

## **50 HR "CT REGISTRY REVIEW COURSE"**

### **Course Control Document**

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### **Course Overview:**

This *50 hour* online self- study "**CT Registry Review Course**" is designed to provide entry level and experienced Technologist with a comprehensive knowledge of elementary principles and practices related to **CT and SPECT/CT imaging**. This course can also be used to prepare technologists to take the NMTCB or ARRT CT Registry exam, or to provide technologist with ARRT, ASRT, NMTCB, ICANL, ACR, and State DOH, Society of Nuclear Medicine and Molecular Imaging- Technologist Section approved category A Voice credits.

### **Course Objectives:**

These courses are intended for Technologist who needs an effective way to prepare for, and pass, the NMTCB/ARRT CT Certification Examination. This course curriculum will provide broad fundamental knowledge of CT and SPECT/CT principles and concepts as outlined in the published Content Specifications of the NMTCB and ARRT. This course provides sample questions and different test strategies to help prepare the student to be successful with the CT certification examination. In addition, the course will consist of an overview of CT Physics, Instrumentation, Radiation Safety and Protection, CT Quality Control, Contrast Medias, Artifacts, Special Procedures, Pediatric and Adult Methodology, Acquisition Protocols, and Cross Sectional Anatomy with and without contrast agents.

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***Title: Syllabus Review (Course Control Document)***

***Title: Disclaimer***

***Title: PRE-TEST***

***Title: MIWIQI Lecture I: Introduction to CT: The Fundamentals (60 minutes)***

***Keywords: CT Definitions, Tomographic Principles, Planes, CT Roots, CT components***

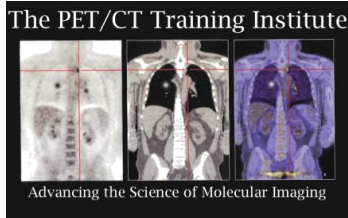
**Objectives:**

- Describe the discovery of computed tomography.
- Explain the basic designs of earlier CT scanner generations.
- Identify the function of CT components.
- List the uses of CT in medical diagnostics.
- Discuss basic image processing.

**Contents**

1. Basic CT Definitions and terminology
2. Tomographic principles
3. Tomographic Planes
4. CT history
5. Founder Godfrey Hounsfield
6. Earlier CT generations
7. Dual Source CT
8. Beam Geometry
9. Pencil Beam
10. Fan Beam
11. Cone Beam
12. Multidetector CT
13. Digital Imaging
14. Sequential Scanning
15. Spiral Imaging
16. Helical Imaging
17. Tissue Differentiations
18. Basic Components of CT System
19. Console
20. Gantry
21. Table
22. CT Tube
23. Generators
24. Slip rings
25. Filters
26. Collimators
27. Detectors
28. Arrays
29. Data Acquisition Systems
30. Array Processors
31. Monitors
32. Archival devices

**MIWIEI: Exam I: "Introduction to CT: The Fundamentals"** You must score an 80% or greater in order to receive SNMMI-TS Voice Credits.



**Title: MIWIIQI Lecture 2: Basic CT Instrumentation (60 minutes)**

**Keywords:** CT scanner components, Axes, Helical Scanners, Conventional Axial Scanning, Volumetric acquisitions, Operators console

**Objectives**

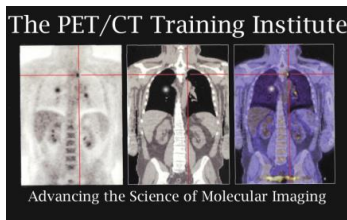
- Explain the CT Scanner Computer System
- Trace the electrical current from the CT Tube to the image display components
- Discuss how to adjust the operator controls that effect the image quality
- Discuss the key elements of a digital CT image.

**Contents**

1. CT Scanner components
2. Patient Imaging table
3. X,Y, Z axes
4. Gantry
5. CT Tube
6. Generator
7. Detectors
8. Collimators
9. Scanner configurations
10. Helical Scanners
11. Axial Scanning
12. MDCT
13. Volumetric Acquisitions
14. Slip rings
15. Operators console
16. Pitch
17. Scan Field of View
18. Display Field of View
19. Annotations
20. Scout localizers
21. Regions of Interest
22. CT/Hounsfield Numbers
23. Window Width
24. Window Level
25. Computer systems

26. *Digital images*
27. *Pixel*
28. *Matrix*
29. *Voxel*
30. *Sampling*
31. *Aliasing*
32. *Spatial Resolution*
33. *Contrast Resolution*
34. *Temporal Resolution*
35. *Noise*
36. *Partial Volume Averaging*

**MIWIEII: Exam 2: “Basic CT Instrumentation”:** You must score an 80% or greater in order to receive SNMMI-TS Voice Credits.



**Title: MIWIIIQI: Lecture 3: “CT Data Acquisition” (90 minutes)**

**Keywords:** Axial Scanning, Spiral Technology, Helical Scanning, Cine, Data Acquisition Systems, ADC, DAC, Amplifiers, Binary Encoding, Fourier Transforms, Aliasing Artifacts

### **Objectives**

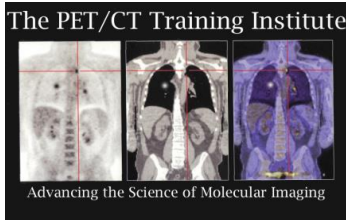
- *Discuss the methods for acquiring CT images.*
- *Explain the Data Acquisition System.*
- *Discuss the process of acquiring the CT data.*
- *Identify the key factors that can influence the raw data.*
- *Review the selectable scanning parameters used to acquire the CT data.*

### **Contents**

1. *Axial Scanning*
2. *Helical Technology*
3. *Spiral Scanning*
4. *Cine mode*
5. *Data Acquisition processes*
6. *Lambert-Beer Law*
7. *CT Hounsfield Numbers*
8. *Data Acquisition System*
9. *Analog to Digital Converters*

10. *Digital to Analog Converters*
11. *Amplifiers*
12. *Transmitted Beam Measurements*
13. *Binary Data Encoding*
14. *Binary System*
15. *Fourier Transformations*
16. *Data Transmissions*
17. *Aliasing Artifacts*
18. *Ring Artifacts*
19. *Convolutions*
20. *Back Projections*
21. *Iterative Algorithm's*
22. *Analytic Reconstructions*
23. *Kernels*
24. *Interpolations*
25. *Digital Acquisition System performances*
26. *CT Tube*
27. *Detectors*
28. *Gas Ionization Detectors*
29. *Scintillation Detectors*
30. *Detector Properties*
31. *Data Acquisition*
32. *Filters*
33. *Collimators*
34. *Pre patient Collimators*
35. *Post Patient Collimators*
36. *Selectable Scan Factors*
37. *Scan Field of View*
38. *Display Field of View*
39. *Matrix*
40. *Slice Thickness*
41. *Spacing*
42. *Reconstruction Intervals*
43. *mAs*
44. *kVp*
45. *Kernels*
46. *Bypass Filters*
47. *Scan Time*
48. *Rotational Arcs*
49. *Rotation Times*
50. *Regions of Interest*
51. *Magnifications*
52. *Focal Spot Size*
53. *Tube Geometry*
54. *Dose Modulation*
55. *Pitch*

**MIWIIIIEIII: Exam3: "CT Data Acquisition":** You must score an 80% or greater in order to receive SNMMI-TS Voice Credits.



**Title: MIWIVQI: Lecture 4: "CT Image Processing and Reconstruction" (90 minutes)**

*Keywords: Linear Interpolation, Filtered Back Projections, Z-Axis Filtering, Interlaced Sampling, Smoothing, Windowing, Rendering, 3-D Reconstructions*

### **Objectives**

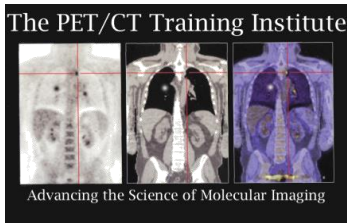
- *Describe the CT reconstruction steps.*
- *Discuss Image Enhancement, and post processing techniques.*
- *Discuss the tools used to view a CT Scan.*
- *Discuss various workstation applications used with specialized CT studies.*
- *Discuss recording and archival of CT data.*

### **Content**

1. *CT Image processing*
2. *Reconstruction*
3. *Mini and Microprocessors*
4. *Array Processors*
5. *Simple Back Projections*
6. *Linear Interpolation*
7. *Z-Axis Filtering*
8. *Interlaced Sampling*
9. *Retrospective Reconstruction*
10. *Reformatting*
11. *Maximum Intensity Pixels*
12. *Image Smoothing*
13. *Edge Enhancements*
14. *Gray Scale Manipulation*
15. *Window Width*
16. *Window Level*
17. *WW/WL Equation*
18. *Shaded Surface Rendering*
19. *Multiplanar Reconstructions*
20. *Curved Multiplanar Reconstructions*
21. *Volume Rendering*

22. 3-D Reconstruction
23. Image Display
24. Cathode X-Ray Tubes
25. Liquid Crystal Display
26. Pan
27. Zoom
28. Scroll
29. Swivel
30. Roll
31. Rotate
32. Measurement
33. Magnify
34. Viewing
35. 2-D vs 3-D
36. Slab
37. Planar
38. Cine
39. Workstation
40. Patient Directory
41. Print
42. Delete
43. Archival
44. Query
45. Network
46. Copy
47. Applications
48. Ejection Fraction
49. Calcium Scoring
50. Stereotaxic
51. Radiation Oncology Treatment Planning
52. Fusion
53. Neurology
54. Vessel Analysis
55. Vessel Tracking
56. Recording
57. Archiving
58. Laser Cameras
59. PACS

**MIWIVEIV: Exam 4: "CT Image Processing and Reconstruction":** *You must score an 80% or greater in order to receive SNMMI-TS Voice Credits.*



**Title: MIWIQI: Lecture 5: “CT Radiation Safety and Protection” (60 minutes)**

**Keywords:** Measuring Patient Doses, CT Dose Indices, mA Modulation, Pitch, Occupational Exposures, CT Order, Contrast Contraindications, Power Injectors, Venipuncture, Extravasation

### **Objectives**

- Describe the methods used to measure a patient's CT dose.
- Discuss the role of the CT Technologist in reducing the radiation exposures.
- Explain the occupational exposures in the CT department.
- Discuss the pediatric patient special considerations.
- Describe ethical considerations, including the overuse of CT, appropriate imaging of pediatric patients and how protocols can affect scanning.
- Discuss basic patient care and safety principles.
- Discuss Venipuncture techniques in the CT lab.
- Discuss the use of CT contrast and Informed Consent.
- Explain PRE and Post procedures Instructions.
- Discuss Emergency procedures.

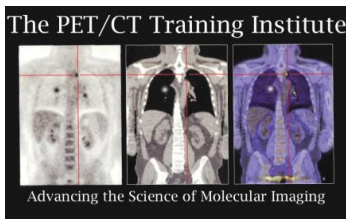
### **Content**

1. Patient Safety
2. Measuring Patient Dose
3. CT Dose Indices
4. Reducing Radiation Dose
5. Patient Education
6. Physicians Education
7. Positioning
8. Shielding
9. Technical Factors
10. kVp and mAs
11. mA Modulation
12. Pitch
13. Collimation
14. Gating
15. Detector Configuration
16. Occupational Exposure
17. CT Order
18. Contrast
19. Contrast Contraindications
20. Power Injectors



21. Venipuncture
22. Venipuncture procedures
23. Extravasation
24. Central Access Devices
25. PICC Lines
26. Port a Cath
27. Perm a Cath
28. Prescan Procedures
29. Metformin
30. Patient Consent
31. IV Lines
32. Post Scan Instructions
33. Ethics
34. Restraints
35. Pediatrics
36. Pregnant Patients
37. Emergency Equipment
38. Emergency Situations

**MIIWIEV: Exam 5: “CT Safety and Protection”:** *You must score an 80% or greater in order to receive SNMMI-TS Voice Credits.*



**Title: MIIWIIQI: Lecture 6: “CT Radiation Dose Calculations” (60 minutes)**

**Keywords:** *Volume CTDI, Patient Dose, mGy, Size Specific Dose Estimates, Dose Length Product, Scan Modes, Table Feed/Increments, Automatic Exposure Controls*

### **Objectives**

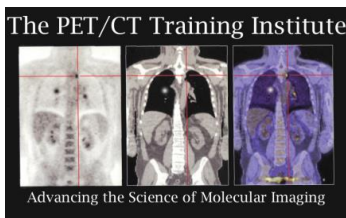
- *Discuss radiation dose output.*
- *Describe how volume CTDI is related to patient dose.*
- *Discuss Dose Modulation and reduction methods.*
- *Describe dose display.*

### **Content**

1. *CTDI Volume*
2. *Patient Dose*
3. *Size Specific Dose Estimate*

4. *ACR Dose Index Registry*
5. *Dose Length Product*
6. *mGy*
7. *Axial*
8. *Helical*
9. *Spiral*
10. *Dynamic*
11. *Table Feed/Increment*
12. *Detector Configuration*
13. *Beam Collimation*
14. *Pitch*
15. *Exposure Time vs Rotation*
16. *Tube Current*
17. *Tube Potential*
18. *Tube Current Time Product*
19. *Effective Tube Current Time Product*
20. *Field of Measurement*
21. *Beam Shaping Filter*
22. *Dose Modulation and Reduction*
23. *Automatic Exposure Control*
24. *Image Quality Reference Parameter*
25. *Angular Tube Current Modulation*
26. *Longitudinal Tube Current Modulation*
27. *ECG Based Tube Current Modulation*
28. *Retrospective Gating*
29. *Organ Based Tube Current Modulation*
30. *Automatic Tube Potential Selection*
31. *Iterative Reconstruction*
32. *Noise Reduction Techniques*
33. *Dose Display*
34. *Post Study Data Page*
35. *Summing dose Report Values*
36. *Dose Notification Levels*
37. *Dose Alert Levels*
38. *Radiation Dose Structured Reports*

**MIIWIEVI: Exam 6: "CT Radiation Dose Calculations":** You must score an 80% or greater in order to receive SNMMI-TS Voice Credits.



**Title: MIIWIIIQI: Lecture 7: “Measuring a Patients Dose from a CT scanner” (90 minutes)**

**Keywords:** Matrix, Voxel, CT Numbers, Grey Scale, Parallel Beam, Fan Beam, Spiral Beam, Tube trajectory, Hounsfield Units, Ionization Chamber, Absorbed Dose

### **Objectives**

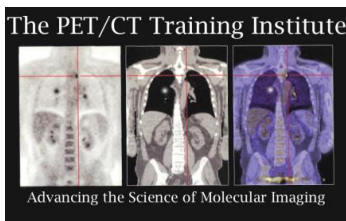
- *Discuss the basic principles of CT*
- *Describe the geometry of a CT scanner.*
- *Examine the measurements of a patient dose.*
- *Discuss the dosimetry quantities in CT.*
- *Describe the principals of thermo luminescent dosimeters.*
- *Examine the CTDI dosimetry of an acrylic phantom.*
- *Explore multi scan average dose.*
- *Discuss dose length products.*
- *Discuss methods for reducing patient doses.*

### **Content**

1. *Tomography*
2. *Background*
3. *X-Radiation*
4. *Tube Principles*
5. *Conventional X-Rays*
6. *Attenuation*
7. *Absorption*
8. *Scatter*
9. *Intensity*
10. *Image Densities*
11. *Prototype CT Scanners*
12. *Present CT Scanners*
13. *2-D Array*
14. *Slice/Cut*
15. *Matrix*
16. *Pixel*
17. *Voxel*
18. *Digital image*
19. *CT Numbers*
20. *Grey Scale*
21. *Phases of CT*
22. *Parallel Beam*
23. *Fan Beam*
24. *Spiral Beam*
25. *Gantry*
26. *X-Ray Tube*
27. *X-Ray Detectors*
28. *Beam Geometry*

29. Tube Trajectory
30. Hounsfield Units
31. CT Number Conversions
32. Volume Acquisitions
33. Serial Acquisitions
34. FOV
35. Image Manipulation
36. Windowing
37. Ionization Chamber
38. Absorbed Dose
39. Single Slice Radiation Dose
40. Weighted CTDI
41. Volume CTDI
42. Dose Length Product
43. Effective Dose
44. Radiation Units
45. Radiation Dosimetry
46. CTDI 100
47. CTDI (w)
48. CTDI (Volume)
49. Pencil Ionization Chamber
50. CT Phantom
51. Z-Axis Dose Profile
52. Thyroid Shield
53. Gonadal Shield

**MIIWIIIEVII: Exam 7: “Measuring a Patients Dose from a CT scanner”:** You must score an 80% or greater in order to receive SNMMI-TS Voice Credits.



