DMS-2750: PRINCIPLES OF VASCULAR IMAGING FOR ABDOMEN AND CARDIAC SONOGRAPHERS

Cuyahoga Community College

Viewing: DMS-2750 : Principles of Vascular Imaging for Abdomen and Cardiac Sonographers

Board of Trustees:
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Academic Term:
Fall 2020

Subject Code
DMS - Diagnostic Medical Sonography

Course Number:
2750

Title:
Principles of Vascular Imaging for Abdomen and Cardiac Sonographers

Catalog Description:
Course designed for sonographers experienced in scanning abdomen and/or cardiac ultrasound exams. Specialized advanced study of selected vascular examinations in the cerebrovascular, peripheral arterial and peripheral venous systems. Examinations include: carotid, arterial physiologic lower extremity, venous duplex upper and lower extremity. Focus on anatomy, hemodynamics, pathology, sonographic appearance of normal and diseased vessels, specific testing methods and sonographic impressions. This course is not intended to fulfill the requirements necessary to take the credentialing examination for vascular technology.

Credit Hour(s):
3

Lecture Hour(s):
2

Lab Hour(s):
3

Requisites

Prerequisite and Corequisite
DMS-1950 Field Experience II or departmental approval.

Outcomes

Course Outcome(s):
Examine and interpret the factors associated with blood flow in the circulatory system for normal, abnormal, and diseased vessels when performing specified vascular exams.

Objective(s):
1. Describe the microscopic and gross anatomy of blood vessels.
2. Identify and label vessels of the cerebrovascular system, lower extremity arterial system, upper and lower extremity venous systems.
3. Explain the factors of hemodynamics in both the arterial and venous systems.
4. List the specific diseases common in the carotid arteries, lower extremity arteries and upper and lower extremity veins.
5. Compare and contrast the signs, symptoms and risk factors associated with arterial and venous diseases.
6. Analyze the differences between direct and indirect testing methods.
7. Explain the sonographic procedure for examination of the carotid arteries, lower extremity arteries, upper extremity veins, and lower extremity veins.
8. Identify the sonographic appearances of normal and abnormal arteries and veins.
9. Explain the qualitative and/or quantitative interpretation for the specified sonographic examinations.

Course Outcome(s):

Perform advanced level technical functions within the scope of practice of a sonographer.

Objective(s):

1. Follows principles of good body mechanics and ergonomics.
2. Applies previous knowledge of physics and instrumentation.
3. Demonstrates advanced technical skill in transducer manipulation and equipment image optimization.
4. Performs specified sonographic examinations according to the professional performance guidelines established by the Society for Vascular Ultrasound.
5. Demonstrates ability to interpret the specified vascular examination.

Methods of Evaluation:

1. Homework assignments
2. Article reviews
3. Oral/written quizzes
4. Written tests
5. Technical observation
6. Image interpretation
7. Scanning competency
8. Technical impressions

Course Content Outline:

1. Concepts
   a. Microscopic anatomy of blood vessels
   b. Anatomy of the heart
   c. Anatomy of extracranial and intracranial arteries
   d. Anatomy of lower extremity arteries and veins
   e. Anatomy of upper extremity arteries
   f. Arterial hemodynamics
   g. Venous hemodynamics
   h. Pathophysiology of arterial and venous diseases
   i. Pathology related to the cerebrovascular system
   j. Pathology related to the peripheral arterial and venous systems
   k. Direct and indirect testing methods
   l. Indications
   m. Contraindications
   n. Patient preparation techniques
   o. Specific examination protocols according to the Society for Vascular Ultrasound (SVU) - Vascular Technology Professional Performance Guidelines
      i. Extracranial Cerebrovascular Duplex Ultrasound Evaluation
      ii. Lower Extremity Arterial Physiologic Evaluation
      iii. Upper Extremity Venous Duplex Evaluation
      iv. Lower Extremity Venous Duplex Evaluation
   p. Qualitative and quantitative interpretation of technical findings
2. Skills
   a. Identifying cross sectional anatomy on a sonographic image
      i. Extracranial carotid vessels
      ii. Lower extremity arteries and veins
      iii. Upper extremity veins
   b. Communicating to a diverse population
   c. Completing a history and physical assessment relevant to the vascular examination
   d. Performing a technical scan according to SVU guidelines
      i. Extracranial Cerebrovascular Duplex Ultrasound Evaluation
      ii. Lower Extremity Arterial Physiologic Evaluation
      iii. Upper Extremity Venous Duplex Evaluation
      iv. Lower Extremity Venous Duplex Evaluation

e. Reinforce proper student demonstration of patient care skills
f. Taking appropriate safety precautions in the laboratory environment
g. Using proper body mechanics while scanning and positioning the patient
h. Using ergonomic features of the equipment to prevent musculoskeletal strains
i. Formulating the technical findings of sonographic images
j. Analyzing medical data and correlating it to the sonographic examination
k. Reporting technical findings of the examination

