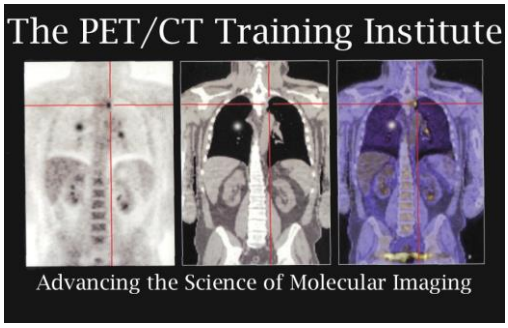

48.5 HR ALTERNATIVE ELIGIBILITY REVIEW COURSE
Course Control Document
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The PET/CT Training Institute, Inc.

SNMMI-TS: 029998 41hr PET Alternative Eligibility Course, Part I:
SNMMI-TS: 029880 7.5hr PET Alternative Eligibility Course, Part II:

Module I: RADIOPHARMACY

TOPIC: **Syllabus**

TOPIC: **Pretest**

TOPIC: Lecture: **MIWIQI: 028714: Basic Math Skills for Nuclear Medicine Technologist I**

Objectives: **1.5 CEH**

1. Explain how to use the Texas Instruments 30 (x) II A Calculator.
2. Demonstrate how to solve the following math problems with the calculator.
    - Radioactive Decay using half-lives
    - Pre-Calibrations
    - Specific Concentrations
3. MIWIQI: QUIZ I**:** **Must score 80% or greater on this and all other tests. You are allowed up to two attempts to successfully complete each test without penalty.**

TOPIC: Lecture: **MIWIQII: 028715: Basic Math Skills for the Nuclear Medicine Technologist II.**

Objectives: **2.0 CEH**

1. Explain how to solve the following math problems with the calculator.
    - Dose Volume Calculations

- Effective Half-life
- Radiation Dose versus time
- Radiation Dose versus distance from source
- Half Value Layers
- Units of Activity, Exposure, and Absorption

2. MIWIQII: QUIZ II:
3. MIWIEI: EXAM I:

TOPIC: **Lecture: MIWIIQI: 028716: Production of Radionuclides**

Objectives: **2.0 CEH**

1. Describe nuclear stability and its relationship to radioactive decay.
2. Describe the basic mechanisms for radionuclide production in a reactor.
3. Describe the fundamentals of particle accelerator operations and the production of radionuclides using particle accelerators.
4. Describe generator kinetics in the production of radionuclides, and detail the difference between transient and secular equilibrium.
5. MIWIIQI: QUIZ I:

TOPIC: **Lecture: MIWIIQII: 028717: PET Radiopharmaceuticals**

Objectives: **2.0 CEH**

1. List and describe the properties of PET Radiopharmaeuticals.
2. Describe Fluorine 18 PET Radiopharmaceuticals.
3. Describe Carbon 11 PET Radiopharmaceuticals.
4. Describe Oxygen 15 PET Radiopharmaceuticals.
5. Describe Nitrogen 13 PET Radiopharmaceuticals.
6. MIWIIQII: QUIZ II:
7. MIWIIEII: EXAM II:

Module I Week III Quiz I:

TOPIC: Lecture: **MIWIIIQI: 028718: Radiopharmaceutical Quality Control**

Objectives: **2.0 CEH**

1. Describe the difference between quality control relative to radionuclide purity, radiochemical purity, and chemical impurities.
2. Describe the difference between sterile compounds and compounds containing pyrogens, and test for ensuring these properties.
3. MIWIIIQI: QUIZ I:

TOPIC**:** Lecture: **MIWIIIQII: 028719: The Nuclear Pharmacy**

Objectives: **2.0 CEH**

1. Discuss the Hot Lab Floor Plan.
2. Identify the restricted areas.
3. Discuss radioactive storage and shielding requirements.
4. Discuss the work surfaces and sinks.
5. Discuss required records.
6. Discuss the Unit Dose Manager.
7. MIWIIIQII: QUIZ II:
8. MIWIIIEIII: EXAM III:

