SPECIAL COMMUNICATION

Nomenclature of the veins of the lower limbs: An international interdisciplinary consensus statement

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An agreement on anatomic terminology is the foundation for a common language in medical science and for an effective exchange of information. A thorough review of the literature has shown need for revision and extension of the official *terminologia anatomica* with regard to the veins of the lower limb.

The foundation of this consensus document was laid by the faculty at a precongress meeting of The Fourteenth World Congress of the International Union of Phlebology (IUP), held in Rome on September 8-9, 2001, under the auspices of the IUP, the International Federation of Associations of Anatomists (IFAA), and the Federative International Committee on Anatomical Terminology (FICAT).

The official names of some veins have been changed according to the guidelines of the FICAT. In addition, previously unnamed veins have received names relevant to their anatomy and clinical significance. Some of the terminology recommendations are innovative, but were judged to be correct by members of the committee. (J Vasc Surg 2002;36: 416-22.)

BACKGROUND

Anatomy of the venous system forms the basis of clinical phlebology and is crucial to the correct evaluation and appropriate treatment of venous disorders. The current official anatomical nomenclature, *Terminologia Anatomica* (TA)[1] has well served anatomists and clinicians involved in investigation and treatment of venous diseases. Deficiency in the nomenclature of the veins of the lower limbs, however, became obvious as knowledge accumulated about their physiology and pathophysiology. In addition, clinicians introduced and used names not present in the TA. Incorrect interpretation of these names led to confusion and even to inappropriate treatment of venous disease. For example, the main deep vein of the thigh, named the "superficial femoral vein" by some clinicians has been erroneously considered to be a superficial vein. This has led to failure to treat deep vein thrombosis.[2] In current usage, the abbreviation "LSV" can represent either long saphenous vein or the lesser saphenous vein.[3] This has led to confusion as to which vein was being referred to. In addition, the official anatomical nomenclature has had an inadequate listing of perforating veins, saphenous vein collaterals, tributary veins, and some of the deep veins. Several of these unlisted veins are reasonably constant in location and connections. They need an official name to obtain terminologic conformity.

OBJECTIVE

The need for a revision and an extension of the *Terminologia Anatomica* with respect to the veins of the lower limbs has stimulated the development of this consensus document. The aim of this project was to offer an internationally acceptable venous anatomical terminology that would satisfy both anatomists and clinicians. Another goal was to avoid any confusion for the clinical practitioner.

The foundation of this consensus document was laid by the faculty at a meeting held in Rome, on September 8-9, 2001, during The Fourteenth World Congress of the International Union of Phlebology (IUP), under the auspices of the IUP, the International Federation of Associations of Anatomists (IFAA) and the Federative International Committee on Anatomical Terminology (FICAT). Input to the document was also solicited from experts not present at the meeting: G. B. Agus (Italy), E. Brizzio (Argentina), J. Caprini (USA), A. Cavezzi (Italy), D. Creton (France), J. Dortu (France), C. Feied (USA), C. Gillot (France), M. P.

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Competition of interest: nil.

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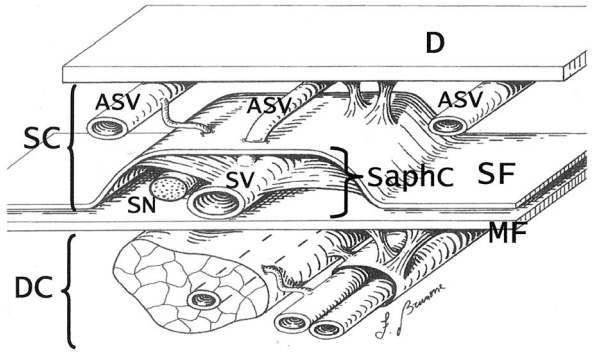

Fig 1. The saphenous compartment (SaphC) is bound superficially by the saphenous fascia (SF) and deeply by the muscular fascia (MF) and contains the saphenous veins (SV) accompanied by the saphenous nerve (SN). The accessory saphenous veins (ASV) lie external to this compartment, close to the dermis (D). *SC*, Superficial compartment; *DC*, deep compartment.

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In this consensus document, the names of some veins have been changed taking into account the past practice of the FICAT.[1] Previously unnamed veins receive names relevant to their anatomy and clinical significance. Eponyms, which are not part of the official anatomical terminology, have been excluded for the most part but a few well-known names have been retained and they are indicated in brackets to assist in identification.

