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After completing these chapters, the reader will be able to:

Chapter 1. PET Radiopharmaceutical Production
- Describe the production of positron-emitting radionuclides from generators and a cyclotron.
- Discuss the methods of producing PET radiopharmaceuticals by precursor techniques.
- Discuss quality control testing of PET radiopharmaceuticals.

Chapter 2. PET Radiopharmaceuticals
- Perform calculations for the conversion between radioactive units of measurement.
- Calculate the volume for PET radiopharmaceutical doses.
- Discuss the elements of performing imaging procedures with a variety of FDA-approved PET radiopharmaceuticals, including the method of radiopharmaceutical localization, delay time to imaging, and basic scanning procedure.

Chapter 3. Radiation Principles and Basic Radiation Detection Devices
- Perform calculations for radioactive decay and precalibration calculations for a variety of radionuclides.
- Describe the fundamental operation of gas-filled detectors, including Geiger, ionization chamber, and dose calibrators.
- Describe the principles of operation of scintillation detectors and block detectors used in PET scanners, including the determination of both energy and event position.

Chapter 4. PET Instrumentation
- Diagram PET/CT scanner design and describe the principles of operation.
- Discuss the advantages of time-of-flight scanners and discuss other modes of image acquisition (2D, 3D, gated, and list mode).
- Discuss PET reconstruction algorithms and image filtering.
- Discuss the importance of attenuation correction in PET imaging.
- Discuss quantitative imaging parameters, including the Standard Uptake Value (SUV).

Chapter 5. CT Instrumentation
- Describe the principles of x-ray production in the CT scanner.
- Discuss the settings for CT x-ray production in clinical use, including kVp, mAs, collimation, rotation speed, slice thickness, FOV, etc.
- List and discuss methods to reduce patient radiation exposure from the CT scan when using the CT for attenuation correction only and in low-dose clinical use.
Chapter 6. Quality Control and Instrumentation Artifacts

- List dose calibrator tests and describe the testing procedures and regulatory compliance for each test.
- Describe PET scanner quality control testing procedures.
- Discuss CT scanner testing procedures and regulatory requirements.
- Discuss types of artifacts that may appear with PET imaging, CT imaging, and combined imaging.

Chapter 7. Radiation Safety in PET/CT

- Write a general laboratory safety program for handling PET radiopharmaceuticals.
- Describe methods for the receipt and disposal of PET radioactive materials.
- Discuss shielding requirements for CT scanner rooms and for patient uptake rooms, including precautions for handling injected patients.

Chapter 8. Patient Care and Emergency Procedures

- Identify common medications associated with oncologic PET/CT procedures.
- Define the process and technique for intravenous access.
- Explain how to keep dose to patients and personnel as low as reasonably achievable.
- Decide which questions will help a technologist gain a better understanding of patient condition to share with the physician.
- List normal ranges for laboratory values.

Chapter 9. Oncology: Patient Preparation and Imaging

- Recommend preparation guidelines to PET patients.
- Explain how to keep dose to patients and personnel as low as reasonably achievable.
- Apply techniques for positioning patients in the bore of the PET/CT scanner.
- Implement infection-control practices that safeguard patients.
- Describe factors affecting the biodistribution of PET radiopharmaceuticals.

Chapter 10. PET Imaging in Oncology

- List radiopharmaceuticals used for routine PET and PET/CT imaging.
- Detail which indications in oncology have shown appropriate use in oncology.
- Cite the common superior and inferior scan locations by cancer type.
- Name the anatomical structures routinely visualized on PET images.
- Differentiate tumor markers by cancer type.
- Summarize indications and contraindications for PET and PET/CT procedures.

Chapter 11. Incorporation of CT and Contrast Media into PET Practices

- Decide which questions will help a technologist gain a better understanding of patient condition to share with the physician.
- Recognize which resources are vital to continued learning.
- List the types of contrast media routinely used in imaging.
- Review steps in the event of a contrast reaction.
Chapter 12. Clinical Artifacts

- Assess if image quality aligns to standards.
- Indicate patterns and artifacts commonly seen in PET data.
- Deduce factors that maximize the quality of the data acquired.

Chapter 13. PET Imaging of the Brain

- Discuss causes of dementia and imaging of memory disorders.
- List medications commonly seen in patients with Alzheimer’s disease.
- Recognize anatomy of the head and patterns of visualization on PET/CT and other imaging modalities.
- Describe some of the radiopharmaceuticals available for imaging of the brain.

Chapter 14. PET Imaging of the Heart

- Explain the techniques and imaging protocols to optimize cardiac PET/CT imaging.
- Review cardiac anatomy.
- Summarize the types of vasodilators used in PET.