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GUIDELINES
MEDICAL EDUCATION

European training requirements in vascular surgery

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1. Introduction

1.1 Preamble

The Union Européenne des Médecins Spécialistes (UEMS) is a non-governmental organization representing national associations of medical specialists (over 1.6 million) at the European level. It has strong links and relations with European institutions (Commission and Parliament), the other independent European medical organizations and the European medical/scientific societies. With a current membership of 40 national associations and 43 specialist sections and European boards, the UEMS promotes the free movement of medical specialists across Europe while ensuring the highest level of training which will pave the way to the improvement of quality of care for the benefit of all European citizens. The UEMS areas of expertise notably encompass Continuing Medical Education, Post-Graduate Training and Quality Assurance. It

is the UEMS conviction that the quality of medical care and expertise is directly linked to the quality of training provided to the medical professionals. Therefore, the UEMS committed itself to contribute to the improvement of medical training at the European level through the development of European standards in the different medical disciplines. One of the added values of the UEMS is the development of new harmonized models for the training of the next generation of medical specialists, and of high standards of clinical practice, hence improved care for patients throughout Europe. It is not important where doctors are trained, they should have at least the same core competencies.

The first step to create an organization to unite vascular surgeons throughout Europe and try to harmonize rules and specialist training was in St. Vincent (Aosta, Italy) in 1991. It was in a meeting organised by Domenico Palombo from March 11 to 14, gathering for first time the represen-

tative delegates of national societies of vascular surgery of 10 European countries (Italy, Germany, France, Belgium, The Netherlands, Denmark, UK, Greece, Portugal, and Spain). As a consequence of this meeting, the Council of Vascular Surgeons of the European Community (EEC) was created to carry out the conclusions of these sessions. The first document was for describing the definition of vascular surgery, including the importance of education.

Although from 1962 there was a specialist section of the main disciplines practiced in the member States in UEMS, vascular surgery was not represented. A few months later, the council of vascular surgeons approach the UEMS. After a phase of negotiation, the Council had to dissolve into the subsection of vascular surgery under the umbrella of the UEMS's monosection of surgery. The subsection quickly became the Division of Vascular Surgery of the UEMS and the activity of the Council was stopped (Edinburgh, 1992).

Initially, there was strong opposition from specialty section of surgery and the European Board of surgery to the establishment of a European Board of Vascular Surgery. The change in the rules governing the acceptance of a specialty in the UEMS, from recognition of two thirds of European Union (EU) countries to recognition in one third, and the hard work of European vascular surgeons allowed the creation of European Board of Vascular Surgery independent of surgery board in 1996.

The first task of the Council of Vascular Surgery Division and European Board of Vascular Surgery was to develop and deliver the EBSQvasc (European Board of Surgery certification of quality of training in vascular surgery) assessment, which took place in Venice (Italy) in 1996, and subsequently every year and nowadays 3 times per year as European Board of Vascular Surgery exam.

In 2004 the Section of Vascular Surgery became independent and separate and in accordance with the statutes of the UEMS Section and Board of Vascular Surgery: "The main objective is to guarantee the highest standards of care in the field of the Vascular Surgery in the countries of the EU, by ensuring that the training of the specialist doctor is raised to the highest possible level."

In some countries in Europe, vascular surgery (VS) is not a monospecialty and training in them is very diverse. The aim of this document was to provide definitions of VS specialist competencies and procedures as well as how to document and assess them.

1.2 Definition of vascular surgery

Vascular surgery is the clinical and scientific discipline concerned with the diagnosis, treatment and prevention of

diseases affecting arteries, veins and lymphatics excluding vessels of the brain and heart.

This discipline originates from various fields in European countries in the last 50 years; in some countries it arises from trauma surgery, in others from general surgery while in others from cardiovascular surgery.

The increase of the prevalence of vascular disease in the EU, the increase in the mean age of our population and the technological development that has taken place in the last 30 years in the diagnosis and treatment of vascular diseases, has allowed vascular surgery to assume a well-defined identity as an autonomous specialty throughout the EU.

The different etiologies of vascular diseases, the interaction between vascular disease and the integrity of the patient's body and the involvement of the vessels by non-vascular pathologies significantly impaired the research activity and the interactions of Vascular Surgery with a long list of basic sciences as well as with other clinical specialties. Nowadays vascular surgery is not just a monospecialty dealing with the diagnosis and therapy of all vascular diseases but is also a key component of multispecialist teams working in the treatment of various pathologies; the role of vascular surgery in the treatment of bone or abdominal oncological pathologies, in the treatment of patients with diabetic foot and patients with end stage disease that need vascular access for hemodialysis are clear examples of involvement of our discipline in the multi-specialty path of diagnosis and treatment of very complex disease and frail patients.

Proper diagnosis and treatment are, of course, dependent on adequate training of dedicated surgeons, and since vascular surgery is a specialty highly dependent on maximum aptitude, it is becoming clear to the public that it is totally unacceptable to practice vascular surgery without a well-structured training program which must provide knowledge on the etiology, pathophysiology, diagnostics and therapy of arterial, venous and lymphatic vascular diseases. Regarding therapy vascular surgeons are trained in surgical, endovascular, and nonsurgical means; therefore, the definition of vascular surgery includes all the possible and modern therapies of vascular diseases.

In conclusion vascular surgery is a discipline that addresses all the needs of the patient with vascular diseases and whose definition is well described by the adjectives "clinical" and "scientific;" this is not a fortuitous conjunction when considered in the light of the spectacular advances for the basic vascular sciences, the diagnostics, and the treatment options that have occurred within a couple of generations.

1.3 Vascular surgery in Europe

By recognizing vascular surgery as a separate and independent section within the UEMS, VS has been recognized as a monospecialty in Europe. The status of the specialty, however, varies among EU countries, but also training curriculum, content and completion of logbooks, trainee evaluation, certifying bodies and board examination. In the vast majority of member states VS is an independent specialty whilst the remainder fall within general surgery (Table I). Accreditation of training program is usually undertaken by National governments or alternatively by national vascular societies. Finally, the examination process is under the responsibility of different bodies including government, vascular societies, or universities. A list of the EU vascular societies may be found attached.