PRELIMINARY DEFINITIONS

The anatomy of the veins of the lower limbs is extremely variable. Nevertheless, there is order in the variability.

The veins of the lower extremities are divided into three systems: the superficial, the deep, and the perforating venous systems. These are located in two main compartments: the superficial compartment and the deep compartment (Fig 1).

The **deep compartment** is bounded by the muscular fascia and contains deep veins. The **superficial compartment** is bounded deeply by the muscular fascia and superficially by the dermis. In English, it would formerly have been said that the tissue between the deep fascia and dermis was superficial fascia. However, it emerged that the term *fascia superficialis* meant different things in English, Italian, French, and German,[4] so the term was dropped and the current international term for the tissue is *tela subcutanea* whose English equivalent term is subcutaneous tissue. The subcutaneous tissue contains the saphenous veins and their tributaries, in addition to accessory and communicating veins.

Within the superficial compartment, ultrasound technology has revealed and traditional anatomical investigations have confirmed a separate **saphenous compartment.**[4,5] This saphenous compartment is bounded superficially by an hyperechoic **saphenous fascia** and deeply by the muscular fascia of the limb. The saphenous fascia is that portion of the membranous layer of the subcutaneous tissue[6] that overlies the saphenous veins (Figs 1 and 2) and their origins or roots (the marginal veins of the foot and the dorsal venous arch). In the past, the membranous layer of the subcutaneous tissue has been referred to by many inappropriate synonyms that should be abandoned: superficial fascia, Colles or Scarpa fascia, subcutaneous pseudofascia, superficial layer of the deep fascia, among others. The saphenous compartment contains the saphenous veins, accompanying arteries, and nerves. Saphenous tributaries, and accessory, collateral and communicating veins lie external to this compartment.[7]

The **accessory saphenous veins** are venous segments that ascend parallel to the saphenous veins, either anterior, posterior or more superficial with respect to the main trunk (Fig 1). This term should include all so-called *collateral veins*, which represent parallel pathways of alternative flow.[8]

The term **perforating veins** is reserved for those veins that perforate the muscular fascia to connect superficial veins with deep veins.[9] The term **communicating veins** is reserved for those veins that interconnect with other veins of the same system.[9]

SUPERFICIAL VEINS

The names of a few superficial veins have been changed from those in the official *Terminologia Anatomica,* the list of which has been extended by adding the names of a few anatomically and clinically relevant veins (Table I).

The term **great saphenous vein** *(vena saphena magna),* abbreviated as **GSV** should be used instead of terms such as long saphenous vein (LSV), greater saphenous vein, and internal saphenous vein. The omission of long saphenous vein is recommended so as to remove confusion caused by the abbreviation LSV, which could represent either the long saphenous vein or the lesser saphenous vein.[3] Similarly, the term **small saphenous vein** *(vena saphena parva)* abbreviated as **SSV,** should be used instead of the terms short, external, or lesser saphenous vein.

The term **confluence of superficial inguinal veins** *(confluens venosus subinguinalis)* corresponds to the veins of the saphenofemoral junction (SFJ). This is termed *Crosse* by many clinicians. It also corresponds to the *Venenstern unter dem Leistenband* of German anatomists.[10]

The term **anterior accessory great saphenous vein** *(vena saphena magna accessoria anterior)* indicates any venous segment ascending parallel to the GSV and located anteriorly, both in the leg and in the thigh.[11](Fig 3, *A*).

The term **posterior accessory great saphenous vein** *(vena saphena magna accessoria posterior)* indicates any venous segment ascending parallel to the GSV and located posteriorly, both in the leg and in the thigh.[12] (Fig 3, *B*). The leg segment corresponds to the so-called *Leonardo's vein* or *Posterior arch vein*.

