Cardiac-Interventional Curriculum

Sponsored by the American Society of Radiologic Technologists, 15000 Central Ave. SE, Albuquerque, NM 87123-3909.

Core Content

Description

The objectives listed below are designed to cover key aspects of anatomy and physiology relevant to medical imaging, interventional procedures, and patient care in cardic and vascular interventional clinical settings.

Objectives

- Describe key anatomical landmarks relevant to medical imaging and interventional procedures.
- Differentiate between blood types and describe the components of blood relevant to clinical practice.
- Compare and contrast arterial and venous systems, including anatomical differences and clinical implications.
- Summarize emergency care procedures and the management of contrast media and medication reactions.
- Investigate the underlying pathophysiology of cardiovascular symptoms, including circulatory and cardiac conditions.
- Explain the physics and production of sound waves in ultrasound imaging technology.
- Evaluate image production through comprehensive understanding and practical application of fluoroscopy, cineangiography, and various imaging projections.
- Evaluate measures for radiation protection for both patients and personnel during medical imaging procedures.
- Demonstrate proficiency in sterile techniques for various interventional procedures, ensuring patient safety and infection control.

Anatomy and Physiology

Content

I. Anatomical Landmarks

II. Blood

A. Types
B. Components
C. Composition

III. Vasculature

A. Arterial
B. Venous

Emergency Care Procedures

Content

I. Airway Management

II. Therapeutic Hypothermia

III. Life Support Medications

IV. Crash Cart

V. Cardiac Life Support

VI. Contrast Media and Medication Reactions

A. Physiologic response
B. Medications
C. Emergency drugs and crash cart

VII. Symptoms, Complications, and Emergencies

A. Circulatory/cardiovascular
B. Respiratory
C. Genitourinary
D. Neurological

Fundamental Principles of Ultrasound

Content

I. Physics and Production of Sound Waves

II. Instrumentation Properties

III. Pulsed Echo

A. Characteristics
B. Controls
C. Signal processing
D. Display modes

IV. Doppler

A. Physical principles
B. Duplex instruments
C. Intravascular (endoluminal) instruments

V. Bioeffects and Safety

VI. Cardiac Imaging
- A. Routes
- B. Equipment and instrumentation
- C. Anatomy and pathophysiology
- D. Diagnosis and assessment

VII. Interventional Guided Techniques
- A. Vascular access studies
- B. Dialysis graft surveillance
- C. Biopsy
- D. Fluid drainage
- E. Ablations
- F. Intraoperative

Image Production

Content

I. Image Acquisition and Equipment
- A. Fluoroscopy
  1. Construction
  2. Characteristics
     - a. Automatic exposure, dose, and brightness control
     - b. Digital subtraction angiography (DSA)
     - c. Magnification
  3. Preventative maintenance
  4. Malfunctions
- B. Cineangiography
- C. Projections
- D. Image production
- E. Data archiving systems
- F. Procedure table
- G. Automatic pressure injector
- H. 3D imaging
- I. CT imaging capabilities

II. Radiation Protection
- A. Patients
- B. Personnel (ALARA)

III. Image Postprocessing
- A. Retrieving and exporting image data
- B. Viewing 3D images
- C. Postprocessing techniques
- D. Quantitative analysis

E. 3D artifacts

Interventional Resources and Supplies

Content

I. Sterile Backtable, Patient Preparation, and Scrubbing

II. Personal Protective Equipment (PPE)

III. Radiation Protection

IV. Euipment and Instrumentation

V. Accessory Devices and Supplies (i.e., adaptors, connectors, stopcocks)

VI. Patient Assessment Instrumentation

VII. Dialysis Catheters and Shunt Sites

Pharmacology and Drug Administration

Content

I. Drug and IV Infusion Calculations

II. Administration Routes

III. Medications

A. Types
B. Antagonists (e.g., protamine, vitamin K)
C. Indications and contraindications
D. Complications
E. Risks and response
F. Conscious sedation