The mean duration of training as monospecialty varies between 5 and 7 years and is shorter in countries that offer independent certification. In almost all countries endovascular training is included in VS curriculum. There are, however, a wide range of specialties that perform endovascular procedures including cardiology, interventional radiology or angiology. As a result, there is a differential in workload and training opportunities in endovascular procedures. A previous survey showed a significant heterogeneity of training centers and of their methods for the evaluation of the trainees. Therefore, it would be desirable to implement a system for accreditation and periodical assessment of the vascular training centers.

National European vascular surgery societies include the following:

- Austria – Österreichische Gesellschaft für Gefäßchirurgie (www.vasc-surg.at);
- Belgium – The Belgian Society for Vascular Surgery (BSVS) (www.bsvs.org/en);
- Bulgaria – Bulgarian National Society of Vascular and Endovascular Surgery (www.bnsavs.org);
- Croatia – Croatian Society for Vascular Surgery (www.hdvk.org);
- Cyprus – Cyprus Society of Vascular and Endovascular Surgery (CSVES) (www.csves.org);
- Czech Republic – The Czech Society for Cardiovascular Surgery (www.cskvch.cz);
- Denmark – Dansk Karkirurgisk Selskab, DKKS (www.karkirurgi.dk);
- Finland – Finnish Society for Vascular Surgery (www.verisuonikirurgit.yhdistysavain.fi);
- France – Société de Chirurgie Vasculaire de Langue Française (www.vasculaire.com);

- Germany – Deutsche Gesellschaft für Gefäßchirurgie Gefäßmedizin (www.gefaesschirurgie.de);
 - Greece – Hellenic Society of Vascular and Endovascular Surgery (www.vascularsociety.gr);
 - Hungary – Hungarian Society for Angiology and Vascular Surgery (www.angiologia.hu);
 - Ireland – The Vascular Society of Great Britain and Ireland (www.vascularsociety.org.uk);
 - Italy – Società Italiana di Chirurgia Vascolare ed Endovascolare (SICVE) (www.sicve.it);
 - Latvia – Latvian Society for Vascular Surgery (www.LFB.lv);
 - Lithuania – Lithuanian Society of Vascular Surgery (www.litvasc.org);
 - Luxembourg – Société Luxembourgeoise de Chirurgie Vasculaire (www.slcv.lu);
 - Malta – Medical Association of Malta (www.uems-vascular.com/national-societies);
 - the Netherlands – Dutch Society for Vascular Surgery (www.nvvv-vaatchirurgie.nl);
 - Norway – The Norwegian Society for Vascular Surgery (www.karkirurgi.no);
 - Poland – Polish Society for Vascular Surgery (www.ptchn.com.pl);
 - Portugal – Sociedade Portuguesa de Angiologia e Cirurgia Vascular (SPACV) (www.spacv.org);
 - Romania – Romanian Society of Vascular Surgery (www.srcv.ro);
 - Slovakia – Slovak Society of Vascular Surgery (SkMA) (www.sscch.sk/portal/en/home-2);
 - Slovenia – Slovenian Society of Vascular Surgery (www.zilni.kirurg.si);
 - Spain – Sociedad española de Angiología y Cirugía Vascular (SEACV) (www.seacv.es);
 - Sweden – The Swedish Society for Vascular Surgery (SSVS) (www.ucr.uu.se/ssvs);
 - Switzerland – Swiss Society for Vascular Surgery (www.swissvasc.ch);
 - Turkey – Turkish Society of Vascular and Endovascular Surgery (<https://uvcd.org.tr/#>);
 - UK – The Vascular Society of Great Britain and Ireland (www.vascularsociety.org.uk).
- European societies for vascular surgery include the following:
- ESVS – European Society for Vascular Surgery (www.esvs.org);
 - ESCVS – European Society for Cardiovascular Surgery (www.escvs.com).

The European Societies for Vascular Surgery are detailed in Table I.

TABLE I.—European societies for vascular surgery.

	Country	Specialty type	Training program accredited by	Admission	General surgery training (y)	Vascular surgery training (y)	Endovascular training (y)	Board examination	Assessment
1	Austria	I	Medical chamber	Local interview	2	4	Included in vs. curriculum	Vascular society	Oral/practical test
2	Belgium	Subspecialty of GS	Specialty board	Local interview	6	2	2	Vascular society	Inspection of the case log
3	Bulgaria	I	Government	Local interview		5	Included in vs. curriculum	Government	Oral/written/practical test
4	Croatia	I	Government	National exam	-	5	Included in vs. curriculum (3 mo)	National medical society	Oral test
5	Czech Republic	I	Government	Local interview	2	4	Included in vs. curriculum (4 mo)	University	Oral/written/practical test and inspection of the case log
6	Cyprus	I			3	4			
7	Denmark	I	Government	Local interview		5	Included in vs. curriculum (1 mo)	Government	Inspection of the case log
8	Estonia	I			-	5	Included in vs. curriculum		
9	Finland	I			3	3	Included in vs. curriculum	University	Written test
10	France	I	Government	National exam		6	Included in vs. curriculum (24 mo)		Oral/written test and inspection of the case log
11	Germany	I	Government	National exam	2	4	Included in vs. curriculum	National board	Oral test
12	Greece	I	Government	Priority list	2	5	Included in vs. curriculum	National board	Oral/written test and inspection of the case log
13	Hungary	I	Government	National exam	2	4	Included in vs. curriculum (6 mo)	Government	Oral test
14	Ireland	Subspecialty of GS	Specialty board	Local interview	4	2	Included in vs. curriculum	National board	Oral/written/ practical test and inspection of the case log
15	Italy	I	Specialty board	National exam	6 months	5	Included in vs. curriculum (12 mo)	University	Oral test
16	Latvia	I	Government	Competition	2	3	Included in vs. curriculum (6 mo)	Vascular society	Oral test, practical skill test
17	Lithuania	I	Government	Local interview	-	5	Included in vs. curriculum (5 mo)	University	Oral/written test
18	Luxembourg	I	Government		2	4	Included in vs. curriculum		Oral/German exam
19	Malta	I	Vascular society	Local interview	2	4	Included in vs. curriculum (24 mo)	National board	Oral/written/practical test
	Country	Specialty type	Training program accredited by	Admission	General surgery training (y)	Vascular surgery training (y)	Endovascular training (y)	Board examination	Assessment
20	The Netherlands	Subspecialty of GS			4	2	Included in vs. curriculum	Vascular society	FEBVS examination
21	Norway	I	Government	Local interview	2	3	Included in vs. curriculum	No oral or written examination	Evaluation of curriculum, inspection of case log, course certificates and attained learning objectives
22	Poland	I	Government	National exam	2	4	Included in vs. curriculum (1 mo)	Government	Oral/written test and inspection of the case log
23	Portugal	I	Government	National exam	1	5	Included in vs. curriculum	Government	Oral test