TOPIC**:** Lecture**: MIWIVQI: 028720: Radioactive Receipt**

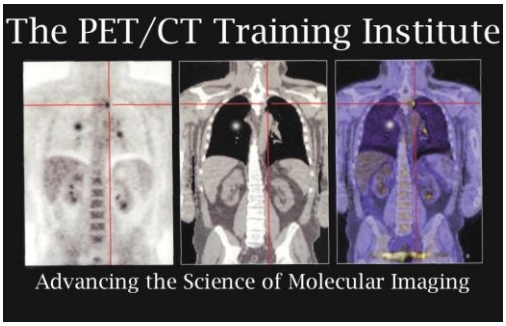
Objectives: **2.0 CEH**

1. Describe how to perform a wipe test on incoming shipments.
2. Describe how to perform a survey of an incoming shipment of radioactive materials.
3. MIWIVQI: QUIZ I:

TOPIC: Lecture: **MIWIVQII: 028721: Radioactive Disposal**

Objectives: **2.0 CEH**

1. Describe CFR 20: Decay in storage procedures
2. Describe Regulatory Issues related to dispensing of radioactive materials 10 CFR 49.
3. Describe daily radiation surveys.
4. MIWIVQII: QUIZ II:
5. MIWIVEIV: EXAM II:



Module II: RADIATION SAFETY

TOPIC: Lecture: **MIIWIQI**: **028609: The History of Radiobiology**

Objectives: **1.5 CEH**

1. Describe the Law of Bergonie and Tribondeau
2. Describe Fractionation Theory
3. Describe Mutagenesis effects of radiation exposure.
4. Describe the Effects of Oxygen as a radio-sensitizer.
5. Describe Effects of Radiation on Reproductive Failure
6. MIIWIQI: QUIZ I: **Must score 80% or greater on this and all other tests. You are allowed up to two attempts to successfully complete each test without penalty.**

TOPIC: Lecture: **MIIWIQII: 028610: Cellular Anatomy and Physiology**

Objectives: **1.5 CEH**

1. Indicate parts of the cell
2. Identify organic compounds and their functions
3. Identify inorganic compounds and their functions
4. Explain Mitosis
5. Explain Meiosis
6. MIIWIQII: QUIZ II:

7. MIIWIEI: EXAM I:

TOPIC: Lecture: **MIIWIIQI**: **028611: Cellular Effects of Radiation**

Objectives: **1.5 CEH**

1. Inspect the direct and indirect effects of radiation.
2. Evaluate the radiolysis of water.
3. Analyze the types of dose-response relationships.
4. Describe target theory.
5. Explain Cell survival curves.
6. MIIWIIQI: QUIZ I:

TOPIC**:** Lecture: **MIIWIIQII: 028612**: **Effects of Initial Exposure to Radiation**

Objectives: **1.5 CEH**

1. Describe hematological, gastrointestinal, and central nervous system syndromes.
2. Describe the local tissue damage to the skin, eyes and gonads.
3. Explain hematologic and cytogenetic effects.
4. MIIWIIQII: QUIZ II:
5. MIIWIIEII: EXAM II:

TOPIC: Lecture: **MIIWIIIQI: 028613: Effects of Long-Term Exposure to Radiation**

Objectives: **1.5 CEH**

1. Describe epidemiology.
2. Examine Risk Estimation Models.
3. Examine Radiation Induced malignancies.
4. Identify life span shortening.
5. Describe genetic damage.
6. Explain irradiation of the fetus.
7. Analyze stochastic and non-stochastic effects.
8. MIIWIIIQI: QUIZ I:

TOPIC: **Lecture: MIIWIIIQII**: **028614: Protection of Personnel**

Objectives: **1.5 CEH**

1. Describe the rationale for radiation protection.
2. Explain personnel dosimeters, dosimetry reports, and duties of the RSO.
3. Define and calculate the dose-limiting recommendations for PET/CT personnel.

4. Explain the basic structural shielding construction and list the items that influence this construction.
5. Describe how the PET/CT Technologist can decrease their radiation exposure during the patient preparation and scanning sequences.
6. Describe how using distance can decrease radiation exposure.
7. Illustrate the Inverse Square Law.
8. Identify garments that can be worn to reduce radiation exposure and explain how each garment should be used.
9. MIIWIIIQII: QUIZ II:
10. MIIWIIIEIII: EXAM III:

TOPIC: Lecture: **MIIWIVQI**: **028615: Measuring Patient Dose from Computerized Tomography Scanners**