**Title: MIIWIIQI: Lecture 8: “CT Image Quality” (90 minutes)**

**Keywords:** Image Quality, Contrast Resolution, Linearity, Uniformity, Spatial Resolution, Temporal Resolution, Focal Spot Size, Image Receptor, Subject Contrast, Selectable Factors, Preset Options, Artifacts

### **Objectives**

- Discuss factors that affect image quality in CT.
- Explain the methodology used to define image quality.
- Identify CT image artifacts.

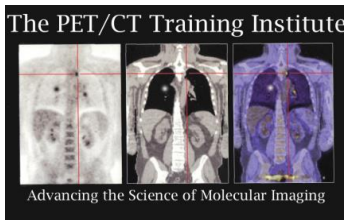
- *List factors that influence artifacts.*
- *Identify the tests associated with a QC program.*

## **Content**

1. *Image quality*
2. *Contrast Resolution*
3. *Linearity*
4. *Noise*
5. *Uniformity*
6. *Spatial Resolution*
7. *Temporal Resolution*
8. *Factors Influencing Image Quality*
9. *Focal Spot Size*
10. *Beam Geometry*
11. *Image Receptor*
12. *Subject Contrast*
13. *Viewing Conditions*
14. *Selectable Factors*
15. *mA*
16. *Scan Time*
17. *SFOV*
18. *DFOV*
19. *Slice Thickness and Spacing*
20. *Filters*
21. *kVp*
22. *Preset Options*
23. *Artifacts*
24. *Beam Hardening Artifacts*
25. *Partial Volume Averaging Artifacts*
26. *Motion Artifacts*
27. *Metal Artifacts*
28. *Equipment Artifacts*
29. *Ring Artifacts*
30. *Cone Beam Artifacts*
31. *Edge Gradient Artifacts*
32. *Out of Field Artifacts*
33. *Quality Control Program*
34. *Principles of QC Testing*
35. *Phantom set up*
36. *CT Number Calibration Tests*
37. *Standard Deviation of the CT Number in Water*
38. *High Contrast Resolution*
39. *Low Contrast Resolution*
40. *Distance Measuring Device Accuracy*
41. *Video Monitor Distortion*
42. *CT Number Flatness*
43. *Hard Copy Output*

- 44. Localization Device Accuracy
- 45. CT Couch Indexing
- 46. CT Couch Backlash
- 47. Light Field Accuracy
- 48. Slice Width
- 49. Radiation Leakage and Scatter
- 50. Measurements by Physicist

**MIIWIEVIII: Exam 8: “CT Image Quality”:** You must score an 80% or greater in order to receive SNMMI-TS Voice Credits



**Title: MIIWIIQI: Lecture 9: “CT Quality Control Procedures”** (90 minutes)

**Keywords:** Quality Assurance, Quality Control, Record Keeping, QC Tests, Average CT Numbers, Standard Deviation, High Contrast Resolution, Low Contrast Resolution, Accuracy, Noise Properties

### Objectives

- Discuss what Quality Control is.
- Discuss why we need Quality Control.
- Explain the principles of Quality Control
- Discuss the Quality Control procedures performed on a CT Scanner.
- Discuss Image Quality.

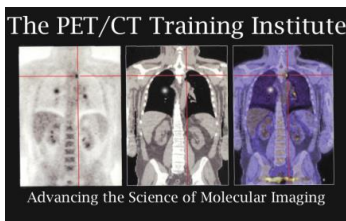
### Content

1. Quality Assurance Program
2. Quality Control
3. Periodic QC procedures
4. Record Keeping
5. Average CT Number in Water
6. Standard Deviation of CT
7. High Contrast Resolution
8. Low Contrast Resolution
9. Accuracy of Distance Measuring Devices
10. Accuracy of Image Measuring Devices
11. Resolution
12. Noise Properties
13. Linearity

14. Common Artifacts
15. Image Quality Parameters
16. Factors Influencing Quality
17. Spatial Resolution
18. Resolvable Object Size
19. Limiting Resolution
20. Geometric Factors affecting Spatial Resolution
21. Geometric Unsharpness
22. Non Geometric Factors affecting Spatial Resolution
23. Reconstruction Algorithms
24. CT Contrast Resolution
25. Noise Level
26. Noise Measurement in CT
27. Photon Flux to Detectors
28. Slice Thickness
29. CT Image Quality Equation
30. Point Spread Function
31. Qualifying Blurring
32. Full Width at Half Maximum
33. Line Spread Function
34. Contrast Response Function
35. CT Phantom
36. Modulation Transfer Function
37. Component Modulation Transfer Function
38. CT Number Calculations
39. Linearity
40. CatPhan
41. Cross field Uniformity
42. CT Artifacts-Distortion
43. CT Artifacts: Causes
44. Motion Artifacts
45. Abrupt High Contrast Changes
46. Beam Hardening Artifacts
47. Partial Volume Effects
48. Ring Artifacts
49. Slice Sensitivity
50. Multiple Scan Average Dose
51. CT Dosimetry
52. Single Dose Descriptor
53. Patient Dose
54. Linear Attenuation Coefficients
55. Attenuation
56. Atomic Number
57. Density of Electrons
58. Thickness
59. Photon Energy
60. kVp
61. Slice Thickness

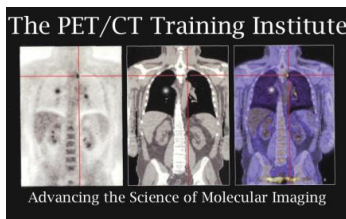
62. Single Row Detectors Scanners
63. Multi Row Detectors Scanners
64. Table Increments
65. Pitch
66. Pitch Affects
67. Reconstruction Intervals
68. Field of View
69. Scan Field of View
70. Reconstruction Field of View
71. Matrix
72. Magnification
73. Window Width and Window Level

**MIIIWIEIX: Exam 9: “CT Quality Control Procedures”:** *You must score an 80% or greater in order to receive SNMMI-TS Voice Credits*



**Title: MIIIWIIIQI: Lecture 10: “Artifacts in CT”**

**MIIIWIIIEX: Exam 10: “Artifacts in Computed Tomography”:** *You must score an 80% or greater in order to receive SNMMI-TS Voice Credits.*



**Title: MIVWIIQI: Lecture 11: “CT Image Processing and Reconstruction” (90 minutes)**

**Keywords:** Image Processing and Reconstruction, Array Processors, Backprojection, Linear Interpolation

### Objectives

- Describe the required steps for CT image reconstruction.
- List the post processing techniques need for image enhancement.
- Define the tools needed used to view a CT image.
- List the workstation applications used for specialized CT Scanning.
- Describe the methods of recording and archiving CT data.

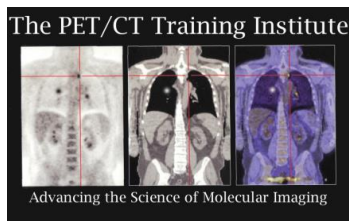


## **Content**

1. Image Processing
2. Image Reconstruction
3. Minicomputer
4. Microprocessor
5. Array Processor
6. Back projection
7. Linear Interpolation
8. Filtered Back projection
9. Longitudinal Interpolation
10. Interlaced Sampling
11. Reconstruction
12. Reformatting
13. Specific Post processing Techniques
14. Maximum Intensity Pixels
15. Minimum Intensity Pixels
16. Image Smoothing
17. Edge Enhancement
18. Gray-Scale Manipulation
19. Window Width
20. Window Level
21. Shaded Surface Rendering
22. Multi planar Reconstruction
23. Curved Multi planar Reconstruction
24. Volume Rendering
25. 3 D Reconstruction
26. Virtual Reality
27. Image Display
28. Image Manipulation
29. Image Recording
30. Image Archiving
31. Cathode Ray Tube
32. Liquid Crystal Display
33. Pan
34. Zoom
35. Image Scrolling
36. Swivel
37. Roll
38. Rotate
39. Measurement
40. Magnify
41. Viewing Modes
42. 2 D vs. 3 D
43. Slab
44. Planar
45. Cine
46. Technologist Workstation
47. Directory

48. Patient List
49. Film
50. Print
51. Delete
52. Archive Button
53. Query
54. Send
55. Network
56. Copy
57. Applications
58. Ejection Fraction
59. Calcium Scoring
60. Stereotaxic
61. Radiation Oncology Treatment Planning
62. Fusion
63. Neurology
64. Vessel Analysis
65. Vessel Tracking
66. Laser Camera
67. PACS

**MIVWIEXI: Exam 11: “CT Image Processing and Reconstruction”:** *You must score an 80% or greater in order to receive SNMMI-TS Voice Credits*



**Title: MIVWIIQI: Lecture 12: “CT Physics and Instrumentation”** (90 minutes)

**Keywords:** Bremsstrahlung Radiation, Characteristic X-Rays, Voltage Variation, CT scanner Design, Rotation Speed, Kernels, Shaded Surface Displays, Scout, Scan Geometry, Mosaic Detectors

### Objectives

- 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 adjustments of X-Ray Tube voltage and current in CT.
- Name the principle parts of a CT scanner.
- Discuss the function of each CT scanner component.
- Discuss how CT image data is acquired and processed.
- Describe the calculation process of the Hounsfield Unit.
- Describe CT number values assigned to various tissues and how each of these values are assigned into meaningful display windowing.
- Discuss CT image quality issues.
- List the origin of CT image artifacts and describe their prevention.

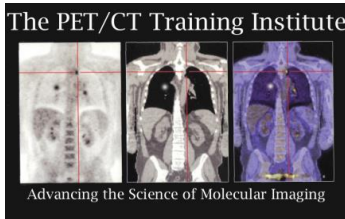
- Discuss appropriate parameters for the acquisition of low-dose CT for PET attenuation correction.
- Describe the parameters and image characteristics required for a diagnostic CT scan.
- Discuss the importance of CT quality Control.
- Review a CT scanner's system configuration.

## **Content**

1. X-Ray Physics
2. Bremsstrahlung Radiation
3. Characteristic X-Rays
4. X-Ray Tube Design
5. Voltage Variation
6. Beam Hardening
7. Advantages and Disadvantages of high kVp
8. Current Variation
9. Advantages and Disadvantages of current variations
10. X-Ray Filters
11. CT scanner design
12. Gantry Composition
13. X-Ray Detectors
14. Collimation
15. Rotation Speed
16. Pitch
17. Increments
18. Image Data Acquisition
19. CT Reconstruction
20. Hounsfield Units
21. Tissue Hounsfield Unit values
22. CT Reconstruction Algorithm's
23. Post Processing Filtering
24. CT Display
25. Limitations of CT Display
26. Volumetric Image Data
27. MIP
28. Shaded Surface Displays
29. Image Noise
30. CT Artifacts
31. Streaks
32. Rings
33. Bands
34. Shading
35. Quality Control
36. Hardware components
37. Scan Geometry
38. Mosaic Detector
39. Detector Configurations
40. Axial Signal Collection
41. Axial Interfacing
42. Axial Intervals
43. Axial Interval with Skip

44. Tilt Correction
45. Helical Pitch
46. Helical Configurations
47. Helical Interface
48. Retrospective
49. Prospective
50. Slice Profiles

### Proceed to Lecture 13



**Title: MIVWIIQII: Lecture 13: “CT Instrumentation and Operations” (60 minutes)**

**Keywords:** Coordinate System, Gantry, Detectors, ADC, High Voltage Generator, Gantry Control, DAC, Scan Controller, Host Computer, Console, Array Processors

### Objectives

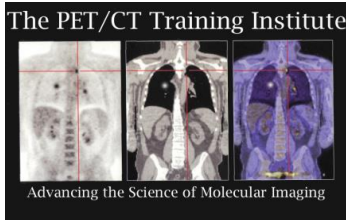
- Discuss the key components of a basic CT scanner.
- Discuss the components found within the housing unit of the Gantry.
- Discuss the coordinate system of a CT scanner.
- Discuss the scannable ranges of a CT system.
- Discuss the patient couch weight limits.
- Discuss the different focal spot sizes.
- Discuss how the tube voltage would have an impact on the CT image.
- Discuss various CT Detector scintillation crystals.

### Content

1. Imaging system
2. Computer system
3. Data display
4. Recording systems
5. Gantry
6. Detectors
7. Analog to Digital Converters
8. Array Processors
9. Storage
10. X-Ray Tube
11. High Voltage Generators
12. Host Computer

13. Gantry Control
14. DAC
15. Scan Controller
16. Console
17. Couch
18. Collimator
19. Aperture
20. Tilt Range
21. Coordinate System
22. Isocenter
23. Tilt Range
24. Maximum Scannable Range
25. Filter
26. Detector Electronics
27. Thermionic Emission
28. Focal Spot Sizes
29. Anode
30. Tungsten
31. Tube Current
32. kVp
33. Time of Exposure
34. Heat Units
35. Technique Compensation
36. CT Generator
37. Collimation
38. Filtration materials
39. Detector Types
40. Scintillation Crystals
41. Photocathodes
42. Sodium Iodide
43. Calcium Fluoride
44. Bismuth Germanate
45. Calcium Tungstate
46. Gas Ionization
47. Computer System
48. Minicomputers
49. Sequential Processing
50. Unix
51. Windows
52. Amplifiers
53. Sample Hold Units
54. Image Display
55. Laser Printers
56. Hard Copy
57. CT Layout

**MIVWIIEXII: Exam 12: “CT Physics and Instrumentation”:** *You must score an 80% or greater in order to receive SNMMI-TS Voice Credits*



**Title: MVWIIQI: Lecture 14: “Cross Sectional Anatomy of the Head and Neck”** (90 minutes)

**Keywords:** Body Planes, Directional Terminology, Skull, Frontal Bones, Parietal Bones, Temporal Bones, Auditory Ossicles, Vestibules, Ethmoid, Sphenoid Sinus, Occipital Bone, Facial Bones, Nasal Septum

### Objectives

- Describe the anatomical planes of the body.
- Define directional terminology related to the body.
- Describe human embryo development
- Name the major structures of the head and neck.
- Describe the function of each anatomical structure.
- Locate specific organs or structures on a schematic image.
- Identify the anatomical planes in which cross sectional images were either acquired or reformatted.
- Recall the structures of the human vascular system.
- Name the 12 cranial nerves, their distribution and function.
- Identify selected muscular structures.