(To be continued)

TABLE I.—European societies for vascular surgery (continues).

Country	Specialty type	Training program accredited by	Admission	General surgery training (y)	Vascular surgery training (y)	Endovascular training (y)	Board examination	Assessment
24 Romania	I	Government at the proposal of vascular society	National exam	9 months	5	Included in vs. curriculum (9 mo)	University	Oral/written/ practical test
25 Slovakia	I	Government	Local interview	2	4	Included in vs. curriculum (3 mo)	National board	Oral/written/ practical test and inspection of the case log
26 Slovenia	I	Government	National exam	2	4	Included in vs. curriculum (9 mo)	National medical chamber	Oral/ practical test
27 Spain	I	Government	National exam	6 months	5	Included in vs. curriculum (24 mo)		No oral or written examination; Inspection of the case log
28 Sweden	I	Vascular society	Local interview	1	4	Included in vs. curriculum	National board	Inspection of the case log and participation in mandatory courses, theoretical and practical
29 Switzerland	I	Government	Local interview	2	4	Included in vs. curriculum (6 mo)	National board	Oral/written/practical test and inspection of the case log
30 Turkey	Cardiovascular surgery Total 6 years	Government	National exam	Included in vs. curriculum	Included in vs. curriculum	Government	Oral/written test and inspection of the case log	Cardiovascular surgery total 6 years
31 UK	I	GMC specialty board	National exam	1	5	Included in vs. curriculum (24 mo)	National board	Part A: SBA and EMI; and Part 2: clinical and oral exam

2. Trainees

2.1 Content of training

2.1.1 Theoretical knowledge

The theoretical knowledge about the content of training is explained in Table II.

2.1.2 Practical skills

The rapidly changing environment in the health care system has led to considerably increased demands and a new didactic paradigm: the transformation from time- and process-based to competency-based medical education and postgraduate training. The focus of this paradigm shift was to regard medical education and training as the development of young doctors with an individual portfolio consisting of clinical knowledge, clinical skills and professional attitudes. The decisive factor in competence orientation is therefore what finally the student or trainee is “able to do,” not what is “retained” in a course or the mere quantity of individually performed operative procedures.

Finally, at the conclusion of the training program, the proficiency of a trainee to practice as a vascular surgeon should be established. During the vascular surgical train-

ing, the achieved level of competency needs to be continuously monitored on the basis of well-defined expectations and through a level of entrustment, which allows for unsupervised practice once sufficient specific competence is gained. However, a didactically justified minimum number of interventions may be recommended for a given category of skills. The present catalogue therefore describes the practical skills required to accomplish the proficiency of a complete vascular surgeon. The decisive factor, however, remains mastery of the skills and continuous monitoring of learning progress rather than achieving minimum numbers.

2.1.2.1 STANDARDS FOR CLINICAL AND TECHNICAL SKILLS

The practical application of knowledge is evidenced through the clinical and technical skills are listed below.

- Has observed – exit descriptor; at this level the trainee:
 - has adequate knowledge of the steps through direct observation;
 - demonstrates that he/she can handle instruments relevant to the procedure appropriately and safely;
 - can perform some parts of the procedure with reasonable fluency.
- Can do with assistance – exit descriptor; at this level the trainee:

TABLE II.—Theoretical knowledge.