IV. Contrast Media Administration

Patient Care, Assessment, and Monitoring

Content

I. Patient Interactions and Management
- A. HIPAA
- B. Communication
- C. Education

II. Vital Signs

V. Patient Assessment
- A. Vascular access
- B. Scales

VI. Lab Values
- A. Chemistry
- B. Hematology
- C. Point-of-care testing
- D. Coagulation
- E. Oxygenation parameters

VIII. IV Therapy

IX. Infection Control

X. Timeout Procedure

Physiologic Monitoring and Recording

Content

I. Physiologic Monitoring
- A. ECG
- B. Pulse oximetry
- C. Capnography
- D. Invasive blood pressure

II. Cardiac Monitoring
- A. Conduction pathway
- B. Sinus rhythm
- C. Pacemakers and defibrillators
- D. Mechanical circulatory support (i.e., intraaortic balloon pump)

III. Recording Systems

Sterile Technique

Content

I. Microorganisms

II. Defense Systems of the Body

III. Chain of Infection

IV. Modes of Transmission

V. Sterilization Methods

VI. Asepsis

VII. Sterile Fields
- A. Patient preparation
- B. Draping
- C. Procedure tray
- D. Equipment packaging and preparation
- E. Maintaining the field
- F. Waste management

VIII. Scrubbing, Gowning, and Gloving
- A. Personal protective equipment (PPE)
- B. Surgical scrub techniques
- C. Sterile solutions
- D. Donning gowns and gloves

Vascular Access

Content

I. Instrument Selection

II. Access Point Selection
- A. Local anesthesia
- B. Medical regimen (e.g., radial catheterization)
- C. Techniques
- D. Positioning and stabilization

III. Patient Risks and Complications

IV. Postprocedural Hemostasis

Vascular Pathophysiology

Content

Heart and great vessels	**Surgery and artificial valves**	**Heart failure and shock**
Rheumatic fever	**Congenital heart disease**	**Aneurysms**
Coronary artery disease	**Thrombus vs. embolus**	**Vascular disease**
Myocardial infarction	**Vessel dissection**	

Focus of content:

I. Conditions, syndromes, and pathology
II. Physiology and mechanisms
III. Signs and symptoms
IV. Hemodynamics
V. ECG changes
VI. Complications
VII. Management and therapy

Cardiac-Interventional Procedures

Description

Content presents a systematic approach to the techniques and procedures technologists use in the performance of vascular and nonvascular interventional procedures. Common to the discussion of all procedures will be the following:

- Anatomy and physiology
- Pathology
- Indications and contraindications
- Patient positioning
- Access method
- Patient management during the examination
- Contrast administration
- Equipment and devices
- Exposure technique
- Image enhancement and processing
- Procedure
- Closure methods
- Recognition and treatment of potential complications

Content

I. Diagnostic Studies
- A. Cardiovascular angiography
- B. Peripheral angiography
- C. Right heart catheterization
- D. Hemodynamics and circulations
- E. Oxygenation assessment
- F. Pressure readings
- G. Pressure waveform interpretation
- H. Intravascular imaging
  1. Optical coherence tomography (OCT)
  2. Intracoronary optical frequency domain imaging (OFDI)
  3. Intravascular ultrasound (IVUS)
- I. Cardiovascular ultrasound
  1. Transthoracic (TTE)
  2. Trans-esophageal (TEE)
  3. Intracardiac echocardiography (ICE)
- J. Coronary hemodynamics
- K. Cardiac biomarkers

II. Percutaneous Coronary Intervention
- A. Angioplasty
- B. Embolization protection
- C. Debulking
- D. Stent deployment
- E. Thrombolysis

III. Percutaneous Structural Intervention
- A. Congenital and structural heart diseases
- B. Patent foramen ovale closure
- C. Atrial and ventricular septal defect closure
- D. Patent ductus arteriosus closure
- E. Left atrial appendage occlusion (mitral clipping)
- F. Transcatheter valve replacement
- G. Interventions

IV. Myocardial Biopsy
- A. Valvuloplasty
- B. Myocardial interventions
- C. Pericardiocentesis
- D. Renal denervation
- E. Inferior vena cava filter placement/retrieval
- F. Foreign body retrieval
- G. Percutaneous ventricular restoration (PVR)

H. Chronic total occlusion

V. Percutaneous Intervention

A. Congenital and structural heart diseases
B. Valvuloplasty
C. Septal ablation
D. Indication (for HOCM)
E. Renal denervation
F. Inferior vena cava filter placement/retrieval
G. Pericardiocentesis
H. Myocardial biopsy
I. Foreign body retrieval
J. Percutaneous ventricular restoration therapy
K. Brachytherapy