### Content

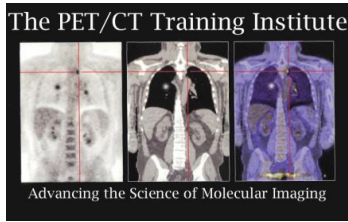
1. Body Planes
2. Directional Terminology
3. Axial Plane
4. Coronal Plane
5. Sagittal Plane
6. Oblique Planes
7. Anterior
8. Posterior
9. Caudal
10. Cranial
11. Proximal
12. Distal
13. Dorsal
14. Ventral
15. Superior

16. Inferior
17. Lateral
18. Medial
19. Prone
20. Supine
21. Skull
22. Frontal Bones
23. Parietal Bones
24. Temporal Bones
25. Petrous Bones
26. Auditory Ossicles
27. Vestibule
28. Ethmoid
29. Sphenoid
30. Sphenoid Sinus
31. Occipital Bone
32. Facial Bones
33. Maxillae
34. Maxillary Sinus
35. Palatine Bones
36. Zygomatic Bones
37. Inferior Nasal Conchae
38. Nasal Conchae
39. Nasal Septum
40. Mandible
41. Brain Tissue
42. Sulci Gyri
43. Gray and White Matter
44. Meninges
45. Dura Mater
46. Falx Cerebri
47. Tentorium Cerebelli
48. Arachnoid Layer
49. Pia Mater
50. Subarachnoid Cistern
51. Cerebellomedullary Cistern
52. Pontine Cistern
53. Cistern of the Lateral Sulcus
54. Interpeduncular Cistern
55. Chiasmatic Cistern
56. Cisterna Ambien's
57. Pineal Gland
58. Cerebrospinal Fluid
59. Choroid Plexus
60. Ventricles
61. Cerebrum
62. Corpus Callosum
63. Longitudinal Fissure

64. Lobes of the Cerebrum
65. Fissures and Sulci
66. Central Sulcus
67. Cerebral Cortex
68. Diencephalon
69. Thalamus
70. Pituitary Gland
71. Brain Stem
72. Cerebral Peduncles
73. Pons
74. Medulla Oblongata
75. Cerebellum
76. Cranial Nerves
77. Arteries of the Brain
78. Cerebral Arteries
79. Vertebral Arteries
80. Basilar Arteries
81. Circle of Willis
82. Venous System
83. Dural Sinuses
84. Superior Sagittal Sinus
85. Inferior Sagittal Sinus
86. Sigmoid Sinus
87. Cavernous Sinus
88. Orbits
89. Organs of Site
90. Bulbus Oculi
91. Eye Muscles
92. Salivary Gland
93. Parotid Gland
94. Sublingual Glands
95. Pharynx
96. Cervical Vertebrae
97. Atlas
98. Axis
99. Dens
100. Transverse Foramina
101. Spinous Process
102. Vertebral Prominence
103. Neck Muscles
104. Carotid Sheath
105. Posterior Triangle
106. Larynx
107. Thyroid Cartilage
108. Thyroid Gland
109. Jugular Veins



**MVWIEXIII: Exam 13: “Cross Sectional Anatomy of the Head and Neck”:** *You must score an 80% or greater in order to receive SNMMI-TS Voice Credits*



**Title: MVWIIQI: Lecture 15: Cross Sectional Anatomy: Chest, Abdomen and Pelvis** (90 minutes)

**Keywords:** Thorax, Diaphragm, Lungs, Mediastinum, Aortic Arch, Heart, LCA, RCA, IVC, Esophagus, Thymus, Rhomboid, Abdomen, Psoas, Celiac Artery, Renal Arteries, Portal Veins, Stomach, Liver

### Objectives

- Define anatomical terms of the Chest, Abdomen, and Pelvis.
- Name the major structures of the Chest, Abdomen and Pelvis.
- Describe the function of each anatomical structure found in the Chest, Abdomen, and Pelvis.
- Identify the abdominal quadrants.
- Locate specific organs or structures on a schematic.

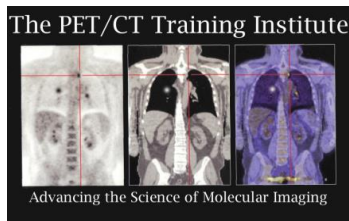
### Content

1. Thorax
2. Thoracic Inlet
3. Costal Cartilages
4. Muscles of the Thorax
5. Diaphragm
6. Pleural Cavities
7. Lungs
8. Hilum
9. Mediastinum
10. Great Vessels
11. Ascending Aorta
12. Branches of the Aorta
13. Descending Aorta
14. Heart
15. Chambers of the Heart
16. Blood Supply to the Heart
17. Right Coronary Artery
18. Pulmonary Circulation
19. Vena Cava

20. Inferior Vena Cava
21. Esophagus
22. Trachea
23. Bronchi
24. Azygos
25. Hemiazygos
26. Thymus
27. Pectoral Muscles
28. Subclavius Muscle
29. Serratus Anterior Muscle
30. Rhomboid
31. Deltoid Muscles
32. Infraspinatus and Supraspinatus Muscles
33. Teres Major
34. Abdomen
35. Diaphragm
36. Diaphragm Opening
37. Artic Hiatus
38. Abdominal Walls
39. Lateral Abdominal Walls
40. Posterior Abdominal Walls
41. Psoas Major
42. Illiopsoas Muscles
43. Quadratus Lumborum Muscles
44. Vasculature
45. Celiac Artery
46. Superior Mesenteric Artery
47. Suprarenal Artery
48. Renal Arteries
49. Gonadal Arteries
50. Lumbar Arteries
51. Median Sacral Artery
52. Common Illiac Artery
53. Inferior Vena Cava
54. Hepatic Portal System
55. Portal Vein
56. Esophagus
57. Stomach
58. Liver
59. Liver Lobes
60. Caudate Lobe
61. Quadrate Lobe
62. Gallbladder
63. Spleen
64. Pancreas
65. Tail of the Pancreas
66. Body of the Pancreas
67. Neck of the Pancreas

68. Kidneys
69. Ureters
70. Adrenal Glands
71. Small Intestines
72. Duodenum
73. Ileum
74. Large Intestines
75. Colon
76. Rectum
77. Urinary Bladder
78. Seminal Vesicles
79. Prostate Gland
80. Corpus Cavernosum

**MVWIIEXIV: Exam 14: “Cross Sectional Anatomy: Chest, Abdomen, and Pelvis”:** *You must score an 80% or greater in order to receive SNMMI-TS Voice Credits*



**Title: MVWIIIQI: Lecture 16: “Gross Cross Sectional Anatomy : Structures of the Heart and Great Vessels in CT” (60 minutes)**

**Keywords:** Rt. Brachiocephalic Vein, Trachea, Esophagus, Brachiocephalic Truck, Lt. Common Carotid Artery, Lt. Subclavian Artery, Superior Vena Cava, Aortic Arch, Teres Minor, Pectoralis major

**Objectives:**

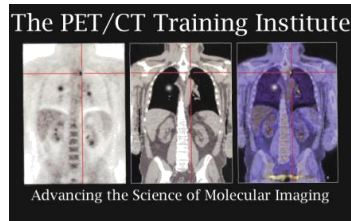
- Discuss the axial cross sectional location of the anatomy of the heart and great vessels.
- Identify pertinent axial anatomic structures of the heart and great vessels with the use of IV contrast agents.

**Content**

1. Right Brachiocephalic Vein
2. Brachiocephalic Truck
3. Left Common Carotid Artery
4. Left Subclavian Artery
5. Esophagus
6. Trachea
7. Superior Vena Cava
8. Aortic Arch
9. Pectoralis Major

10. Teres Minor
11. Scapula
12. Spinal Cord
13. Serratus Anterior
14. Arch of Azygous Vein
15. Thoracic Aorta
16. Ascending Aorta
17. Azygous Vein
18. Left Pulmonary Artery
19. Left Main Bronchus
20. Right Main Bronchus
21. Pulmonary Trunk
22. Sternum
23. Left Superior Pulmonary Vein
24. Right Coronary Artery
25. Right Atrium
26. Left Atrium
27. Left Coronary Artery
28. Right Ventricle
29. Left Ventricle
30. Left Inferior Pulmonary Vein
31. Right Inferior Pulmonary Vein
32. Latissimus Dorsi
33. Interventricular Septum
34. Xiphoid Process
35. Inferior Vena Cava
36. Coronary Sinus
37. Hemiazygous Vein
38. Apex
39. Diaphragm
40. Posterior Intercostal Artery
41. Lingula of Left Lung
42. Linea Alba
43. Right Lobe of the Liver
44. Intercostal Muscles
45. Costodiaphragmatic Recess
46. Left Lobe of the Liver
47. Fundus of the Stomach
48. Internal Thoracic Artery
49. Spleen
50. Caudate lobe of the Liver

**Proceed to the next lecture.**



**Title: MVWIIIQII: Lecture 17: “Gross Cross Sectional Anatomy: CT of the Thorax viewed with Lung Windows” (60 minutes)**

**Keywords:** Infraspinatus, Subscapularis, Left Subclavian Artery, Brachiocephalic Trunk, Trachea, Teres major, Left Common Carotid Artery, Aortic Arch, Pectoris Major, Superior Vena Cava, Superior Mediastinum

**Objectives**

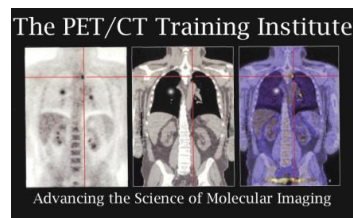
- Review axial views of the thorax with emphasis on viewing through the lung windows algorithm as seen by Computed Tomography.
- Review axial images of the thorax with IV contrast agents as viewed through the lung windows algorithm in CT.

**Content**

1. Left Brachiocephalic Vein
2. Left Common Carotid Artery
3. Left Subclavian Artery
4. Scapula
5. Esophagus
6. Subscapularis
7. Infraspinatus
8. Teres Major
9. Trachea
10. Right Brachiocephalic Vein
11. Sternoclavicular Joint
12. Arch of Aorta
13. Superior Vena Cava
14. Superior Mediastinum
15. Ascending Aorta
16. Anterior Mediastinum
17. Thoracic Aorta
18. Trachea Bifurcation
19. Trapezius
20. Transversospinalis
21. Longissimus
22. Iliocostalis Thoracis
23. Trasversospinalis
24. Carina
25. Left Main Bronchus

26. Internal Thoracic Artery
27. Arch of Azygous Vein
28. Azygous Vein
29. Right Main Bronchus
30. Eparterial Bronchus
31. Right Pulmonary Artery
32. Left Pulmonary Artery
33. Sternum
34. Right Intermedius Bronchus
35. Left Superior Lobar Bronchus
36. Right Atrium
37. Left Atrium
38. Superior Pulmonary Vein
39. Left Coronary Artery
40. Right Coronary Artery
41. Aortic Semilunar Valves
42. Aortic Vestibule
43. Left Ventricle
44. Right Ventricle
45. Serratus Anterior
46. Latissimus Dorsi
47. Bronchi
48. Papillary Muscle
49. Atrioventricular Sulcus
50. Coronary Sinus
51. Interventricular Septum
52. Costomediastinal Sulcus
53. Vertebral Canal
54. Inferior Vena Cava
55. Thoracic Duct
56. Diaphragm

**MVWIIIE XV: Exam 15: "Gross Cross Sectional Anatomy of the Chest"** *You must score an 80% or greater in order to receive SNMMI-TS Voice Credits*



**Title: MVWIIIQIII: Lecture 18: “Gross Cross Sectional Anatomy: CT of the Abdomen and Pelvis without Contrast Agents” Part I (60 Minutes)**

**Keywords:** Axial Orientation, Liver, Hepatic Vein, Inferior Vena Cava, Hemiazygous Vein, Stomach, Spleen, Right Renal Gland, Left Renal Gland, Left Crus of Diaphragm, Left Kidney, Right Kidney

**Objectives:**

- Identify the axial anatomy of the Abdomen with and without Contrast Agents.
- Identify the axial anatomy of the Pelvis with and without Contrast Agents.

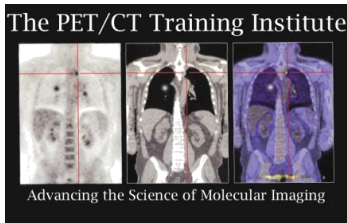
**Content:**

1. Hepatic Flexure of the colon
2. Splenic Flexure of the colon
3. Acetabulum
4. Pubic Symphysis
5. Sternum
6. Right Ventricle
7. Interventricular Septum
8. Left Ventricle
9. Esophagus
10. Aorta
11. Azygous Vein
12. Vertebral Canal
13. Latissimus Dorsi
14. Intercostal Muscles
15. Hemiazygous Vein
16. Liver
17. Stomach
18. Spleen
19. Inferior Vena cava
20. Stomach with air and barium
21. Rugae of Stomach
22. Right Renal Gland
23. Left Renal Gland
24. Left Crus of Diaphragm
25. Portal Vein
26. Celiac Artery
27. Left Kidney
28. Right Kidney
29. Gall Bladder
30. Superior Mesenteric Vein
31. Descending Duodenum
32. Left Renal Vein
33. Right Renal Vein
34. Left Psoas Major
35. Right Psoas Major
36. Transverse Colon

37. Inferior Mesenteric Artery
38. External Oblique Muscle
39. Internal Oblique Muscle
40. Left Common Iliac Artery
41. Right Common Iliac Artery
42. Small Intestine
43. Jejunum
44. Ascending colon
45. Cecum
46. Ileocecal Junction
47. Sacroiliac Joints
48. Left Common Iliac Vein
49. Right Common Iliac Vein
50. Left External Iliac Artery
51. Right External Iliac Artery
52. Sigmoid Colon
53. Ileum
54. Anterior Sacral Foramina
55. Piriformis Muscles
56. Gluteus Maximus Muscles
57. Rectus Abdominis Muscles
58. Rectum
59. Hiatus Sacralis
60. Urinary Bladder
61. Pectineus
62. Coccyx
63. Acetabulum
64. Left Femoral Artery
65. Left Femoral Vein
66. Right Femoral Artery
67. Right Femoral Vein
68. Head of the Femur
69. Greater Trochanter of Femur
70. Lesser Trochanter of Femur
71. Obturator Internus Muscle
72. Ischiorectal Fossa
73. Great Saphenous Vein
74. Rectus Femoris
75. Vastus Lateralis Muscle
76. Spermatic Cord
77. Prostate
78. Pubic Symphysis
79. Penis
80. Ischial Tuberosities

**Proceed to Part II:**





**Title: MVWIIIQIII: Lecture 19: “Gross Cross Sectional Anatomy: CT of the Abdomen and Pelvis with Contrast Agents” Part II (60 minutes)**

**Keywords:** Axial Orientation, Liver, Hepatic Vein, Inferior Vena Cava, Hemiazygous Vein, Stomach, Spleen, Right Renal Gland, Left Renal Gland, Left Crus of Diaphragm, Left Kidney, Right Kidney

**Objectives:**

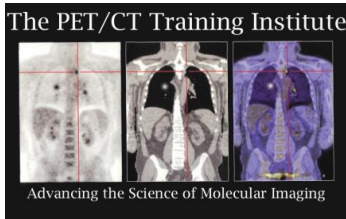
- Identify the axial anatomy of the Abdomen with Contrast Agents.
- Identify the axial anatomy of the Pelvis with Contrast Agents.

**Content:**

1. Hepatic Flexure of the colon
2. Splenic Flexure of the colon
3. Acetabulum
4. Pubic Symphysis
5. Sternum
6. Right Ventricle
7. Interventricular Septum
8. Left Ventricle
9. Esophagus
10. Aorta
11. Azygous Vein
12. Vertebral Canal
13. Latissimus Dorsi
14. Intercostal Muscles
15. Hemiazygous Vein
16. Liver
17. Stomach
18. Spleen
19. Inferior Vena Cava
20. Stomach with air and barium
21. Rugae of Stomach
22. Right Renal Gland
23. Left Renal Gland
24. Left Crus of Diaphragm
25. Portal Vein
26. Celiac Artery
27. Left Kidney
28. Right Kidney
29. Gall Bladder

30. Superior Mesenteric Vein
31. Descending Duodenum
32. Left Renal Vein
33. Right Renal Vein
34. Left Psoas Major
35. Right Psoas Major
36. Transverse Colon
37. Inferior Mesenteric Artery
38. External Oblique Muscle
39. Internal Oblique Muscle
40. Left Common Iliac Artery
41. Right Common Iliac Artery
42. Small Intestine
43. Jejunum
44. Ascending colon
45. Cecum
46. Ileocecal Junction
47. Sacroiliac Joints
48. Left Common Iliac Vein
49. Right Common Iliac Vein
50. Left External Iliac Artery
51. Right External Iliac Artery
52. Sigmoid Colon
53. Ileum
54. Anterior Sacral Foramina
55. Piriformis Muscles
56. Gluteus Maximus Muscles
57. Rectus Abdominis Muscles
58. Rectum
59. Hiatus Sacralis
60. Urinary Bladder
61. Pectineus
62. Coccyx
63. Acetabulum
64. Left Femoral Artery
65. Left Femoral Vein
66. Right Femoral Artery
67. Right Femoral Vein
68. Head of the Femur
69. Greater Trochanter of Femur
70. Lesser Trochanter of Femur
71. Obturator Internus Muscle
72. Ischiorectal Fossa
73. Great Saphenous Vein
74. Rectus Femoris
75. Vastus Lateralis Muscle
76. Spermatic Cord
77. Prostate

- 78. Pubic Symphysis
- 79. Penis
- 80. Ischial Tuberosities



**Title: MVWIIIQIV: Lecture 20: “Gross Cross Sectional Anatomy: CT of the Head” (60 Minutes)**

**Keywords:** CT History, Protocolling, Variables, Patient History, Terminology, Artifacts, Contrast, Safety

**Objectives:**

- \*Discuss the first CT scanner used for head examinations.
- \*Discuss the parameters used for acquiring a CT of the Head on a 64 slice scanner.
- \*Discuss the procedures when a CT of the head is requested.
- \*Discuss various head protocols.
- \*Discuss CT variables in the acquisition menu.
- \*Discuss CT Terminology
- \*Discuss the use of CT Contrast in head procedures.
- \*Review the risks of using iodinated contrast agents.
- \*Discuss who is at risk for anaphylactic reactions from the contrast agents. \*Discuss the risk factors for contrast induced acute renal failure.
- \*Discuss CT Radiation Safety.
- \*Discuss the Hounsfield Units.
- \*Review the CT Plains of the body.
- \*Review normal CT Anatomy of the Head.