Vascular system	Type of competence	Specification
Vascular – arterial disease	Disease/condition	Epidemiology, pathophysiology, and risk factors for atheromatosis
Vascular – arterial disease	Disease/condition	Physical examination
Vascular – arterial disease	Disease/condition	Non-invasive diagnostics
Vascular – arterial disease	Disease/condition	Invasive diagnostics
Vascular – arterial disease	Disease/condition	Acute thrombosis and ischemia
Vascular – arterial disease	Disease/condition	Cerebrovascular disease
Vascular – arterial disease	Disease/condition	Compartment syndromes
Vascular – arterial disease	Disease/condition	Diabetic foot
Vascular – arterial disease	Disease/condition	Peripheral arterial emboli
Vascular – arterial disease	Disease/condition	Peripheral vascular occlusive disease
Vascular – arterial disease	Disease/condition	Aortic dissection
Vascular – arterial disease	Disease/condition	Arterial aneurysms – aortic
Vascular – arterial disease	Disease/condition	Arterial aneurysms – peripheral
Vascular – arterial disease	Disease/condition	Arterial aneurysms – visceral
Vascular – arterial disease	Disease/condition	Nonatherosclerotic occlusive diseases
Vascular – arterial disease	Disease/condition	Acute aortic syndromes (dissection, PAU, IMH, rupture)
Vascular – arterial disease	Disease/condition	Visceral artery occlusive disease
Vascular – arterial disease	Disease/condition	Thoracic outlet syndrome
Vascular – arterial disease	Disease/condition	Complications of endovascular and open surgical procedures
Vascular system	Type of competence	Specification
Vascular – arterial disease	Disease/condition	Vascular graft infections
Vascular – arterial disease	Operation/procedure	Risk factor modification management
Vascular – arterial disease	Operation/procedure	Non-surgical management of the patient with arterial disease
Vascular – arterial disease	Operation/procedure	Principles of open vascular surgery
Vascular – arterial disease	Operation/procedure	Principles of endovascular surgery
Vascular – arterial disease	Operation/procedure	Thrombolysis
Vascular – arterial disease	Operation/procedure	Extra-anatomic bypass
Vascular – arterial disease	Operation/procedure	Amputations
Vascular – arterial disease	Operation/procedure	Lower extremity revascularization both open and endovascular
Vascular – arterial disease	Operation/procedure	Upper extremity revascularization both open and endovascular
Vascular – arterial disease	Operation/procedure	Abdominal and aortoiliac aneurysm/repair both open and endovascular
Vascular – arterial disease	Operation/procedure	Aortoiliac reconstruction for occlusive disease both open and endovascular
Vascular – arterial disease	Operation/procedure	Extracranial vessels – surgical management (open and endo)
Vascular – arterial disease	Operation/procedure	Operative management of aortic dissection both open and endovascular
Vascular – arterial disease	Operation/procedure	Operative management of thoracic and thoracoabdominal aneurysm both open and endovascular
Vascular – arterial disease	Operation/procedure	Graft-enteric fistula – management
Vascular – arterial disease	Operation/procedure	Mesenteric occlusive disease – both open and endovascular
Vascular – arterial disease	Operation/procedure	Management of popliteal entrapment
Vascular – arterial disease	Operation/procedure	Management of peripheral aneurysms
Vascular – arterial disease	Operation/procedure	Management of vascular graft infection
Vascular – arterial disease	Operation/procedure	Superior mesenteric artery embolectomy/thrombectomy
Vascular system	Type of competence	Specification
Vascular – arterial disease	Operation/procedure	Management of compartment syndrome of the limb
Vascular – arterial disease	Operation/procedure	Management of abdominal compartment syndrome
Vascular – venous disease	Disease/condition	Epidemiology, pathophysiology, and risk factors for venous disease
Vascular – venous disease	Disease/condition	Physical examination
Vascular – venous disease	Disease/condition	Non-invasive diagnostics
Vascular – venous disease	Disease/condition	Invasive diagnostics
Vascular – venous disease	Disease/condition	Evaluation of the swollen leg
Vascular – arterial disease	Disease/condition	Thrombophlebitis
Vascular – venous disease	Disease/condition	Varicose veins
Vascular – venous disease	Disease/condition	Chronic venous insufficiency
Vascular – venous disease	Disease/condition	Venous thromboembolism
Vascular – venous disease	Disease/condition	Vena cava disease

(To be continued)

TABLE II.—Theoretical knowledge (continues).

Vascular system	Type of competence	Specification
Vascular – venous disease	Operation/procedure	Non-operative management of venous insufficiency (including compression therapy of venous leg ulcer)
Vascular – venous disease	Operation/procedure	Non-operative management of venous thrombosis
Vascular – venous disease	Operation/procedure	Thrombolysis
Vascular – venous disease	Operation/procedure	Surgical management of venous insufficiency (open and endovascular, including wound care of venous leg ulcer)
Vascular – venous disease	Operation/procedure	Surgical management of venous occlusive disease (open and endovascular)
Vascular – venous disease	Operation/procedure	Surgical management of vena cava disease (open and endovascular)
Vascular – access	Disease/condition	Vascular access for dialysis
Vascular – access	Operation/procedure	Arteriovenous graft/fistula
Vascular – access	Operation/procedure	Vascular exposure – principles
Vascular – access	Operation/procedure	Venous access devices – insertion
Vascular system	Type of competence	Specification
Vascular – lymphatic disease	Disease/condition	Epidemiology, pathophysiology, and risk factors for lymphedema
Vascular – lymphatic disease	Disease/condition	Physical examination
Vascular – lymphatic disease	Disease/condition	Non invasive and invasive diagnostics
Vascular – lymphatic disease	Operation/procedure	Non-surgical management of lymphedema
Vascular – lymphatic disease	Operation/procedure	Lymph venous fistula, liposuction, lymph node transfer, [...]
Vascular – trauma	Operation/procedure	Management of vascular trauma
Vascular – diabetic foot	Disease/condition/procedure/orthopedic treatment/vascular treatment/aftercare	Overall management of diabetic foot/organization of diabetic foot clinic
Vascular – bleeding	Operation/procedure	Embolization techniques
Vascular – bleeding	Operation/procedure	Open surgical treatment
Vascular – malformations	Disease/condition	Epidemiology, pathophysiology, classification, and treatment principles
Vascular – malformations	Operation/procedure	Embolization techniques
Vascular – endoleaks	Operation/intervention	Embolization techniques
Radiation	Disease/condition	Legal and technical requirements in radioprotection

- knows all the steps - and the reasons that lie behind the methodology;
- can carry out a straightforward procedure fluently from start to finish;
- knows and demonstrates when to call for assistance/advice from the supervisor (knows personal limitations).
- Can do whole but may need assistance – exit descriptor; at this level the trainee:
 - can adapt to well-known variations in the procedure encountered, without direct input from the trainer;
 - recognizes and makes a correct assessment of common problems that are encountered;
 - is able to deal with most of the common problems;
 - knows and demonstrates when he/she needs help;
 - requires advice rather than help that requires the trainer to scrub.
- Competent to do without assistance, including complications – exit descriptor, at this level the trainee:

- with regard to the common clinical situations in the specialty, can deal with straightforward and difficult cases to a satisfactory level and without the requirement for external input;
- is at the level at which one would expect an independent practitioner to function;
- is capable of supervising trainees.

2.1.2.2 BASIC SKILLS

Basic skills include the following.