VI. Therapy

A. Ventricular assist devices
B. Intraaortic balloon counterpulsation
C. Ventricular assist devices and ECMO

VII. Conduction System Studies

A. Arrhythmia detection
B. Arrhythmia ablation
C. Cardioversion

VIII. Subcutaneous Implantable Devices

A. Types
B. Indications
C. Electrophysiology
D. Pacemaker codes (e.g., North American Society of Pacing and Electrophysiology [NASPE], British Pacing and Electrophysiology Group [BPEG])

IX. Wireless Transcatheter Pacing System

X. External Prophylactic Pacemaker

XI. Paced Beat Recognition

A. Arrhythmia detection
B. Arrhythmia ablation
C. Cardioversion
D. Implants
E. Pacemaker, temporary insertion
F. Transcutaneous pacemaker
G. Electrophysiology studies
H. Loop recorders and implantable recording/monitoring devices

XII. Pediatric Cardiology Interventions

A. Common anomalies
B. Corrective procedures
C. Shunts

Vascular-Interventional Procedures

Description

Content presents a systematic approach to the techniques and procedures technologists use in the performance of vascular and nonvascular interventional procedures. Common to the discussion of all procedures will be the following:

- Anatomy and physiology
- Pathology
- Indications and contraindications
- Patient positioning
- Access method
- Patient management during the exam
- Contrast administration
- Equipment and devices
- Exposure technique
- Image enhancement and processing
- Procedure
- Closure methods
- Recognition and treatment of potential complications

Content

I. Neurologic

A. Intracranial angiography
B. Extracranial angiography
C. Spinal angiography
D. Embolization
E. Thrombolysis and thrombectomy
F. Angioplasty
G. Stent placement
H. Discography
I. Vertebral augmentation

II. Thoracic

A. Pulmonary angiogram
B. Thrombolysis and thrombectomy
C. Thoracic aortography
D. Bronchial angiogram
E. Embolization
F. Thoracentesis
G. Biopsy

H. Drainage

III. Genitourinary (GU) Studies

A. Renal angiography
B. Adrenal angiography
C. Reproductive angiography
D. Venous sampling
E. Nephrostomy
F. Ureteral stents
G. Ureteral dilation
H. Nephroureterostomy
I. Percutaneous stone extraction
J. Embolizations
K. Renal artery angioplasty
L. Renal artery stent placement
M. Cystostomy

IV. Gastrointestinal (GI) Studies

A. Selective visceral angiography
B. Pharmacoangiography (e.g., pitressin injection)
C. Embolization
D. Angioplasty
E. Stent placement
F. Stone extraction
G. Percutaneous transhepatic cholangiogram
H. Biliary drainage/stenting
I. Cholecystostomy
J. Alcohol and radiofrequency ablation of the liver
K. Gastrostomy/gastrojejunostomy
L. Endoscopic retrograde cholangiopancreatography (ERCP)
M. Transjugular intrahepatic portosystemic shunt (TIPS)
N. Chemoembolization
O. Radioembolization (Yttrium-90)

V. Peripheral Studies (Arterial and Venous)

A. Abdominal aortography
B. Upper extremity angiography
C. Lower extremity angiography
D. Angioplasty
E. Stent/placement
F. Thrombolytic therapy (e.g., tissue plasminogen activator (tPA), retavase)
G. Foreign body retrieval
H. Embolization
I. Pharmacoangiography (vasodilator: nitroglycerin, Integrilin)
J. Endovenous thermal ablation (EVTA) procedures

VI. Venous

A. Central venous access/port placement
B. Dialysis catheter placement
C. Dialysis shunt management
D. Cavagram
E. Foreign body retrieval
F. Stent placement
G. Thrombolysis
H. Angioplasty
I. Venous sampling studies

VII. Miscellaneous Procedures

A. Abscess drainage
B. Pressure measurements
C. Biopsy
D. Paracentesis
E. Radiofrequency ablation (RFA)
F. Microwave ablation
G. Cryoablation
H. Chest tube placement
I. Drain tube injection
J. Activated clotting time

Resources

This list of resources will assist educators in sampling the pool of references and study materials that pertain to medical imaging. The resources list should be viewed as a snapshot of available materials. Omission of any one title is not intentional. Because the creation of literature and media related to the field is dynamic, educators are encouraged to search additional sources for recent updates, revisions, and additions to this collection of titles.

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