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Dirigente Medico
- disciplina Medicina Nucleare -

da

assegnare alla S.C. Medicina Nucleare,
nell'ambito del Dipartimento Area Radiologica dell'Ente

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#1
This chapter has four main components: (1) basic physics, (2) radioactivity, (3) interaction of radiation with matter and (4) counting statistics as relevant to nuclear medicine. In the first part, the atomic theory (in brief), electron configuration, electron binding energy, atomic emissions, nuclear structure and nuclear forces are described. In the second part, radioactivity is described in detail which is an important topic in nuclear physics.

#2
Nuclear stability, modes of radioactive decay, exponential law in radioactive decay with relation between half-life and decay constant and radioactive equilibrium (both secular and transient) are included. The third part is on interactions of radiation (both charged particles and electromagnetic radiation) with matter. Linear attenuation coefficient and its relation with half value layer (HVL) is duly explained.

#3
The photoelectric effect, Compton scattering and pair production and their relative contribution/importance are also mentioned. The fourth and the last part of the chapter is on counting statistics. It includes the types of errors in nuclear medicine data, measurements of central tendencies particularly the estimation of standard deviation, use of chi square test in counting measurements. Propagation of error in nuclear medicine data is explained with examples.

#4
Introduction on the need of radiation safety regulations is highlighted in the beginning of the chapter. The linear non-threshold (LNT) model is given in brief while explaining the difference between stochastic and deterministic effects followed by the objective of radiation protection. The units of radiation dose (both SI and traditional) used in radiation safety are mentioned. After explaining the system of dose limitation, the annual dose limits for the occupational staff and public as recommended by ICRP (2007) are given in tabular form.

#5
The chapter deals with radiation safety in nuclear medicine in detail. Safety requirements and procedures in diagnostic (both conventional and PET) and therapeutic nuclear medicine have been described in detail. Radiation safety of staff, parents and public has been adequately covered. Emphasis has been given to good working habits (practice) for the staff while handling radioactivity in hot laboratory, injection site, imaging rooms, etc.

#6
The misadministration of radiopharmaceuticals to the patients and their avoidance has been appropriately described. Further the radiation emergencies in nuclear medicine and their management have also been included adequately. The text finally describes the management of radioactive waste in general and the waste generated in radioiodine therapy in particular.

#7
Nuclear medicine facilities must have essential accessories and equipment to meet quality assurance requirements and to comply with national or international standards. These equipments should be used under well understanding of their capabilities, limitations, and

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environmental conditions. They can be classified into non-imaging, reference radioactive sources, and radiopharmacy-related equipment and tools. Non-imaging equipment category includes dose calibrator, well counter, thyroid uptake probe, intraoperative probes, survey meters, area monitors, X-ray computed tomography (CT) dosimetry, and others.

#8
The second category includes an array of radioactive reference sources that commonly used in calibration and daily quality control and assurance. The last category comprises those equipments that commonly used in radiopharmacy laboratory including high-performance liquid chromatography, thin layer chromatography scanner, gas chromatography, gamma spectrometer, pH meter, and specialized tools for the determination of bacterial endotoxins.

#9
Preparation and dispensing of radiopharmaceuticals should be carried out in special conditions of particle count and microbiological monitoring that could be achieved under aseptic conditions or use of laminar flow cabinet of proper grade. Moreover, labeled isotopes or finally formulated products have to pass through specific quality checks and acceptance criteria so as to maintain patient safety and achieve optimal diagnostic quality. Implementation of those equipment and tools into nuclear medicine daily practice is obviously integral part of the overall success of the clinical service.

#10
The preparation, characterization, and molecular properties of technetium-99m (99mTc) radiopharmaceuticals have been reviewed within a simplified theoretical framework based on a few fundamental concepts of coordination chemistry. The properties of various categories of 99mTc complexes have been classified according to a set of characteristic metallic functional groups, also called 99mTc cores or 99mTc fragments. These metallic fragments exhibit a selective reactivity toward specific classes of ligands and, thus, completely determine the chemical and structural characteristics of the resulting 99mTc complexes.