Miami Dade College

Course Description

NMT2130C | Nuclear Medicine Pharmacology | 3.00 credits

Students will learn how to maintain radiopharmaceutical laboratory records and materials, obtain a generator equate, prepare radiopharmaceuticals, perform quality control tests, and dispose of radioactive waste appropriately. The ordering of pharmaceuticals in appropriate dosage and effective time frames will also be included. Prerequisites: NMT1002L, NMT1312C, NMT1705C, NMT2613; Corequisites: NMT2130C, NMT2723C, NMT2814C.

Course Competencies:

Competency 1: The student will be able to demonstrate an understanding of general terminology and theories regarding the use of radiopharmaceuticals by:

1. Defining terminology associated with the understanding of radiopharmaceuticals:
    a. radiopharmaceutical
    b. pharmaceutical
    c. radionuclide
    d. Curie (and associated units)
    e. Becquerel (and associated units)
    f. specific activity units
    g. toxicity
    h. progenicity
2. Explaining the tracer theory as applied to diagnostic uses of radiopharmaceuticals
3. Listing and describing methods of radionuclide production, stating the advantages and disadvantages of each method

Competency 2: The student will be able to demonstrate an understanding of the various generators used in the field of nuclear medicine by:

1. Discussing the composition, construction, and technical theory of wet and dry generators, specifically emphasizing the Mo99/tc99m generator systems
2. Listing step-by-step procedures for eluting a generator
3. Describing problems associated with wet and dry generator systems and discuss methods that can be used to detect and prevent problems such as "breakthrough"
4. Giving appropriate data and calculate the generator activity that should be present at a given time
5. Defining secular and transient equilibrium regarding parent/daughter half-lives and regeneration cycles for the daughter products
6. Describing the physical and chemical properties of technetium
7. Identifying the physical and chemical properties and uses of other radionuclides, including but not limited to isotopes of iodine, xenon, indium, thallium, gallium, chromium, cobalt, krypton, fluorine, and phosphorus

Competency 3: The student will be able to demonstrate an understanding of how to utilize commercially prepared kits by:

1. Describing the procedure for preparing radiopharmaceuticals kits from TC99m pertechnetate
2. Detailing the quality control procedures that should be followed for the generator evaluation and the kit product when preparing 99mTC radiopharmaceuticals in-house
3. Describing methods of quality control that should be used to check commercially prepared radiopharmaceuticals
4. Differentiating between radionuclide and radiochemical purity
5. Describing several methods of separation that can be employed in preparing radioactive compounds

6. Describing USP-approved methods that can be used to test for sterility and pyrogenicity of pharmaceuticals
7. Outlining a record-keeping system consistent with NRC and HRS requirements for proper ordering, dispensing, labeling, storage, and disposal of radioactive materials
8. Designing a laboratory area for radio pharmacy, including preparation, dispensing, and storage areas, fully considering radiation safety requirements

Competency 4: Students will be able to demonstrate an understanding of positron emitters that are produced by cyclotron by:

1. Listing positron emitters that are produced by generator systems and those produced by cyclotron systems
2. Discussing positron emitters' physical and chemical characteristics that make them appropriate isotopes for imaging radiopharmaceuticals
3. Tracing the biochemical pathways of radiopharmaceuticals labeled with commonly used positron emitters
4. Describing the technical tasks associated with synthesizing radiopharmaceuticals labeled with positron emitters
5. Stating the requirements for quality control of PET imaging agents
6. Describing techniques for administration of PET imaging agents that are unique due to the nature of the agents

Competency 5: The student will be able to demonstrate an understanding of radiopharmaceutical properties by:

1. Listing characteristics that make a radiopharmaceutical an excellent diagnostic or therapeutic agent
2. Differentiating between diagnostic and therapeutic radiopharmaceutical regarding patient dose, energy emissions, and toxicity
3. Naming and describing several methods of localization that are employed in the use of radiopharmaceuticals
4. Giving the name of a radiopharmaceutical, indicating the method of localization and bio routing of the compound
5. Discussing compartmentalization and kinetics of the various radiopharmaceutical compounds
6. Discussing target-to-nontarget ratios and state relative ratios for various radiopharmaceuticals

Competency 6: The student will be able to demonstrate an understanding of regulations that apply to the nuclear medicine field by:

1. Stating NRC, DOH, and FDA regulations governing the use of radiopharmaceuticals
2. Differentiating between an investigational new drug (IND) and a new drug application (NDA) and describing the steps that must be taken to develop and approve new radiopharmaceuticals

Competency 7: Students will be able to demonstrate an ability to complete tasks as assigned related to the practice of nuclear medicine by completing the following tasks (in a clinical practice setting or laboratory exercise):

1. Eluting a 99Mo/99mtc generator
2. Performing quality/control procedures on the generator evaluate
3. Assaying the eluate
4. Preparing sulfur colloid, MAA, and other 99mtc compounds from kits
5. Performing all mathematical calculations needed to determine quantities to use in making kits and in preparing patient doses
6. Using sterile techniques throughout all steps of the radiopharmaceutical preparation
7. Maintaining all required records
8. Using radiation safety techniques throughout all steps of the radiopharmaceutical preparation
9. Performing appropriate quality control procedures (chromatography) on all kit compounds
10. Identifying the appropriate radiopharmaceutical and calculate the patient dose, given a request for a patient study

11. Preparing the patient dose in a syringe using gloves, syringe shields, and sterility techniques

Learning Outcomes:

- Communicate effectively using listening, speaking, reading, and writing skills
- Solve problems using critical and creative thinking and scientific reasoning
- Formulate strategies to locate, evaluate, and apply information