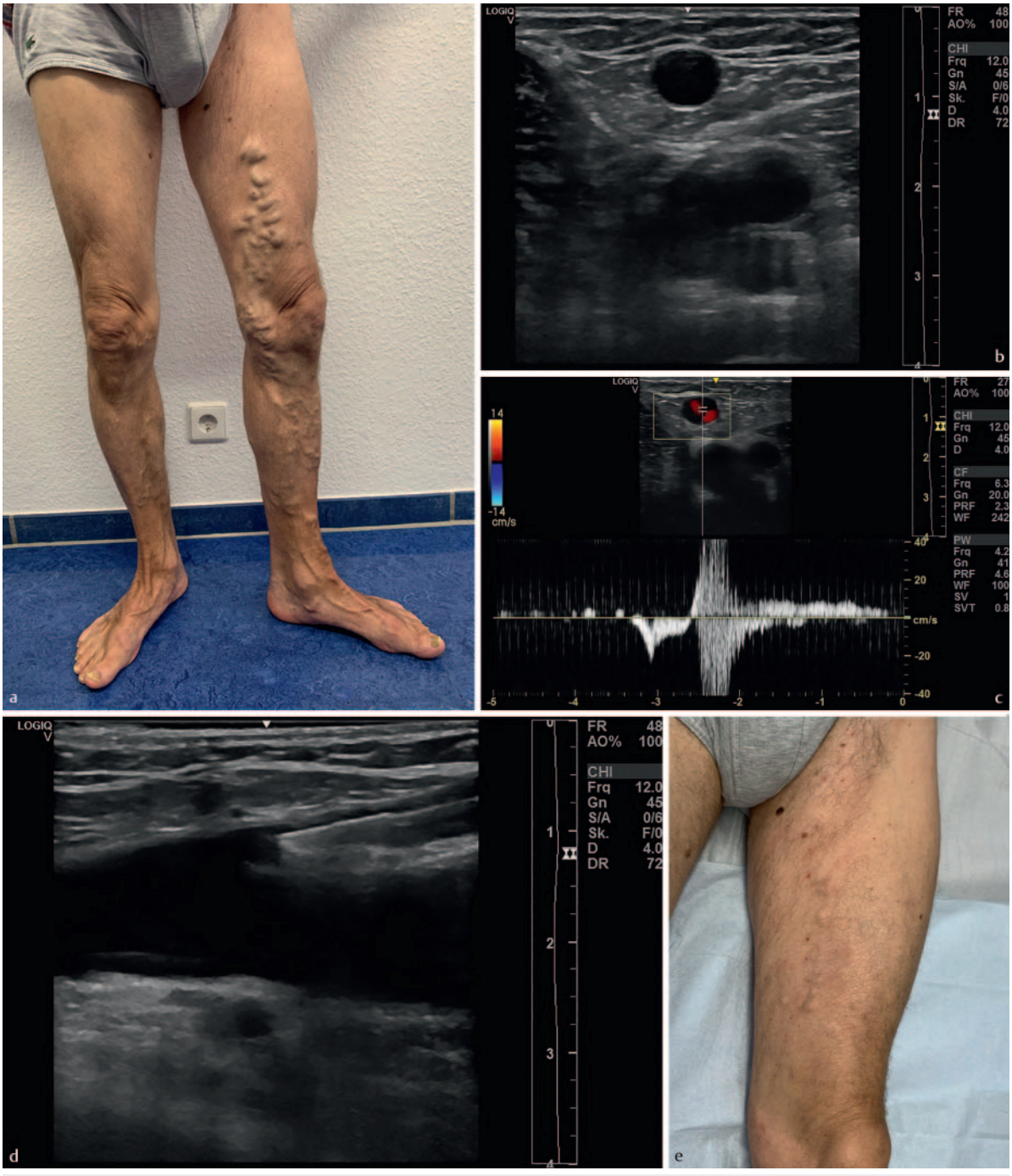
Treatment options in case of isolated AASV reflux with competent GSV (only Terminal valve incompetent, junction then feeding AASV) (Hach Stage I, Stücker Type 1)

According to the American College of Phlebology Guidelines, endovenous thermal ablation (EVLA or RFA) is recommended for the patients with isolated symptomatic incompetence of AASV (recommendation grade 1C) [20]. In practice, thermal ablation of AASV trunk is usually combined with either phlebectomies or foam sclerotherapy of epifascial AASV tributaries. Ultrasound guided foam sclerotherapy (UGFS) as monotherapy is also recommended for the treatment of AASV incompetence with the same recommendation grade. This method could be the treatment of choice in case with tortuous AASV when it is impossible to perform its long catheter (thermal) ablation or in case the AASV has reduced diameter.

Irrespective of the chosen treatment method it is necessary to remember that the very proximal refluxing portion of GSV remains untreated. There is no evidence if the longer segment of GSV will become incompetent in time.