- preparation of the surgeon for surgery:
 - effective and safe hand washing, gloving and gowning;
- administration of local and regional anesthesia:
 - accurate and safe administration of local anesthetic agent;
- incision of skin and subcutaneous tissue:
 - ability to use scalpel, diathermy and scissors;
 - closure of skin and subcutaneous tissue;

- accurate and tension free apposition of wound edges:
 - knot tying:
 - single handed;
 - double handed;
 - instrument;
 - superficial;
 - deep;
- hemostasis:
 - control of bleeding vessel (superficial);
 - diathermy;
 - suture ligation;
 - tie ligation;
 - clip application;
 - transfixion suture;
- tissue retraction:
 - tissue forceps;
 - placement of wound retractors;
- use of drains: insertion, fixation, removal;
- tissue handling:
 - appropriate application of instruments and respect for tissues;
 - biopsy techniques;
 - skill as assistant:
 - anticipation of needs of surgeon when assisting.

2.1.2.3 SPECIAL VASCULAR SURGICAL SKILLS

Basic diagnostic skills are listed below.

- Noninvasive examination:
 - physical vascular examination;
 - dynamic venous function tests;
 - plethysmography;
 - TCpO₂-measurement;
 - handheld Doppler assessment;
 - measurement of compartment pressures.
- Vascular ultrasound:
 - flow velocity measurement, flow measurement – detection and quantification of stenosis and occlusion in arteries, veins and at anastomoses;
 - extracranial brain supplying arteries and veins (CW-Doppler, Duplex);
 - abdominal and retroperitoneal arteries and veins (B-mode, CW-Doppler, Duplex);
 - screening for AAA and measure aortic diameter;
 - perform venous ultrasound studies (B-mode, Duplex);
 - perform ultrasound assessment of peripheral arteries (B-mode, CW-Doppler, Duplex);
 - percutaneous puncture of arteries and veins under ultrasound guidance;

- quality assurance guidelines and requirements for vascular ultrasound.
- Diagnostic angiography:
 - retrograde femoral artery puncture;
 - antegrade femoral artery puncture;
 - ultrasound guided arterial and venous puncture;
 - secure vascular access with sheath;
 - intravenous or intraarterial pressure measurement;
 - guidewire position using fluoroscopy and placement of non-selective catheter in aorta;
 - obtain satisfactory intraoperative angiograms – recognition of inadequate study and need for alternative angiographic views;
 - European and National Legal Requirements in Radioprotection; accountability in:
 - justification process;
 - optimization of principles in general and specifically for interventional procedures;
 - quality assurance processes and recommendations;
 - documentation and archiving;
 - continuous education and professional development.

Vascular procedures are listed below.

- An open vascular surgical procedure is a procedure that requires surgical exposure of one or more arteries or veins for:
 - the correction of arterial or venous diseases, deformities or defects;
 - the repair of arterial or venous injury;
 - the treatment of other diseases requiring arterial or venous reconstruction.
 - An endovascular surgical procedure is a procedure that requires the use of guide wires and/or catheters in one or more arteries or veins and fluoroscopy guidance for:
 - the correction of arterial or venous diseases, deformities or defects;
 - the repair of arterial or venous injury;
 - the treatment of other diseases requiring guide wire/catheter manipulations in arteries or veins.
- The essential steps of an open or endovascular vascular procedure are:
- exposure or acquisition of access;
 - control or maintenance of access;
 - morphological definition of the pathology;
 - vascular intervention (reconstruction, replacement, repair, explantation);
 - completion quality assurance;
 - closure.

The principle operator for both open and endovascular procedures is the person who performs the majority of the essential steps of the procedure:

- open vascular and endovascular surgical procedures are both classified into three levels, based on how much specific training or experience would be required for a typical procedure of its kind:

- basic – procedures requiring little or no specific training or experience;
- intermediate – procedures requiring specific training or experience;
- advanced – procedures requiring advanced training or experience.

Open vascular procedures are divided into basic, intermediate and advanced.

- Basic:
 - elements of arterial procedures: *i.e.* one anastomosis or arterial exposure without further reconstruction;
 - upper and lower limb embolectomy/thrombectomy with or without patch closure;
 - surgical treatment of varicose veins;
 - major and minor limb amputation;
 - miscellaneous: ligation (*e.g.* of traumatic bleed); and suture closure (*e.g.* false aneurysm).

- Intermediate:
 - bypass (anatomic or extra-anatomic), endarterectomy (open or remote), patching, interposition, or other reconstruction of stenotic, occlusive, or aneurysmal disease at the following levels; femoral, popliteal or infra-axillary arteries and any sequential combination of these levels;

- surgical treatment of varicose veins with perforator incompetence procedures;
 - access surgery (*e.g.* arterio-venous fistula without graft) (excl. catheters).

- Advanced:
 - bypass (anatomic or extra-anatomic), endarterectomy, patching, interposition, or other reconstruction of stenotic, occlusive, or aneurysmal disease of supra-aortic trunks, thoracic, juxta-suprarenal-infrarenal abdominal aorta, iliac, tibial, or pedal arteries and any sequential combination of these levels;

- surgical treatment of glomus tumors;
 - visceral arteries procedures (incl. embolectomy/thrombectomy);
 - access surgery (*e.g.*, prosthetic arterio-venous fistula with graft);
 - deep venous reconstructions (except all superficial venous and perforator incompetence procedures);
 - vascular reconstructions for graft/stent infection;

- microvascular repair of small blood vessels;
- renal, liver, or pancreas transplantation.

Endovascular procedures are divided into basic, intermediate, and advanced.

- Basic:
 - PTA with or without stent placement of stenotic lesions at the following levels: iliac, femoral, popliteal (or transition zones) arteries;
 - endovenous treatments of varicose veins.
- Intermediate:
 - PTA with or without stent placement of arterial occlusion at the following levels – iliac, femoral, popliteal (or transition zones) arteries;
 - PTA with or without stent placement of stenotic or occlusive lesion at the following levels – upper limb arteries, arterio-venous fistula (or transition zones);
 - PTA with or without stent placement of stenotic lesion at the following levels – tibial or pedal arteries;
 - stent-graft placement in iliac, femoral and popliteal arteries;
 - fluoro-assisted thrombectomy (open or percutaneous);
 - thrombolysis for arterial/venous thrombosis;
 - vena cava filter placement and Vena cava filter retrieval.
- Advanced:
 - PTA with or without stent placement of stenotic or occlusive lesion at the levels of abdominal aorta;
 - PTA with or without stent placement of stenotic or occlusive lesion at the levels of supra-aortic trunks;
 - PTA with or without stent placement of occlusive lesion at the following levels: tibial or pedal arteries;
 - any kind of aortic stentgraft (EVAR, F/BEVAR, TEVAR, etc.);
 - visceral arteries endovascular procedures;
 - endovascular procedures at the levels of central veins;
 - any kind of endovascular thoracic aortic procedure without implantation of aortic stent graft (*i.e.* support for the heart failure, for the regeneration of organs for transplantation purposes, etc.);
 - coil embolization in vascular territories.

