الهيئة السعودية للتخصصات الصحية
Saudi Commission for Health Specialties

VASCULAR SURGERY CURRICULUM

بسم الله الرحمن الرحيم

Preface

This curriculum will provide a customizing guide that is universally applicable for SCFHS fellowship in vascular surgery and based on the needs, it will represent a vital part of learning.

The primary goal of this curriculum is to enrich the training experience of vascular fellowship trainees by outlining the learning objectives to become independent and competent vascular surgeons.

In addition to informing trainees, trainers, and training supervisors with goals and objectives of training, a major impact on planning, execution, and quality assurance of training outcomes are expected.

This curriculum may contain sections outlining some regulations of training; however, these need to be sought from "General Bylaws" and "Executive Policies" published by the Saudi Commission for Health Specialties (SCFHS), which is the national regulatory body of postgraduate training programs and fellowships across health professions in Saudi Arabia.

The regulations can be accessed online through the official SCFHS website. When there is a discrepancy in regulation statements, the one mentioned in the updated bylaws and executive policies will be the reference to apply; as it is subject to periodic refinements, please refer to the electronic version posted online for the most updated edition at: www.scfhs.org.sa

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We would also like to acknowledge that the CanMEDS framework is a copyright of the Royal College of Physicians and Surgeons of Canada, and many of the description's competencies have been acquired from their resources (Please refer to: CanMEDS 2015 physician competency framework; Frank JR, Snell L, Sherbino J, editors. CanMEDS 2015 Physician Competency Framework. Ottawa: Royal College of Physicians and Surgeons of Canada; 2015.).

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FOREWARD

The vascular surgery fellowship curriculum development team acknowledges valuable contributions and feedback from scientific committee members in the development of this curriculum. We extend special appreciation and gratitude to all the members who have been pivotal in the completion of this booklet, especially the Curriculum Group, the Curriculum Specialists, and the Scientific Council of Surgery. We would also like to acknowledge that the CanMEDS framework is a copyright of the Royal College of Physicians and Surgeons of Canada, and many of the descriptions' competencies have been acquired from their resources.

The curriculum of vascular surgery fellowship focuses on providing a training guide for general surgeons. who, upon completion of the fellowship, will be qualified vascular surgery specialists who meet the needs and exceed the expectations.

The implementation of this curriculum is accomplished by adopting competency-based education.

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Introduction

1. Context of Practice

In the 1950s, vascular surgery was part of general surgery and in some centers part of cardiovascular and thoracic surgery[1]. Vascular surgery started to be recognized as a solo subspecialty in the early 1970s, and formal training started in the late 1970s in many centers in North America and Europe[1, 2]. As a result, more recognition and support for vascular surgery has been observed in many centers worldwide.

In Saudi Arabia, the first academic division of vascular surgery was established in 1993, and the first structured vascular surgery fellowship training started in 1998[3]. The number of vascular surgeons in the Kingdom of Saudi Arabia has remained stagnant over the last decade. Furthermore, the need for more vascular surgeons in the future will increase with the increasing elderly population, the growing prevalence of chronic diseases, and complex medical conditions.

In the United States, the demand for adult primary care services will increase by approximately 14 percent between 2013 and 2025. Vascular surgery has the highest projected demand growth (31 percent), followed by cardiology (20 percent), and neurological surgery, radiology, and general surgery (18 percent each). Market indicators, such as long waiting times to obtain appointments, suggest that the current supply is inadequate to meet the current demand. Failure to train sufficient numbers could exacerbate the already long waiting periods for appointments, reduce access to care for some of the nation's most vulnerable patients, and reduce their quality of life[4]. Technological innovation, skill labs, and availability of well-trained, enthusiastic senior vascular surgeons will provide both the experiences and environment where fellows can develop the required surgical skills, medical knowledge, communication, clinical skills, and professional attitudes. These will enable them to become physicians committed to lifelong learning, medical system integration, excellence in the diagnosis of vascular diseases, and performance of open vascular surgery and endovascular interventions.

Currently, vascular surgeons are challenged by their own demands to offer all aspects of integrated vascular care; therefore, general principles are emphasized, as well as the importance of independent study, the ability to critically assess the medical literature, develop an understanding of research, and keep abreast of new developments so that fellows can continue their education well beyond the period of fellowship training.

2. Goal and Responsibility of Curriculum Implementation

The ultimate goal of this competency-based curriculum, with an explicit representation of learning domains (knowledge, skills, and behavior) is to guide trainees to become competent in the vascular surgery specialty. This goal will require significant efforts and coordination from all stakeholders involved in postgraduate training. As an "adult-learner," trainees have to demonstrate full engagement with the proactive role by carefully understanding learning objectives, as well as through self-directed learning, problem solving, and openness and readiness to apply what they have learned by reflective practice from feedback and formative assessment. They also have to ensure self-wellbeing and seek support when needed. Fellowship directors play a vital role in making the implementation of this curriculum extremely successful. Training committee members, particularly fellowship administrators and chief fellows, have a significant impact on curriculum implementation. Trainees should be able to share responsibility in curriculum implementation. The Saudi Commission for Health Specialties (SCFHS) applies the best models of training governance to achieve the finest quality of training. Academic affairs in training centers and regional supervisory training committees will play a major role in supervision and implementation. The surgical scientific committee will be responsible for ensuring that the content of this curriculum is constantly updated to match the best-known standards in postgraduate education of vascular surgery sub-specialties.

