NMED-2302: NUCLEAR MEDICINE PROCEDURES II

Cuyahoga Community College

Viewing: NMED-2302 : Nuclear Medicine Procedures II

Board of Trustees:
January 2024

Academic Term:
Fall 2024

Subject Code
NMED - Nuclear Medicine Technology

Course Number:
2302

Title:
Nuclear Medicine Procedures II

Catalog Description:
Study of diagnostic nuclear medicine procedures relating to the central nervous, genitourinary, and cardiovascular systems as well as tumor imaging. This course includes anatomy and physiology, pathophysiology, and protocols for routine and non-routine nuclear medicine procedures.

Credit Hour(s):
2

Lecture Hour(s):
2

Requisites

Prerequisite and Corequisite
NMED-1302 Nuclear Medicine Procedures I, NMED-1604 Nuclear Radiopharmacy, NMED 2601 Molecular & Fusion Imaging with Pharmacology, and NMED-1501 Radiation Physics.

Outcomes

Course Outcome(s):
Analyze general disorders and disease states of the nervous, genitourinary, and cardiovascular systems as they will apply to Nuclear Medicine.

Objective(s):
1. Relate the anatomy and physiology of the nervous, genitourinary, and cardiovascular systems to nuclear medicine methodologies.
2. Describe general disorders and disease states of the nervous, genitourinary and cardiovascular systems including pediatric specific disorders.
3. Discuss general disorders and diseases of the cardiovascular, central nervous and genitourinary systems as they would apply to the nuclear medicine department.

Course Outcome(s):
Analyze and differentiate various types of tumors as they apply to Nuclear Medicine.

Objective(s):
1. Identify the characteristics of neuroendocrine tumors, non-hodgkins/hodgkins lymphoma, lymphoscintigraphy and breast cancer and metastatic disease for each disease stated.
2. Compare the different diagnostic imaging procedures used for each disease.
3. Relate which radiopharmaceutical is most effective when imaging each disease.

Course Outcome(s):

Explain procedures for performing nuclear medicine studies.

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. Relate the anatomy and physiology of the nervous, genitourinary, and cardiovascular systems to nuclear medicine methodologies.
2. Describe procedures, protocols, and acquisition parameters for the nervous, genitourinary, and cardiovascular systems including imaging of tumors and pediatric patients.
3. Discuss general disorders and diseases of the cardiovascular, central nervous and genitourinary systems as they would apply to the nuclear medicine department.
4. List radiopharmaceuticals that would be used in imaging the nervous, genitourinary, and cardiovascular systems.

Course Outcome(s):

Explain planar and dynamic acquisitions and the use of Single Positron Emission Computed Tomography (SPECT) when performing nuclear medicine procedures.

Objective(s):

1. List radiopharmaceuticals that would be used in imaging the nervous, genitourinary, and cardiovascular systems.
2. Describe planar and dynamic acquisitions in nuclear medicine procedures.

Methods of Evaluation:

1. Quizzes
2. Exams
3. Midterm
4. Final Exam
5. Written assignments
6. Case studies
7. Participation

Course Content Outline:

1. Central Nervous System
    a. Anatomy and Physiology
    b. Disorders, diseases and pathology as related to imaging including but not limited to:
        i. Dementia
        ii. Alzheimer's
        iii. Depression
        iv. Brain death
        v. Transient ischemic attack
        vi. Cerebrovascular accident
        vii. Stroke
        viii. Cerebral spinal fluid leak
        ix. Chronic migraines
        x. Epilepsy
        xi. Seizure disorders
        xii. Brain cancer
        xiii. Glioblastoma
        xiv. Neuroendocrine tumors
        xv. Hydrocephalus
        xvi. Chronic drug use/abuse
        xvii. Alcoholism
        xviii. Bipolar disorder

xix. Schizophrenia
xx. Parkinson's disease

c. Radiopharmaceuticals
i. 99mTc Sodium pertechnetate
ii. Tc99m pentetate/DTPA
iii. Tc99m bicisate/ECD
iv. Tc99m exametazime/HMPAO
v. Iodine-123 ioflupane datscan
vi. Indium-111 Pentetate (DTPA)
vii. F-18 Florbetapir/ F18 Florbetaben
viii. F-18 Fluorodeoxyglucose (FDG)]
ix. Newly approved radiopharmaceuticals; F18 Flutemetamol

d. Methodology including preparation, procedures, and acquisition parameters
i. Brain flow
ii. Brain death
iii. Brain imaging, planar
iv. Brain imaging, Single photon emission tomography (SPECT)
v. Brain Positron Emission Tomography (PET)
vi. Cisternogram
vii. cerebral spinal fluid (CSF) leak
viii. CSF shunt patency
ix. DaT Scan (dopamine transmittors)
x. Pediatric considerations
xi. Advancing technologies and emerging protocols.