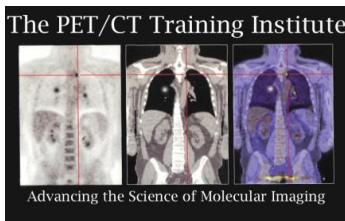
**Content:**

1. Nasal septum
2. Maxillary Sinus
3. Lateral Pterigoid Plate
4. Medial Pterigoid Plate
5. Spinal Cord
6. Styloid Process

7. Mastoid Process
8. Ramus of the Mandible
9. Coronoid process
10. Foramen Magnum
11. Vertebral Artery
12. Medulla Oblangata
13. External Auditory Meatus
14. Temporal Mandibular Joint
15. Eye Globe
16. Lacrimal Gland
17. Cerebellar Hemisphere
18. Lens
19. Auditory Tubes
20. Internal Occipital Protuberance
21. Sigmoid Sinus
22. Petrous bone
23. Basilar Artery
24. Optic Nerve
25. Crista Galli
26. Pons
27. Sphenoidal Sinus
28. Dorsum Sellae
29. Sella Tursica
30. Tentorium Cerebelli
31. Aged Brain
32. Abnormal CT Scans of the Head
33. Subdural Hematomas
34. Acute Ischemic Lt. MCA Stroke
35. Head Trauma
36. Brain Death
37. Seizures
38. Heterotopia
39. Transverse Sinus Thrombosis
40. Acute Hemorrhage
41. Acute, Subacute, Chronic bleeds
42. Subarachnoid Hemorrhage
43. Increased Intracranial Pressure
44. Cerebral Artery Stroke
45. Abnormal Ventricles
46. Bone Pathologies
47. Neuroemergencies
48. Subacute Infarcts
49. Territories
50. Venous Occlusions
51. Venous Hemorrhagic Infarcts
52. Skull Fractures
53. Linear Skull Fractures
54. Depressed Comminuted Skull Fractures

55. Basilar Skull Fractures
56. Tentorial Hemorrhage
57. Infections
58. Congenital
59. Meningitis
60. Pyogenic Parenchymal Infections
61. Encephalitis
62. Tuberculous and Fungal
63. Parasitic Infections
64. Herpes Simplex
65. Neurocystercosis
66. Aneurysms
67. Ateriovenous Malformations
68. Normal MR anatomy

**MVWIIIXVI: Exam 16: “CT Cross Sectional Anatomy of the Head”** *You must score an 80% or greater in order to receive SNMMI-TS Voice Credits*



**Title: MVIWIQI: Lecture 21: “CT Special Procedures”** (90 Minutes)

**Keywords:** Multi detector CT, Trauma CT, Musculoskeletal CT, Arthrograms, Interventional CT, Biopsy, Aspirations, Radiofrequency Ablation, Cryoablation, Urography, Cystography, Angiography

**Objectives:**

- Describe current trends and applications of CT in the Radiology suite.
- Explain basic techniques for additional uses of CT applications.
- Identify uses of CT for trauma and identifying pathological conditions.
- Recognize the uses of Virtual CT.
- Explain how CT is used in Radiation Treatment Planning.
- Explain the Uses of CT in Nuclear Medicine.

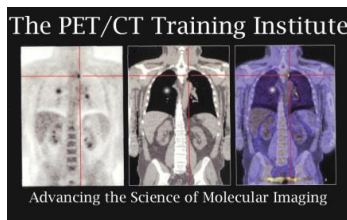
**Content:**

1. Multi detector CT
2. Trauma
3. Pathological Modifications

4. Trauma Acquisitions
5. Trauma of the Chest/Abdomen/Pelvis
6. Angiographic CT of Trauma
7. Benefits of CT in the ER
8. Non-Emergency CT
9. Musculoskeletal system CT
10. CT Arthrograms
11. Interventional CT
12. CT Biopsy
13. CT Fluid Aspirations and Drainage
14. Percutaneous Cryoablation
15. Radiofrequency Ablation
16. Fusion Volume Navigation
17. Urographic CT Procedures
18. Urographic Contrast Agents
19. CT Cystography
20. Renal Stone Quantification
21. Renal Transplants
22. CTA
23. Neurological Digital Subtraction Angiography techniques
24. CTA: Circle of Willis
25. CTA: Carotid Arteries
26. CTA: Body
27. CTA: Thoracic or Abdominal Aorta Pre-endovascular Artery Repair
28. ECG-Gated CTA: Thoracic Aorta
29. CTA: Thoracic or Abdominal Aortic Dissection
30. CTA: Subclavian Artery
31. Preoperative Planning Coarctation
32. CTA: Deep Inferior Epigastric Perforator Flap Planning
33. Preoperative Planning for Breast Reconstruction
34. CTA: Mesenteric Ischemia
35. CTA: Renal Arteries
36. CTA Runoff: Lower Extremity
37. CTA: Upper Extremity
38. CTA: Living Liver Donor
39. Neurological Venography
40. Body Venography
41. CT Perfusion
42. Virtual CT Endography
43. Virtual Bronchoscopy
44. Virtual Autopsy
45. Virtual Colonoscopy
46. CT Enterography
47. Dual-source/Dual Energy CT
48. Mass Differentiation- Cyst vs. Tumor
49. Stone Characterization
50. Gout Study
51. Perfusion Blood Volume

- 52. Bone Removal
- 53. Plaque Removal
- 54. Bariatric
- 55. Cardiac CT
- 56. ECG Gating
- 57. Patient Preparation
- 58. PET/CT
- 59. Radiopharmaceuticals
- 60. FDG Imaging Procedures
- 61. SPECT/CT
- 62. CT Radiation Treatment Planning
- 63. CT Simulations
- 64. Cone Beam CT
- 65. 4-D CT
- 66. CT Myelograms
- 67. Dynamic CT Myelograms
- 68. Portable CT

**MVIWIEXVII: Exam 17: “Introduction to CT Special Procedures”:** *You must score an 80% or greater in order to receive SNMMI-TS Voice Credits.*



**Title: MVIWIQII: Lecture 22: “The CT Protocols Manual”:** (120 Minutes)

**Keywords:** CT Scan parameters, Scan Acquisition, User interface Basics, Dose Modulation, Reduction Tools, SFOV, DFOV, SP, SL/Thickness, Algorythm, kVp, mA/sec., Retros, Target, Contrast

**Objectives:**

- Identify the relevant terms from established standard CT lexicons.
- Recognize the acquisition parameters for various CT Protocols.
- Understand the key components of the CT Protocols Manual
- Review the indications for the basic CT protocol.
- Understand the correct Field of View size for various CT protocols.
- Understand how to adjust these technical parameters to perform the CT study.
- Understand the following key technical parameters of CT protocols.
  1. SFOV: (Small Field of View)
  2. DFOV: (Display Field of View)
  3. SP/Th: (Slice Thickness)
  4. Alg: (Algorythm)

- 5. kV: (Kilovoltage)
- 6. mA/Sec: (Miliamperage/second)
- 7. Retros: (Retrospective Reconstruction)

**Content:**

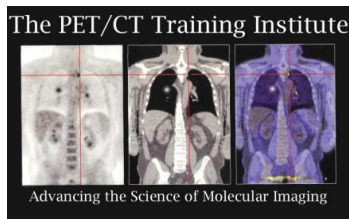
- 1. CT Scan Acquisition terms for:
  - a. GE
  - b. Philips
  - c. Siemens
  - d. Toshiba
  - e. Hitachi
  - f. Neusoft
  - g. Neurologica
- 2. Dose Modulation tools
- 3. Dose Reduction tools
- 4. Automatic Exposure Controls
- 5. Angular Tube Modulation
- 6. Longitudinal Tube Current Modulation
- 7. ECG-Based Tube Current Modulation
- 8. Image Quality Reference Parameters for AEC
- 9. Multi-Slice Detector Geometry of various CT manufacturers
  - a. Detector Array Design
  - b. Detector configuration
- 10. Image Reconstruction and Display
  - a. Window width
  - b. Window Center
  - c. Reconstruction FOV
  - d. Prescribing
- 11. Contrast Media Tools
  - a. Bolus Tracking
  - b. Test Bolus
  - c. Time-Attenuation Curves
  - d. Monitoring Delays
  - e. Scan Delays
- 12. Multi-Planar Formatting
- 13. Service Tools
- 14. Applications Tools
- 15. Workflow
- 16. CT Protocol Manual applications;
  - a. Cavernous Sinus
  - b. Temporal Bone
    - 1. CFS Otorrhea
    - 2. Cochlear Implants
    - 3. 8<sup>th</sup> Cranial Nerve
    - 4. Inflammatory Disease
    - 5. Trauma
    - 6. Middle Ear Mass



7. Pulsatile Tinnitus
  8. Petrous Apex Mass
  9. Jugular Fossa Mass
  10. Malignant Tumors
- c. Orbits
1. Trauma
  2. Varix
  3. Retinoblastoma
  4. Ocular Masses
  5. Inflammatory Diseases
  6. Optic Nerve Pathways
  7. Graves' Disease
- d. Sinuses/Naval Cavity
1. CFS Rhinorrhea
  2. Congenital Lesions
  3. Choanal Atresia
  4. Simple Inflammatory Disease
  5. Complicated Inflammatory Disease
  6. Benign/Malignant Tumors
- e. Facial Bones
1. Congenital Growth Related Acquired Deformities
  2. Benign/ Malignant Tumors
  3. Trauma
- f. Mandible
1. Trauma
  2. Inflammatory Benign Diseases
  3. Malignant Tumors
  4. Dental Implants
  5. Temporal Mandibular Joint
- g. Nasopharynx
1. Benign Masses
  2. Malignant Tumors
  3. Inflammatory Disease
  4. Clivus Lesions
- h. Parapharyngeal
1. Inflammatory Disease
  2. Benign/Malignant Tumors
- i. Parotid Gland
1. Inflammatory Disease
  2. Benign Masses
  3. Malignant Tumors
  4. Masses of Unknown Etiology
- j. Oropharynx
1. Soft Palate Malignant Tumors
  2. Tonsil/Glossotonsillar Sulcus Malignant Tumors
  3. Tongue Base Malignant Tumors
  4. Posterior Pharyngeal Wall Malignant Tumors
- k. Oral Cavity

1. Inflammatory Disease
  2. Benign Masses
  3. Hard Palate Malignant Tumors
  4. Retromolar Trigone/Upper GBS Malignant Tumors
  5. OT/FOM/Lower GBS Malignant Tumors without Bone Involvement
  6. OT/TOM/Lower GBS Malignant Tumors with Bone Involvement
- i. Larynx/Hypopharynx
1. Trauma
  2. Inflammatory Disease
  3. Benign Masses
  4. Malignant Tumors
  5. Subglottic Tracheal Stenosis
- m. Submandibular Gland
1. Inflammatory Disease Benign Masses
  2. Malignant Tumors
- n. Neck/ Thoracic Inlet
1. Congenital Lesions
  2. Vascular Lesions
  3. Skin Cancer/Melanoma of the Neck
  4. Skin Cancer/Melanoma of the Face
  5. Skin Cancer/Melanoma of the Scalp
  6. Mass of Unknown Etiology
  7. Brachial Plexus
  8. Lymph Node Survey/ Lymphoma
- o. Thyroid/Parathyroid
1. Inflammatory Disease
  2. Benign Masses
  3. Thyroglossal Duct Cyst
  4. Malignant Thyroid Tumors
  5. Parathyroid Adenomas
- p. Syndromes
1. Unknown Primary
  2. Serous Otitis Media
  3. Trigeminal Neuralgia
  4. Atypical Facial Pain
  5. Facial Nerve Weakness/Paralysis
  6. Hemifacial Spasms
  7. Tongue Weakness/ Atrophy
  8. Horner Syndrome
  9. Otagia
  10. Vocal Cord Paralysis
  11. Dysphagia/ Odynophagia
- q. Fractures
1. Acetabular
  2. Calcaneal
  3. Cervical Spine
  4. Chest
  5. Femoral Neck

6. Humeral Head
  7. Lumbar spine Disc Disease
  8. Piriformis
  9. Wrist
  10. Scaphoid
  11. Carpal
  12. Lisfrac
  13. Tarsal Navicular
  14. Shoulder Arthrogram
  15. Thoracic
  16. Lumbar
  17. Tibial Plateau
- r. Body Protocols
1. Abdomen Survey
  2. Pelvic Survey
  3. Cervical/Uterine/Prostate/Bladder Cancer
  4. Chest/Abdomen Survey
  5. Chest/Abdomen/Pelvis Survey
  6. Chest Survey
  7. Pelvic Survey
  8. Chest/Abdomen/Pelvis Trauma



**Title: MVIWIIQI: Lecture 23: “CT Procedures Manual” Part I: (60 Minutes)**

**Keywords:** Technical Protocols, Area of Concern, Clinical History, Positional Landmarks, Topogram Direction, Respiratory Phase, Scan Type, Rotation time, kVp, Pitch, Detector width, Detector Rows

**Objectives:**

- Discuss how to take a patient CT history.
- Identify the proper landmarks for positioning the patient for the study.
- Identify the topogram direction for the study.
- Understand the correct respiratory phase when acquiring the study.
- Understand the proper kVp, mA, Rotation Time, Pitch, Detector Width and Rows.
- Understand the average Tube output radiation exposure.