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[1] Avgerinos ED, Aksoy M, Bisdas T, et al. Vascular Training Profiles across Europe. Europe Journ Vascu Endovasc Surg. 2013 December;46(6):719-725, doi: https://doi.org/10.1016/j.ejvs.2013.08.003

[2] Joseph L. Mills Sr. MD, Vascular surgery training in the United States: A half-century of evolution, Journal of Vascular Surgery, Volume 48, Issue 6, Supplement, December 2008, Pages 97S, https://doi.org/10.1016/j.jvs.2008.07.090

[3] Vascular Surgery Fellowship Program, College of Medicine, King Saud University, Riyadh, https://medicine.ksu.edu.sa/ar/node/2347

[4] Dall TM, Gallo PD, Chakrabarti R, West T, Semilla AP, Storm MV. An aging population and growing disease burden will require a large and specialized health care workforce by 2025. Health Aff (Millwood). 2013 Nov;32(11):2013-20. doi: 10.1377/hlthaff.2013.0714. PMID: 24191094.

VI. Abbreviations Used in This Document

Abbreviation	Description
AAA	Abdominal Aortic Aneurysm
CBD	Case-Based Discussion
CBE	Competency-Based Education
COT	Consultation Observation Tool
CPA	Continuous Professional Activities
CPD	Continuous Professional Development
CT	Computerized Tomography
DOPS	Direct Observation of Procedural Skills report
ER	Emergency Room
F1	First year of Fellowship
F2	Second year of Fellowship
F3	Third year of Fellowship
FITER	Final In-training Evaluation Report
FTC	Fellowship Training Committee
Lab	Laboratory
M&M	Morbidity and Mortality
MBBS	Bachelor of Medicine and Bachelor of Surgery
Mini-CEX	Mini-Clinical Experience Report
MR	Magnetic Resonance
OPD	Outpatient Department
OR	Operating Room
OSCE	Objective Structured Clinical Examination
OSPE	Objective Structured Practical Examination
PBL	Practice-based Learning
PT	Progress Test
SCFHS	Saudi Commission for Health Specialties
TBL	Team-based learning

VII. Fellowship Entry Requirements

Please refer to the updated executive policy of SCFHS on admission and registration.

Website: www.scfhs.org.sa

VIII. Learning and Competencies

1. Introduction to Learning Outcomes and Competency- Based Education

At the completion of training, the fellow will have acquired the following competencies and will function effectively as follows:

Medical Expert

Definition:

Integrate all of the CanMEDS roles, and apply medical knowledge, clinical skills, and professional attitudes in the provision of patient-centered care

Key and Enabling Competencies

Vascular Surgeons are able to:

- **Integrate all of the CanMEDS roles to provide optimal, ethical, and patient-centered medical care**
  - Perform consultation effectively, including the presentation of well-documented assessments and recommendations in written and/or oral form, in response to a request from another healthcare professional. The consultation will result in advice on the diagnosis and treatment of patients with the following conditions:
    - Acute and chronic visceral ischemia including but not limited to renal artery occlusive disease
    - Aneurysms of the aorta and other vessels
    - Aortic dissections
    - Arteriovenous malformations
    - Chronic lower and upper extremity arterial occlusive disease
    - Chronic venous diseases
    - Conditions requiring amputation
    - Extracranial cerebrovascular disease
    - Local and systemic complications of vascular therapy
    - Lymphedema
    - Non-atherosclerotic vascular disease
    - Thoracic outlet syndrome
    - Vascular access for dialysis
    - Vascular trauma
    - Venous thromboembolic disease
  - Demonstrate effective use of all CanMEDS competencies relevant to vascular surgery
  - Identify and appropriately respond to relevant ethical issues arising in patient care
  - Demonstrate the ability to prioritize professional duties when faced with multiple patients and problems

- **Establish and maintain clinical knowledge, skills, and behavior appropriate to vascular surgery practice**
    - Apply knowledge of the clinical, socio-behavioral, and fundamental biomedical sciences relevant to vascular surgery by describing the anatomy, physiology, and pathophysiology of the circulatory system in health and disease.
    - Describe therapeutic options, including indications, risks, and benefits, for both operative and non-operative treatments available to patients with vascular disease.
    - Provide a strategy for risk stratification and risk factor modification in patients with vascular disease
    - Describe the effect of coagulation disorders on the vascular system
    - Summarize the noninvasive and invasive diagnostic modalities available
    - Describe the behaviors of biological and synthetic grafts and their respective complications
    - Interpret appropriate biostatistics and epidemiology measures relating to vascular surgery
    - Describe safety procedures appropriate for the use of radiation and how they relate to vascular imaging.
    - Apply lifelong learning skills of the role of scholar
    - Integrate the best evidence and practices available to enhance the quality of care and patient safety in vascular surgery practice
- **Perform a complete and appropriate assessment of a vascular surgery patient**
    - Identify and effectively explore issues to be addressed in a patient encounter
    - Elicit a history that is relevant, clear, concise, and accurate to the context and preferences for the purposes of diagnosis, management, health promotion, and disease prevention.
    - Perform a focused physical examination
    - Select medically-appropriate investigative methods
- **Demonstrate effective clinical problem solving and judgment to address patient problems and use preventive and therapeutic interventions effectively**
    - Implement a management plan in collaboration with a patient and the patient's family
    - Demonstrate appropriate and timely application of preventive and therapeutic interventions
    - Ensure that appropriate informed consent is obtained for therapies

- **Demonstrate proficient and appropriate use of procedural skills, both diagnostic and therapeutic**