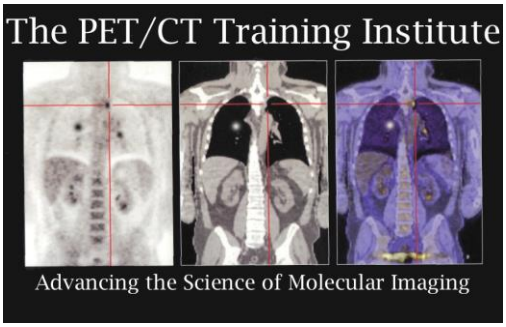
Objectives: **1.5 CEH**

1. Describe CT Scanner X-Ray Beam Geometry
2. Explain Methods of Measuring Patient Dose.
3. Describe Multiple Scan Average Dose curves.
4. Define CT Dose Index.
5. Measuring the CT Dose Index.
6. Describe Spiral/Helical CT Scanner Dosimetry.
7. Explain methods for reducing the patient dose from the CT Scanner.
8. Illustrate dosimetry survey of CT Scanners.
9. MIIWIVQI: QUIZ I:

TOPIC: Lecture: **MIIWIVQII: 028616: Radiation Safety in PET Imaging**

Objectives: **1.5 CEH**

1. Describe cautions signs and labels.
2. Describe the Do's and Don'ts in PET Radiation protection.
3. Explain how to clean up a radioactive spill.
4. MIIWIVQII: QUIZ II:
5. MIIWIVEIV: EXAM IV:



Module III: INSTRUMENTATION

TOPIC: Lecture: **MIIIWIQI: 028722: Intro to Survey Meters**

Objectives**:** **1.5 CEH**

1. Describe the construction and operating principles of gas filled detectors, to include the GM Survey Meter and ionization detectors.
2. Describe the Quality Control requirements to maintain compliance for a Survey meter.
3. Demonstrate how to use a Survey Meter.
4. Describe how to read the Survey Meter.
5. Describe Constancy procedures.
6. Describe a battery check.
7. MIIIWIQI: QUIZ I: Must score 80% or greater on this and all other tests. You are allowed up to two attempts to successfully complete each test without penalty.

TOPIC: **Lecture: MIIIWIQII**: **028723: Intro to Dose Calibrators**

Objectives: **2.0 CEH**

1. Describe the construction and operating principles of a Dose Calibrator.
2. Describe the Quality Control requirements to maintain compliance.
3. Describe Constancy procedures.
4. Describe Accuracy procedures.
5. Describe Linearity procedures.

6. Describe Geometric Variations procedures.
7. MIIIWIQII: QUIZ II:
8. MIIIWIEI: EXAM I:

TOPIC: Lecture: **MIIIWIIQI: 028724: Intro to Scintillation Detectors**

Objectives: **2.0 CEH**

1. Describe the physics of converting light into electrons via photoelectric interactions in the crystals.
2. Describe the use of collimators in limiting the photon beam.
3. Describe the relationship between Spatial Resolution and Spatial Sensitivity in collimator choice.
4. MIIIWIIQI: QUIZ I:

TOPIC: Lecture: **MIIIWIIQII**: **028725: The Electronics of Scintigraphy**

Objectives: **2.0 CEH**

1. Describe the Pulse Height Analyzer
2. Describe the use of Upper and Lower Level discrimators.
3. Describe the Quality Control of a Gamma Camera.
4. Describe the Daily Spatial Uniformity Flood.
5. Describe the Weekly Spatial Resolution Test.
6. Describe the Weekly Spatial Linearity Test.
7. Describe the Center of Rotation procedures.
8. Describe the Uniformity Correction Flood.
9. MIIWIIQII: QUIZ II:
10. MIIWIIEII: EXAM II:

TOPIC: Lecture: **MIIIWIIIQI**: **028621: PET Instrumentation**

Objectives: **1.5 CEH**

1. List detector crystals that can be used for PET imaging and describe their properties.
2. Explain the fundamental operation of dedicated and Hybrid PET Scanners and their design.
3. Describe the detection of True, Scatter, and random events.
4. Describe Transmission imaging and its need and use in attenuation corrected images.
5. Characterize the visual presentation of non-attenuated and attenuated corrected images.
6. MIIIWIIIQI: QUIZ I:

TOPIC: Lecture: **MIIIWIIIQII**: **028622: Acquisition, Processing, and Display of PET Images**.