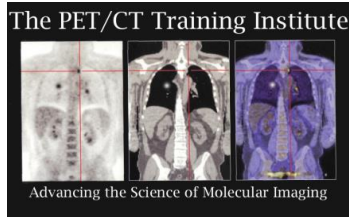
- Identify the optimal Slice Thickness/ Spacing, Algorithm and Reconstruction destination for the data set.
- Understand the Scan Start and End Locations
- Discuss the IV Contrast Volume, Type, and Rate of administration.
- Understand the Scan Delays for the acquisition.
- Choose the proper 2D or 3D acquisition modes.
- Discuss Pediatric CT Protocols

**Content:**

1. GE Light speed 16 CT Scanner
2. GE VCT Protocols
3. CT and MRI Patient Clinical History Sheet
4. Chest/Abdomen/Pelvis with Thoracic and Lumbar Spine Protocol
  - a. Position/Landmark
  - b. Topogram Direction
  - c. Respiratory Phase
  - d. Scan Type
  - e. kVp
  - f. mA/ Rotation time
  - g. Pitch
  - h. Speed (mm/rotation)
  - i. Noise Index
  - j. AEC (Dose Reduction)
  - k. Detector Width x Rows (Beam Collimation)
  - l. Average Tube Output
  - m. Helical Set
  - n. Scan Start/ End Location
  - o. Display Field of View
  - p. IV Contrast Volume/Type/Rate
  - q. Scan Delay
  - r. 2D/3D Technique used
  - s. PACS
5. Neck CTA, Chest Abdomen Pelvis Run Off Protocols
6. Neck CTA, Chest Abdomen Pelvis and Cervical, Thoracic, and Lumbar Spines Trauma Protocols
7. Prospective Gated Coronary CTA
  - a. Bypass Graft Patency
  - b. Stent Patency
  - c. Cardiomyopathy
  - d. Anomalous Arteries
  - e. CAD
  - f. Thoracic Aorta aneurysm
  - g. Pulmonary Emboli
8. Prospective Gated Aorta and Cardiac valves
  - a. Ascending Aorta Aneurysm
  - b. Dissections
  - c. Aortic Valve disease

9. Gated Aorta and Carotid CTA
10. Gated Aorta and Abdominal CTA (TAVI)
11. Calcium Scoring

**MVIWIEXVIII: Exam 18: “CT Procedures”:** *You must score an 80% or greater in order to receive SNMMI-TS Voice Credits.*



**Title: MVIWIIQII: Lecture 24: “CT Procedures Manual” Part II: (60 Minutes)**

**Keywords:** Cholesteatoma, Hearing Loss, Fractures, Pediatric Spine, Pediatric Pelvis, Pediatric Pectus Excavatum, Pediatric Neck CTA, Chest, Abdomen, Pelvis, Pediatric Mastoiditis

**Objectives:**

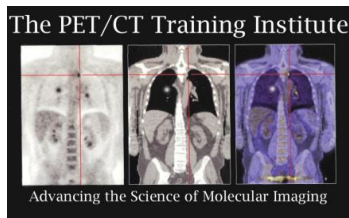
- Identify the proper landmarks for positioning the patient for the study.
- Identify the topogram direction for the study.
- Understand the correct respiratory phase when acquiring the study.
- Understand the proper kVp, mA, Rotation Time, Pitch, Detector Width and Rows.
- Understand the average Tube output radiation exposure.
- Identify the optimal Slice Thickness/ Spacing, Algorithm and Reconstruction destination for the data set.
- Understand the Scan Start and End Locations
- Discuss the IV Contrast Volume, Type, and Rate of administration.
- Understand the Scan Delays for the acquisition.
- Choose the proper 2D or 3D acquisition modes.
- Identify various Pediatric CT Protocols

**Content:**

1. GE Light speed 16 CT Scanner Protocols
2. GE VCT Protocols
  - a. Position/Landmark
  - b. Topogram Direction
  - c. Respiratory Phase
  - d. Scan Type
  - e. kVp

- f. mA/ Rotation time
  - g. Pitch
  - h. Speed (mm/rotation)
  - i. Noise Index
  - j. AEC (Dose Reduction)
  - k. Detector Width x Rows (Beam Collimation)
  - l. Average Tube Output
  - m. Helical Set
  - n. Scan Start/ End Location
  - o. Display Field of View
  - p. IV Contrast Volume/Type/Rate
  - q. Scan Delay
  - r. 2D/3D Technique used
  - s. PACS
3. Pediatric Temporal Bones
    - a. Cholesteatoma
    - b. Hearing Loss
    - c. Fractures
  4. Pediatric Spine
  5. Pediatric Pelvis for RLQ Pain
  6. Pediatric Pelvis
  7. Pediatric Pectus Excavatum
  8. Pediatric CTA Neck, Chest, Abdomen, Pelvis
  9. Pediatric Neck
  10. Pediatric Mastoiditis
  11. Pediatric Hips, Acetabulum
  12. Pediatric Low Dose Helical Head

**MVIWIIXIX: Exam 19: “CT Procedures Manual” Part II:** *You must score an 80% or greater in order to receive SNMMI-TS Voice Credits.*



**Title: MVIWIQIII: Lecture 25: “CT Procedures Manual” Part III: (60 Minutes)**

**Keywords:** Pediatric Face, Orbits, Sinus, Pediatric Extremity, Pediatric Choanal Atresia, Pediatric Chest, Pediatric Face Trauma, Pediatric Brain CTA, Pediatric Head, Axial Brain, 3D Head, Abdomen, Pelvis

## Objectives:

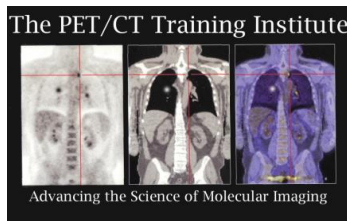
- Identify the proper landmarks for positioning the patient for the study.
- Identify the topogram direction for the study.
- Understand the correct respiratory phase when acquiring the study.
- Understand the proper kVp, mA, Rotation Time, Pitch, Detector Width and Rows.
- Understand the average Tube output radiation exposure.
- Identify the optimal Slice Thickness/ Spacing, Algorithm and Reconstruction destination for the data set.
- Understand the Scan Start and End Locations
- Discuss the IV Contrast Volume, Type, and Rate of administration.
- Understand the Scan Delays for the acquisition.
- Choose the proper 2D or 3D acquisition modes.
- Identify various Pediatric CT Protocols

## Content:

1. GE Light speed 16 CT Scanner Protocols
2. GE VCT Protocols
  - a. Position/Landmark
  - b. Topogram Direction
  - c. Respiratory Phase
  - d. Scan Type
  - e. kVp
  - f. mA/ Rotation time
  - g. Pitch
  - h. Speed (mm/rotation)
  - i. Noise Index
  - j. AEC (Dose Reduction)
  - k. Detector Width x Rows (Beam Collimation)
  - l. Average Tube Output
  - m. Helical Set
  - n. Scan Start/ End Location
  - o. Display Field of View
  - p. IV Contrast Volume/Type/Rate
  - q. Scan Delay
  - r. 2D/3D Technique used
  - s. PACS
3. Pediatric Face/ Orbits/Sinus
4. Pediatric Extremity
5. Pediatric Choanal Atresia
6. Pediatric Chest
7. Pediatric Brain Trauma/Face
8. Pediatric Brain CTA
9. Pediatric Helical Head
10. Pediatric Axial Brain

11. Pediatric 3D Head
12. Pediatric Abdomen/Pelvis
13. Lumbar Sacral Spine
  - a. Fracture
  - b. Trauma
  - c. Mets
  - d. Disc Rupture
  - e. Disc Herniation
  - f. Stenosis
  - g. Post Myelogram
14. Thoracic Spine
  - a. Trauma
  - b. Fracture
  - c. Facet Dislocation
  - d. Abscess

**MVIWIIEXX: Exam 20: “CT Procedures Manual” Part III:** *You must score an 80% or greater in order to receive SNMMI-TS Voice Credits.*



**Title: MVIWIIQIV: Lecture 26: “CT Procedures Manual” Part IV:** (60 Minutes)

**Keywords:** Cervical Spine, Hand and Wrist CT, Patella Tracking, Lower Extremity Runoffs, Knee, Elbow, Ankle, Foot, Pelvic Floor Fractures, Acetabular Fractures, Routine Pelvis,

**Objectives:**

- Identify the proper landmarks for positioning the patient for the study.
- Identify the topogram direction for the study.
- Understand the correct respiratory phase when acquiring the study.
- Understand the proper kVp, mA, Rotation Time, Pitch, Detector Width and Rows.
- Understand the average Tube output radiation exposure.
- Identify the optimal Slice Thickness/ Spacing, Algorithm and Reconstruction destination for the data set.
- Understand the Scan Start and End Locations
- Discuss the IV Contrast Volume, Type, and Rate of administration.
- Understand the Scan Delays for the acquisition.
- Choose the proper 2D or 3D acquisition modes.

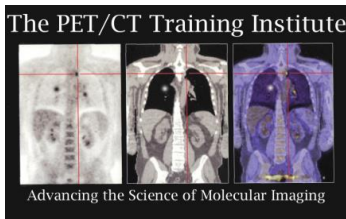


**Content:**

1. Cervical Spine CT
  - a. Fractures
  - b. Trauma
  - c. Mets
  - d. Disc Rupture
  - e. Disc Herniation
  - f. Stenosis
  - g. Post Myelogram
2. Wrist/Hand CT
  - a. Fracture
  - b. Dislocation
  - c. Osteomyelitis
  - d. Bone Injury
  - e. Bone Tumor
3. Shoulder CT
  - a. Fracture
  - b. Dislocation
  - c. Osteomyelitis
  - d. Bone Injury
  - e. Bone Tumor
4. Patella Tracking/Femoral Anteversion
  - a. Knee Pain
  - b. Evaluate Patella location
  - c. Femoral Anteversion
5. Lower Extremity Runoff CTA
  - a. Peripheral Artery Disease
  - b. Claudication
6. Knee CT
  - a. Fracture
  - b. Dislocation
  - c. Osteomyelitis
  - d. Bone Injury
  - e. Bone Tumor
7. Elbow CT
  - a. Fracture
  - b. Dislocation
  - c. Osteomyelitis
  - d. Bone Injury
  - e. Bone Tumor
8. Ankle/ Foot CT
  - a. Fracture
  - b. Dislocation
  - c. Osteomyelitis
  - d. Bone Injury
  - e. Bone Tumor
9. Pelvis for Fracture/Acetabulum

- a. Trauma
  - b. Fracture
  - c. Dislocation
10. Routine Pelvis
- a. Mass
  - b. Mets
  - c. Lymphoma
  - d. Fractures
  - e. Post CT Cystograms

**MVIWIIEXXI: Exam 21: “CT Procedures Manual” Part IV:** *You must score an 80% or greater in order to receive SNMMI-TS Voice Credits.*



**Title: MVIWIIQV: Lecture 27: “CT Procedures Manual” Part V: (60 Minutes)**

**Keywords:** Three Phase Kidney, Renal Mass, Renal Donor CTA, Pancreatic Mass, Nissan Fundoplication, Para-Esophageal, Hematuria, Enterography, Three Phase Liver, Pelvis CT

**Objectives:**

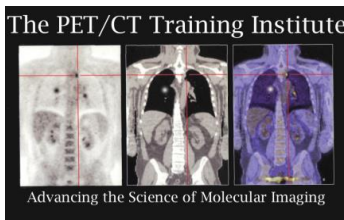
- Identify the proper landmarks for positioning the patient for the study.
- Identify the topogram direction for the study.
- Understand the correct respiratory phase when acquiring the study.
- Understand the proper kVp, mA, Rotation Time, Pitch, Detector Width and Rows.
- Understand the average Tube output radiation exposure.
- Identify the optimal Slice Thickness/ Spacing, Algorithm and Reconstruction destination for the data set.
- Understand the Scan Start and End Locations
- Discuss the IV Contrast Volume, Type, and Rate of administration.
- Understand the Scan Delays for the acquisition.
- Choose the proper 2D or 3D acquisition modes.

**Content:**

1. Renal RF Three Phase Kidney
  - a. Evaluate/Characterize a known Renal Mass before and after tumor ablation
2. Renal Mass
  - a. Evaluate/Characterize a potential Renal Mass
3. Renal Donor CTA

- a. Evaluation of Renal Arteries of potential renal transplant donor
- b. Evaluation of Renal Arteries Stenosis
- c. Aneurysm
4. Pancreatic Mass
  - a. Known or Suspected Pancreatic Mass
5. Nissan Fundoplication/Para-Esophageal CT
  - a. Evaluation of patient who has undergone a surgical procedure of tucking or folding the fundus of the stomach around the esophagus to prevent reflux.
  - b. Evaluate the repair of a hiatal hernia.
6. Hematuria
  - a. Non Contrast and dual medullary and delayed phase study for patients with hematuria.
7. IV Contrast CT Enterography
  - a. Evaluation of diseases affecting the mucosa and bowel wall.

**MVIWIEXXII: Exam 22: "CT Procedures Manual" Part V:** *You must score an 80% or greater in order to receive SNMMI-TS Voice Credits.*



**Title: MVIWIQI: Lecture 31: "CT Methodology I":** (90 Minutes)

**Keywords:** Head Procedures, Positioning, Parameters, Neck Procedures, Scan Mode, Cervical Spine Procedures, Pitch, Chest CTA, Timing Bolus, Abdomen Procedures, Pelvic CTA, Thoracic/Lumbar Spine Procedures, Extremities, 3 D Reconstruction

**Objectives:**

- Properly position a patient and select appropriate parameters for the CT Examination.
- Explain why different window widths and levels are selected.
- List the required imaging planes for each procedure.
- List the information that should be noted on each scout and scan image.
- Discuss how to review images for quality and accuracy.

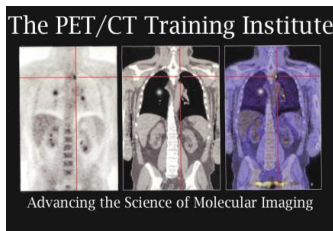
**Content:**

1. Routine Head Procedure
  - a. Positioning
  - b. Scout Image
  - c. Scan Mode
  - d. Scan Field of View
  - e. Scan Parameters
  - f. Pitch
  - g. Algorithms

- h. Image Annotation
- i. Image Archiving
- j. Contrast
- k. Image Review
- 2. Routine Neck Procedure
  - a. Positioning
  - b. Scout Image
  - c. Scan Mode
  - d. Scan Field of View
  - e. Scan Parameters
  - f. Pitch
  - g. Algorithms
  - h. Image Annotation
  - i. Image Archiving
  - j. Contrast
  - k. Image Review
- 3. Routine Cervical Spine Procedure
  - a. Positioning
  - b. Scout Image
  - c. Scan Mode
  - d. Scan Field of View
  - e. Scan Parameters
  - f. Pitch
  - h. Algorithms Image Annotation
  - i. Image Archiving
  - j. Contrast
  - k. Image Review
- 4. Routine Cervical Spine Procedure
  - a. Positioning
  - b. Scout Image
  - c. Scan Mode
  - d. Scan Field of View
  - e. Scan Parameters
  - f. Pitch
  - g. Algorithms
  - h. Image Annotation
  - i. Image Archiving
  - j. Contrast
  - k. Image Review
- 5. Routine CT Chest Angiogram Procedure
  - a. Positioning
  - b. Scout Image
  - l. Scan Mode
  - m. Scan Field of View
  - n. Scan Parameters
  - o. Pitch
  - p. Algorithms
  - q. Image Annotation
  - r. Image Archiving
  - s. Contrast
  - t. Labels

- u. Post Processing
- v. Timing
- w. Image Review
- 6. Chest CTA: PE Study
- 7. Chest CTA: Thoracic Aorta
- 8. Routine Abdomen/Pelvis Procedure
  - a. Positioning
  - b. Scout Image
  - d. Scan Mode
  - e. Scan Field of View
  - f. Scan Parameters
  - g. Pitch
  - h. Algorithms
  - i. Image Reconstruction
  - j. Post Processing
  - k. Timing
  - l. Image Annotation
  - m. Image Archiving
  - n. Contrast
  - o. Image Review
- 9. Abdomen/Pelvis CTA
- 10. Abdomen/Pelvis Contrast
- 11. Routine Thoracic and Lumbar Spine Procedures
  - a. Positioning
  - b. Scout Image
  - d. Scan Mode
  - e. Scan Field of View
  - f. Scan Parameters
  - g. Pitch
  - h. Algorithms
  - i. Image Annotation
  - j. Image Archiving
  - k. Contrast
  - l. Image Review
- 12. Routine Extremity Procedures
  - a. Positioning
  - b. Scout Image
  - b. Scan Mode
  - c. Scan Field of View
  - d. Scan Parameters
  - e. Pitch
  - f. Algorithms
  - g. Image Annotation
  - h. Image Archiving
  - i. Contrast
  - j. Image Review

**MVIWIEXXIV: Exam 24: "CT Methodology I":** *You must score an 80% or greater in order to receive SNMMI-TS Voice Credits.*



**Title: MVIIWIQII: Lecture 32: “CT Methodology II”:** (60 Minutes)

**Keywords:** Risks, Patient Orientation, CT Brain, Indications, Positioning, Arm Position, Parameters, Unit Controls, Gantry Tilt, Lateral View, Slice Thickness, Soft Tissue, Bone Window, Omnipaque 300, Bolus

**Objectives:**

- Discuss the patient preparation for a CT Brain.
- Discuss setting up the patient on the Gantry Table for CT Brain.
- Discuss the respiratory cycle for acquiring a CT Brain.
- Discuss tilting the CT Gantry parallel to the Orbital-Meatal Line.
- Discuss start slice at Tentorial Rim to Vertex of Skull.
- Discuss Tumor or Mets Brain Protocol with and without contrast.
- Discuss the filming of Bone fractures.
- Discuss the scout films for the Sella Turcica.
- Discuss patient set up for CT Pituitary Fossa.
- Discuss the Pre and Post Contrast Images for CT Pituitary Fossa.
- Discuss the Patient Preparation for CT of the Neck.
- Discuss the use of contrast material with a bolus injection for spiral CT.
- Discuss the Position for CT of the Neck.
- Discuss the start and end slices for CT Neck.
- Discuss CT scan of the Chest Patient Preparation.
- Discuss the positioning of the patient in the Gantry for CT of the Chest.
- Discuss the Start and End slices for Chest CT.
- Discuss the Unit Controls of the CT scanner when setting up the acquisition for CT Chest.
- Discuss the factors that could interfere with the accuracy of the CT of the Abdomen.
- Discuss the Patient preparation procedures for CT of the Abdomen.
- Discuss the use of Oral and IV Contrast for CT of the Abdomen.
- Discuss the Start and End slices for CT of the Abdomen.
- Discuss the patient preparation for CT of the Lumbar Spine.
- Discuss the start and End slices for acquiring a CT of the Lumbar Spine.
- Discuss the Unit Controls for the acquisition of a CT of the Lumbar Spine.