  - Demonstrate effective, appropriate, and timely performance of diagnostic procedures
    - Application and interpretation of invasive imaging modalities, including venography and angiography
    - Application and interpretation of noninvasive imaging modalities, including computed tomography [CT] scan, magnetic resonance [MR] imaging, and ultrasound.
  - Include safe and competent performance of the following interventions:
    - Amputation/fasciotomy
    - Aortic reconstruction
    - Arterial exposure and control
    - Carotid surgery including endarterectomy
    - Endovascular interventions including angioplasty
    - Interventions for acute ischemia
    - Lower extremity arterial reconstruction
    - Mesenteric artery and renal artery reconstruction
    - Repair of aortic aneurysms:
      Elective (endovascular and open)
      Ruptured aortic aneurysms (open and endovascular)
    - Repair of peripheral and visceral aneurysms
    - Repair of vascular trauma
    - Surgery for thoracic outlet syndrome
    - Upper extremity vascular reconstruction
    - Vascular access surgery
    - Venous procedures treatment of acute and chronic venous disease
  - Apply knowledge and skills in the application of endovascular interventions, and other treatment modalities, including:
    - Endovascular aortic aneurysm repair (abdominal and thoracic)
    - Balloon angioplasty and stenting
    - Arterial embolization
    - Venous ablation techniques
  - Ensure informed consent is obtained for procedures
  - Document and disseminate information related to procedures performed and their outcomes over the short and long term
  - Ensure adequate follow-up is arranged for procedures performed

- **Seek appropriate consultation from other health professionals, recognizing the limits of their own expertise**
    - Demonstrate insight into their own limits of expertise
    - Demonstrate effective, appropriate, and timely consultation with another health professional as required for optimal patient care.
    - Arrange appropriate follow-up care services for patients

Communicator

Definition:

Facilitate the doctor-patient relationship and the dynamic exchanges that occur before, during, and after the medical encounter.

- **Develop rapport, trust, and ethical therapeutic relationships with patients and families**
    - This is a core clinical skill for vascular surgeons, and effective physician-patient communication can foster patient satisfaction, physician satisfaction, adherence, and improved clinical outcomes.
    - Respect patient confidentiality, privacy, and autonomy.
    - Facilitate an effective structured clinical encounter.
    - Accurately elicit and synthesize relevant information and perspectives of patients and families, colleagues, and other professionals by gathering information about a disease and patients' concerns, and seeking relevant information from other sources
    - Convey relevant information and explanations accurately to patients and families, colleagues, and other professionals
    - Develop a common understanding of issues, problems, and plans with patients, families, and other professionals to develop a shared plan of care
    - Convey effective oral and written information about a medical encounter

Collaborator

Definition:

Work within a healthcare team to achieve optimal patient care. Key and enabling competencies: Vascular surgeons are able to:

- **Participate effectively and appropriately in an interprofessional vascular surgery team**
  - Describe the vascular surgeon's roles and those of other professionals and their responsibilities
  - Recognize and respect the diversity of roles, responsibilities, and competencies of other professionals in relation to their own
  - Work with others to assess, plan, provide, and review other tasks, including but not limited to research, educational work, fellowship review, or administrative responsibilities
  - Describe the principles of team dynamics and respect team ethics, including confidentiality, resource allocation, and professionalism
  - Demonstrate appropriate leadership in a health care team
- **Work with other health professionals effectively to prevent, negotiate, and resolve interprofessional conflict**
  - Demonstrate a respectful attitude
  - Employ collaborative negotiation to resolve conflicts
  - Respect differences and address misunderstandings
  - Reflect on interprofessional team function

Manager

Definition:

Vascular surgeons are integral participants in health care organizations, establish sustainable practices, make decisions about allocating resources, and contribute to the effectiveness of the health care system.

- **Participate in activities that contribute to the effectiveness of their health care organizations and systems**
  - Work collaboratively with others in their organizations
  - Participate in systemic quality process evaluation and improvement, including patient safety initiatives
- **Manage their practice and career effectively**
  - Set priorities and manage time effectively to balance all aspects from patient care to vascular surgery practices.
- **Allocate finite health care resources appropriately**
  - Recognize the importance of just allocation of healthcare resources, balance effectiveness, efficiency, and access with optimal patient care
  - Apply evidence and management processes for cost-appropriate care

- **Serve in administration and leadership roles**
  - Chair or participate effectively in committees and meetings
  - Plan relevant elements of health care delivery to make efficient use of time and personnel

Health Advocate

Definition:

Use expertise and influence to advance the health and well-being of individual patients, communities, and populations.

- **Respond to individual patient health needs and issues as part of patient care**
  - Identify the health needs of an individual patient
  - Identify opportunities for advocacy, health promotion, and disease prevention: Manage factors as they affect the overall health of vascular patients
  - Advocate for the timely delivery of care to the vascular patient
- **Respond to the health needs of the communities that Vascular surgery serve**
  - Describe the practice communities that they serve
  - Appreciate the possibility of competing interests between the communities served and others
- **Identify the determinants of health for the people that they serve**
  - Identify the determinants of health of the population, including barriers to access to care and resources.
  - Identify vulnerable or marginalized people within those served and respond appropriately
- **Promote the health of individual patients, communities, and population**
  - Describe an approach to implementing a change in the health determinants of the population they serve.
  - Describe how public policy impacts on the health of the population served
  - Advocate for the management of risk factors in vascular patients with a multisystem disease
  - Identify points of influence in the health care system and its structure
  - Demonstrate an appreciation of the possibility of conflict inherent in their role as health advocates for a patient or community with that of their role as a manager of health resources.
  - Describe the role of the medical profession in advocating collectively for health and patient safety

Scholar

Definition:

Demonstrate a lifelong commitment to reflective learning as well as the creation, dissemination, application, and translation of medical knowledge.