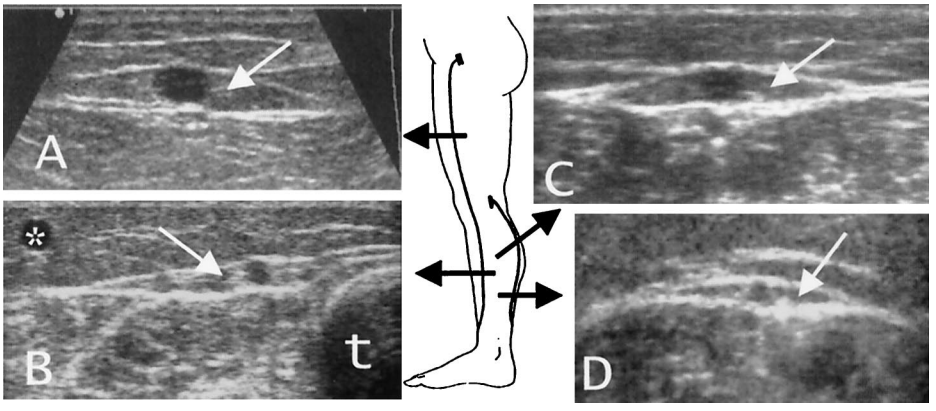

Fig 2. Sonography of the saphenous compartment (*white arrows*) along the great saphenous vein at the thigh (**A**) and at the leg (**B**) and along the small saphenous vein at the calf (**C**) and in the distal lower leg (**D**). Sonography clearly demonstrates that the saphenous veins are enwrapped by two hyperechoic *fasciae*. Note in **B,** the posterior accessory saphenous vein (*) and the tibia (t).

The term **superficial accessory great saphenous vein** *(vena saphena magna accessoria superficialis)* indicates any venous segment ascending parallel to the GSV and located more superficially above the *saphenous fascia*, both in the leg and in the thigh.[13](Figs 4, *A* and *B*).

The **cranial extension of the small saphenous vein** *(extensio cranialis venae saphenae parvae)* courses in the groove between the biceps femoris and semimembranosus muscles (Fig 3, *C*). This vein has been called "femoropopliteal vein."[14] A cranial extension of the SSV that communicates with the GSV via the posterior thigh circumflex vein is often termed the *vein of Giacomini.*

The **superficial accessory small saphenous vein** (*vena saphena parva accessoria superficialis*) ascends parallel to the SSV and is located more superficially, above the *saphenous fascia*[15] (Fig 4, *C*).

The **anterior thigh circumflex vein** *(vena circumflexa femoris anterior)* is a tributary vein of the GSV (or of the anterior accessory great saphenous vein) ascending obliquely in the anterior thigh.[16] It may originate from the lateral venous system (Fig 3, *D*).

The **posterior thigh circumflex vein** (*vena circumflexa femoris posterior*) is a tributary vein of the GSV (or of the posterior accessory great saphenous vein), which ascends obliquely in the posterior thigh. This vein may originate in the SSV, in its cranial extension, or in the lateral venous system.[17](Fig 3, *E*).

One or more **intersaphenous vein(s)** (*vena(e) intersaphena(e)*) course obliquely at the calf to connect the SSV with the GSV[18] (Fig 3, *C*).

The **lateral venous system** (*systema venosa lateralis membri inferioris*) is extended on the lateral thigh and leg.[19] It represents the remnant of the embryonic *vena marginalis lateralis.*

In TA, all the **veins of the foot** were listed as superficial veins. They should be identified according to their topographic location. It is important to note that the dorsal

Table I. Superficial veins

*Terminologia anatomica**	*Proposed terminology*
Greater or long saphenous vein	Great saphenous vein
	Superficial inguinal veins
External pudendal vein	External pudendal vein
Superficial circumflex vein	Superficial circumflex iliac vein
Superficial epigastric vein	Superficial epigastric vein
Superficial dorsal vein of clitoris or penis	Superficial dorsal vein of clitoris or penis
Anterior labial veins	Anterior labial veins
Anterior scrotal veins	Anterior scrotal veins
Accessory saphenous vein	Anterior accessory great saphenous vein
	Posterior accessory great saphenous vein
	Superficial accessory great saphenous vein
Smaller or short saphenous vein	Small saphenous vein
	Cranial extension of the small saphenous vein
	Superficial accessory small saphenous vein
	Anterior thigh circumflex vein
	Posterior thigh circumflex vein
	Intersaphenous veins
	Lateral venous system
Dorsal venous net of the foot	Dorsal venous network of the foot
Dorsal venous arch of the foot	Dorsal venous arch of the foot
Dorsal metatarsal veins	Superficial metatarsal veins (dorsal and plantar)
Plantar venous network	Plantar venous subcutaneous network
Plantar venous arch	
Plantar metatarsal veins	Superficial digital veins (dorsal and plantar)
Lateral marginal vein	Lateral marginal vein
Medial marginal vein	Medial marginal vein

*1998.