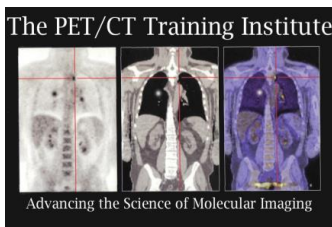
**Content:**

1. Risks
  - a. Nausea
  - b. Breathing Difficulty
2. Patient education

3. Patient History
4. Prior to showing up to center
5. CT Brain
  - a. Tumors
  - b. Blood clots
  - c. Hemorrhages
  - d. Acute Cranial Facial Trauma
  - e. Strokes
  - f. Intracranial Hemorrhage
  - g. Headaches
  - h. Positioning
    - i. Supine
    - j. Arm location
    - k. Head immobilizing
    - l. Parameters
    - m. Respiratory Cycle
    - o. Unit Controls
    - p. Pathological Findings
    - q. Pre Contrast baseline
    - r. IV Contrast
    - s. Post Contrast Examination
    - t. Filming
6. Pituitary Fossa CT
  - a. 2 mm Cuts for High Resolution
  - b. Zooming
  - c. Dynamic CT
7. Neck CT
  - a. Patient Preparations
  - b. Contrast
  - c. Positioning
  - d. Supine
  - e. Arm position
  - f. Head immobilized
  - g. Start and End Slice
  - h. Respiratory Cycle
  - i. Unit Controls
8. Chest CT
  - a. Patient Preparation
  - b. Positioning
  - c. Supine
  - d. Arm position
  - e. Start and End Slice
  - f. Respiratory Cycle
  - g. Unit Controls
9. Abdominal CT
  - a. Factors that can interfere with accuracy of CT Abdomen
    1. Metallic Objects
    2. Barium in the intestines from recent study
    3. Stool
    4. Bowel Gas
  - b. Patient Preparation

1. Fasting
  2. May need Ultrasound for Radiologist
  3. Oral laxative
  4. Sedatives
  5. Remove foreign objects
  6. Put patient in gown
  - c. Oral Contrast
  - d. IV Contrast
10. Lumbar Spine CT
- a. Patient Preparation
  - b. Contrast
  - c. Positioning
    1. Supine
    2. Feet First
    3. Arms above head
    4. Knees flexed
  - d. Starting and Ending slices
  - e. Respiratory Cycle
  - f. Unit Controls
  - g. Filming

**MVIWIEXXV: Exam 25: "CT Methodology II":** *You must score an 80% or greater in order to receive SNMMI-TS Voice Credits.*



**Title: MVIWIQIII: Lecture 33: "Principles of Patient Care in CT" (120 minutes)**

**Keywords:** Maslow's Hierarchy of Needs, Grieving Process, Vital Signs, Cyanosis, Infusions, Collecting Containers, Patient Transfers, Sliding Boards, Consent, BUN, Creatine levels, Hyperventilating, Responsibilities, Side Effects, Non-Ionic Contrasts, Ionic Contrasts, Needles

**Objectives:**

- List Maslow's Hierarchy of Needs for the Patient
- Discuss the Grieving Process
- List the normal ranges for Vital Signs.
- Discuss the types of collecting containers used in CT.
- Discuss the CT Procedures requiring Consent.
- Discuss the requirements before using Contrast agents.



- Identify the High Risk patients to contrast material.
- Discuss the effects of Ionic vs. Nonionic Contrast Medias.
- Discuss the types of angiocatheter needles.
- List possible veins for venipuncture.
- List the gauge of needle suitable for a CTA procedure.
- Discuss the key parameters of a Power Injector.
- Discuss the purpose of a Contrast Warmer.
- Discuss the first aid steps for an extravasation.
- List the Mild reactions to contrast material symptoms.
- List the Moderate reactions to contrast material symptoms.
- Discuss the technologist responsibilities during a Moderate Contrast Reaction.
- List the Severe reactions to contrast material symptoms.
- Discuss the types of shock patients can experience in CT.
- List the types of Oral Contrast agents.
- Discuss the Biopsy procedures.
- Discuss the various Blood clotting time lab tests.
- List the factors that influence drug administration.
- Discuss various drug administration routes.
- Discuss parenteral drug administration methods.
- List drugs that act on the nervous system used in CT.
- List drugs used to treat cardiovascular disease.
- List the drugs used in treating allergic responses.
- Discuss the legal aspect working with patients in CT.
- Discuss the security of health information.

**Content:**

1. Maslow's Hierarchy of Needs
  - a. Physiological needs
  - b. Safety and security
  - c. Love and belongingness
  - d. Self Esteem
  - e. Self-Actualization
2. Grieving Process
  - a. Denial
  - b. Anger
  - c. Bargaining
  - d. Depression
  - e. Acceptance
3. Patient Assessments
  - a. Vital Signs
    1. Temperature
    2. Pulse
    3. Respiration
    4. Blood Pressure
- 4 Infusion and Collecting Containers
- 5 Consent
  - a. Arthrography
  - b. Biopsy

- c. CTA
- d. Myelography
- 6 Types of Consents
  - a. Informed
  - b. Implied
- 7 IV Contrast requirements
  - a. BUN
  - b. Creatine
  - c. Patient Preparation
  - d. Steroid Therapy
- 8 Mild hyperventilation before breath hold
- 9 Side Effects vs. Reactions
  - a. Non-Ionic (water soluble)
  - b. Ionic (Iodine based)
- 10 Technologists responsibilities
  - a. Patient History
  - b. Clinical complaints
  - c. Food or Drug Allergies
  - d. Previous Contrast reactions
  - e. Asthma
  - f. Hay fever
  - g. Hives
- 11 High Risk patients to reactions
  - a. Hypersensitivity towards iodinated contrast agents
  - b. Diabetes Mellitus
  - c. Asthma or other respiratory conditions
  - d. Multiple myeloma
  - e. Severe Dehydration
  - f. Chronic or acute renal or hepatic failure
- 12 Effects of Ionic vs. Non Ionic Contrast Agents
- 13 Angiocatheter needles
  - a. Butterfly
  - b. Over the needle catheter
  - c. Straight through the needle
- 14 Veins for venipuncture
  - a. Superficial Dorsal Veins
  - b. Basilic Vein
  - c. Dorsal Venous Arch
  - d. Cephalic Vein
  - e. Median Cubital Vein
  - f. Radial Vein
  - g. Median Vein of Forearm
- 15 Gauge suitable for CTA
  - a. 18 gauge
  - b. 20 gauge
- 16 Power Injector
- 17 Power Injector parameters
  - a. Volume of contrast
  - b. Rate in ml/sec
  - c. Time of Injection
  - d. Scan Delay time

- 18 Contrast Warmer
- 19 Extravasation Steps
- 20 Drugs to hold prior to or after CT Scan
- 21 Mild Reactions (Self Limiting)
  - a. Nausea and Vomiting
  - b. Hives (Urticaria)
  - c. Itching
  - d. Sneezing
  
  - e. Extravasation
  - f. Vasovagal Response
- 21 Moderate Reactions
  - a. Excessive Urticaria
  - b. Tachycardia
  - c. Giant hives
  - d. Excessive Vomiting
- 22 Technologist responsibilities during Moderate Reactions
- 23 Severe Reactions
  - a. Very Low Blood Pressure
  - b. Cardiac or Respiratory arrest
  - c. Convulsions
  - d. Laryngeal edema
  - e. Cyanosis
  - f. Difficulty in breathing
  - g. Profound shock
- 24 Common shocks in CT
- 25 Shock symptoms
  - a. Hypotension
  - b. Weak Pulse
  - c. Rapid Pulse
  - d. Rapid Breathing
- 26 Other shock types
  - a. Hypovolemic
  - b. Septic
  - c. Cardiogenic
  - d. Neurogenic
  - e. Anaphylactic
- 27 Oral Contrast Procedures
- 28 Types of Oral Contrast
  - a. Barium Sulfate
  - b. Water soluble (Gastrographin)
  - c. Air
  - d. Carbon Dioxide (Effervescent Agents)
- 29 Barium Sulfate Contraindications
- 30 Oral Contrast patient preparations
- 31 Biopsy restrictions
- 32 Blood clotting level components
  - a. PT
  - b. PTT
  - c. Platelets Count
- 33 Pharmacology

34 Drug Excretion Routes

- a. Perspiration
- b. Tears
- c. Feces
- d. Breast milk
- e. Saliva

35 Factors that influence drug administration

- a. Age
- b. Gender
- c. Hormonal Differences
- d. Emotional or Psychological State
- e. Time of Day
- f. Channel or Route of Administration

36 Drug Administration Routes

- a. Oral
- b. Topical
- c. Parenteral
- d. Sublingual
- e. Intrathecal
- f. Rectal
- g. Transdermal
- h. Inhalation

37 Parenteral Drug Administration

- a. Subcutaneous
- b. Intradermal
- c. Intramuscular
- d. Intravenous
- e. Intrathecal

38 Drug Names

- a. Trade name
- b. Chemical name
- c. Generic name
- d. Official name

39 Drugs with effect on Nervous System

- a. Chloral Hydrate
- b. Morphine Sulfate
- c. Lidocaine

40 Other drugs in CT

- a. Analgesics
- b. Antipyretics
- c. Anti-Inflammatory
- d. Lasix
- e. Heparin
- f. Nitroglycerin

41 Drugs to treat allergic responses

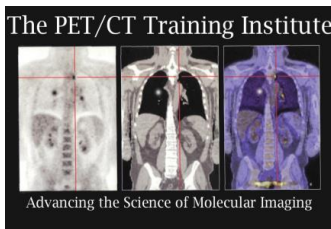
- a. Epinephrine
- b. Benadryl

42 Legal Aspects of CT Imaging

- a. Ordinary Negligence
- b. Gross Negligence

- c. Assault
- d. Battery
- e. False Imprisonment
- f. Defamation of Character
  
- g. Libel
- h. Slander
- i. Fraud
- j. Invasion of Privacy
- k. Patient Confidentiality
- l. Security of Information from Health Informatics 43 Legal Doctrines in CT
  - a. Respondeat Superior

**MVIIWIIEXXVI: Exam 26: “Principles of Patient Care in CT”:** *You must score an 80% or greater in order to receive SNMMI-TS Voice Credits.*



**Title: MVIIIWIIQI: Lecture 34: “CT Pathology I” (30 Minutes)**

**Keywords:** Pathology, Hounsfield Unit, CT Number, Hernias, Lymphoma, Ovarian Cysts, Pancreatic Cancers, Pleural Effusions, Renal Cysts, Sarcomas, Ewings Sarcoma, Sinus Mass, Toxoplasmosis, Traumatic Injury

**Objectives:**

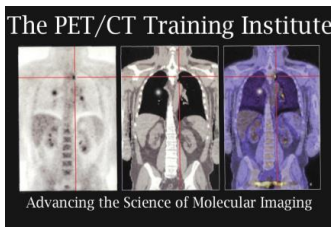
- Identify selected pathology found on CT Images.
- Name the causes of some of the pathology found in this lecture.
- Provide statistical data on the prevalence of certain pathological conditions.
- List symptoms associated with the presence of selected pathology.
- Distinguish between the CT appearance of normal organs and tissues from those involved with pathology.
- Define the pathological processes.

**Content:**

1. Image Display
2. Hounsfield Units/ CT Numbers
3. CT Numbers and Pathology
4. Appendicitis
5. Hernia
  - a. Incisional Hernia

- b. Bochdalek
  - c. Diaphragmatic
6. Pancreatitis
  7. Hydrocephalus
  8. Lymphoma
    - a. Hodgkins
    - b. Non-Hodgkins
    - c. Lymphoadenopathy
  9. PET/CT
  10. Meningiomas
  11. Ovarian Cysts
  12. Pancreatic Cancers
  13. Pleural Effusion
  14. Renal Cysts
  15. Sarcomas
    - a. Ewings Sarcoma
  16. Sinus Mass
  17. Toxoplasmosis
  18. Traumatic Injury

**MVIIIWIIEXXVII: Exam 27: “CT Pathology Part I”:** *You must score an 80% or greater in order to receive SNMMI-TS Voice Credits.*



**Title: MVIIIWIQII: Lecture 35: “CT Pathology II” (30 Minutes)**

**Keywords:** Adrenal Glands, Aneurysms, Appendicitis, Bezoar, Cerebral Arteriovenous Malformation, CVA, Ischemic Stroke, Cholecystitis, Colon Cancer, Polysplenia, Coronary Artery Calcification, Calcium Scoring, Hemangioma, Pancolitis, Lung Cancer

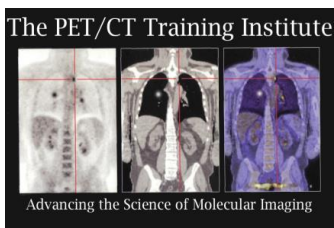
Objectives:

- Identify pathology on selected CT Images.
- Name the pathology presented on some of the images.
- Provide statistics on the prevalence of certain pathology.
- List symptoms associated with the presence of selected pathology.
- Distinguish between the CT appearance of normal organs and tissues from those involved in pathology.
- Define the pathological processes found in this lecture.

Content:

1. Adrenal Glands
2. Adrenal Masses
  - a. Adenomas
  - b. Cysts
  - c. Lipomas
  - d. Mets
  - e. Pheochromocytomas
3. Aneurysms
4. Classification of Aneurysms
  - a. True
    1. Saccular
    2. Fusiform
  - b. False
    1. Pseudoaneurysms
  - c. Abdominal
  - d. Bilateral Iliac Artery
  - e. Carotid Artery
  - f. Splenic Artery
  - g. Diverticular
5. Appendicitis
  - a. Bezoar
6. Cerebral Arteriovenous Malformation
7. Cerebrovascular Accidents
8. Ischemic Stroke
9. Cholecystitis
10. Colon Cancer
11. Congenital Abnormalities
12. Polysplenia
13. Vascular abnormalities associated with Polysplenia
14. Coronary Artery Calcifications
15. Calcium Scoring
16. Hemangioma
17. Pancolitis
18. Lung Carcinoma

**MVIIIWIIEXXVIII: Exam 28: "CT Pathology Part II":** *You must score an 80% or greater in order to receive SNMMI-TS Voice Credits.*



**Title: MIXWIQI: Lecture 36: CT Contrast Agents Part I: (150 Minutes)**

**Keywords:** Contrast Medium, Radiation Quality, Film Contrast, Small Bowel Obstruction, Iodine Contrast, Hypaque, Isopaque, Hexabrix, Isovue, Omnipaque, Oxilan, Isopromide, Visipaque

**Objectives:**

- Discuss the purpose of Contrast Agents.
- Understand the physical and physiological principles of Contrast medias.
- Discuss why contrast agents are necessary.
- Discuss the ways contrast agents can enter the body.
- Discuss the uses of contrast with GI Imaging.
- List contrast agents used today in the CT department.
- List the injection rates of contrast materials in CT.
- Discuss the differences between contrast agents.
- Discuss the history of contrast agents in medicine.
- Compare the chemical structures of ionic and non -ionic contrast agents.
- Discuss the adverse reactions contrast agents can cause.
- Discuss the patient preparation for a procedure with contrast agents.
- Outline the categories of reactions to contrast agents.
- Discuss the administration of contrast Medias to the breastfeeding mothers.
- Discuss those certain patients that are at increased risk for extravasation.
- Discuss the use of contrast agents with children.
- Discuss adverse reactions to Gadolinium-based contrast agents.
- Discuss the risk factors associated with IV Contrast agents.
- Discuss premedicating patients with a known contrast reaction.
- Discuss how to handle patients with various levels of contrast reactions.
- Discuss the use of a power injector.
- Discuss key parts of the power injector.
- Discuss future directions of contrast enhanced CT procedures.
- Discuss the advancements of the modern power injector.
- Discuss current applications of the pressure injector.
- Discuss venipuncture techniques.
- Discuss key acquisition parameter used for a routine CTA procedure.
- Discuss CT of the abdomen with contrast agents.
- Discuss factors that affect the CT image quality.
- Discuss methods for reducing patient artifacts in Cardiac CT.
- Distinguish between Prospective and Retrospective ECG scanning.
- Discuss Contrast Media guidelines for use.

