DMS-1701: VASCULAR SONOGRAPHY I

Cuyahoga Community College

Viewing: DMS-1701 : Vascular Sonography I

Board of Trustees:
May 2020

Academic Term:
Fall 2020

Subject Code
DMS - Diagnostic Medical Sonography

Course Number:
1701

Title:
Vascular Sonography I

Catalog Description:
Specialized study of cerebrovascular and peripheral arterial vascular system as related to ultrasound imaging. Focus on anatomy, hemodynamics, pathology and sonographic appearance of normal and diseased arteries. Discussion of direct/indirect testing methods and the sonographic findings. Explanation of medical and surgical interventions used in the treatment of vascular disease.

Credit Hour(s):
4

Lecture Hour(s):
4

Requisites

Prerequisite and Corequisite
Concurrent enrollment in DMS-1311 Initial Sonographic Scanning.

Outcomes

Course Outcome(s):
Recognize the movement of blood flow through the arterial system in both normal and diseased vessels when performing vascular exams.

Objective(s):
1. Describe microscopic and gross anatomy of blood vessels.
2. Identify and label the vessels of the heart, cerebrovascular and peripheral arterial systems from a diagram and sonographic images.
3. Explain the meaning of arterial hemodynamics.
4. Describe the various factors that affect resistance to blood flow.
5. Identify the signs, symptoms and risk factors associated with arterial disease.
6. List the pathologies of the arterial system and describe their sonographic appearances.
7. Describe the cardiovascular effects of hormone therapy in transgender patients.

Course Outcome(s):
Explain the procedure to the patient and provide technical findings of direct and indirect testing methods associated with arterial vascular examination to the physician.

Objective(s):
1. Identify standard imaging views used for evaluation of the carotid vessels, and upper and lower extremity arteries for both direct and indirect testing.
2. Recognize the difference between qualitative and quantitative interpretation of a waveform.
3. Compare and contrast the indications, limitations, and uses of color duplex imaging, plethysmography, and transcranial Doppler.

4. Describe the patient preparation necessary for each arterial test.
5. Complete a pertinent history and physical examination specific to each arterial test.

Course Outcome(s):

Identify medical and surgical interventions utilized in the treatment of cardiovascular diseases in order to explain it to the patient.

Objective(s):

1. Explain the importance of lifestyle changes
2. List the main medications utilized in the treatment of cardiovascular disease, their effects, indications and contraindications.
3. List and explain the surgical treatments most commonly used for cerebrovascular and peripheral vascular diseases.

Methods of Evaluation:

1. Article reviews
2. Class participation
3. Final examination
4. Homework assignments
5. Oral/Written quizzes
6. Research/Semester project
7. Written tests

Course Content Outline:

1. Concepts
   a. Patient preparation techniques
   b. Exam protocols
   c. Clinical examination techniques
   d. Cross sectional anatomy of heart vessels
   e. Cross sectional anatomy of cerbrovascular systems
   f. Cross sectional anatomy of peripheral arterial systems
   g. Arterial pathology
   h. Pathophysiology of arterial disease
   i. Arterial hemodynamics
   j. Direct vs. indirect testing methods
   k. Qualitative and quantitative technical findings
   l. Indications
   m. Contraindications
   n. Arterial testing techniques
   o. Scanning techniques
   p. Cerbrovascular testing techniques
2. Skills
   a. Reporting technical findings of exam
   b. Identifying cross sectional anatomy of the vessels of the heart, cerbrovascular, and peripheral arterial systems.
   c. Completing a history and physical examination
   d. Correlating medical data
   e. Communicating with patient
3. Issues
   a. Medical ethics
   b. Physician interaction
   c. Diversity
   d. Patient interaction
   e. Scope of Practice
   f. Verbal and non-verbal communication limitations

Topical Outline

1. Anatomy (vessel routes, variations, and collaterals)
   a. Microscopic anatomy
   b. Circulation

i. Cardiopulmonary
ii. Systemic
iii. Portal

c. Cardiopulmonary anatomy
i. Walls
ii. Internal structures
1. Chambers
2. Septa
3. Valves
iii. Pulmonary arteries and veins

d. Peripheral arterial system
i. Upper extremity
ii. Lower extremity

e. Cerebrovascular system
i. Extracranial
ii. Intracranial

2. Arterial Hemodynamics: Flow physics
a. Heart rate
b. Blood pressure
c. Energy Concepts
i. Kinetic energy
ii. Potential energy
iii. Gravitational energy
iv. Energy gradient
d. Resistance
e. Poiseuille"s law
f. Bernoulli effect
g. Reynolds number
h. Blood flow characteristics - Flow patterns
i. Effects of exercise on flow (non-diseased arteries)
j. Effects of stenosis on flow
k. Effects of collateralization on flow

3. Mechanisms of disease
a. Atherosclerosis
b. Thrombosis
c. Embolism
d. Acute arterial occlusion
e. Aneurysm
f. Non-atherosclerotic diseases
i. Arteritis
ii. Vasospastic disorders
iii. Entrapment syndromes
iv. Coarctation of the aorta

4. Effects of secondary disorders on flow
a. cardiac diseases
b. pulmonary diseases
c. anemia
d. hypertension
e. diabetes mellitus