Objectives **1.5 CEH**

1. Describe 2D and 3D acquisition protocols.
2. Describe scan protocol parameters.
3. Describe Whole-Body versus Total Body acquisition modes.
4. Describe Dynamic Acquisition modes.
5. Define SUV and explain how it is calculated and used.
6. Describe critical elements in generating quantitative measurements.
7. Describe the process of data reconstruction.
8. Describe the implications of image fusion and describe the PET/CT Scanner.
9. MIIIWIIIQII: QUIZ II:
10. MIIIWIIIEIII: EXAM III:

TOPIC: Lecture: **MIIIWIVQI**: **028623: An Overview of PET Quality Control Procedures**

Objectives: **1.5 CEH**

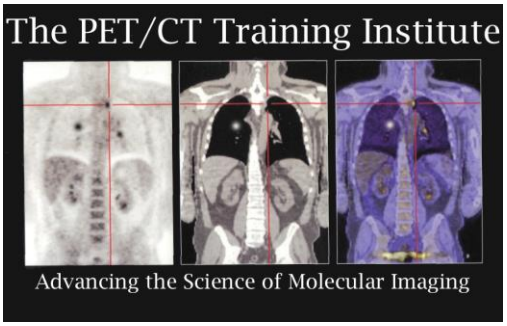
1. Describe the daily quality control procedures performed on a Hybrid PET/CT Scanner.
2. Describe the frequency of PET/CT Quality Control Procedures.
3. Analyze a typical Blank Scan.
4. Describe Blank Scans.
5. Describe Coincidence Timing Circuitry.
6. Describe Singles.
7. Describe Normalization
8. Describe Well Counter Calibration.
9. MIIIWIVQI: QUIZ I:

TOPIC**:** Lecture: **MIIIWIVQII: 028624: Troubleshooting Image Artifacts in PET/CT**

Objectives: **1.5 CEH**

1. Identify mis-registration artifacts.
2. Describe Patient Motion Artifacts.
3. Describe Beam Hardening Artifacts.
4. Identify Contrast Material Artifacts.
5. Describe Partial Volume Averaging Artifacts.

6. Describe Equipment induced Artifacts.
7. Analyze Metal Artifacts.
8. Identify Ring Artifacts.
9. MIIIWIVQII: QUIZ II:
10. MIIIWIVEII: EXAM IV



Module IV: Part II: PET Alternative Eligibility Course

Lecture Topic: 029880: MIVWIQI: Lecture I: "***Methods for Reducing Radiation Exposure in a PET/CT Lab: PET Component"***

Lecture Overview:

This online self-study course is intended to inform the technologist in practical methods to reduce the radiation exposure in the PET/CT Lab to the patient, visitors, and staff.

Learning Objectives**:** **2.0 hr**

Upon successful completion of this online self-study course, the technologist will be able to:

- List the various sources of radiation exposure found in a PET/CT Lab.
- Identify ways to reduce the radiation exposures from a PET/CT Lab department layout.
- Explore safe practice considerations when designing a PET/CT Lab.
- Discuss the key team members in planning a PET/CT Lab.
- List methods for restricting access to controlled and uncontrolled areas in a PET/CT Lab.
- Explain potential areas of exposures found in the PET hot lab.
- Discuss the Room Layout in designing a PET/CT Lab.
- Discuss the Interview, Consultation, and Office layout design for the PET/CT Lab.
- Discuss the Waiting and Uptake Room layout design plans for a PET/CT Lab.
- Discuss the Scanning Room layout design for a PET/CT Lab.

- Discuss the Post Scan or Recovery Room for a PET/CT Lab.
- Explain shielding exposure limiting considerations for a PET/CT Lab.
- Discuss Dose Reduction Strategies for the staff.
- Describe the requirements of a good Radiation Safety Program.
- Discuss the categories of hazards and weighting factors within a PET/CT Lab.
- Explore the biological effects of radiation exposures.
- Define ALARA.
- Define Background Equivalent Radiation Time (BERT).
- List sources of natural background radiations.
- Identify the various organizations involved in regulating radiation exposures.