3. Issues
   a. Medical ethics
   b. Code of Ethics for the Profession of Diagnostic Medical Sonography
   c. Standards of practice
   d. Scope of Practice for the Diagnostic Ultrasound Professional
   e. Diversity
   f. Safety
   g. Quality
   h. Patient interaction
   i. Verbal and non-verbal communication limitations
   j. Physician interaction

TOPICAL OUTLINE:

1. Anatomy (vessel routes, variations, and collaterals)
   a. Microscopic anatomy
   b. Heart
      i. Walls
      ii. Internal structures
         1. chambers
         2. septa
         3. valves
   c. Cerebrovascular system
      i. Extracranial
      ii. Intracranial
   d. Peripheral arterial system
      i. Lower extremity
   e. Peripheral venous system
      i. Upper extremity
         1. deep system
         2. superficial system
      ii. Lower extremity
         1. deep system
         2. superficial system
         3. perforating (communicating) system
   f. Anatomical variants
      i. Arterial
      ii. Venous
   g. Common collateral routes
      i. Arterial
         1. lower extremity
         2. cerebrovascular
      ii. Venous
         1. collateralization versus recanalization
2. Hemodynamics
   a. Arterial
      i. Pressure gradient
      ii. Heart rate
      iii. Blood pressure
      iv. Resistance
      v. Blood flow characteristics - flow patterns
      vi. Effects of exercise on flow (non-diseases arteries)
      vii. Effects of stenosis on flow
   b. Venous

i. Pressure gradient
ii. Calf muscle "pump"
iii. Valves
iv. Respiration
v. Gravity
vi. Hydrostatic pressure

3. Mechanisms of disease
   a. Arterial
      i. Atherosclerosis
      ii. Thrombosis
      iii. Embolism
      iv. Acute arterial occlusion
      v. Aneurysm
      vi. Carotid body tumor
      vii. Arterial dissection
      viii. Neointimal hyperplasia
      ix. Subclavian steal
   b. Venous
      i. Acute
         1. Thrombosis
            a. deep vein thrombosis (DVT)
            b. superficial vein thrombosis (SVT)
         2. Phlegmasia alba dolens
         3. Phlegmasia cerulea dolens
      ii. Chronic
         1. Thrombosis
         2. Valvular insufficiency
         3. Varicose veins
         4. Ulceration
      iii. Soft tissue mass
         1. Baker"s cyst
4. 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
      ii. Posterior circulation
      iii. Non-hemispheric
   c. Risk factors
   d. Physical examination
      i. Palpation of pulses
      ii. Auscultation of flow
      iii. Brachial blood pressure
   e. Direct testing method (Color duplex imaging)
      i. Indications/uses/limitations
      ii. Patient preparation
      iii. Examination Protocol
      iv. Scanning technique
         1. Guidelines for optimizing Color Doppler Imaging
         2. Guidelines of optimizing Spectral Doppler Analysis
      v. Technical impressions
         1. Quantitative measurements
         2. Plaque characterization
5. Peripheral arterial testing (lower extremity)
   a. Patient history
      i. Signs and symptoms
      ii. risk factors

b. Physical examination
    i. Observation
    ii. Palpation of pulses
c. Indirect testing method (Arterial physiologic testing)
    i. Capabilities/indications
    ii. Limitations
    iii. Patient preparation
    iv. Examination protocol/technique for lower extremity
        1. Continuous wave (CW) doppler evaluation
        2. Plethysmography
            a. Pulse volume recording (PVR)
            b. Photoplethysmography (PPG) for digits
        3. Segmental pressures
            a. Exercise testing (treadmill)
            b. Reactive hyperemia
            c. Toe raises
    v. Technical impression of indirect tests
        1. Qualitative analysis
        2. Quantitative analysis

6. Peripheral venous testing *upper and lower extremity)
    a. Patient history
        i. Signs and symptoms
        ii. Risk factors
    b. Physical examination
        i. Observation
    c. Direct testing method (Color duplex imaging)
        i. Capabilities/indications
        ii. Limitations
        iii. Patient preparation
        iv. Examination protocol/technique for upper extremity
            1. Deep system
            2. Superficial system
        v. Examination protocol/technique for lower extremity
            1. Deep system
            2. Superficial system
        vi. Technical impression
            1. Quantitative measurements
            2. Thrombus characterization
            3. Compressibility of vein

Resources

Kremkau, Frederick. *Sonography Principles and Instruments*. 10th ed. St. Louis, MO: Saunders, 2020.

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Curry, Reva Arnez, and Betty Bates Tempkin. *Sonography: Introduction to Normal Structure and Function.* 4th ed. St. Louis, MO: Saunders, 2015.

Edelman, Sidney K. *Understanding Ultrasound Physics.* 4th ed. Woodlands, TX: ESP, Inc, 2012.

Rumwell, Claudia, and Michalene McPharlin. *Vascular Technology: An Illustrated Review.* 5th 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.

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.

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

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

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

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

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