The routine surgical treatment with high ligation of the SFJ, ligation of the GSV and stripping of the AASV is also applicable.

The GSV sparing surgery (CHIVA) proposes the so called lateral crossectomy, interrupting the AASV with flush ligation at the confluence with GSV. Very seldom after many years the GSV turns incompetent (Mendoza, non-published data). In the evolution of techniques, also under CHIVA auspices, the AASV might be closed with endoluminal heat up to the confluence with GSV, re-



▶ **Fig. 16** **a** AASV refluxing tributary. Source: Arrien GmbH. **b** cross section below the junction with AASV ventrally to the deep vein. Source: Arrien GmbH. **c** case 2–3 cross section 2 cm distally with reflux in AASV. Source: Arrien GmbH. **d** case 2–4 longitudinal view of the junction with LASER tip positioned distally to the ostium. e case 2–5 immediate result after LASER ablation of the 9 proximal cm of the saphenous trunk and sclerotherapy of the varicosities (1 % polydocanol foam, 10 ml). Source: Arrien GmbH

specting the terminal valve. The competent preterminal valve will hinder the reflux to fill the GSV.

However, we do not have published data to demonstrate the preference of CHIVA strategy in this group of patients.

Disadvantages of mono AASV ablation in case of groin GSV hypoplasia

In case of groin hypoplasia of GSV with AASV substitution the same treatment as in isolated AASV incompetence could be performed. But if reflux is spreading for the distal part of GSV (lower thigh and leg portion) it would be appropriate to perform ablation of these portions as well, up to

the lowest point of truncal reflux. Under the CHIVA approach, the proximal part of the GSV will recover as soon as the distal reflux path has been closed, thus the only closure of the junction part of AASV would be enough [22].

As always, the precise US examination is mandatory for the anatomic distinction between GSV and AASV, documenting the course of reflux and planning of treatment strategy. Otherwise in case of recurrence of SFJ reflux through hypoplastic GSV after ablation of "hybrid" saphenous trunk it can be wrongly interpreted as long stump of GSV after long catheter thermal or nonthermal ablation.

CASE 2

68 years old man with varicose veins starting next to the groin region since 20 years (▶ **Fig. 16a**), now provoking itching at the ankle. Large visible veins at thigh and leg. Ultrasound investigation shows one single saphenous trunk in the groin with incompetent terminal and preterminal valve, with lateral path (▶ **Fig. 16b, c**), thus this is a situation with GSV groin aplasia and refluxing AASV feeding the visible varicose vein at the midthigh. Further down the GSV is present and competent.
Treatment comprises laser ablation of the proximal trunk (▶ **Fig. 16d**) and sclerotherapy of the tributary, local anesthesia, 20 minutes of treatment duration, immediate result see (▶ **Fig. 16e**).

Conclusions

In the majority of cases anterior accessory saphenous vein is GSV's "satellite", that performs venous drainage from the same territory as GSV. It can be easily distinguished by ultrasound due to its lateral position in relation to GSV.

Sometimes it can substitute hypoplastic GSV becoming the main draining vein in the groin. Here it can be a challenge to perform its anatomic identification and, in case of truncal insufficiency, to choose the appropriate strategy for the treatment and postoperative monitoring.

Conflict of Interest

Declaration of financial interests

Receipt of research funding: no; receipt of payment/financial advantage for providing services as a lecturer: no; paid consultant/internal trainer/salaried employee: no; patent/business interest/shares (author/partner, spouse, children) in company: no; patent/business interest/shares (author/partner, spouse, children) in sponsor of this CME article or in company whose interests are affected by the CME article: no.

Declaration of non-financial interests

Erika Mendoza: General Secretary Dt. Gesellschaft für Phlebologie

Authors

Oksana Riabinska

MD, PhD, 1980–1986 study of human medicine at Kharkiv Medical Institute, Ukraine. 1987–1988 residency in internal medicine. 2004–2017 medical research at Institute of General and Emergency Surgery NAMS of Ukraine. There she has specialized on vascular ultrasound and endoluminal therapies of varicose veins. Since 2017, she works as phlebologist at the Institute of Veins, Kharkiv, Ukraine. She has specialized on duplex ultrasound of the superficial leg veins and the treatment of varicose vein disease.

Erika Mendoza

Dr. med., study of medicine in Madrid (Universidad Autónoma) until 1990; 1994 specialist in general medicine, Madrid, Spain. 1995–1996 general practitioner in her own medical practice in Trujillo, Spain. She learned duplex ultrasound for application of CHIVA method in Barcelona, Paris, Ferrara. Since 1997, she works in her own medical practice in Wunstorf/Hannover with focus on phlebology. 2003 specialty training in palliative care at Mildred-Scheel-Akademie, Cologne.