Course Outline:

I. Sources of Radiation Exposure
    1. Radiopharmaceuticals
    2. Patients
    3. Sealed sources
    4. CT Scanner
    5. Toilet
    6. Injection room
    7. Waiting room
    8. Waste storage

II. Layout of a PET/CT Lab

III. Workplace Practice Considerations
    1. Number of Patients
    2. Type and amount of radiopharmaceutical
    3. Length of time near a patient
    4. Physical PET/CT Lab layout
        a. Assaying radiopharmaceuticals
        b. Administering and preparation of radiopharmaceuticals
        c. Uptake period
        d. Escorting patients to and from the scan room
        e. Patient positioning
        f. Daily quality Control

IV. Minimizing exposures
    1. Department design
    2. Good safe practices
    3. Patient instructions/cooperation
    4. Time, Distance, and Shielding

V. Planning team
    1. Architect
    2. Project manager
    3. Medical physicist

4. Radiation Safety Officer
5. Construction Site Engineer
6. Administration
7. PET/CT Technologist
8. PET/CT Physician

VI. Controlled and Restricted areas
1. Radiopharmaceutical storage
2. Calibration sources
3. Dispensing
4. Waste storage
5. Patient Injection area
6. Patient Holding and uptake Room
    a. Recliner
    b. Gurney
    c. Shielded waste and sharps container
    d. Dimmer light switch
    e. Climate control
    f. Closed circuit TV
7. Patient toilet
8. Interview Room
9. Waiting Room
10. Scan Room
    a. Leaded glass window
    b. Communication system
    c. IV Contrast Injector
11. Post scan changing room

VII. Shielding considerations
1. Limited exposure
    a. Patients
    b. Workers
    c. Visitors
    d. Detectors
2. Calculating PET/CT Shielding needed
    a. Dose rate constant
    b. External dose rate
    c. Typical activity
    d. Uptake time
    e. Workload
3. CT Shielding
    a. Scan room

VIII. Dose reduction strategies for the staff
1. Patient handling

2. Occupational exposures

IX. Radiation Protection Program Staff
    1. Responsibilities
    2. Radiation Safety Committee
    3. Rules
    4. Protocols
    5. Practices
        a. Radiopharmacist
        b. PET/CT Technologist
        c. Nursing
        d. Ancillary support

X. PET/CT Category of Hazards
    1. Hot Lab Category of Hazards
        a. Low Hazard
        b. Medium Hazard
        c. High Hazard
    2. Weighting factors according to radionuclide
        a. Class radionuclide
    3. Weighting factors according to area
    4. Premises not frequented by patients
        a. Low Hazard
        b. Medium Hazard
        c. High Hazard
    5. Premises frequented by patients
        a. Low Hazard
        b. Medium Hazard
        c. High Hazard

XI. Biological effects of radiation exposures

XII. ALARA

XIII. Background Equivalent Radiation Time (BERT)

XIV. Natural background radiations
    1. Terrestrials
    2. Cosmic
    3. Internal
    4. Man-Made

XV. Organizations involved in regulating radiation exposures
    1. NCRP
    2. ICRP
    3. NRC
    4. EPA
    5. FDA
    6. OSHA

XVI. Radiation Safety Committee and RSO
XVII. Quiz

Course Lecture: 029880: MIVWIQII: Lecture II: ***"Methods for Reducing Radiation Exposure in PET/CT Lab : CT Component"***

Lecture Overview:

This online self-study course is intended to inform the technologist in practical methods to reduce the radiation exposure in the PET/CT Lab by modifying key CT acquisition parameters, utilizing immobilization devices, and assisting the physician with sedation medications to minimize patient motion.

Learning Objectives**:** **2.0 hr**

Upon successful completion of this online self-study course, the technologist will be able to:

- Identify various types of CT scanner rotations.
- Define the traditional units of radiation exposure.
- Define the international units of radiation exposure.
- Discuss CT Dosimetry measurements.
- Discuss CT beam geometry.
- Explain factors effecting patient dose from a CT scanner.
- Discuss dose reduction methods with a CT scanner.
- Discuss the importance of proper patient positioning.
- Identify key CT acquisition parameters effects on radiation exposure.
- Discuss various types of patient shielding devices.
- List effective radiation dose values from a CT scan.
- Identify alternative methods for dose reduction.
- Discuss the parent's role in reducing a child's radiation exposure.
- Discuss standardized CT protocol development.
- List child immobilization devices used to control patient motion.
- Discuss alternative immobilization devices found within the lab.
- Discuss methods for sedating a child.
- List required equipment needed to sedate a child.
- Discuss sedation medication effects.
- List common sedation medications.
- Describe intra procedural monitoring.
- Discuss post procedural monitoring.

