Aortic Endovascular Interventions Training Curriculum

Description

In the era of duty hour restrictions and increasing medico-legal pressures, surgical simulation offers a viable alternative to bridge the gap in experience and knowledge of residents[2].
Training within a proficiency-based, virtual-reality training program can increase competency and reduce errors and complications during real surgical procedures[10].
The skills acquired in the simulated environment should be transferable to the real clinical environment[4].
The Simbionix ANGIO Mentor™ is a virtual reality simulator that provides a safe work environment for a variety of endovascular procedures.
The following curriculum is intended to promote the acquisition of endovascular skills and procedural performance for peripheral endovascular interventions.

Objectives

- Practicing and acquiring competence in endovascular technical skills:
  - Guidewire and catheter handling
  - Performing diagnostic arteriography
  - Imaging Techniques – using fluoroscopy, DSA and roadmapping
  - Contrast - using Power Injection and Hand Injection
  - Accurately positioning and deploying a stent graft without compromising important vessels
- Mastering and achieving confidence in the following interventional procedures, in a simulated environment:
  - EVAR
  - TEVAR
  - Peripheral Embolization (EVAR-related cases)
- Practicing and acquiring competence in the following:
  - Managing endoleaks Type I, Type II
  - Hemodynamic Patient Management
  - Using medications

Specialties

Vascular Surgery, Interventional Radiology, Thoracic Surgery.

Target Audience

Individuals or groups interested in following a structured curriculum to promote acquisition of endovascular skills and procedural performance for peripheral endovascular interventions.

Assumptions

Previous knowledge in anatomical and procedural steps.

Suggested Time Length

The suggested program can be implemented during 6 months of residency, consisting of weekly faculty-mentored simulation-based sessions. Completing one case successfully in each module should take between 30 minutes to one hour.

Authors

This curriculum has been designed by Simbionix to serve as a template for institution Program Directors, who may tailor the curriculum to individual training needs. See references for a detailed review of published studies.

Introduction to Curriculum

Before each module is performed, provide a full demonstration of one case by an experienced operator, with an opportunity for the trainee to ask questions.
Suggested time length for the familiarization period is approximately 40 minutes.

1.1 EVAR Module (Endovascular Abodminal Aortic Aneurysm Repair)

This module allows practicing complete endovascular abdominal aortic aneurysm repair using a stent graft system.

Objectives:

- Learn to select proper size of stent graft components
- Accuratly orient and position the stent graft delivery system using radiopaque markers
- Accurately deploy a bifurcated stent graft in various neck lengths and angulations, excluding the renal arteries and hypogastric arteries
- Practice recapturing and repositioning the graft
- Practice gate cannulation techniques in different levels of difficulty
- Practice contralateral leg and extensions positioning and deployment
- Practice stent graft balloon moulding
- Practice final angiography and assessement of endoleaks
- Practice endoleak management and troubleshooting techniques

Instructions:

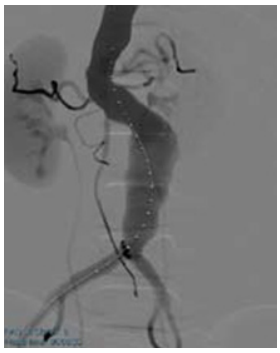
The module enables free-style training using different techniques, alternative approaches, and acquisition of the skill and knowledge necessary to safely cope with possible complications.
Practice selection of appropriate graft size, stiff wire introduction, positioning and deplopyment of bifurcated stent, gate cannulation, contralateral leg positioning and deployment, stent-graft balloon inflation and final angiography.

Case 1 - EVAR

10 deg, 24mm long neck

Case 2 - EVAR

45 deg, 52mm long neck

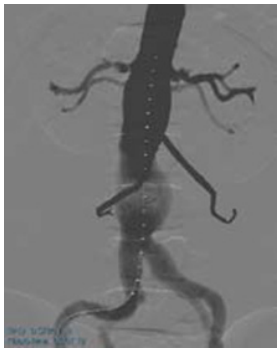


Case 3 - EVAR

58 deg, 31mm long neck

Case 4 - EVAR

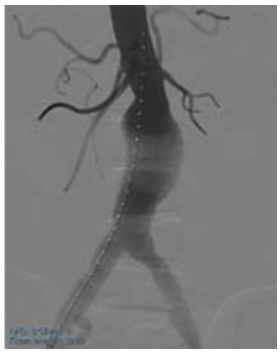
35 deg, 21mm long neck, tortuous iliacs



Case 5 - EVAR

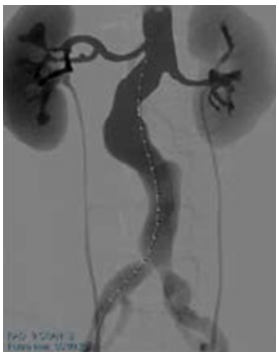
60 deg, 15mm long X 27mm wide neck

Bilateral ectatic iliacs



Case 6 - EVAR

40 deg, 18mm long neck



Case 7 - EVAR

60 deg, 35mm long neck

Bilateral ectatic iliacs

1.2 TEVAR Module

Objectives:

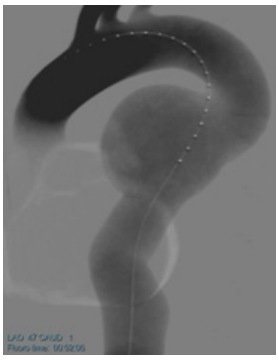
- Learn to select proper size of stent graft components
- Accurately orient and position the stent graft delivery system using radiopaque markers
- Accurately deploy a proximal stent graft in various aortic structures, having sufficient landing zone and avoiding graft migration and subclavian blockage
- Practice correct graft deployment
- Practice extending with additional grafts
- Practice stent graft balloon moulding
- Practice final angiography and assessement of endoleaks
- Practice endoleak management and troubleshooting techniques

Instructions:

The module enables free-style training using different techniques, alternative approaches, and acquisition of the skills and knowledge necessary to safely cope with possible complications.

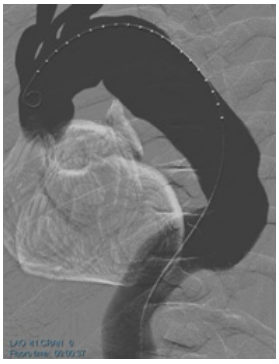
Practice selection of appropriate graft size, stiff wire introduction, positioning and deployment of one or several stent grafts, stent-graft balloon inflation and final angiography.

Following performance of the patient case, the trainee is required to analyze his/her performance report and set personal standards for improvement.



Case 1 - TEVAR

Aneurysm case. Saccular aneurysm, challenging wire manipulation to the aortic arch.



Case 2 - TEVAR

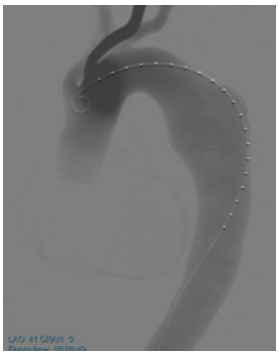
Aneurysm case. Fusiform aneurysm, challenging graft deployment. 2-3 grafts are required.

Case 3 - TEVAR

Transection case. Saccular aneurysm, subclavian might be blocked due to insufficient landing zone.

Case 4 - TEVAR

Transection case. Saccular aneurysm, aneurysm borders are hard to distinguish, unless proper angulation is maintained (aneurysm is anterior).



Case 5 - TEVAR

Aneurysm case. Fusiform aneurysm, coming from both the outer and inner aortic walls.

Case 6 - TEVAR

Aneurysm case. Fusiform aneurysm, challenging graft deployment due to aneurysm shape. 2-3 grafts are required.

1.3 Peripheral Embolization Module

The Peripheral Embolization module provides an opportunity to perform adjunctive therapies related to EVAR: hypogastric artery embolization and Type II endoleak embolization.

Objectives:

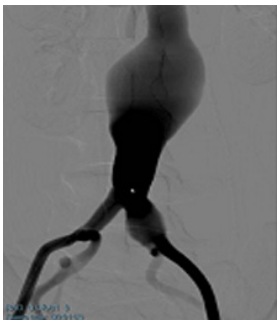
- Practice hypogastric artery embolization in case of common iliac artery aneurysm and planning to overstent the hypogastric artery
- Ptractice type II endoleak treatment post-procedurally
- Perform diagnostic aortrogram
- Perform selective catheterization to diagnose the target embolization site
- Reach the target embolization site using a microcatheter or a diagnostic catheter
- Use different types and shapes of microcoils and macrocoils
- Appropriately size the coils according to the target embolization site
- Avoid complications during coil delivery: spasm, coil migration, perforation

Instructions:

The module enables free-style training using different techniques, alternative approaches, and acquisition of the skills and knowledge necessary to safely cope with possible complications.

Perform diagnostic aortography and selectively catheterize the target vessel leading to the embolization site. Perform coil embolization of the target site .

Following performance of the patient case, the trainee is required to analyze his/her performance report and set personal standards for improvement.