Correspondence

MD Oksana Riabinska
Institute of veins, Kharkiv
Yaroslava Mudrogo Street 37
61024 Kharkiv
Ukraine
oriabinska@gmail.com

Dr. Erika Mendoza
Venenpraxis Wunstorf
Speckenstraße 10
31515 Wunstorf
Deutschland
erika.mendoza@t-online.de

References

[1] Mühlberger D, Morandini L, Brenner E. Venous valves and major superficial tributary veins near the saphenofemoral junction. J Vasc Surg 2009; 49: 1562–1569

[2] Garcia-Gimeno M, Rodriguez-Camarero S, Taggarro-Villalba S et al. Duplex mapping of 2036 primary varicose veins. J Vasc Surg 2009; 49: 681–689

[3] Ricci S, Georgiev M. Ultrasound anatomy of the superficial veins of the lower limb. J Vasc Technol 2002; 26: 183–199

[4] Zollmann P, Zollmann C, Zollmann P et al. Determining the origin of superficial venous reflux in the groin with duplex ultrasound and implications for varicose vein surgery. J Vasc Surg Venous Lymphat Disord 2017; 5 (1): 82–86. doi:10.1016/j.jvsv.2016.10.001

[5] Shin S, Lee BB, Deaton DH et al. Endovenous laser ablation of the anterior accessory greater saphenous vein. Society for Military Vascular Surgery and Chesapeake Vascular Society 36th Annual Meeting. Bethesda, MD 2009 December 3–5

[6] Garner JP, Heppell PS, Leopold PW. The lateral accessory saphenous vein – a common cause of recurrent varicose veins. Ann R Coll Surg Engl 2003; 85: 389–392

[7] De Maesseneer MG. What a phlebologist should know about the anterior accessory saphenous vein? Phlebolymphology 2019; 26 (2): 66–72

[8] Caggiati A, Mendoza E, Murena-Schmidt R et al. Anatomy of the superficial veins. In: Mendoza E, Lattimer C, Morrison N, eds; Duplex ultrasound of superficial leg veins. Berlin Heidelberg: Springer; 2014: 201–215

[9] Lemasle P, Uhl JF, Lefebvre-Vilardebo M et al. Veines lymphoganglionnaires inguinales. Aspects anatomiques et échographiques. Conséquences sur la définition de la néogenèse. Conséquences thérapeutiques. Phlebologie 1999; 52 (3): 263–269

[10] Cavezzi A, Labropoulos N, Partsch H et al. A duplex ultrasound investigation of the veins in chronic venous disease of the lower limbs – UIP consensus document. Part II. Anatomy. Eur J Vasc Endovasc Surg 2006; 31: 288–299

[11] Ricci S, Caggiati A. Does a double long saphenous vein exist? Phlebology 1999; 14: 59–64

[12] Kockaert M, de Roos KP, van Dijk L et al. Duplication of the great saphenous vein: a definition problem and implications for therapy. Dermatol Surg 2012; 38: 77–82

[13] Ricci S, Moro l, Ferrini A et al. The E point: a new echographic great saphenous identification sign in specific anatomical variants and applications. Phlebology 2017; 32 (2): 120–124

[14] Ricci S, Georgiev M, Cappelli M. Définition de la veine saphène accessoire antérieure et de son rôle dans la maladie veriqueuse. Phlébologie 2004; 57: 135–140

[15] Riabinska O, Osmanov R. Hybrid AASV – GSV vein: incidence and peculiar course. Phlebological review. International Union of Phlebology Chapter Meeting, Krakow 2019 August 25–27, Abstract: 21

[16] Riabinska O. New ultrasound criterion for differentiation between GSV and AASV. Int Angiol 2018; 37 (Suppl. 1): 43

[17] Ricci S, Cavezzi A. Echo-anatomy of long saphenous vein in the knee region: proposal for a classification in five anatomical patterns. Phlebology 2002; 16: 111–116

[18] Caggiati A, Mendoza E. Segmental hypoplasia of the great saphenous vein and varicose disease. Eur J Vasc Endovasc Surg 2004; 28: 257–261

[19] Caggiati A, Bergan JJ, Gloviczki P et al. Nomenclature of the veins of the lower limb: extensions, refinements, and clinical application. J Vasc Surg 2005; 41 (4): 719–724. doi:10.1016/j.jvs.2005.01.018

[20] Gibson K, Khilnani N, Schul M et al. American College of Phlebology Guidelines – Treatment of refluxing accessory saphenous veins. Phlebology 2017; 32 (7): 448–452

[21] Fink C. Simultaneous preventive ablation of the AASV after thermal ablation of an insufficient great saphenous vein – the SYNCHRONOUS tria. Annual Meeting of the German Society of Phlebology, Leipzig 2020

[22] Zamboni P, Gianesini S, Menegatti E et al. Great saphenous varicose vein surgery without saphenofemoral junction disconnection. Brit J Surg 2010; 97: 820–825

Bibliography

Phlebologie 2021; 50: 24–38
DOI 10.1055/a-1246-5731
ISSN 0939-978X

Georg Thieme Verlag KG, Rüdigerstraße 14,
70469 Stuttgart, Germany