4. Effects of hormone therapy in transgender patients
- hypertension
- myocardial infarction
- stroke

1. Peripheral arterial testing
a. Patient history
i. Signs & symptoms
ii. Risk factors and contributing diseases
b. Physical examination

i. Observation
ii. Palpation of pulses
iii. Auscultation of flow

c. Direct testing (Color duplex imaging)
i. Indications/uses/limitations
ii. Patient preparation
iii. Scanning techniques
1. Native vessels
a. Gray-scale, color flow, and Doppler/spectral analysis
2. Hemodialysis access grafts
a. Gray-scale, color flow, and Doppler/spectral analysis
3. Arteriovenous fistula
a. Gray-scale, color flow, and Doppler/spectral analysis
4. Peripheral bypass grafts
a. Gray-scale, color flow, and Doppler/spectral analysis
iv. Technical findings of Doppler velocity (audible, spectral analysis)
1. Qualitative
2. Quantitative

d. Indirect testing (physiologic testing)
i. Continuous wave Doppler evaluation
ii. Segmental pressures
1. Exercise testing (treadmill)
2. Reactive hyperemia
3. Allen test
iii. Plethysmography
1. Pulse volume recording (PVR)
2. Photoplethysmography (PPG) for digits
3. Thoracic outlet syndrome testing
iv. Technical findings of indirect tests
1. Qualitative
2. Quantitative

2. Cerebrovascular testing
a. Patient history
i. Transient Ischemic Attack (TIA)
ii. Reversible Ischemic Neurologic Deficit (RIND)
iii. Cerebrovascular Accident (CVA)

b. Signs and symptoms based on location
i. Anterior circulation (ICA, ACA, MCA & ACoA)
ii. Posterior circulation (Vertebrobasilar arts., PCA, PCoA)
iii. Non-hemispheric

c. Risk factors and contributing diseases
d. Mechanisms of disease
i. Athererosclerosis
ii. Emboli
iii. Aneurysm
iv. Dissection
v. Fibromuscular Dysplasia
vi. Carotid body tumors
vii. Subclavian steal

e. Effects of intracranial and extracranial disorders on flow
f. Physical examination
i. Palpation of pulses
ii. Auscultation of flow
iii. Brachial blood pressure

g. Direct testing method (Color Duplex imaging)
i. Indications/uses/limitations
ii. Patient preparation
iii. Scanning technique
iv. Impression

1. Quantitative measurements
2. Plaque characterization

h. Direct testing method (Transcranial Doppler)
   i. Indications/uses/limitations
   ii. Patient preparation
   iii. Scanning techniques
   iv. Impression
      1. Occlusion
      2. Vasospasm
      3. Arteriovenous malformation
      4. Brain death

i. Indirect testing methods (periorbital Doppler, Oculopneumoplethysmography)
   i. Indications/uses/limitations
   ii. Patient preparation
   iii. Scanning techniques
   iv. Technical impression of waveform
      1. Qualitative
      2. Quantitative

j. Treatment for arterial disease
   i. Medical therapy
      1. Prevention
      2. Pharmacology
   ii. Compression therapy for pseudoaneuryam
   iii. Thrombin injection for treatment of pseudoaneurysm
   iv. Endovascular treatment
      1. angioscopy
      2. angioplasty/stents
      3. atherectomy
   v. Surgical treatment
      1. Endarterectomy
      2. Patch graft endarterectomy

k. Related diagnostic testing
   i. Laboratory values
   ii. Angiography
   iii. Magnetic resonance angiography
   iv. Computed tomography

Resources

Ridgway, Donald. *Introduction to Vascular Scanning: A Guide for the Complete Beginner.* 4th ed. Pasadena, CA: Appleton Davies, 2014.

Zierler, R. Eugene and David L Dawson. *Strandness's Duplex Scanning in Vascular Disorders.* 5th ed. Philadelphia PA: Lippincott Williams Wilkins, 2015.

Pellerito, John S. and Joseph F. Polak, eds. *Introduction to Vascular Ultrasonography.* 6th ed. Philadelphia, PA: Saunders, 2012.

Rumwell, Claudia, and Michalene McPharlin. *Vascular Technology: An Illustrated Review.* 5th ed. Pasadena, CA: Appleton Davies, 2014.

Krebs, Carol A., Charles S. Odwin, and Arthur C. Fleischer. *Appleton and Lange's: Review for the Ultrasonography Examination.* 4th ed. New York: McGraw Hill, 2011.

Daigle, Robert J. *Techniques in Noninvasive Vascular Diagnosis: An Encyclopedia of Vascular Testing.* 4th ed. Littleton, CO: Summer, 2014.

Size, Gail P. *Inside Ultrasound: Vascular Reference Guide.* Pearce, AZ: Inside Ultrasound Inc., 2013.

Kupinski, Ann Marie. *Diagnostic Medical Sonography: The Vascular System*. 2nd. Baltimore, MD: Wolters Kluwer, 2018.

Myers, Kenneth and Amy May Clough. *Practical Vascular Ultrasound: An Illustrated Guide.* Boca Raton, FL: CRC Press, 2014.

Upchurch, Gilbert R. and Peter K. Henke. *Clinical Scenarios in Vascular Surgery.* 2nd ed. Philadelphia, PA: Wolters Kluwer, 2015.

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