- **Maintain and enhance professional activities through ongoing learning**
  - Describe the principles of maintenance of competence
  - Describe the principles and strategies for implementing a personal knowledge management system
  - Recognize and reflect on learning issues in practice
  - Conduct personal practice audits
  - Pose an appropriate learning question
  - Access and interpret the relevant evidence
  - Integrate new learning into practice
  - Evaluate the impact of any change in practice
  - Document the learning process
  - Evaluate and adopt as appropriate emerging technologies
  - Participate in learning activities and meetings
  - Develop a strategy to maintain an up-to-date evidence-based practice considering that diagnostic and therapeutic modalities will change throughout the career of vascular surgeons.
- **Critically evaluate medical information and its sources, and apply this appropriately to practice decisions**
  - Describe the principles of critical appraisal
  - Critically appraise retrieved evidence to address a clinical question
  - Integrate critical appraisal conclusions into clinical care
  - Identify appropriate use of biostatistics as it applies to clinical research and reviews related to vascular surgery.
  - Incorporate new information technologies appropriately into the practice of vascular surgery
- **Facilitate the learning of patients, families, students, residents, fellows, other health professionals, the public and others, as appropriate**
  - Describe principles of learning relevant to medical education
  - Identify collaboratively the learning needs and desired learning outcomes of others
  - Select effective teaching strategies, lectures and content to facilitate others' learning
  - Provide effective feedback

- **Contribute to the development, dissemination, and translation of new knowledge and practices**
    - Describe the principles of research, scholarly inquiry and research ethics
    - Pose a scholarly question
    - Conduct a systematic search for evidence
    - Select and apply appropriate methods to address the question
    - Disseminate the findings of a study
    - Participate in a scholarly research, quality assurance, or educational project
        - Development of the hypothesis, which must include a comprehensive literature review
        - Development of the protocol for the scholarly project
        - Preparation of a grant application
        - Development of the research ethics proposal
        - Interpretation and synthesis of the results

Professional

Definition:

Commit to the health and well-being of individuals and society through ethical practice, profession-led regulation, and high personal standards of behavior.

- Exhibit appropriate professional behaviors in practice, including honesty, integrity, commitment, compassion, respect, and altruism
- Demonstrate a commitment to delivering the highest quality care and maintenance of competence
- Recognize and appropriately respond to ethical issues encountered in practice
- Recognize and manage real or perceived conflicts of interest
- Recognize the principles and limits of patient confidentiality
- Maintain appropriate boundaries with patients

- **Participation in profession-led regulation**
    - Demonstrate knowledge and understanding of professional, legal and ethical codes of practice
    - Fulfill the regulatory and legal obligations required of current practice
    - Recognize and respond to others' unprofessional behaviors in practice
- **Demonstrate a commitment to physician health and sustainable practice**
    - Balance personal and professional priorities to ensure personal health and a sustainable practice
    - Strive to heighten personal and professional awareness and insight
    - Recognize other professionals in need and respond appropriately

2. Fellowship Duration

This fellowship consists of three years of full-time, structured supervised training in vascular surgery. The candidate must rotate between at least two accredited centers.

3. Fellowship Rotations

Training year	Mandatory core rotations*			Elective rotations**			Vacation
	Rotation name	Duration	Setting	Rotation name	Duration	Setting	Duration
F1	Vascular surgery	8 months	ER,OR,ward, OPD	Interventional radiology	2 months	Angio suite	1 month
	Vascular Lab	1 month	Vascular Lab				
F2	Vascular surgery	8 months	ER,OR,ward, OPD	Interventional radiology	2 months	Angio suite	1 month
	Vascular Lab	1 month	Vascular Lab				
F3	Vascular surgery	10 months	ER,OR,ward, OPD				1 month
	Vascular Lab	1 month	Vascular Lab				

(*Mandatory core rotation: Set of rotations that represent the fellowship core component and are mandatory to do.
**Elective rotation: Set of rotations that are related to the specialty, as determined by the scientific council/committee, and the trainee is required to do some of them).

4. Mapping of Learning objectives and competency roles to fellowship rotation:

Trainees and trainers should work together to achieve the objectives of teaching and formative assessments. Expectations should evolve as the training level progresses (training stage, milestones).

Junior-level (F1) Competency-Matrix: to map Competency, Learning Domain, and Milestones:

Rotation	Duration	Domain	Objectives	Setting
Vascular surgery	8 months each year	Knowledge	Learn the principles of evaluation and management of vascular problems. Know the principles of hemodialysis access procedures and management of complication.	ER, OPD, OR, ward
		Skills	Practice the pre-, peri-, and post-operative care of vascular patients. Participate in arteriovenous access and basic lower extremity bypass and open varicose vein surgery. Dictate operative note.	ER, OPD, OR, ward
		Attitude	Respond to individual patient health needs and issues as part of patient care. Participate in the research. Maintain and enhance professional activities through ongoing learning. Critically evaluate medical information and its sources and apply this appropriately to practice decisions. Communicate effectively with patients and their families regarding care.	ER, OPD, OR, ward
Vascular lab	1 month each year	Knowledge	Have a basic knowledge of ultrasound physics.	Vascular Lab
		Skills	Able to deal with ultrasound-guided interventions. Familiar with routine noninvasive vascular diagnosis, including continuous wave and pulsed Doppler, and Color-flow duplex ultrasound scan technology.	Vascular Lab
		Attitude	Exhibit appropriate professional behaviors in practice, including honesty, integrity, commitment, compassion, and respect.	Vascular Lab
Interventional radiology	Elective 2 months	Knowledge	Know the interventional radiology principles in diagnosis and treatment of vascular problems.	Angio suite
		Skills	Involve with endovascular procedures under the guidance of full-time faculty. Practice aortograms and runoff as well as venograms and fistulograms. Practice basic and advanced catheterization.	Angio suite
		Attitude	Recognize the limits of their own expertise. Participate effectively and appropriately in an interprofessional vascular surgery team.	Angio suite

Senior-level (F2, F3) Competency-Matrix: to map Competency, Learning Domain, and Milestones:

Rotation	Duration	Domain	Objectives	Setting
Vascular surgery	8 months each year	Knowledge	Understand the evaluation and testing required for patients undergoing aortic, cerebrovascular, and peripheral vascular procedures. Define options for managing ruptured aortic aneurysms. Discuss complex vascular disorders such as carotid body tumors and aortic diseases. Understand diagnosis and treatment of children with vascular diseases.	ER, OPD, OR, ward
		Skills	Participate in the outpatient clinical activities. Make all primary management decisions independently. See all consultations to the vascular surgery service. Decide regarding type and timing of surgical procedures. Able to complete all procedures with minimal to no assistance required from faculty. Perform all categories of major vascular surgical procedures under the direct supervision of the attending staff. Competent with the treatment of venous disease insufficiency and varicose veins. Competent with the evaluation and treatment of thoracic outlet diseases. Participate in open major vascular procedures, thoracoabdominal aneurysms, and thoracic outlet procedures as well as procedures for vascular injuries. Participate in the assessment and treatment of pediatric vascular disease including traumatic vascular injuries.	ER, OPD, OR, ward
		Attitude	Provide optimal, ethical, and patient-centered medical care. Recognize the importance of just allocation of health care resources, balancing effectiveness, efficiency, and access with optimal patient care. Contribute to the development, dissemination, and translation of new knowledge and practices. Promote the health of individual patients, communities, and populations. Able to take a junior fellow through simple cases.	ER, OPD, OR, ward
Vascular lab	1 month each year	Knowledge	Have a basic knowledge of vascular noninvasive imaging as it applies to current established techniques of vascular diagnosis.	Vascular Lab
		Skills	Able to perform and interpret the results of noninvasive testing modalities performed for major non-cardiac vascular disorders.	Vascular Lab
		Attitude	Develop rapport, trust, and ethical therapeutic relationships with patients and families.	Vascular Lab
Interventional radiology	Elective 2 months	Knowledge	Know the principles of endovascular procedures.	Angio suite
		Skills	Practice angioplasty, stenting, thrombolytic therapy, embolization, laser plaque ablation, and aortic endo-grafting including the thoracic and abdominal aorta using simple and branched grafts. Participate in complex endovascular procedures including fenestrated aortic endografting.	Angio suite
		Attitude	Work with other health professionals effectively to prevent, negotiate, and resolve interprofessional conflict.	Angio suite

IX. Continuum of Learning

Training in vascular surgery is similar to other specialties in that learning should take place in each stage of progression. Vascular specialty is a relatively new branch with rapid progress in a short time that mandates lifelong continuous professional development (CPD). In the last 10-15 years, for example, major changes occurred in the treatment of aortic surgery, such as aortic trauma and infrarenal AAA in older patients. You must keep in mind the necessity of CPD throughout your career to meet the demands of your profession. The following table shows how the role is progressively expected to develop throughout the junior and senior levels of practice.

General Specialty	F1 (Junior Level)	F2 (junior Level)	F3 (senior level)
General surgery board	Dependent/supervised practice	Dependent/supervised practice	Increase Independent practice/supervised practice
Obtain basic health science and foundational level to core discipline knowledge	Obtain fundamental knowledge related to core clinical problems of vascular surgery. For example, hemodynamic of the circulatory system, pathophysiology of main disease.	Apply knowledge to provide appropriate clinical care related to core clinical problems of the specialty. Increase the ability to plan the treatment course of main vascular cases	Acquire advanced and up-to-date knowledge related to core clinical problems of the specialty
General clinical and surgical skills.	Apply clinical skills such as vascular physical examination and starting practical procedures related to the core presenting problems and procedures of the specialty like vascular access, anastomosis technique and central lines.	Analyze and interpret the findings from clinical skills to develop appropriate differential diagnoses and management plan for the patient. Increase the development of vascular operative and endovascular skills	Increase independency in certain well-practiced procedures, participation in more complex demanding procedures

X. Teaching Methods

The teaching process in fellowship training is based mainly on the principles of adult learning theory. The trainees feel the importance of learning and play active roles in the content and the process. The training programs implement the concept of adult learning in each feature of the activities where the fellows are responsible for their own learning requirements. Formal training includes the following teaching activities:

- Fellowship Specific Learning Activities.
- General Learning Opportunities.

1.1. Fellowship Specific Learning Activities

Trainees are required to attend educational activities, and non-compliance can subject them to disciplinary actions. It is advisable to link attendance and participation in these activities to continuous assessment tools. Fellowship administration should support these activities by providing reserved time for trainees to attend and participate in them.

A) Fellowship Academic half-day:

Every week, at least two to four hours of formal training time (commonly referred to as academic half-day) should be reserved. Formal teaching time is an activity that is planned in advance with an assigned tutor, time slots, and venue. It excludes bedside teaching and clinic postings. The academic half-day covers the core specialty topics that are determined and approved by the specialty's scientific council aligned with the specialty-defined competencies and teaching methods. The core specialty topics will ensure that important clinical problems of the specialty are well taught. It is recommended that lectures be conducted in an interactive, case-based discussion format. The learning objectives of each core topic need to be clearly defined, and it is preferable to use a pre-learning material. Whenever applicable, core specialty topics should include workshops, team-based learning (TBL), and simulation to develop skills in core procedures. The chief fellow should work together to ensure the planning and implementation of academic activities as indicated in the curriculum. There should be an active involvement of the trainee in the development and delivery of the topics under faculty supervision; the involvement might be in the form of delivery, content development, research, and so on. The supervisor's educator should make sure that each topic is stratified into three categories of the learning domain: knowledge, skill, and attitude (see Appendix A for the top knowledge topic and procedure list).