2.1.3 Professionalism

Professionalism is most often defined using the CanMeds framework (Royal College of Physicians and Surgeons of Canada) as explained in the paragraphs below.

As professionals, physicians are committed to the health and well-being of individual patients and society through ethical practice, high personal standards of behaviour, ac-

countability to the profession and society, physician-led regulation, and maintenance of personal health.

Key concepts of professionalism include:

- commitment to patients – physician must demonstrate a commitment to patients by applying best practices and adhering to high ethical standards. He must:

- exhibit appropriate professional behaviors and relationships in all aspects of practice, demonstrating honesty, integrity, humility, commitment, compassion, respect, altruism, respect for diversity, and maintenance of confidentiality;

- demonstrate a commitment to excellence in all aspects of practice;

- recognize and respond to ethical issues encountered in practice;

- recognize and manage conflicts of interest;w

- exhibit professional behaviors in the use of technology-enabled communication.

- Commitment to society – physician must demonstrate a commitment to society by recognizing and responding to societal expectations in health care. He must:

- demonstrate accountability to patients, society, and the profession by responding to societal expectations of physicians;

- demonstrate a commitment to patient safety and quality improvement.

- Commitment to the profession – physician must demonstrate a commitment to the profession by adhering to standards and participating in physician-led regulation. He must:

- fulfill and adhere to the professional and ethical codes, standards of practice, and laws governing practice;

- recognize and respond to unprofessional and unethical behaviors in physicians and other colleagues in the health care professions;

- participate in peer assessment and standard setting.

- Commitment to self – demonstrate a commitment to physician health and well-being to foster optimal patient care. He must:

- exhibit self-awareness and manage influences on personal well-being and professional performance;

- manage personal and professional demands for a sustainable practice throughout the physician life cycle;

- promote a culture that recognizes, supports, and responds effectively to colleagues in need.

In the Code of Professional Conduct of the American College of Surgeon, the Task Force laid out 2 sets of professional responsibilities, one to patients and another to society.

The responsibilities to patients include:

- serving as advocates for patients' needs;
- complete disclosure of therapeutic options;
- disclosure of conflict of interest that might influence the medical decision;

- respecting and understanding patients;

- full disclosure of adverse events and medical errors;
- acknowledgment of patients' psychological, social, cultural, and spiritual needs;ww

- encompassing special needs of terminally ill patients;
- supporting the needs of patients' families;
- respecting other health care professionals.

The responsibilities to society include:

- providing the highest quality of surgical care;

- abiding by the values of honesty, confidentiality, and altruism;

- lifelong learning;

- maintaining surgical competence;

- self-regulation through setting, maintaining, and enforcing practice standards;

- evaluating treatment outcomes to improve the quality of care;

- informing public of the expertise;

- improving public health by communicating with government, healthcare organization, and industry;

- establishing an effective and efficient distribution of healthcare resources;

- providing care without socioeconomic discrimination;

- participating in educational programs addressing professionalism.

The practice of vascular surgery is inherently stressful, and surgeons are at high risk for burnout and other stress-related disorders, particularly younger trainees. It is important for the surgical leadership to recognize these inherent risks and to mentor our junior faculty. Physician wellness should be an integral part of the institutional quality improvement program.

Analyses of adverse events in health care have revealed that many underlying causes originate from failings in non-technical aspects of performance rather than a lack of technical expertise. Professionalism should be taught during vascular trainees' curriculum. Vascular training should include a culture of professionalism, and trainees should be part of that culture. Patient and staff feedback should also be routinely requested for all members of the team and lapses of professionalism should be openly discussed among team members.

According to the Code of Professional Conduct of the American College of Surgeon, the training should promote professional autonomy to enable vascular trainees to act in

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the best interests of the patient and the public. In addition to knowledge and practical skills, it is recommended that the curriculum includes:

- basic knowledge of scientific methodology, principles of clinical research, evidence-based medicine, and rules and regulations concerning research. This knowledge must ensure a total independence from industry marketing messages or financial support;
- ethics, patient rights and protection of privacy on clinical practice and medical research;
- national and European legislation related to health care, laws, regulations, guidelines and recommendations;
- legal rules of employment and working conditions.

2.2 Organization of training

2.2.1 Schedule of training

The training period in vascular surgery should be sufficient to ensure that a trainee has met all the required educational needs covering the full range of the specialty and leading to the ability for independent practice. The implementation of this general principal into clinical practice is influenced by several factors such as clinical volume and faculty of each training center, as well as the ability of each individual trainee to acquire the necessary educational and training competencies. With the spectrum of VS having been broadened by the evolution of endovascular surgery and the advances in imaging, the minimum duration of training in VS is recommended to be 5 years, whereas a duration of up to 7 years may be considered appropriate by national authorities. The first two years should be focused on developing basic patient care and technical skills. Rotations in related disciplines including general surgery, cardiology, cardiac surgery, interventional radiology ICU and stroke units provide both basic open technical skills as well as exposure to medical problems highly relevant to vascular surgery patients. The following years should be focused in vascular and endovascular surgery. Training should be structured according to the level of difficulty and complexity of the procedures (basic, intermediate, advanced) and the competence level that is required to be achieved (has observed; can do with assistance; can do whole but may need assistance; competent to do without assistance, including complications). By the final year of training both operative and non-operative competency in the performance of both elective and emergency vascular surgery should be achieved. Training in vascular ultrasound is an essential part of training in contemporary vascular surgery. The full spectrum of the preoperative, intraoperative, and postoperative use of vascular ultrasound should be incor-

porated in the curriculum of training, either as a separate educational section or a daily/weekly activity.