Course Outline:

I. CT scanner rotation
    1. Axial
    2. Volume
    3. Multislice
        a. Fundamentals
        b. Effectiveness
        c. Quad detectors
II. Traditional radiation units
    1. Roentgen
    2. RAD
    3. REM

III. International radiation units
    1. C/kg
    2. Gray
    3. Sievert
IV. Ionization chambers
V. CT Dosimetry
    1. CTDI
    2. MSAD
    3. CT dose metrics
    4. CT dose volume
    5. Effective dose
VI. Tissue weighting factors
VII. CT beam geometry
    1. MSAD
    2. CTDI
    3. CT vs. MSAD
    4. Effects
    5. MSAD vs. Bed Index
VIII. Factors affecting patient dose
    1. Kvp
    2. mAs
    3. Pitch
    4. Collimation
    5. Bed Index
    6. Beam Geometry
    7. Detector set up
        a. Repeats
        b. Shielding
        c. Alignment

    d. Patient size

IX. Dose reduction methods
    1. Bed Index
    2. Spiral pitch
    3. Collimation
    4. Noise
    5. Source distance
    6. Object distance
    7. Kvp
    8. mAs
    9. Patient positioning
    10. Correct alignment
    11. Tube position for scout

X. Effects on image quality
    1. Kvp
    2. Field of View
    3. Filters
    4. Noise
    5. Slice thickness
    6. Post processing filters
    7. Algorythms
    8. Rotation time
    9. Dose modulation
    10. Patient alignment

XI. Shielding
    1. Contact shields
    2. Gonadal Shields
    3. Bismuth Breast shields
    4. Protocols

XII. Effective Radiation Dose Values

XIII. Alternative methods for reducing radiation exposure

XIV. Parents role in reducing radiation exposures to the child

XV. CT Protocol development
    1. CT protocols
    2. Technologist role
    3. Manufacturers role
    4. Physicians role

XVI. Child Immobilization devices
    1. Tam-Em Boards
    2. Papoose Boards
    3. Alternative immobilization devices
        a. Tape

b. Sheets
c. Towels
d. Sand bags
e. Sponge blocks
f. Compression bands
g. Stockinettes
h. Ace bandages

XVII. Sedation
1. Consent
2. Pre sedation evaluation
   a. Allergies
   b. Medications history
   c. Past history
   d. Last meal
3. Patient preparation
   a. Clear liquids
   b. Breast milk
   c. Formula/light solids
4. Monitoring/training of personnel
5. Equipment
   a. Crash cart
   b. Oxygen
   c. Ventilation bags
   d. Masks
   e. Suction
   f. BP cuff
   g. Pulse oximeter
   h. Defibrillator
   i. Drug antagonist

XVIII. Sedation medications
1. Sedation
2. Analgesics
3. Amnesia
   a. Barbiturates
   b. Benzodiazepines
   c. Narcotics
   d. Chloral hydrate

XIX. Reversal agents
1. Nalxone
2. Flumazenil

XX. Intra procedural monitoring

XXI. Post procedural monitoring

XXII. Exam

Course Lecture: 029880: MIVWIQIII: Lecture III: ***"Basic Instrumentation of SPECT/CT: SPECT Component"***

Lecture Overview:

This online self-study course is intended to inform technologist on basic instrumentation, quality control, acquisition, reconstruction, and analysis of SPECT imaging.

Learning Objectives**:** **1.5 hr**

Upon successful completion of this online self-study course, the technologist will be able to:

- Discuss basic instrumentation components of a gamma camera.
- Discuss factors affecting image formation.
- Identify key SPECT system computer hardware.
- Discuss frequency of SPECT gamma camera quality control.
- Discuss SPECT image acquisition modes.
- List gamma camera acquisition modes.
- List clinical application modes of SPECT/CT.
- Discuss SPECT reconstruction algorythms.
- Identify SPECT reorientation models.
- Discuss SPECT Display.
- Discuss SPECT quantitation programs.
- Identify various hard copy formats.