The following is a table with example topics that illustrate the half-day activities:

Topic	Presenter	Date
Vascular anatomy and physiology		
History taking and physical examination of the patients with vascular problems		
Noninvasive vascular testing with ultrasound-based therapeutics		
Central veins approach for hemodialysis		
Catheter directed thrombolysis		
Hemodialysis access procedures and complication management		
Clinical research		
Early recognition and treatment of complications of vascular surgery		
Compartment syndrome		
Hypercoagulable states		
Antithrombotic therapy		
Endovascular diagnostics and therapeutics		
Intimal hyperplasia		
Carotid body tumors		
Carotid stenosis		
Carotid and vertebral injuries		
Extremity vascular injuries		
Abdominal vascular injuries		
Thoracic vascular injuries		
Traumatic aortic dissection		
Ruptured AAAs		
Anastomotic aneurysms		
Splanchnic artery aneurysms		
Thoracic-abdominal aortic diseases		
Ischemic related ulcers		
Lumbar sympathectomy		
Peripheral arterial diseases		
Medical treatment of claudication		
Upper extremity revascularization		
Renovascular hypertension		
Thoracic outlet syndrome		
Venous disease		
Lymphedema		
Fibromuscular dysplasia		
Takayasu's disease		
Buerger's disease		

B) Practice-based learning:

Fellows are expected to build their capacity based on self-directed learning by exposures during bedside, vascular lab, OR, ER, Angio Suite, and other work-related activities that include courses and workshops to:

- Demonstrate the ability to effectively utilize systematic methodology to assess practice experience and perform practice-based improvement activities.
- Locate, appraise, and assimilate evidence from scientific studies related to patients' vascular problems.
- Demonstrate the ability to obtain and utilize information from the patient population and the larger population from which they are drawn to enhance patient care.
- Utilize information technology to manage information, access online medical data, and support their own education.
- Demonstrate the ability to utilize knowledge of study designs and statistical methods to recognize strengths and weaknesses in clinical studies and other information on diagnostic and therapeutic effectiveness.
- Facilitate the education of residents, and other healthcare professionals.

Practice-based learning also allows educators to supervise trainees to become competent in the required fellowship practical skills that ensure fulfilling of the domains of knowledge, psychomotor, and/or attitude learning. Each trainee needs to maintain a logbook documenting the procedures observed, performed under supervision, and independently. It would be prudent to determine the minimum number of procedures to be done before training completion and the minimum number needed to maintain competency after certification.

C) Morning report:

The goals for morning reports are to teach efficient handover strategies and vascular case presentation skills, to allow discussion of the management of interesting vascular cases, and enhance problem solving and multidisciplinary team skills.

1.2. General Learning Opportunities

A formal training time should be supplemented by:

- Journal Club every month.
- Grand rounds weekly.
- Involvement in quality improvement committees and meetings as required.
- Morbidity and Mortality (M&M) monthly.

XI. Assessment and Evaluation

1. Purpose of Assessment

Assessment plays a vital role in the success of postgraduate training. It will guide trainees and trainers to achieve defined standards, learning outcomes, and competencies. The assessment will provide feedback to learners and faculty regarding curriculum development, teaching methods, and quality of the learning environment. A reliable and valid assessment is an excellent tool for assessing curriculum alignments between objectives, learning methods, and assessment methods. Finally, assessment assures patients and the public that health professionals are safe and competent to practice.

It can serve the following purposes:

a. **Assessment for learning:** Trainers use information from trainees' performance to inform their learning for improvement. It enables educators to use information about trainees' knowledge, understanding, and skills to provide feedback to them about learning and how to improve.

b. **Assessment as learning:** It involves trainees in the learning process, which enables them to monitor their own progress. Trainees use self-assessment and educators' feedback to reflect on their progression. It develops and supports trainees' metacognitive skills. Assessment as learning is crucial in helping students become lifelong learners.

c. **Assessment of learning:** It is used to demonstrate the achievement of learning. This is a graded assessment and usually counts toward the trainee's end-of-training degree.

d. **Feedback and evaluation:** Assessment outcomes will represent quality metrics that can improve learning experience.

Miller's Pyramid of Assessment provides a framework for assessing the trainees' clinical competences, which acts as a road map for the trainers to select the assessment methods to target different clinical competencies including "knows," "knows how," "shows how," and "does."

For the sake of organization, assessment will be further classified into two main categories: formative and summative.

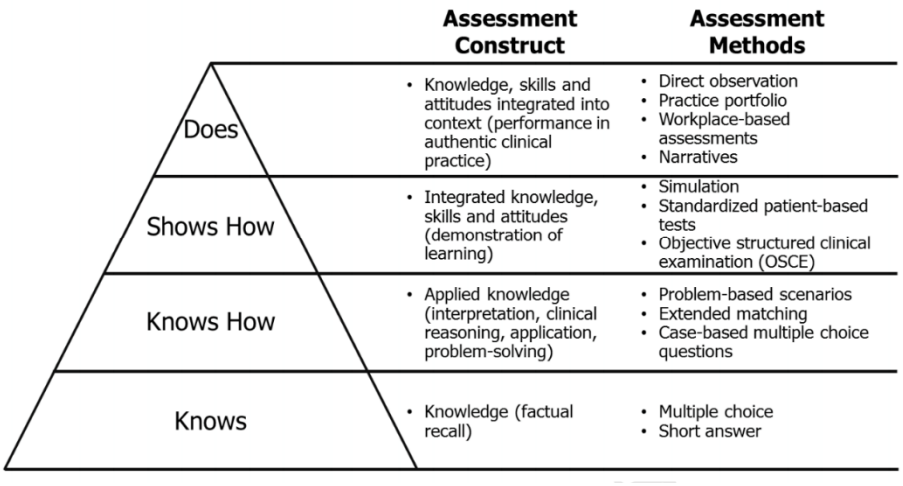
2. Formative Assessment

2.1 General Principles

Formative assessment (also referred to as continuous assessment) is a component of assessment that is distributed throughout the academic year aiming primarily to provide trainees with effective feedback. Adult learners should make every effort for feedback throughout their training journey. Every two weeks at least one hour should be assigned by trainees to meet with their mentors, to review performance reports. Input from the overall formative assessment tools will be utilized at the end of the year to make the decision to promote each individual trainee from the current-to-subsequent training level. Formative assessment will be defined based on scientific (council/committee) recommendations (usually updated and announced for each individual fellowship at the start of the academic year). (The executive policy for continuous assessment is available online at www.scfhs.org.