A continuous education program throughout the training should be established consisting of:

- a program of lectures including visiting speakers;
- clinical case presentations;
- conferences, including the National Society and the European Society for Vascular Surgery annual meeting;
- journal clubs;
- mortality and morbidity meetings;
- research meetings;
- teaching in ethics, administration, management, and economics;
- radiation protection courses.

Inclusion of simulators, wet labs and vascular research activities should be encouraged.

Although the schedule of training in VS, including minimum duration of training, required timing and particular qualifications, lies with the national health authorities in each European country and depends on various local needs and specificities, homogenization of training will facilitate recognition of progress and achievements across EU member countries and will assure the public that the training has been of an appropriate European standard.

2.2.2 Assessment and evaluation

During the training, in the curriculum of vascular surgery trainees need permanent feedback to check their performance, to reflect their attitude and to improve skills and knowledge. Workplace assessments on a regular base is important for an immediate and structured feedback. With the “entrustable professional activities” (EPAs) for vascular surgery the progress in the performance over time can be monitored. This tool is conceptualized to check for clinical competences in the daily activities of a vascular surgeons in training. The trainee will be assessed for his clinical task by different supervisors. To check for competences means not only to test skills and knowledge but also the attitude of a colleague and his ability to solve unexpected events.

The performance can be rated in five levels: 1) observation; 2) need of direct supervision; 3) indirect supervision; 4) unsupervised practice; and 5) able to supervise. In the daily business of education level 2 to level 4 are important to rate the performance of a vascular surgeon in training. At least three evaluations on a same level are required to fulfil an EPA. All operations and interventions should be documented in a logbook overtime and each candidate must present and summarize two patient histories per year and the lessons learned during an interdisciplinary morbidity and mortality conference.

As far as the final exam is concerned, with the summative FEBVS Exam (Fellow of the European Board of Vascular Surgery) the candidate must demonstrate that he passed a structured education program and can show a minimal level of competence. The Examination Committee is the responsible to assure the internal and external validation of the summative assessment including organization assessment, validation of the questions, evaluation of the results, feedback, standard setting, observer and examiner selection, examiner training, number of examiners, quality assurance, indemnity insurance, appeals procedures.

In a one-day exam the candidates have:

- to discuss a scientific paper;
- to discuss and evaluate clinical cases;
- to explain clinical situations;
- to perform practical work on a simulator (skills assessment).

3. Trainers

3.1 Process for recognition as trainer

There are very different and non-harmonized levels in the different European countries in terms of professional development and educational training support, promotion of skill development, and encouragement of educational innovations among faculty in vascular surgery. Trainers are responsible for engaging positively with training, support and appraisal relating to their role, and are accountable for the resources they receive to support education and training. They must act in line with professional guidance for all doctors – they must be positive role models demonstrating good medical practice. They are expected to maintain and continue to develop knowledge and skills on an ongoing basis through continuing professional development. Educators are involved in and contribute to the learning environment and culture.

During the process for recognition as trainer, qualification and experience are requested. A trainer is an appropriately trained and experienced doctor who is responsible for the education and training of postgraduate medical trainees which takes place in an environment of medical practice. All trainers shall be board-certified vascular surgeons accredited either at European or national level with the following additional qualifications: teaching experience, documented in the form of a teaching assignment to a local university, and/or hold acknowledged expertise in one or in a few particular aspects of vascular surgery, but do not have to hold a university assignment or a personal research tradition. Their individual teaching competence and qualifications in

the training program could be also recognized by national authorities. Trainers must be selected against suitable criteria and receive an appropriate induction to their role, access to appropriately funded professional development and training for their role, and an appraisal against their educational responsibilities. Trainers must have enough time in job plans to meet their educational responsibilities so that they can carry out their role in a way that promotes safe and effective care and a positive learning experience.

During the process for recognition as trainer, core competencies are required. Strongly recommends that national programs “Teach the Tutors”/“Training the Trainers” should be created throughout European countries to use learning models focused on conceptual learning and behavioral practice to increase faculty members “pedagogical knowledge,” provide instructional training, and promote the implementation of active learning across all curricular phases. The programs should be built on the belief that developing educational competencies is an ongoing process linked to both conceptual learning and behavioral practice. The core competencies for tutors and trainers should rely on teaching qualities that define teaching performance:

- creating a positive learning climate;
- professional attitude towards residents;
- communication of learning goals;
- evaluation of residents;
- feedback to residents.

To achieve proper quality management for trainers in the near future should be endorse the European or national system for evaluation of teaching qualities tool to measure and enhance teaching performance of clinical teachers. All trainers should be encouraged by UEMS to participate in teamwork education programs to foster a positive culture of learning and teamwork within the team.

3.2 Quality management for trainers

Training programs in VS are the responsibility of an institution accredited in the field by the relevant national authority. The education division of the institution monitors the validity of the workplace’s accreditation and its adherence to the national training legislation, including the maximum number of trainees per trainer and the duration of training. The institution commits itself to including training activities as part of the workload of the trainers. The director of the training program within the institution, usually the head of the vascular surgery department, is responsible for the selection of qualified trainers in accordance with the given stipulations. The director of the program can organize a course for newly qualified trainers

before the beginning of the training program. The workplace must be organized such that trainers have sufficient time to devote to their trainees and trainees are able to meet all the requirements of the training program, including the number of specific tasks they must fulfil. Trainers meet with the candidates once a month to evaluate each trainee's progress and, once a year, report the results of these assessments to the director of the program. The institution commits itself to support the continual education of its trainers in new therapeutic procedures via certified courses and/or other educational means. The competence of the trainers should be assessed at 5-year intervals as part of the re-accreditation of the workplace.