**Content:**

1. Purpose
2. Names
3. Necessity
4. Routes of administration



5. Negative Agents
  - a. Air
  - b. Carbon Dioxide
  - c. Gases
6. Influences
7. Atomic Number
8. Quality
9. Types
10. Positive Agents
11. Barium Sulfate
12. Gastrografin
13. Iodine Contrast
  - a. Hypaque
  - b. Isopaque
  - c. Hexabrix
  - d. Isovue
  - e. Omnipaque
  - f. Oxilan
  - g. Iopromide
  - h. Visipaque
14. Ionic
15. Non Ionic
16. Indications
17. Blood Vessels
18. Injection Rates
  - a. CTA Chest w/Contrast
  - b. CT Chest w/Contrast
  - c. CT Radiation Therapy
  - d. CT Abdomen/Pelvis w/Contrast
  - e. CT Head w/wo Contrast
  - f. Vascular CTA Chest (Adult)
19. Digestive Tract
20. Forms
  - a. Liquid
  - b. Paste
  - c. Tablet
21. Molecular Properties
  - a. Viscosity
  - b. Osmolality
  - c. Chemotoxicity
  - d. Hydrophilicity
  - e. Histamine-Releasing potentials
22. Dosing
23. Uroselectan
24. Structural Comparison
25. Adverse reactions
26. Hypersensitivities
  - a. Urticaria

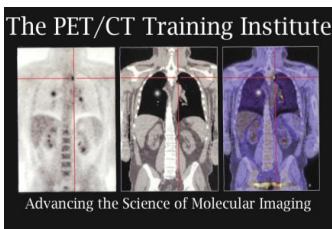
- b. Cardiovascular reactions
  - c. Bronchospasm
  - d. Laryngospasm
  - e. Antigen-antibody interactions
27. Categories of reactions
- a. Minor
  - b. Moderate
  - c. Severe
28. Patient preparation
29. Side Effects Barium Sulfate
- a. Stomach cramps
  - b. Diarrhea
  - c. Nausea
  - d. Vomiting
  - e. Constipation
30. Severity
- a. Dose
  - b. Route
  - c. Rate of delivery
31. Types of reactions
- a. Anaphylactoid
  - b. Nonanaphylactoid
  - c. Chemotoxic
  - d. Vasovagal
  - e. Iopathic
  - f. Combined
32. True Incidence
- a. Medication
  - b. Local anesthetics
  - c. Needles
  - d. Catheters
  - e. Anxiety
33. Fatal Outcomes
- a. Underlying conditions
  - b. Coronary Artery Disease
  - c. GI Distress
  - d. Skin Rash
  - e. Ulcers
  - f. Headaches
  - g. Fatigue
  - h. Asthma
34. Patient Selection
- a. History
  - b. Hemodynamic
  - c. Neurological
  - d. Nutritional
  - e. Allergies
  - f. Asthmatic

- g. Anxiety level
- 35. Breast Feeding Mothers
- 36. Methods of delivery
- 37. Risk of Extravasation
  - a. Non communicable
  - b. Elderly
  - c. Infants
  - d. Children
  - e. Altered Consciousness
  - f. Severely Ill
  - g. Debilitated
  - h. Abnormal Circulation
- 38. Site of extravasation
  - a. Tender
  - b. Local edema
  - c. Erythema
  - d. Surgical Consultation
  - e. Altered tissue perfusion
  - f. Sensational changes
  - g. Skin ulcerations
  - h. Blistering
- 39. Adverse reactions to Gadolinium
- 40. Treatment
- 41. Risk Factors
- 42. Policy
- 43. Procedures
- 44. Premedicating patients
- 45. Other Effects
  - a. Hives
  - b. Itching
  - c. Red skin
  - d. Swelling of the throat
  - e. Hoarseness
  - f. Agitation
  - g. Confusion
  - h. Fast Heart beat
  - i. Bluish skin color
- 46. Cystic Fibrosis patients
- 47. Asthmatic patients
- 48. Dehydrated patients
- 49. Pregnant patients
- 50. Treatment
- 51. Medication
- 52. Power injector
- 53. Equipment
- 54. Hose System
- 55. Pump Hose
- 56. Patient Hose

57. Touch terminal
58. Insert Hose System
59. Uses
60. Bolus
61. Timing
62. Consistency
63. Costs
64. Future uses
65. Injection rates
66. Concentration vs. Enhancement
67. Concentration vs. Flow rate
68. Effects of Iodine Concentration
69. Advances
70. Current applications
71. CTA requirements
72. Patient preparation
73. Venipuncture veins
74. Needles
75. Gauges
76. Parameters
77. Slice thickness
78. Spatial resolution
  - a. Cerebral CTA
  - b. Abdominal CTA
  - c. Thoracic CTA
79. Spiral Pitch
80. kVp, mA, Time
81. Reconstruction Intervals
82. Subsecond scanning
83. Volume of Contrast
84. Rate
85. Time of Injection
86. Scan Delay
87. Contrast warmer
88. Automated Systems
  - a. Smart prep
  - b. Care
  - c. Surestart
89. Scanning Methods
  - a. Bolus Tracking
  - b. Bolus Timing
  - c. Manual Preset Time
90. Other diagnostic applications
91. Biopsy
92. Abscess Drainages
93. CT Abdomen
94. Image Quality
95. Image Resolution

96. Applications
  - a. Circle of Willis
  - b. Renal Arteries
  - c. Abdominal Runoffs
  - d. Femoral Runoffs
  - e. Cardiac CT
97. Motion reduction techniques
  - a. Prospective Gating
  - b. Retrospective Gating
98. Contrast Guidelines

**MIXWIEXXIX: Exam 29: “CT Contrast Agents I”:** *You must score an 80% or greater in order to receive SNMMI-TS Voice Credits.*



**Topic: MIXIQII: Lecture 37: “CT Contrast Agents II” (120 Minutes)**

Keywords: Characteristics of Reactions, Risk Factors, Diagnosing a reaction, Treatment, Prevention, Incidence, Onset, Anaphylactoid, Chemotactic, Mechanisms, Cutaneous, Seafood, Atopic patients

**Objectives:**

- Discuss the types and characteristics of a reaction.
- List the risk factors for a reaction.
- Discuss how to diagnose a reaction.
- Discuss the treatment plan for a reaction.
- Discuss the prevention of a reaction.
- Discuss the incidence of a reaction.
- Discuss the immediate onset of a reaction.
- Compare anaphylactoid vs. chemotactic reactions.
- Discuss the mechanism of an anaphylactoid contrast reaction.
- Discuss the risk factors for an anaphylactoid reaction.
- Discuss the non-immediate response to contrast reactions.
- Discuss the risk factors for non-anaphylactoid reactions.
- Discuss the risk of seafood allergies with contrast agents.
- List the facts on shellfish allergies and contrast reactions.
- Discuss symptoms of an anaphylactoid reaction.
- List the common symptoms of anaphylactoid reactions.

- List the clinical criteria for anaphylaxis reactions.
- Discuss contrast reaction delays.
- Discuss the typical delayed reaction patient.
- Discuss the delayed reaction post biopsy.
- Discuss the infrequent delay reaction patients.
- Discuss test to find the delayed reaction patient.
- Discuss the treatment plan for adverse reactions.
- Discuss the therapy plan for adverse reactions.
- Discuss methods for enhancing pediatric safety during a contrast reaction.
- Discuss anaphylaxis treatment plan.
- Discuss CPR procedures.
- Discuss the medications used during a reaction.
- Discuss how to handle the reaction emergency.
- Discuss the delayed emergency reaction treatment.
- Discuss methods to prevent contrast reactions.
- Discuss Tramer's Systematic Review of Severity Grades to reactions.
- Discuss the benefits to using H1 Antihistamines for preventing reactions.
- Discuss the use of Corticosteroids in the prevention of contrast reactions.
- Discuss methods for preventing contrast reactions.
- Discuss the emergent procedures for preventing reactions.
- Discuss the history of contrast use in CT.
- Discuss the cofounding variables for use of contrast agents on patients.
- Discuss the ACR recommendation for preventing contrast reactions.
- Discuss contrast induced nephropathy.
- Discuss when to check the creatinine levels of a patient.
- Discuss what does not work in dealing with contrast reactions.
- Discuss ways to prevent contrast induced nephropathy.
- Discuss the patients on Metformin.
- Discuss Metformin contraindications.

**Content:**

1. Types
2. Risk factors
3. Diagnosis
4. Treatment
5. Prevention
6. Incidence
7. Immediate reactions
8. Anaphylactoid (Non-Immunological)
9. Chemotoxic (Cardiac, neurological, or Nephrotoxic)
10. Mechanisms
11. Severe anaphylactoid reactions
12. Possible risks factors
13. Risk factors for non anaphylactoid reactions
14. Seafood Allergies

15. Atopic patients
16. Facts on shellfish allergies
17. Myths
18. Symptoms of anaphylactoid reactions
19. Common symptoms
  - a. Flushing
  - b. Pruritus
  - c. Urticaria
  - d. Angioedema
  - e. Bronchospasm
  - f. Wheezing
  - g. Laryngospasm
  - h. Stridor
  - i. Hypotension
  - j. Shock
  - k. Loss of consciousness
20. Grade I: Mild Reactions
  - a. Limited nausea
  - b. Limited Vomiting
  - c. Pruritus
  - d. Diaphoresis
21. Grade II: Moderate Reactions
  - a. Faintness
  - b. Severe Vomiting
  - c. Profound Urticaria
  - d. Facial edema
  - e. Laryngeal edema
  - f. Mild bronchospasm
22. Grade III: Severe Reactions
  - a. Hypotensive shock
  - b. Pulmonary edema
  - c. Respiratory arrest
  - d. Cardiac arrest
  - e. Convulsions
23. Clinical criteria for anaphylaxis
  - a. Acute onset (hours to minutes)
  - b. Skin and mucosal symptoms
  - c. Airway compromised
  - d. Decreased blood pressure
  - e. Exposure to known allergen
  - f. History of severe reaction
  - g. GI Symptoms with food allergy
24. Delayed reactions
25. Risk Factors
26. Biopsy findings
27. Infrequent reactions
28. Diagnostic testing for propensity for reactions
  - a. Blood tests

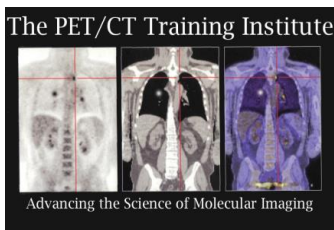
- b. Skin testing
- 29. Treatment for anaphylaxis
- 30. Treatment Plan
- 31. Enhancing Pediatric Safety during an reaction
- 32. Broselow Luten Pediatric Emergency Tape
- 33. Information sheet
- 34. Anaphylaxis treatment plan
  - a. Epinephrine
  - b. Supine position
  - c. Oxygen
  - d. H1 and H2 Antihistamines
  - e. IV Fluids
  - f. Steroids
- 35. Assessing signs and symptoms
- 36. CPR
  - a. Adult
  - b. Child
- 37. Drugs used for Anaphylaxis
  - a. Epinephrine
  - b. Sodium Chloride
  - c. Anti-histamines
  - d. Diphenhydramine
  - e. Cetirizine
  - f. Ranitidine
- 38. Bronchodilators
  - a. Nebulizer
  - b. Albuterol
  - c. Levalbuterol
  - d. Atrovent
  - e. Glucagon
- 39. Vasopressors
- 40. Corticosteroids
- 41. Patterns of reactions
  - a. Uniphasic
  - b. Biphasic
  - c. Protracted
- 42. Prolonged Observation periods
- 43. Beta Blockers
- 44. Ace Inhibitors
- 45. Receptor blockers
- 46. Medications for special considerations
  - a. MAO Inhibitors
  - b. Tricyclic Anti-depressants
- 47. Vagal reactions
- 48. Prevention of first reaction
- 49. Patient history of prior reactions
- 50. Evidence of pretreatment of reactions
- 51. Tramer Systematic Review of Premedication



52. Tramer Severity Grade
53. Benefits of using H1 Antihistamines for prevention of reactions
54. Benefits of using H1 and H2 Antihistamines for preventing reactions
55. Benefits of corticosteroids systematic review
56. Pre-Medication- Unclear benefits
57. Current recommendations for patients with prior history of reactions
58. Categories
59. Emergent procedures for prevention of reactions
60. Delayed reaction prevention
61. History of Contrast
62. Importance of contrast agents
63. Oral contrasts
64. Adverse reaction occurrence
65. Iodine allergy
66. Seafood allergy
67. ACR recommendations for patient has history of reactions
68. Does prevention work
69. Asthmatics and IV contrast
70. Contrast induced nephropathy
71. Checking creatinine levels
  - a. Age greater than 70 years old
  - b. CHF
  - c. Cirrhosis
  - d. Diabetes
  - e. Multiple Myeloma
  - f. Anemia
  - g. Sepsis
  - h. Hypotension
  - i. Hypertension
  - j. Nephrotoxic drugs
72. What does not work
  - a. Diuresis
  - b. Mannitol
  - c. Furosemide
  - d. Vasodilators
  - e. Dopamine
  - f. Fenoldopam
  - g. Atrial Natriuretic peptides
  - h. Calcium Channel Blockers
  - i. Ace Inhibitors
  - j. Endothelin Receptor antagonists
  - k. Aminophylline
  - l. Theophylline
73. Preventing Contrast Induced Nephropathy
74. Patients taking metformin
75. Metformin and IV Contrast agents
76. Metformin Contraindications
  - a. Hypersensitivity

- b. DKA
- c. Diabetic Coma
- d. Chronic Liver Disease
- e. CHF
- f. Vitamin B-12 Deficiency
- g. Recent MI
- h. Shock
- i. Severe Systemic Disease
- j. Pulmonary Insufficiency

**MIXWIEXXX: Exam 30: “CT Contrast Agents II”:** *You must score an 80% or greater in order to receive SNMMI-TS Voice Credits.*



**Title: MIXWIQIII: Lecture 38: “Basic Patient Skills for the CT Technologist: (90 Minutes)**

**Keywords:** Vital Signs, Body temperature, Pulse, Respiration, Blood Pressure, Guidelines, Height and Weight, Intake and Output, Edema, Dehydration, Trauma CT, Indications, Epidural Hematoma

**Objectives:**

- Discuss taking the vital signs of the patient.
- Discuss the purpose of vital signs to monitor the patients’ health.
- Discuss the factors affecting the temperature reading of a patient.
- Discuss the equipment used to detect the patient’s temperature.
- Discuss the sites to take a patient’s temperature.
- Discuss the safety precautions when taking a patients temperature.
- Discuss the measurement of a patients pulse.
- Discuss the sites for taking a patient’s pulse.
- Discuss the factors that affect a patient’s pulse.
- Discuss the measurement of a patient’s respiration.
- Discuss the factors that can affect a patient’s respiration rate.
- Discuss the measurement of a patient’s blood pressure.
- Discuss the factors influencing blood pressure changes.
- Discuss the equipment used to acquire the blood pressure values.
- Discuss the guidelines for blood pressure measurements.
- Discuss how to read the blood pressure gauge.
- Discuss the measurement of the patient’s height and weight.
- Discuss the measuring of a patient’s Intake and Output of fluids.