Formative assessment will have the following features, which are used based on the Miller's pyramid (Figure 1):

- Multisource: minimum of four tools
- Comprehensive: covering all learning domains (knowledge, skills, and attitude)
- Relevant: focusing on workplace-based observations



(Figure 1: Miller's Pyramid)

1- Adapted from Walsh CM In-training gastrointestinal endoscopy competency assessment tools: types of tools, validation, and impact. Best Practice & Research Clinical Gastroenterology 2016 Jun 1;30(3):357-74.

2- Miller GE. The assessment of clinical skills/competence/performance Acad Med. 1990;65(9 Suppl): S63–7.

Competency-milestone oriented: reflecting the trainee's expected competencies that match their developmental level

Trainees should play an active role in seeking feedback during training. However, trainers are expected to provide timely and formative assessments. The SCFHS will provide an e-portfolio system to enhance communication and analysis of data arising from formative assessments.

Trainers and trainees are directed to follow the recommendations of the scientific council regarding the updated forms, frequency, distribution, and deadlines related to the implementation of evaluation forms.

2.2 Formative Assessment Tools:

Formative assessment tools should be based on the three learning domains:

1- Knowledge

- Annual written promotion exam.
- Annual structured oral exam.

2- Skills

- Logbook
- Research Activities

3- Attitude

- ITER: In-Training Evaluation Report

Learning Domain	Summative Assessment Tools	Passing Score
Knowledge	Annual written promotion exam	At least borderline pass in each tool
	Annual structured oral exam	
Skills	Logbook (reviewed every six months)	At least reach the minimum requirements for each type of procedures (see Appendix-B)
	Research Activities	At least one article published
Attitude	ITER: In-Training Evaluation Report (at the end of each rotation)	At least borderline pass

The evaluation of each component will be based on the following criteria:

Percentage	< 50%	50-59.4%	60-69.4%	>70%
Description	Clear fail	Borderline fail	Borderline pass	Clear pass

To achieve unconditional promotion, the candidate must score a minimum of "borderline pass" in all components.

The fellowship director can still recommend the promotion of candidates in case the candidate's score was "borderline fail" in one or two components at maximum, and these scores should not belong to the same area of assessment (for example: both borderline failures should not belong to skills); and the candidate must have passed all other components and scored a minimum of clear pass in at least two components.

For further details on this section, please refer to the general bylaws and executive policy of assessment (available online: www.scfhs.org).

3. Summative Assessment

3.1 General Principles

Summative assessment is a component of assessment that aims primarily to make informed decisions on trainees' competency. In comparison to the formative assessment, summative assessment does not aim to provide constructive feedback.

To be eligible for the final exams, a trainee should be granted a **"Certification of Training-Completion."**

3.2 Promotion Examination

This is a written exam held at the end of each academic year. It permits the trainee to be promoted to the next year of training.

3.3. Final In-training Evaluation Report (FITER)

In addition to approval of the completion of clinical requirements by the supervising committee, FITER is also prepared by fellowship directors for each fellow at the end of his or her final year of training. This report shall be the basis of obtaining the certificate of training fellowship completion, as well as the qualification for the final examination.

For further details on this section, please refer to the general bylaws and executive policy of assessment (available online: www.scfhs.org).

3.4 Certification of Training-Completion

To be eligible for the final exam, each trainee is required to obtain the "Certification of Training-Completion" based on the training bylaws and executive policy.

Trainees will be granted the "Certification of Training-Completion" once the following criteria are fulfilled:

1- Successful completion of all training rotations.
2- Completion of training requirements (e.g., logbook, research, others) as outlined in FITER that is approved by the scientific council/committee of the vascular program.
3- Passing all promotion exams.
4- Clearance from SCFHS training affairs that ensures compliance with tuition payments and the completion of universal topics.

The "Certification of Training-Completion" will be issued and approved by the supervisory committee or its equivalent according to SCFHS policies.

3.5 Final Specialty Examinations

The final specialty examination is the summative assessment component that grants trainees the specialty's certification. It has two elements:

- Final written exam: To be eligible for this exam, trainees are required to have the *"Certification of Training-Completion."*
- Final clinical/practical exam: Trainees will be required to pass the final written exam to be eligible to sit for the final clinical/practical exam.

	Cognition		Domains			
	K1	K2	Pathophysiology and anatomy	Investigation and diagnosis	Treatment	Total required items
1. Vascular trauma	0	15	2	6	7	15
2. Aortic and renal artery diseases	0	15	2	6	7	15
3. Peripheral arterial diseases	0	15	2	6	7	15
4. Mesenteric vascular diseases	0	6	2	2	2	6
5. Carotid diseases	0	10	2	3	5	10
6. Thoracic outlet syndrome	0	3	1	1	1	3
7. Venous disease	0	7	2	2	3	7
8. Hemodialysis access	0	10	2	3	5	10
9. Lymphedema	0	3	1	1	1	3
10. Vascular surgical complications	0	10	1	4	5	10
11. Research, ethics, and patient safety	0	6				
Total						100

Blueprint for Vascular Surgery promotion and final Examination

		DIMENSIONS OF CARE				
		Health Promotion & Illness Prevention 1±1 Station(s)	Acute 5±1 Station(s)	Chronic 3±1 Station(s)	Psychological Aspects 1±1 Station(s)	# Station(s)
DOMAINS FOR INTEGRATED CLINICAL	Patient Care 7±1 Station(s)	1	1	1		3
	Patient Safety & Procedural Skills 1±1 Station(s)		1			1
	Communication & Interpersonal Skills 2±1 Station(s)			1	1	2
	Professional Behaviors 0±1 Station(s)					0
	Total Stations	1	2	2	1	6

Blueprint for Vascular Surgery annual structured oral exam and final clinical Examination

For further details on this section, please refer to the general bylaws and executive policy of assessment (available online: www.scfhs.org).