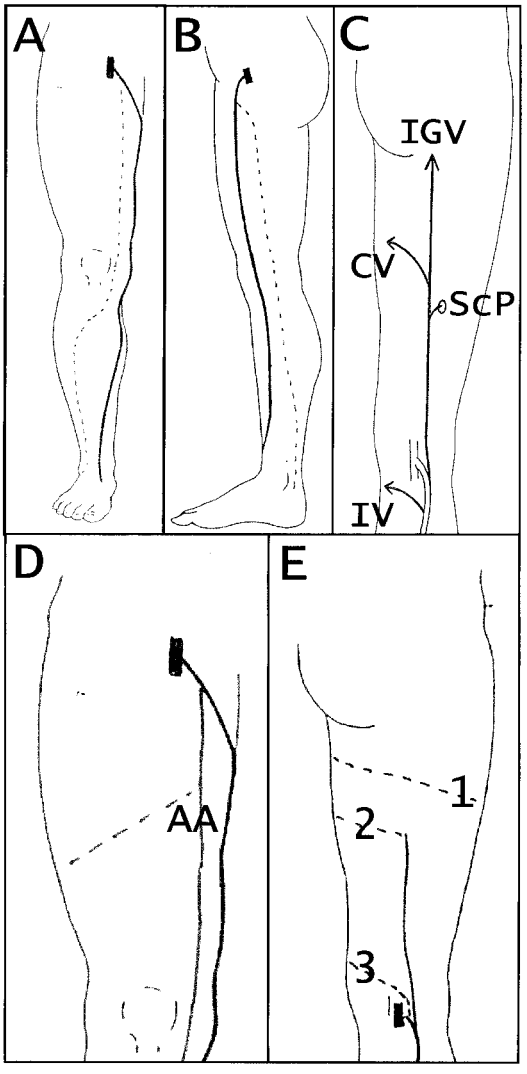

Fig 3. A, The course of the anterior accessory great saphenous vein (*dotted line*) is parallel and more anterior to the great saphenous vein (*black line*). **B,** The course of the posterior accessory great saphenous vein (*dotted line*) is parallel and more posterior with respect to the great saphenous vein (*black line*). **C,** The cranial extension of the small saphenous vein (*black line*) ends in the inferior gluteal vein (IGV) and can be connected to a sciatic perforator (ScP) or to the great saphenous vein via the posterior thigh circumflex vein (CV). One or more intersaphenous veins (IV) connect the small and great saphenous veins at the calf. **D,** The anterior thigh circumflex vein (*dashed line*) ascends obliquely in the anterior thigh to reach the anterior accessory great saphenous vein (AA) or the great saphenous vein. **E**: The posterior thigh circumflex vein (*dashed lines*) originates from the lateral venous plexus (*1*), or from the cranial extension of the small saphenous vein (*2*) or directly from the small saphenous vein (*3*). It courses obliquely in the posterior thigh toward the great saphenous vein.

venous arch and the lateral and medial marginal veins course into the foot extension of the saphenous compartments.[20]

DEEP VEINS

The names of a few deep veins have been changed from those in the TA, and the list has been extended by adding the names of a few anatomically and clinically relevant veins (Table II).

The **common femoral vein (***vena femoralis communis***)** runs from the confluence of the femoral vein and the deep femoral vein to the external iliac vein at the inguinal ligament. The **femoral vein** originates from the popliteal vein at the upper margin of the popliteal fossa and courses in the femoral canal. The unauthorized term "superficial femoral vein" should not be used for this vein because it is a deep vein[2] and is not in the official TA.[1]

The **profunda femoris vein** (*vena profunda femoris*, alternative term **deep femoral vein**) originates from the confluence of veins draining the muscles of the posterior and lateral thigh, the deep femoral communicating veins. The term *deep vein of thigh* listed in TA must be abandoned because it is nonspecific and misleading.

