

NMED-2600: MOLECULAR AND FUSION IMAGING

Cuyahoga Community College

Viewing: NMED-2600 : Molecular and Fusion Imaging

Board of Trustees:

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Academic Term:

Fall 2020

Subject Code

NMED - Nuclear Medicine Technology

Course Number:

2600

Title:

Molecular and Fusion Imaging

Catalog Description:

Examines the methodology of advanced molecular imaging and fusion imaging in the field of nuclear medicine and analyzes current trends and advances in the field. Focus is on patient preparation, imaging protocols, radiation safety, and special considerations for fusing nuclear medicine studies with computed tomography and magnetic resonance imaging.

Credit Hour(s):

2

Lecture Hour(s):

2

Requisites

Prerequisite and Corequisite

NMED-1501 Radiation Physics and NMED-1701 Nuclear Medicine Instrumentation.

Outcomes

Course Outcome(s):

Differentiate between varying types of advanced molecular imaging and fusion imaging.

Objective(s):

1. Explain the historical background of advanced molecular imaging.
2. Define advanced molecular imaging.
3. Explain fusion imaging.
4. Discuss advantages and disadvantages to various types of fusion imaging.

Course Outcome(s):

Explain the methodology of various types and techniques of fusion imaging.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Describe and discuss various imaging protocols for SPECT/CT, PET/CT, SPECT/MR, and PET/MR.
2. Describe quality control for fusion imaging equipment and instrumentation.
3. Examine special considerations for combining other imaging modalities with nuclear medicine.

Course Outcome(s):

Discuss current topics and advances in the fields of advanced molecular imaging and fusion imaging.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Discuss current research as it relates to molecular imaging and fusion imaging.
2. Examine current trends in molecular imaging.
3. Examine new and emerging fusion imaging instrumentation and techniques.

Methods of Evaluation:

1. quizzes
2. exams
3. worksheets
4. writing assignments
5. case studies
6. presentations

Course Content Outline:

1. Advanced Molecular and Fusion Imaging
 - a. Defining molecular imaging
 - b. Historical background
2. SPECT/CT system
 - a. System characteristics
 - i. Quality control
 - ii. SPECT components
 - iii. CT components
 - iv. Spatial resolution
 - v. Sensitivity
 - b. Imaging protocols
 - i. Neurologic
 - ii. Cardiac
 1. CT angiography
 2. Imaging plaque
 - iii. Cancer imaging: diagnose and staging
 - iv. Miscellaneous uses
 - c. Processing data
 - d. Creating an image set
 - i. Filter selection and tomographic reconstruction
 - ii. Attenuation correction
 - e. Analyzing the results
 - i. Normal versus abnormal results
 - ii. Case study review
 - f. Special considerations
 - i. Patient preparation
 - ii. Contraindications and adverse reactions
 - iii. Radiation safety considerations
 - iv. Advantages and disadvantages
 - v. Regulations on nuclear medicine technologists regarding hybrid CT
 - vi. Uses in molecular imaging
 - vii. New advances
3. Positron Emission Tomography/Computed Tomography (PET/CT)
 - a. PET/CT system characteristics
 - i. Quality control
 - ii. PET components
 - iii. CT components
 - iv. Spatial resolution
 - v. Sensitivity