XII. Fellowship and Course Evaluation

SCFHS applies variable measures to evaluate the implementation of this curriculum. The training outcomes of this fellowship will undergo the quality assurance framework endorsed by the Central Training Committee at the SCFHS. Trainees' assessment (both formative and summative) results will be analyzed and mapped to curriculum content. Other indicators that will be incorporated are as follows:

- Report of the annual trainees' satisfaction survey
- Reports from trainees' evaluation of faculty members
- Reports from trainees' evaluation of rotations
- Reports from the annual survey of fellowship directors
- Data available from fellowship accreditations
- Reports from direct field communications with trainees and trainers

Goal-based Evaluation: The intended achievement of milestones will be evaluated at the end of each stage to assess the progress of the curriculum delivery, and any deficiency will be addressed in the following stage utilizing the time devoted to trainee-selected topics and professional sessions.

In addition to subject-matter opinion and best practices from benchmarked international fellowships, SCFHS will apply a robust method to ensure that this curriculum will utilize all the data that will be available during the time of revision of this curriculum in the future.

XIII. Policies and Procedures

This curriculum represents the means and materials outlining learning objectives with which trainees and trainers will interact to achieve the identified educational outcomes. The Saudi Commission for Health Specialties (SCFHS) has a full set of "General Bylaws" and "Executive Policies" (published on the official SCFHS website) that regulate all processes related to training. General bylaws of training, assessment, and accreditation as well as executive policies on admission, registration, continuous assessment and promotion, examination, trainees' representation and support, duty hours, and leaves are examples of regulations that need to be applied. Trainees, trainers, and supervisors need to apply this curriculum in compliance with the most updated bylaws and policies that can be accessed online (via the official SCFHS website, www.scfhs.org).

XIV. Appendices

A. **Knowledge topic and procedure list**
B. **Procedures Logbook minimum requirements**
C. **References**

Appendix-A

Knowledge topic and procedure list:

Conditions	Procedures
Aortic aneurysm	Aortic aneurysm repair
Aortic dissection	Aortocaval fistula repair
Aortic ulcers	Aortoenteric fistula repair
Aortic valve disease	Arteriovenous fistula surgery
Arteriosclerosis / atherosclerosis	Arteriovenous malformation surgery
Arteriovenous fistula	Bypass surgery
Arteriovenous malformation	Carotid angioplasty and stenting
Blood clots	Carotid artery stenting
Carotid artery disease	Carotid endarterectomy
Chylothorax	Celiac artery bypass
Chylous complications	Coronary angioplasty and stents
Chylous effusions	Endovascular reconstruction
Critical limb ischemia	Endovenous laser therapy
Deep vein occlusions	Ex vivo renal artery reconstructions
Deep vein thrombosis	Inferior vena cava (IVC) filter retrieval
Ehlers-Danlos syndrome	Inferior vena cava (IVC) placement
Fibromuscular dysplasia	Laser ablation
Intestinal ischemia	Mesenteric artery bypass
Klippel-Trenaunay syndrome	Open vascular reconstruction
Lymphedema	Radiofrequency ablation
Marfan syndrome	Renal artery angioplasty
Median arcuate ligament syndrome	Renal artery bypass
Nutcracker syndrome	Renal artery endarterectomy
Pelvic congestion syndrome	Stenting to repair aneurysms
Peripheral artery disease (PAD)	Subfascial endoscopic perforator surgery
Popliteal artery aneurysm	Thoracic duct embolization
Renal aneurysms	Thoracic outlet decompression
Renal artery stenosis	Thrombectomy
Takayasu's arteritis	Vascular stenting
Thoracic outlet syndrome	Vein removal
Thrombophlebitis	Vena cava reconstruction
Varicocele	Vertebral artery reconstruction
Varicose veins	
Vascular infections and complications	
Vascular malformations	
Venous diseases	
Venous leg swelling	
Venous tumors	
Venous ulcers	
Vertebral artery disease	

Appendix-B

Procedures Logbook minimum requirements:

Procedure	Number
Angiography	200
Doppler studies	100
Duplex scanning	100
Creation of native and prosthetic vascular access for hemodialysis	100
Diabetic foot infection	100
Management of chronic limb ischemia	100
Embolectomy	70
Major and minor amputations	50
Management of varicose veins	50
Vascular trauma	50
Aortic dissection	10
Direct reconstruction of aortoiliac occlusive diseases	10
Infrainguinal bypasses	10
Congenital vascular malformation	5
Extra-anatomic bypasses	5
Management of central and peripheral arteriovenous fistulae	5
Management of cerebrovascular diseases	5
Peripheral aneurysms	5
Thoracic outlet syndrome	5
Thrombendarterectomy of aorta and peripheral arteries	5
Sympathectomies (lumbar, cervicodorsal)	4
Carotid artery aneurysms	2
Carotid body tumors	2
Management of lymphedema	2
Management of renovascular hypertension	2
Management of vasospastic arterial diseases	2
Caval interruption procedures	1
Total	**1000**

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