The **deep femoral communicating veins (***venae comitantes arteriae perforantium***;** formerly the *perforating veins*), are the *venae comitantes* (accompanying veins) of the perforating arteries that originate from the deep femoral artery. The term "perforating" veins should not be applied to these veins because it is reserved for veins connecting superficial and deep veins.[9]

The **sciatic vein** (*vena ischiadica*) is the main trunk of the primordial deep venous system (the *axial vein* of embryo). It courses close to the sciatic nerve and may assume an important role as a collateral pathway for the femoral vein.[21]

The term **"sural veins"** is not sufficient to appropriately designate the complex venous system of the calf. This should be designated as **soleal veins** (*venae solealis*)**,** the veins of the soleus muscle[22] and **gastrocnemius veins** (*venae gastrocnemii*).[23] The latter are divided in **medial gastrocnemius vein** (*vena medialis gastrocnemii),* **lateral gastrocnemius vein (***vena lateralis gastrocnemii***), and intergemellar vein** (*Vena intergemellaris*)**,** the vein ascending between the two heads of the gastrocnemius, just below the SSV.[24] (Fig 4, *D*).

The term **genicular venous plexus** (*plexus venosus genicularis*) should replace the term genicular veins. At the knee, deep veins do not correspond exactly to the branches of the popliteal artery (articular arteries). They are arranged in a complex plexus of interconnecting veins.[25]

The **deep veins of the foot** are the medial plantar veins, lateral plantar veins, deep plantar venous arch, deep metatarsal veins (plantar and dorsal), deep digital veins (plantar and dorsal), and the pedal vein.

PERFORATING VEINS

The perforating veins (PV; or "perforators") are numerous and very variable in arrangement, connection, size, and distribution.[26] In clinical practice, perforating veins have been associated frequently with names of authorities, often incorrectly from a historical point of view, and some-

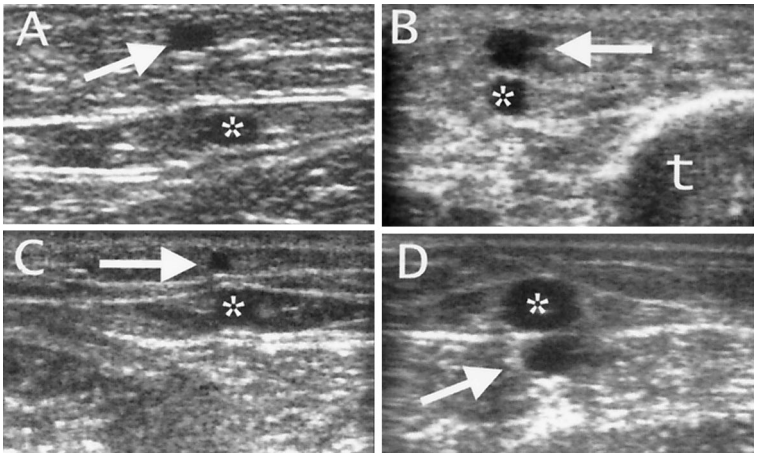

Fig 4. The superficial accessory great saphenous vein (*arrows*) at the thigh (**A**) and in the leg (**B**) can be recognized in its parallel and more superficial course with respect to the Great Saphenous Vein (*); *t*, tibia. **C,** The superficial accessory small saphenous vein (*arrow*) overlies the small saphenous vein (*) by which it is separated by the hyperechoic saphenous fascia. **D,** The intergemellar vein (*arrow*) courses deep to the small saphenous vein (*) between the heads of the gastrocnemius.

Table II. Deep veins

*Terminologia anatomica**	*Proposed terminology*
Femoral vein	Common femoral vein
	Femoral vein
Profunda femoris vein or deep vein of thigh	Profunda femoris vein or deep femoral vein
Medial circumflex femoral vein	Medial circumflex femoral vein
Lateral circumflex femoral vein	Lateral circumflex femoral vein
Perforating veins	Deep femoral communicating veins (accompanying veins of perforating arteries)
	Sciatic vein
Popliteal vein	Popliteal vein
Sural veins	Sural veins
	Soleal veins
	Gastrocnemius veins
	Medial gastrocnemius veins
	Lateral gastrocnemius veins
	Intergemellar vein
Genicular veins	Genicular venous plexus
Anterior tibial veins	Anterior tibial veins
Posterior tibial veins	Posterior tibial veins
Fibular or peroneal veins	Fibular or peroneal veins
	Medial plantar veins
	Lateral plantar veins
	Deep plantar venous arch
	Deep metatarsal veins (plantar and dorsal)
	Deep digital veins (plantar and dorsal)
	Pedal vein

*1998.