Course Outline:

I. SPECT gamma camera instrumentation components
    1. Crystal
    2. Photomultiplier tubes
    3. High voltage power supply
    4. Pre-amplifier
    5. Amplifier
    6. Gain control
    7. Pulse height analyzer
    8. Spectrometers
    9. Scintillation crystals
    10. Positional circuitry
    11. Collimators
    12. SPECT cameras

II. Factors affecting image formation

1. SPECT performance
2. Magnification factors
3. Multi-energy spatial registration
4. Uniformity
5. Collimator efficiency
6. Energy resolution
7. Count rate performance
8. SPECT quality control
9. Tomographic resolution
10. Patient motion
11. Center of Rotation

III. SPECT Computer hardware
1. Array processors
2. Data acquisition systems
3. Amplifier
4. Analog to Digital Converters
5. Sample Holding Units

IV. SPECT frequency of Quality Control
1. Uniformity
2. Tomographic uniformity
3. Spectrum display
4. Energy resolution
5. Sensitivity
6. Pixel size
7. Center of Rotation
8. Linearity
9. Resolution
10. Count loss
11. Multiple window
12. Total performance phantoms

V. Gamma Camera acquisition modes
1. Static
2. Dynamic
3. List
4. Gated SPECT
5. Dynamic SPECT
6. Whole Body SPECT
7. SPECT
8. SPECT/CT

VI. Clinical applications of SPECT/CT
1. Cardiac
2. Bone

3. Renal
4. Gastric
5. Hepatobiliary
6. Thyroid
7. Pulmonary
8. Brain

VII. SPECT image acquisition modes
1. Step and shoot
2. Continuous
3. Continuous step and shoot
4. 180 degrees vs. 360 degrees
5. Image pixels
6. Counts per pixel
7. Number of projections
8. Zoom

VIII. SPECT Reconstruction Algorythms
1. Filtered Back projection
2. Iterative
3. 9-Point smoothing
4. Filtering
5. Transformation of Domains
6. Frequency domain
7. Attenuation correction

IX. SPECT Reorientation Models
1. Transverse
2. Longitudinal
3. Oblique
4. Cardiac
    a. Vertical Long Axis
    b. Horizontal Long Axis
    c. Short Axis

X. Hard Copy Formats
1. Solid State Laser Printer
2. Gas Laser Printers
3. Image storage medias
4. Picture Archival Communication Systems

XI. SPECT Display
1. Volume rendering
2. Surface rendering
3. Color vs. Grey Scale

XII. SPECT Quantitation
1. Perfusion Quantitation I

2. Perfusion Quantitation II
3. Polar Maps I
4. Polar Maps II
5. 3-D Cardiac

XIII. Exam

Course Lecture: 029880: MIVWIQIV: Lecture IV: ***"Basic Instrumentation of SPECT/CT: CT Component"***

Lecture Overview:

This online self-study course is intended to inform technologist on basic physics, instrumentation, quality control, acquisition, reconstruction, and analysis of CT imaging.

Learning Objectives**:** **2.0 hr**

Upon successful completion of this online self-study course, the technologist will be able to:

- Describe the physics processes involved in the production of x-rays.
- Describe the role of each component in the x-ray tube.
- Discuss the role of proper adjustment of x-ray tube voltage and current in CT.
- Discuss the key parameters of kVp, mA, Time, Slice thickness, and Slice Increments.
- Name the principle parts of a CT scanner.
- Discuss the function of each CT scanner component.
- Describe how a helical CT scanner operates and the component changes that made this technology possible.
- Describe how CT image data are acquired and processed.
- Describe the calculation process of Hounsfield units.
- Describe CT number values assigned to various tissues and how these values are assigned into meaningful display windowing.
- List parameters set by the operator for CT use and describe the effect of each on the images.
- Discuss the CT image quality issues.
- List the origin of CT image artifacts and describe their prevention.
- Discuss appropriate parameters for the acquisition of low-dose CT for SPECT attenuation correction.
- Describe the parameters and image characteristics required for a diagnostic-quality CT scan.
- Discuss the integration of CT procedures into the combined SPECT/CT examination.
- Discuss occupational radiation exposure from operating a CT scanner.
- Discuss patient radiation exposure from a CT scanner.
- Describe the frequency of CT quality control.
- Discuss CT quality control.
- Discuss basic SPECT/CT technology.
- Describe SPECT/CT architecture.