2. Genitourinary System
a. Anatomy and Physiology
b. Disorders, diseases and pathology as related to imaging including but not limited to:
i. Glomerulonephritis
ii. Polycystic kidney disease
iii. Hydronephrosis
iv. Urinary tract infections
v. Vesicoureteral reflux
vi. Renal artery stenosis
vii. Renal hypertension
viii. Renal cancer
ix. Kidney stones
x. Acute renal failure
xi. Chronic renal failure
xii. Obstruction
xiii. Polycystic kidney disease

c. Radiopharmaceuticals
i. Tc99m pentetate/DTPA (Diethylene Triamine Pentacaetic Acid).
ii. Tc99m mertiatide/MAG3 (mercapto acetyl tri glycine)
iii. Tc99m succimer/DMSA (meso-2,-3-dimercaptosuccinic acid)
iv. I123 MIBG (meta-iodobenzylguanidine)
v. I131 MIBG
vi. Enalaprilat
vii. Captopril
viii. Furosemide
ix. Newly approved drugs

d. Methodology including preparation, procedures, and acquisition parameters
i. Cystogram, direct
ii. Effective renal plasma flow (ERPF)
iii. Glomerular filtration rate (GFR)
iv. Renal anatomy, planar
v. Renal anatomy, SPECT
vi. Renal flow
vii. Renal perfusion

viii. Renal morphology
ix. Renogram
x. Pediatric considerations
xi. Advancing technologies and emerging protocols

3. Cardiovascular System
   a. Anatomy and Physiology
   b. Disorders, diseases and pathology as related to imaging including but not limited to:
      i. Angina
      ii. Hypertension
      iii. Congestive heart failure
      iv. Cardiomyopathy
      v. Transient ischemic dilatation
      vi. Arrhythmias
      vii. Aortic stenosis
      viii. Aneurysm
      ix. Endocarditis
      x. Left ventricular hypertrophy
      xi. Pulmonary hypertension and right ventricular hypertrophy
      xii. Ischemia
      xiii. Infarction
      xiv. Myocarditis
      xv. Rheumatic fever
      xvi. Shingles
      xvii. Valvular diseases
      xviii. Mitral valve prolapse
      xix. Coronary artery bypass
      xx. Cardiovascular stenting
      xxi. Pacemakers
      xxii. Chemotherapy toxicity
      xxiii. Effects of drug abuse
   c. Radiopharmaceuticals
      i. Tc99m pyrophosphate/PYP
      ii. Tc99m sestamibi/MIBI
      iii. Tc99m tetrofosmin
      iv. Tc99m labeled RBCs
      v. Tl201 thallous chloride
      vi. F18 FDG
      vii. N13 ammonia
      viii. Rb82 chloride
      ix. Oxygen-15
      x. Carbon-11
      xi. Newly approved radiopharmaceuticals: I-123 MIBG
   d. Methodology including preparation, procedures, and acquisition parameters
      i. Myocardial perfusion, planar
      ii. Myocardial perfusion, SPECT, SPECT/CT
      iii. Myocardial perfusion, gated SPECT
      iv. Myocardial perfusion PET
      v. Pharmacological stress testing
         1. Dipyridamole/persantine
         2. Adenosine
         3. Regadenoson/lexiscan
         4. Dobutamine
         5. Atropine
         6. Aminophylline
      vi. First pass for ejection fraction (EF) and wall motion
      vii. Gated cardiac blood pool, rest
      viii. Gated cardiac blood pool, stress

ix. Gated cardiac blood pool, SPECT
x. Cardiac shunt
xi. Cardiac viability with PET
xii. Pediatric considerations
xiii. Advancing technologies and emerging protocols

4. Tumor Imaging
   a. Anatomy and Physiology
   b. Disorders, diseases and pathology as related to imaging including but not limited to:
      i. Neuroendricrine tumors
      ii. Non-Hodgkins lymphoma
      iii. Hodgkins disease
      iv. Primary cancers
      v. Metastatic disease
      vi. Cancer staging
      vii. Peptide receptor tumors
   c. Radiopharmaceuticals
      i. Gallium-67
      ii. Iodine-131
      iii. 99mTc sestamibi
      iv. Tc99m sulfur colloid
      v. F-18FDG
      vi. In111 labeled MAB (capromab pendetide)
      vii. In111 ibritumomab tiuxetan
      viii. Newly approved radiopharmaceuticals: Ga68 Dotatate; I125 Seeds
   d. Methodology including preparation, procedures, and acquisition parameters
      i. Lymphoscintigraphy for breast cancer
      ii. Lymphoscintigraphy for melanoma
      iii. Tumor Imaging with Gallium (planar and SPECT)
      iv. I-131 Whole Body imaging for Thyroid Cancer/Metastatic Survey
      v. Positron Emission Tomography
      vi. Positron emission Tomography fused with Computed tomography
      vii. Peptide receptor imaging
      viii. Somatostatin receptor imaging
      ix. Monoclonal antibodies
      x. Pediatric considerations
      xi. Advancing technologies and emerging protocols: Liver lung shunt mapping

Resources

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

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

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. (2019) *Essentials of Nuclear Medicine Imaging*, Philadelphia, Pa.: W.B. Saunders.

Prekeges, J. (2013) *Nuclear Medicine Instrumentation (2nd ed.)*, Sudbury, MA: Jones and Bartlett Publishing.

Shackett, P., (Ed.). (2019) *Nuclear Medicine Technology: Procedures and Quick Reference (2nd ed.)*, Philadelphia, Pa.: Lippincott, Williams, and Wilkins.

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