Table III. Perforating veins

Main groups	*Subgroups*
Foot perforators	Dorsal foot pv or intercapitular veins
	Medial foot PV
	Lateral foot PV
	Plantar foot PV
Ankle perforators	Medial ankle PV
	Anterior ankle PV
	Lateral ankle PV
Leg perforators	Medial leg PV
	Paratibial PV
	Posterior tibial PV
	Anterior leg PV
	Lateral leg PV
	Posterior leg PV
	Medial gastrocnemius PV
	Lateral gastrocnemius PV
	Intergemellar PV
	Para-achillean PV
Knee perforators	Medial knee PV
	Suprapatellar PV
	Lateral knee PV
	Infrapatellar PV
	Popliteal fossa PV
Thigh perforators	Medial thigh PV
	PV of the femoral canal
	Inguinal PV
	Anterior thigh PV
	Lateral thigh PV
	Posterior thigh PV
	Posteromedial
	Sciatic PV
	Posterolateral
	Pudendal PV
Gluteal perforators	Superior gluteal PV
	Midgluteal PV
	Lower gluteal PV

PV, Perforator vein.

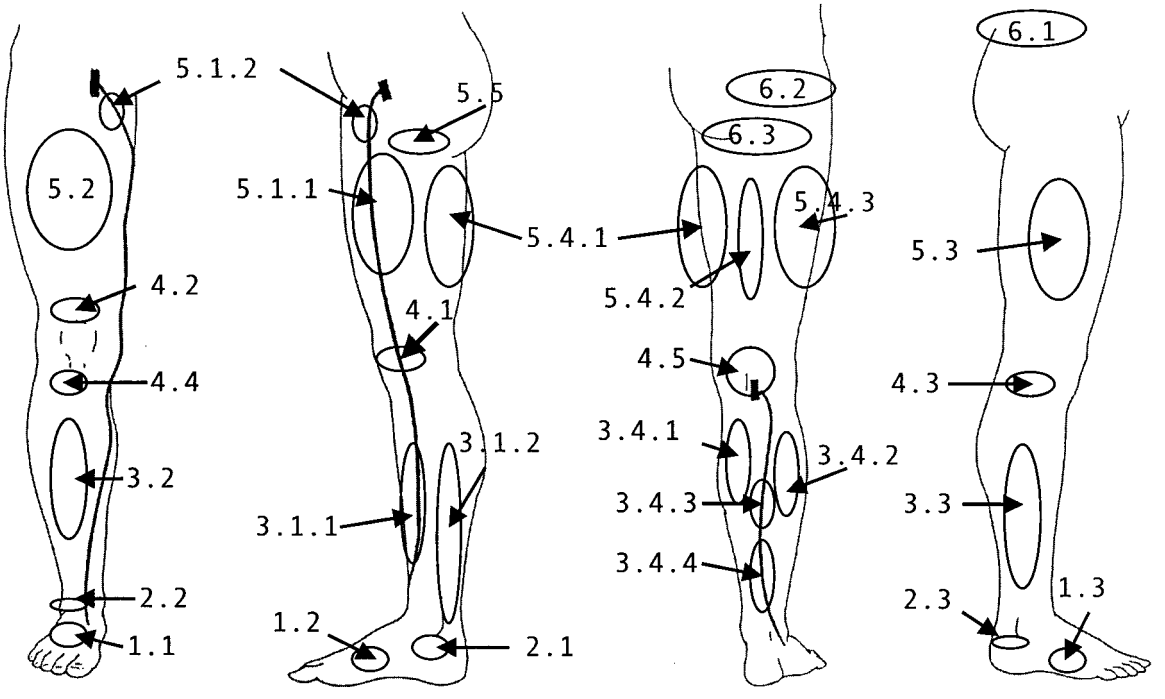

Fig 5. Schematic representation of the topography of the main groups of perforating veins (PVs). Foot PVs: *1.1*, dorsal foot PV; *1.2*, medial foot PV; *1.3*, lateral foot PV. Ankle PVs: *2.1*, medial ankle PV; *2.2*, anterior ankle PV; *2.3*, lateral ankle PV. Leg PVs: *3.1.1*, paratibial PV; *3.1.2*, posterior tibial PV; *3.2*, anterior leg PV; *3.3*, lateral leg PV; *3.4.1*, medial gastrocnemius PV; *3.4.2*, lateral gastrocnemius PV; *3.4.3*, intergemellar PV; *3.4.4*, para-achillean PV. Knee PVs: *4.1*, medial knee PV; *4.2*, suprapatellar PV; *4.3*, lateral knee PV; *4.4*, infrapatellar PV; *4.5*, popliteal fossa PV. Thigh PVs: *5.1.1*, PV of the femoral canal; *5.1.2*, inguinal PV; *5.2*, anterior thigh PV; *5.3*, lateral thigh PV; *5.4.1*, posteromedial thigh PV; *5.4.2*, sciatic PV; *5.4.3*, posterolateral thigh PV; *5.5*, pudendal PV. Gluteal PVs: *6.1*, superior gluteal PV; *6.2*, midgluteal PV; *6.3*, lower gluteal PV.

times misleading. Instead, descriptive terms designating location are preferred. Perforators are grouped on the basis of their topography, as in Table III and in Fig 5.

The **perforators of the foot** *(venae perforantes pedis)* are divided into **dorsal foot perforators,** with their equivalent term **intercapitular veins, medial foot perforators, lateral foot perforators, and plantar foot perforators,** according to their location.[27]

The **ankle perforators** *(venae perforantis tarsalis)* are designated in **medial ankle perforators, anterior ankle perforators,** and **lateral ankle perforators,** according tp their topography.[27]