- Discuss the causes of edema.
- Discuss the symptoms of edema.
- Discuss the causes of dehydration for a patient.
- Discuss the symptoms of dehydration of a patient.
- Discuss the process of measuring and recording the Intake and Output of patient's fluids.
- Discuss the Trauma CT patient.
- Discuss the indications of CT of the Head.
- Discuss the rules for dealing with the trauma patient.
- Discuss the normal range for the BUN.
- Discuss the normal range for the Creatinine.

**Content:**

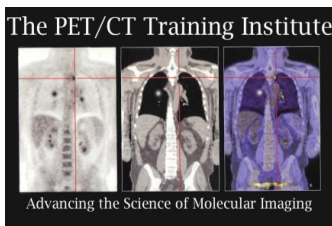
1. Vital signs
2. Temperature
3. Pulse
4. Respiration
5. Blood Pressure
6. Purpose
7. Heat production
  - a. Muscles
  - b. Glands
  - c. Oxidation of food
8. Heat Loss
  - a. Respiration
  - b. Perspiration
  - c. Excretion
9. Factors affecting temperature
  - a. Exercise
  - b. Illness
  - c. Age
  - d. Time of Day
  - e. Medications
  - f. Infections
  - g. Emotions
  - h. Hydration
  - i. Clothing
  - j. Environmental temperature
  - k. Air movement
10. Equipment
  - a. Oral
  - b. Rectal
11. Types of thermometers
12. Normal temperature range for adults
  - a. Oral
  - b. Rectal
  - c. Axillary

13. Reading a glass thermometer
14. Sites to take temperature
  - a. Oral
  - b. Rectal
  - c. Axillary
  - d. Tympanic
15. Safety precautions
16. Measuring the pulse
17. Sites for taking pulse
  - a. Radial
  - b. Temporal
  - c. Carotid
  - d. Brachial
  - e. Femoral
  - f. Popliteal
  - g. Dorsalis pedis
  - h. Apical
18. Factors affecting pulse
  - a. Age
  - b. Sex
  - c. Position
  - d. Drugs
  - e. Illness
  - f. Emotions
  - g. Activity level
  - h. Temperature
  - i. Physical training
19. Normal pulse ranges
20. Measuring respiration
21. Factors affecting respiration rates
  - a. Age
  - b. Activity level
  - c. Position
  - d. Drugs
  - e. Sex
  - f. Illness
  - g. Emotions
  - h. Temperature
22. Qualities of normal respiration
23. Documenting respiratory rates
24. Measuring blood pressure
25. Factors influencing blood pressure
  - a. Weight
  - b. Sleep
  - c. Age
  - d. Emotions
  - e. Sex
  - f. Heredity

- g. Viscosity of blood
  - h. Illness
  - i. Disease
26. Equipment for taking the blood pressure
  27. Normal blood pressure ranges
  28. Guidelines for taking the blood pressure
  29. Blood pressure gauge readings
  30. Measuring Height and weight of patient
  31. Guidelines for measuring a patients weight and height
  32. Measuring Intake and Output of fluids of a patient
  33. Edema
  34. Symptoms of Edema
    - a. Weight gain
    - b. Swelling of feet
    - c. Swelling of ankles
    - d. Swelling of hands
    - e. Swelling of fingers
    - f. Swelling of face
    - g. Decreased urine output
    - h. Shortness of breath
    - i. Collection of fluids in the abdomen
  35. Dehydration
  36. Symptoms of dehydration
    - a. Thirst
    - b. Decreased urine output
    - c. Parched or cracked lips
    - d. Dry, cracked skin
    - e. Fever
    - f. Weight Loss
    - g. Concentrated Urine
    - h. Tongue coated and thick
  37. Causes of dehydration
    - a. Poor fluid intake
    - b. Diarrhea
    - c. Bleeding
    - d. Vomiting
    - e. Excessive perspiration
  38. Measuring and Recording Intake and Output
  39. Intake
    - a. Mouth
    - b. Food items
    - c. Tube feedings
    - d. IV fluids
  40. Output
    - a. Urine
    - b. Stool
    - c. Emesis
    - d. Drainage

- e. Suctioned secretions
- f. Excessive perspiration
- 41. Traumatic CT patients
- 42. Indication for CT Head
- 43. Epidural Hematomas
- 44. Mass effect of the brain
- 45. Basilar skull fractures
- 46. Depressed skull fractures
- 47. Rich's Rules for Trauma patients
- 48. BUN
- 49. Creatinine
- 50. Sternal fractures
- 51. Dissecting aneurysms
- 52. Pulmonary emboli
- 53. Lacerated spleen
- 54. Kidney stones
- 55. Fractured calcaneus

**MIXWIEXXI: Exam 31: "Basic Patient Care skills for the CT Technologist":** *You must score an 80% or greater in order to receive SNMMI-TS Voice Credits.*



**Title: MXWIQI: Lecture 39: "Basic Instrumentation of SPECT/CT" (120 Minutes)**

**Keywords:** Physics, X-Ray, Tube, Voltages, Current, Components, Helical scanners, Hounsfield Units, CT numbers, Windowing, Artifacts, Low Dose CT, Occupational exposure, CT Quality Control

**Objectives:**

- Describe the physics processes involved in the production of Xrays.
- Describe the role of each component in the Xray tube.
- Discuss the role of proper adjustment of the Xray tube voltage and current in CT.
- Name the principle parts of the CT scanner.
- Discuss the function of the CT scanner components.
- Describe the function of a helical CT scanner and its components.
- Describe CT data acquisition and processing.
- Describe Hounsfield units.
- Describe the CT number values assigned to various tissues and how these values are assigned meaningful display windowing.
- List the parameters set by the technologist and the effects of these parameters on the image.

- Discuss CT image quality.
- List the origin of CT artifacts and their prevention.
- Discuss appropriate parameters for the acquisition of low dose CT.
- Describe the parameters and image characteristics required for a diagnostic quality CT scan.
- Describe the integration of the CT scan into the combined PET/CT or SPECT/CT exam.
- Discuss occupational radiation exposure from operating a CT scanner.
- Describe the CT Quality Control program.
- Discuss CT Quality Assurance.
- Discuss SPECT/CT Technology.
- Describe SPECT/CT architecture.
- Discuss the technical skills to operate a SPECT/CT Scanner.
- Discuss the effects of CT based attenuation correction in SPECT/CT.
- Discuss radiopharmaceuticals used in SPECT/CT.
- Compare today's SPECT/CT Systems.

**Content:**

1. CT Physics
2. Bremsstrahlung Radiation
3. Characteristic X-Rays
4. X-Ray Tube
5. Production of X-Rays
6. kVp
7. mA
8. Time
9. Slice Thickness
10. Slice increments
11. Voltage variations
12. Noise
13. Focal spots
14. Filaments
15. X-Ray filters
16. Filtration material
17. Principles of CT
18. CT scanner design
19. CT system components
20. Gantry
21. Detectors
22. X-Ray tube heat capacity
23. Heat Unit calculation
24. Anode
25. Cathode
26. CT Generator
27. Collimation
28. Advantages of Thinner Collimation
29. Compromises of Thinner Collimation

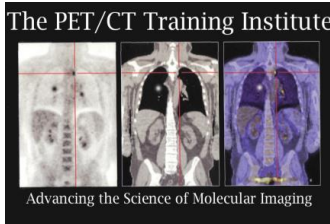
30. Rotation speed
31. Pitch
32. Increment
33. Helical scanners
34. Image data acquisition
35. Reconstruction
36. Display
37. Control console
38. Matrix
39. Coordinate system
40. Aperture
41. Isocenter
42. Patient Orientation
43. Tilting
44. Patient Couch
45. Scannable range
46. Scan Field of View
47. Display Field of View
48. Surview
49. Scanogram
50. Topogram
51. Volumetric CT
52. AP Scout
53. Lateral Scout
54. Fundamentals of Multislice CT
55. Axial Scan
56. Spiral scan
57. Conventional CT
58. Spiral/Helical CT
59. Advantages
60. Digital Projections
61. Table speed
62. Advantages of Volume CT
63. Multislice fundamentals
64. Multislice effectiveness
65. Dual slice detectors
66. Quad Detector Technology
67. Sixth Generation Scanners
68. Seventh Generation Scanners
69. Slip Ring Technology
70. Single Slice vs. Multislice CT
71. Single Row detectors
72. Multi Row detectors
73. Slice Thickness
74. Spiral CT pathway
75. Display of Volumetric data
76. Image quality
77. High Contrast



78. Low Contrast
79. Image noise
80. Low Dose CT for attenuation correction
81. Attenuation
82. Integrated SPECT/CT Protocols
83. CT Protocols
84. Diagnostic CT
85. Abdominal CT
86. Chest CT
87. Neck CT
88. Contrast Media
89. Contrast Agents
90. Administration
91. Iodine
92. Barium Sulfate
93. Gastrografin
94. Rectal Contrast
95. CT Advantages
96. Limitation of CT
97. Goals of CT
98. Density Information
99. Window Settings
100. Image Quality
101. Isotropic Imaging
102. Post Processing Options
103. Attenuation coefficients
104. Pixel size
105. Reconstruction
106. Pixel vs. Voxel
107. Image display
108. Grey Scale
109. CT Numbers
110. CT Number vs. Brightness level
111. CT Number of Cyst
112. CT Number of Lipoma
113. Filtered Back projection
114. Hounsfield Scale
115. Windowing
116. Narrow Contrast
117. Wide Contrast
118. Host Computer
119. CT Operating System
120. Array Processors
121. DAS
122. Amplifier
123. ADC
124. Sample/Hold Unit
125. Image recording and storage devices

126. Laser Printers
127. Hard copy
128. Image storage media
129. Communications
130. Radiopharmaceuticals
131. CT Quality control
132. General QC Tests
133. Alignment laser Accuracy
134. Table Incrimination accuracy and collimation
135. Helical Pitch accuracy
136. kVp accuracy
137. Half Value Layer
138. Exposure Reproducibility and Linearity
139. Radiation Profile width
140. Slice Sensitivity Profile
141. Image quality measures
142. Phantoms and test tools
143. Noise and field Uniformity axial scan
144. Field Uniformity and Volume Scan
145. CT Number linearity
146. Low Contrast detectability
147. Spatial resolution
148. Modulation Transfer function
149. Reconstruction time
150. Scout views
151. Display and hard copy image quality
152. Dosimetry Measurements CTDI
153. CT Equipment Quality Assurance Program
154. Acceptance testing
155. AAPM Acceptance testing recommendations
156. Annual ACR Requirements
157. Monthly Tests
158. Continuous Quality control
159. Daily Tests
160. AutoQA Lite Overview
161. CT Radiation Safety
162. Basic SPECT/CT
163. Overview of SPECT/CT architecture
164. SPECT/CT Protocols
165. Basic Technologist Skills to operate a scanner
166. Advantages of SPECT/CT
167. Effects of CT Based Attenuation Correction in SPECT/CT
168. Diagnostic Quality CT Studies
169. CT Internal Radiation Dose Dosimetry
170. Estimated Radiation Dose from a SPECT/CT Procedure
171. SPECT/CT radiopharmaceuticals
172. Comparing today's SPECT/CT Systems

**MXWIEXXXIII: Exam 33: “Basic Instrumentation of SPECT/CT”:** *You must score an 80% or greater in order to receive SNMMI-TS Voice Credits.*



**Title: MXWIIQII: Lecture 40: “The Electronics of a SPECT Detector” (60 Minutes)**

**Keywords:** Hal Anger, Design, Photomultiplier Tubes, High Voltage Power Supply, Preamplifier, Gain Control, Pulse Height Analyzer, Spectrometers, Collimators, Uniformity, Spatial Linearity

**Objectives:**

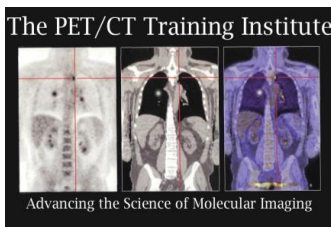
- Discuss the key electrical components of a gamma camera system.
- Discuss the positional circuitry of an analogue camera system.
- Discuss the positional circuitry of a hybrid camera system.
- Discuss the positional circuitry of a digital camera system.
- Discuss the choices of collimators used in imaging.
- Discuss the principles of uniformity.
- Discuss the principles of spatial linearity.
- Discuss the principles of system efficiency.
- Discuss the principles of energy resolution.

**Content:**

1. Anger Scintillation Camera
2. Design
3. Photomultiplier tubes
4. High voltage power supply
5. Preamplifiers
6. Gain Control
7. Pulse Height Analyzers
8. Spectrometers
9. Analog Camera
10. Hybrid Camera
11. Digital Camera
12. Collimators
13. Parallel Hole Collimators
14. Pinhole Collimators
15. Converging Collimators
16. Diverging Collimators
17. Image Formation

18. Spatial Resolution
19. Uniformity
20. Spatial Linearity
21. Multi energy Spatial Resolution
22. System efficiency
23. Collimator efficiency
24. Energy resolution
25. Count rate performance

**MXWIEXXXIV: Exam 34: “The Electronics of a SPECT Detector”:** *You must score an 80% or greater in order to receive SNMMI-TS Voice Credits.*



**Title: MXWIQIII: Lecture 41: “Clinical Applications of SPECT/CT” (60 Minutes)**

**Keywords:** SPECT, CT, Hybrid Imaging, Advantages, Bone Imaging, Infection Imaging, Oncological Imaging, Sentinel Node Localization, I-131 Body Imaging, General Imaging, Low Dose CT

**Objectives:**

- Discuss the purpose of Hybrid Imaging techniques.
- Discuss implementation considerations when designing a SPECT/CT suite.
- Discuss the advantages of SPECT/CT.
- Discuss the general indications for SPECT guided low dose procedures.
- Discuss the general indications for SPECT guided diagnostic CT when anatomic information is needed.
- Discuss Sentinel Node localization with SPECT/CT.
- Discuss the use of SPECT/CT in Skeletal Disease.
- Discuss the use of SPECT/CT in Parathyroid Tumors.
- Discuss the use of SPECT/CT for tumors of the Sympathetic Nervous System and Adrenal Cortex tumors.
- Discuss the diagnosis of pheochromocytoma with Tc99m MIBG SPECT/CT.
- Discuss the use of SPECT/CT in cardiac imaging.
- Discuss the use of cardiac gating in SPECT/CT.
- Discuss the principles of cardiac gating.
- Compare the differences between regular SPECT and Gated SPECT.
- Discuss the requirements for a Gated SPECT study.
- Discuss the use of SPECT/CT in differentiating thyroid cancers.
- Discuss the use of SPECT/CT in Bone Imaging.

- Discuss the use of SPECT/CT for suspected bone infections.
- Discuss the role of SPECT/CT in oncological applications.
- Discuss the role of SPECT/CT with I-131 Whole body imaging.
- Discuss the role of SPECT/CT with General Nuclear Medicine procedures.

**Content:**

1. SPECT
2. CT
3. Hybrid Imaging
4. CT Coregistration
5. Background
6. Implementation considerations
7. Advantages
8. Clinical applications
9. Low Dose CT
10. Indications
11. Diagnostic CT
12. Sentinel Node Localization
13. Skeletal Diseases
14. Malignant skeletal diseases
15. Parathyroid tumors
16. Sympathetic Nervous System
17. Adrenal cortical tumors
18. Pheochromocytoma
19. Tc99m MIBG
20. Cardiac Imaging
21. Cardiac Gating
22. Utility of gating
23. Methodology
24. Comparison between SPECT vs. Gated SPECT
25. Hardware requirements
26. Differentiating Thyroid Cancers
27. Bone Imaging
28. Bone Infections
29. Oncology Imaging
30. I-131 Whole Body Imaging
31. Thyroid Cancers
32. Lung Cancers
33. General Nuclear Medicine Imaging
34. Additional considerations
35. Other applications of SPECT/CT

**MXWIEXXXV: Exam 35: “Clinical Applications of SPECT/CT”:** *You must score an 80% or greater in order to receive SNMMI-TS Voice Credits.*

**Title: POST TEST**

**Title: Course Evaluation**

