18 Radiopharmaceuticals

OBJECTIVES

After reading this chapter, the student will be able to:

1. Compare and contrast the three principal types of radioactive decay (i.e., alpha, beta, gamma)
2. Compare and contrast the use of radiopharmaceuticals in diagnostics and therapeutics
3. Identify the diagnostic and/or therapeutic role(s) and delivery method(s) for the following radiopharmaceuticals: ^{99m}Tc, ^{89}Sr, ^{90}Y, ^{201}Tl, ^{67}Ga, ^{111}In, ^{123}I/^{131}I, and ^{153}Sm
4. Describe the concept and therapeutic utility of positron emission tomography (PET)
5. Identify indications for the following nonradioactive pharmaceuticals in nuclear medicine: Prussian blue, acetazolamide, captopril, dipyridamole, adenosine, and furosemide
6. Describe the organization of a nuclear pharmacy in a community and hospital setting
7. Define the role of the nuclear pharmacist (e.g., radiopharmaceutical preparation, quality assurance, dispensing, safety, consultation)

By definition, a radiopharmaceutical is a radioactive pharmaceutical agent that is used for diagnostic or therapeutic procedures (1). For a product to be classified as a radiopharmaceutical agent safe for human use, the preparer must satisfy a state agency, the State Board of Pharmacy, and two branches of the federal government whose responsibilities in this category have overlapping jurisdictions. They are the Food and Drug Administration (FDA) and the Nuclear Regulatory Commission (NRC). The extent of oversight by the board of pharmacy differs between states. Because of the stringent regulations of the NRC, some state boards defer and do not have specific rules for nuclear pharmacies. Other state boards have rules within their pharmacy practice acts that relate to the practice of nuclear pharmacy.

Over the past four decades, the discipline of nuclear pharmacy, or radiopharmacy, has become highly specialized and contributed positively to the practice of nuclear medicine. Nuclear pharmacy, the first specialty in pharmacy recognized (in 1978) by the Board of Pharmaceutical Specialties, focuses on the safe and effective use of radioactive drugs or radiopharmaceuticals.

The application of radiopharmaceuticals is divided into two major areas, diagnostic and therapeutic. The diagnostic side is well established, while the therapeutic side of nuclear medicine is evolving. For example, more than 100 radiopharmaceutical products