The **perforators of the leg** *(venae perforantes cruris)* are divided infour main groups. The perforators of the **medial leg** are designated as paratibial and posterior tibial. **Paratibial perforators** connect the main trunk or trbutaries of the GSV with the posterior tibial veins and course close to the medial surface of the tibia. These correspond to the so-called Sherman PV (at the lower and mid leg) and Boyd PV (at the upper leg). **Posterior tibial perforators** (Cockett perforators)[28]connect the posterior accessory great saphenous vein with the posterior tibial veins. These correspond to the so-called Cockett PV. They should not be named first, second, and third. As recommended by Frank Cockett,[29] they can be indicated topographically as upper, middle, and lower.

The **anterior leg perforators** pierce the anterior tibial compartment and connect the anterior tributaries of the GSV to the anterior tibial veins.

The **lateral leg perforators** connect veins of the lateral venous plexus with the fibular veins.

The **perforators of the posterior leg** are divided into **medial gastrocnemius perforators** (in the medial calf), **lateral gastrocnemius perforators** (in thelateral calf), **intergemellar perforators** (connecting the SSV with the calf veins, also called "mid-calf perforator of May"), **para-Achillean perforators** (connecting the SSV with the fibular veins; also called "perforator of Bassi").

The **perforators of the knee** *(venae perforantes genus)* are designated as **medial knee perforators, suprapatellar perforators, lateral knee perforators, infrapatellar perforators, popliteal fossa perforators**, according to their location.

The **perforators of the thigh** *(venae perforantes femoris)* are grouped on the basis of their topography. On the medial thigh are the **perforators of the femoral canal** (Dodd) and the **inguinal perforators,** which connect the GSV (or its tributaries) with the femoral veinat the groin.

The **anterior thigh perforators** pierce the quadriceps femoris. The **lateral thigh perforators** pierce the lateral muscles of the thigh. On the **posterior thigh,** Perforators are designated as **posteromedial thigh perforators (**those piercing the adductor muscles), **sciatic perforators** (lying along the midline of the posterior thigh), **posterolateral thigh perforators** (those piercing the biceps femoris and semitendinosus muscles, also called "perforator of Hach"), and **pudendal perforators.**

The **perforators of the gluteal muscles** *(venae perforantes glutealis)* are divided in **superior, mid,** and **lower** perforators.[29]

CONCLUDING REMARKS

A common anatomical terminology is the foundation for a common language in phlebologic sciences. Further, such a common language is important for investigation of the venous system and for accurate diagnosis and correct treatment of venous disorders. Universally accepted new terminology will facilitate effective international exchange of information.

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