- Discuss the technical skills to operate a SPECT/CT system.
- Discuss the advantages of SPECT/CT.
- Discuss the effects of CT based attenuation correction in SPECT/CT.
- Discuss new and current radiopharmaceuticals used in SPECT/CT.
- Compare today's SPECT/CT systems

Course Outline

I. Physics of X rays
    1. Bremsstrahlung radiation
    2. Characteristic radiation
II. Production of X rays
    1. Tube design
III. Key parameters
    1. kVp
    2. Miliamperage
    3. Time
    4. Slice thickness
    5. Slice increment
IV. Voltage variations
V. Filters
VI. Principles of CT
VII. Scanner design
    1. System configuration
    2. Electronics
        a. Gantry
        b. Detectors
        c. Tube
        d. Generator
        e. Collimation
        f. Rotation speed
        g. Pitch
        h. Increments
VIII. Helical
IX. Data acquisition
X. Reconstruction
XI. Display
XII. Console
XIII. Coordinate system
XIV. Table
    1. Scan range
    2. Field of View

XV. Scanning methods
    1. Topogram
    2. Axial
    3. Volumetric
    4. Continuous
XVI. Multi-slice fundamentals
    1. Effectiveness
    2. Dual slice
    3. Quad detectors
    4. Slip ring
XVII. Image quality
    1. High contrast
    2. Low contrast
XVIII. Noise
    1. Low dose attenuation correction
XIX. Integrated SPECT/CT
    1. CT protocols
    2. Diagnostic CT
    3. Abdominal CT
    4. Chest CT
    5. Neck CT
XX. Contrast agents
    1. Iodine
    2. Barium sulfate
    3. Gastrografin
    4. Rectal
XXI. Advantages of CT
    1. Limitations
    2. Goals
XXII. Density information
XXIII. Window settings
    1. Spatial resolution
    2. Isotropic resolution
    3. Post processing
XXIV. Pixel size
    1. Voxel size
XXV. Grey scale
    1. CT numbers
XXVI. CT computer
    1. Operating system
    2. Array processors
    3. Data acquisition system

4. Amplifier
5. ADC
6. Sample Hold Unit

XXVII. Image storage devices
1. Laser printers
2. Hard copy
3. Storage media
4. Communication systems

XXVIII. CT Quality Control
1. Noise and field uniformity
2. CT number linearity
3. Low contrast detectability
4. Spatial resolution
5. Hard copy and display QC

XXIX. Dosimetry Quality Control
1. CTDI
2. Patient

XXX. Alignment laser accuracy
1. Table increments
2. Collimator
3. Scan volume
4. Helical pitch

XXXI. Kilo voltage accuracy

XXXII. Half value layers

XXXIII. Exposure reproducibility and linearity

XXXIV. Radiation profile width

XXXV. Slice sensitivity profile

XXXVI. Phantoms and test tools

XXXVII. Acceptance testing

XXXVIII. Continuous quality control program
1. Localization light accuracy
2. Slice thickness
3. Image noise
4. Field uniformity
5. High contrast resolution
6. Artifact evaluation
7. CT number accuracy
8. Display and hard copy image quality

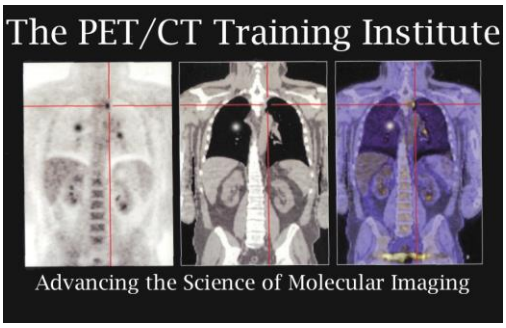
XXXIX. Daily QC tests

XL. CT radiation safety

XLI. Basic SPECT/CT technology

XLII. SPECT/CT architecture

XLIII. SPECT/CT protocol development
XLIV. Technologist skills
XLV. Advantages of SPECT/CT
XLVI. Effects of CT based attenuation correction
XLVII. Diagnostic CT
XLVIII. Internal radiation dosimetry
XLIX. Estimated radiation exposures
L. Radiopharmaceuticals
LI. Comparing SPECT/CT systems
    1. GE Lightspeed VCT
    2. GE Discovery NM/CT
    3. Mediso Anyscan
    4. Philips XCT
    5. Siemens Symbia
LII. Exam
LIII. Course Evaluation
LIV. Post Test



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