4. Training institutions

4.1 Process for recognition as training center

As far as requirements for clinical activities are concerned, training institutions offering postgraduate education in VS should be recognized and accredited by the national competent authority. Training should generally be carried out in university hospitals or affiliated teaching hospitals, while part of the training rotation may take place in general (regional) hospitals if/where accepted by the national authorities. The teaching institution should have a chief / director of training with at least 10 years of clinical experience after specialist accreditation and with specific training. Further, the institution must possess all the necessary infrastructure to provide structured training in VS. This must include a diverse and sufficiently large inpatient and outpatient service, adequate teaching staff, operating theatres, angio- (hybrid) suites and other (theoretical) learning facilities. The training of a trainee will be led and managed by a specialist/consultant in VS. This specialist will be active in the practice of vascular surgery with personal responsibility for the management of patients with a wide range of vascular surgical conditions. Within a training center there would be several other specialists (trainers) who would be able to supervise and personally train a trainee. The time required for providing training, supervision and teaching should be included as responsibilities in the work schedules of trainers. Together with program director the trainers will be able to ensure that the clinical experience of the trainee will prepare them for clinical work as a specialist. The foundation of postgraduate education in VS is practice-based training in conjunction with formal teaching sessions with the aim of integrating theory and clinical activities. The main goals and outcomes should be clearly outlined. The teaching institution should be able to provide the trainee a possibility to meet patients

both on the ward and in the out-patients' clinic, thus providing a learning opportunity for critical reading around clinical problems. Ward rounds should be led by a consultant and include feed-back on clinical and decision-making skills. Trainees should have the opportunity to assess both new and follow-up patients and discuss each case with the supervisor to allow feedback on diagnostic skills and gain the ability to plan investigations. Further, it is essential that trainees have the possibility to care patients both an emergency and routine basis. The number of patients and the case-mix should be sufficient for undertaking comprehensive supervised practical vascular surgical and endovascular procedures with a consultant or more senior trainee. Surgical and endovascular training should also include the care and counselling of the patient/careers before and after the procedure thus gaining competence in these aspects of VS. Also, with advances in technology the use of simulators will play an increasing part in the training of practical procedures. As trainees gain experience, they will progress from observing to performing and from simple to more complex cases. Trainees should maintain a logbook of experience. A trainee must have progressively increased personal responsibility for the care of patients with vascular surgical conditions and retain their general medical skills to be able to identify patients who present to a vascular service but whose underlying clinical problems are not vascular. Other clinical learning opportunities should include regular multidisciplinary meetings to determine optimal care for patients and such meetings will involve both medical and other healthcare staff. Formal (theoretical) teaching and learning possibilities would include at least the following: lectures, case presentations and small group discussions including (scientific) presentations at clinical and academic meetings. The number of training positions must be in accordance with the resources of the training center and the manpower planning projection of each EU national state. The work delivered by trainees must comply with the European Working Time Directive. Part-time training should be allowed; duration of training should be extended accordingly.

Requirements on equipment and accommodation are the following: 1) a training center must have appropriate equipment and support to enable the clinical practice that would be expected of a training center and thus provide the necessary educational opportunities for trainees; 2) trainees should have suitable and comfortable accommodation for their work; 3) the trainee must have adequate time for theoretical study and computing and information technology together with classic library resources must be available; 4) all trainees must engage in clinical audit and

can engage in research; and 5) the physical facilities and equipment for training should be evaluated regularly for their appropriateness and quality.

4.2 Quality management within training institutions

Quality management within training institutions is achieved through the application of several standards/measures.

First, according to manpower planning, training institutions should appoint a coordinator responsible for the composition, implementation, and supervision of a specialty training program. Roles of trainer and trainee need to be clearly defined. Allotted time of at least one day per week should be implemented for specialty training interaction. Manpower planning is under the jurisdiction of each member state according to their needs for Vascular Surgeons.

Second, regular reports are also an important part of quality management. In fact, training centers shall undertake internal audits of their performance as part of the requirements for continuing national recognition / accreditation. Any national evaluation of a training center's performance is expected to include the demonstration that it is:

- providing care for patients with a wide range of vascular surgical conditions;
- providing educational and training support for trainees and others;
- part of a healthcare system that provides immediate access to relevant investigations as well as providing when necessary immediate access to other clinical specialties that may be required by their patients.

Training centers should keep records of the progress of their trainees, including any matters relating to fitness to practice or other aspects that might affect a trainee's registration with the relevant national body. The program director has specific responsibilities in this regard. Annual reports on various aspects of an institution's specialty training program should be made publicly available. Such reports should include the results of the internal audits described above.

Third, external auditing also plays an important role in quality management. Training centers and institutions

shall be recognized and accredited by their relevant national authority or equivalent body. This accreditation shall be subject to regular review and shall be subject to reassessment and renewal at not more than five yearly intervals. Renewal audits shall include a site visit similar to the initial accreditation visit and will also review the internal audit results since the previous visit.

Fourth, transparency of programmed training reflects the quality management of institutions. In fact, it is expected that a training center will publish details of the training provision available with details of the clinical service it provides and the specialist and other staff. Such information would include the training program, the nature of the clinical experiences with which a trainee would be engaged and the support and interaction with the trainer and chief of training program. There would be a named individual whom a prospective trainee might contact and discuss the program.

Lastly, the organization of structure for training coordination is fundamental. There should be a national (or equivalent) program for training leading to recognition as a specialist/consultant with specific knowledge and skills in vascular surgery within that country. The trainee's job plan should allow sufficient time for developmental activities separate from their involvement with clinical service provision. The job plans of trainers and of chiefs of training programs should include sufficient time for them to fulfil their educational and training responsibilities. Training centers will be recognized and approved by the relevant national authority. To assist a specialist/consultant with specific knowledge and skills in VS moving from one EU country to another, it would be expected that they have satisfactorily completed the European training program in VS thus demonstrating that he/she has the required knowledge, clinical skills and competences as well as having demonstrated appropriate professional behaviors and has been engaged with sufficient amount of clinical work for employment in the post they are seeking. Such accomplishments would be verified by passing the Fellowship of the European Board of Vascular Surgery (FEBVS) examination.

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