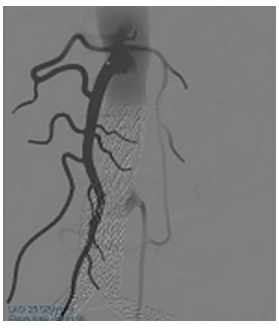


Case 2 – Peripheral Embolization

Internal Iliac Artery Embolization Prior to Endovascular AAA Repair.

Instructions:

Select the desired approach (crossover/ipsilateral), using a diagnostic catheter access the left internal iliac. Place 0.035" coils through the diagnostic catheter to block the internal iliac artery.



Case 5 – Peripheral Embolization

Post-EVAR Type II Endoleak

Instructions:

Selectively catheterize the SMA. Perform an angiogram to find the endoleak location in the IMA. Deliver microcoils through a microcatheter to the IMA leak.

Catheterize the right internal iliac artery. Introduce a microcatheter into the iliolumbar artery and deliver microcoils to the lumbar artery to block the 2nd part of the endoleak.

ANGIO Mentor Studies

1. **Training with simulation versus operative room attendance.** Desender LM, Van Herzeele I, Aggarwal R, Vermassen FE, Cheshire NJ. Department of Thoracic and Vascular Surgery, University Hospital Ghent, Ghent, Belgium. *J Cardiovasc Surg (Torino). 2011 Feb;52(1):17-37*.
2. **Simulation in Neurosurgical Residency Training: A New Paradigm** Alejandro M. Spiotta, MD Richard P. Schlenk, MD The Cleveland Clinic Foundation, Cleveland, Ohio, USA. *The Congress of Neurological Surgeons(CNS) Quarterly 2010 page 18-20*.
3. **The Utility of Endovascular Simulation to Improve Technical Performance and Stimulate Continued Interest of Preclinical Medical Students in Vascular Surgery** Jason T. Lee , Mary Qiu , Mediget Teshome, Shyam S. Raghavan, Maureen M. Tedesco, and Ronald L. Dalman Division of Vascular Surgery, Stanford University School of Medicine, Stanford, California. *Journal of Surgical Education Volume 66, Issue 6, November-December 2009, Pages 367-373*. Available online 30 January 2010.
4. **Results from endovascular skills training for surgical residence**. Jason T. Lee, Division of Vascular Surgery, Stanford University School of Medicine, Stanford, California.
5. **Virtual Reality Simulation in the Endovascular Field** Aggarwal Rajesh , Herzeele Isabelle Van European Virtual Reality Endovascular Research Team (EVEREST) *US Cardiology, 2008;5(1):41-5*.
6. **Experienced endovascular interventionalists objectively improve their skills by attending carotid artery stent training courses.** S. Neequaye, I. Van Herzeele, R. Aggarwal, M. Hamady, A. Darzi, T. Cleveland, P. Gaines, N. Cheshire Department of Biosurgery and Surgical Technology, Imperial College London, U.K. *Presented in the prize session of the European Society for Vascular Surgery (ESVS) Annual Meeting September 20 - 23, 2007 in Madrid, Spain*.
7. A**nalysis of simulated angiographic procedures. Part 2: extracting efficiency data from audio and video recordings**. Duncan JR, Kline B, Glaiberman CB.Mallinckrodt Institute of Radiology, Washington University School of Medicine, 510 S. Kingshighway Blvd., St. Louis, MO 63110, USA. *J Vasc Interv Radiol. 2007 Apr;18(4):535-44*.
8. T**he use of interventional cardiovascular simulation to evaluate operator performance: The carotid Assessment of operator performance by the Simbionix carotid StEnting Simulator Study (ASSESS)** Giora Weisz, Jacque Devaud, Stephen Ramee, Mark Reisman, William Gray Cardiovascular Research Foundation, and Center for Interventional Vascular Simulation, New-York Presbyterian Hospital, Columbia University, New York, NY *Journal of the Society for Simulation in Healthcare 2007, Volume2, Issue 1*.
9. **Preliminary Results of Construct Validity of an Endo Vascular Simulator** Giora Weiss, Colombia University, New York. The abstract was *accepted and presented **at the 2006 TCT meeting** October 22- 26, 2006 in Washington DC. J Vasc Surg. 2012 Jun 26. [Epub ahead of print]*
10. **Development of a Virtual Reality Training Curriculum for Laparoscopic Cholecystectomy** Aggarwal, P. Crochet, A. Dias, A. Misra, P. Ziprin and A. Darzi *British Journal of Surgery 2009; 96: 1086–1093*.