- b. Imaging protocols
 - i. Neurologic
 - 1. Dementia and neurologic disorders
 - 2. Stroke and perfusion imaging
 - 3. Seizure disorders
 - 4. Psychological and behavioral
 - ii. Cardiac
 - 1. Myocardial perfusion
 - 2. Viability studies
 - 3. Molecular
 - iii. Cancer imaging: diagnose and staging
 - iv. Miscellaneous uses
- c. Processing data
- d. Creating an image set
 - i. Filter selection and tomographic reconstruction
 - ii. Attenuation correction
- e. Analyzing the results
 - i. Normal versus abnormal results
 - ii. Case study review
- f. Special considerations
 - i. Patient preparation
 - ii. Administering radioactive sugar and patient monitoring
 - iii. Creating the ambiance for brain imaging injections
 - iv. Contraindications and adverse reactions
 - v. Radiation safety considerations
 - vi. Advantages and disadvantages
 - vii. Uses in molecular imaging
 - viii. New advances
- 4. Single Photon Emission Tomography/Magnetic Resonance (SPECT/MR)
 - a. Physics Review
 - i. MR physics
 - b. SPECT/MR system
 - c. System characteristics
 - i. Quality control
 - ii. SPECT components
 - iii. MR components
 - iv. Spatial resolution
 - v. Sensitivity
 - d. Imaging protocols
 - i. Neurologic
 - 1. Dementia and neurologic disorders
 - 2. Stroke and perfusion imaging
 - 3. Seizure disorders
 - 4. Psychological and behavioral
 - ii. Cardiac
 - e. Cancer imaging: diagnose and staging
 - f. Infection and abscess imaging
 - g. Miscellaneous
 - h. Processing data
 - i. Creating an image set
 - i. Filter selection and tomographic reconstruction
 - ii. Attenuation correction
 - iii. Image processing techniques for MR
 - j. Analyzing the results
 - i. Normal versus abnormal results
 - ii. Case study review
 - k. Special considerations
 - i. MR safety and patient screening
 - ii. Patient preparation

- iii. Contraindications and adverse reactions
- iv. Radiation safety considerations
- v. Advantages and disadvantages
- vi. Regulations for nuclear medicine technologists regarding hybrid MR
- vii. Functional MR
- viii. MR spectroscopy
- ix. Uses in molecular imaging
- x. New advances

5. Positron Emission Tomography/Magnetic Resonance(PET/MR)

- a. PET/MR system characteristics
 - i. Quality control
 - ii. PET components
 - iii. MR components
 - iv. Spatial resolution
 - v. Sensitivity
- b. Imaging protocols
 - i. Neurologic
 - 1. Dementia and neurologic disorders
 - 2. Stroke and perfusion imaging
 - 3. Seizure disorders
 - 4. Psychological and behavioral
 - ii. Cardiac
 - 1. Myocardial perfusion
 - 2. Viability studies
 - 3. Molecular
 - iii. Cancer imaging: diagnose and staging
 - iv. Infection and abscess imaging
 - v. Miscellaneous
- c. Processing data
- d. Creating an image set
 - i. Filter selection and tomographic reconstruction
 - ii. Attenuation correction
- e. Analyzing the results
 - i. Normal versus abnormal results
 - ii. Case study review
- f. Special considerations
 - i. MR safety and patient pre-screening
 - ii. Patient preparation
 - iii. Administering radioactive sugar and patient monitoring
 - iv. Creating the ambiance for brain imaging injections
 - v. Contraindications and adverse reactions
 - vi. Radiation safety considerations
 - vii. Advantages and disadvantages
 - viii. Uses in molecular imaging
 - ix. New advances

6. Current Trends

- a. Advanced molecular imaging
- b. Hybrid/fusion imaging techniques
- c. Emerging technologies
- d. Newly approved drugs
- e. Current research

Resources

Bolus, N., & Glasgow, K.W., (Eds.). (2018) *Review of Nuclear Medicine Technology (5th Ed.)*, Reston, VA: Society of Nuclear Medicine and Molecular Imaging.

Lee, K.H. (2015) *Basic Science of Nuclear Medicine: Bare Bone Essentials*, Reston, VA: Society of Nuclear Medicine and Molecular Imaging.

Mettler, F., & Guiberteau, M. (2018) *Essentials of Nuclear Medicine and Molecular Imaging* (7th ed.). Philadelphia, PA: Elsevier.

Saha, G. (2018) *Fundamentals of Nuclear Pharmacy* (7th ed.). Cham, Switzerland: Springer International Publishing.

Ziessman, H.A., O'Malley, J.P. & Thrall, J.H. (2014) *Nuclear Medicine: The Requisites* (4th ed.), Philadelphia, PA: Elsevier.

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