Radiology diagnosting imaging and radiotherapy techniques

INTEGRATED COURSE: DIAGNOSTIC IMAGING TECHNIQUES III

CFU: 12
SSD: MED/50, MED/36
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MODULE: *Diagnostic Imaging and radiotherapy*
NUMERO DI CFU: 6
SSD: MED/36
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MODULE: *Medical Sciences and techniques*
CFU: 6
SSD: MED/50
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REREQUISITES

Basic knowledge of physics, interaction of radiation with matter, radiation protection. Human anatomy

LEARNING OBJECTIVES

Upon completion of the course, students should know and understand the physical principles of radiation therapy and nuclear medicine. Know the basic notions of radiotherapy treatment techniques, of the physical principles of the equipment, of the scintigraphic examinations, including the instrumentation, the methods of acquiring and processing images, the main indications of the examinations and finally the main normal and pathological findings of these examinations.
In relation to PET topics, students should understand the physical bases and instrumentation of Positron Emission Tomography. Know the methods of reconstruction and processing of images, the various artifacts, the techniques for correcting these artifacts and the main indications and clinical basis of PET examinations.
In addition, knowledge of advanced MR and CT imaging techniques will be provided

LEARNING OUTCOMES

Knowledge and understanding)
At the end of this course, the student must:
Know the physical principles of radiotherapy treatment techniques
Know the radiotherapy and nuclear medicine instrumentation
Know the physical principles of scintigraphic and PET examinations
Describe how images are acquired and processed
Learn about image artifacts and techniques for correcting such artifacts
Explain the main indications for performing scintigraphic and PET examinations and be able to recognize the main normal and abnormal findings.

Applying knowledge and understanding
At the end of the course, the student will be able to:
Acquire the knowledge to carry out radiotherapy treatments
Acquire and process scintigraphic and Positron Emission Tomography examinations

Communication skills
At the end of the course, the student must:
Use specific scientific terminology appropriately.
Be able to apply their knowledge and understanding in order to demonstrate a professional approach while working and possess adequate skills both to conceive and support arguments and to solve problems in their field of study.

Making judgements
At the end of the course, the student must know:
carry out general assessments relating to the topics covered.

COURSE SYLLABUS

Syllabus DIAGNOSTIC IMAGING AND RADIOTHERAPY
The physical basis of nuclear medicine
Types of scintigraphy
Lung scintigraphy
Lymphoscintigraphy
Gastrointestinal bleeding scan
Meckel's Diverticulum scintigraphy
Bone scan in mandibular condylar hyperplasia
Ocreotide scintigraphy
PET physics and instrumentation
Reconstruction, processing and quantification of PET images
PET artifacts and correction techniques

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Scientific and clinical basis of PET applications
Radiotherapy equipment: introduction to the use of Linac
The teaching program will address the following topics: Definitions; Electromagnetic and corpuscular radiation and consequent radiobiological effect on neoplastic tissues and normal tissues; Beams of photons and electrons of different energy and characteristics of the action on the surface and in depth; Definition of volumes in radiotherapy; Dose fractionation and treatment techniques; Toxicity; Examples of treatment in various organ pathologies.
Radiotherapy equipment: introduction to the use of dedicated machines
The teaching program will address the following topics: explanation of the problems inherent in the different phases of the path of the cancer patient candidate for radiation treatment, deepening those concerning treatment planning and delivery for both 3D techniques and ultra-conformed and volumetric ones.
General principles of oncological radiotherapy
The teaching program will address the following topics: radiotherapy, therapeutic purposes and additions.
Therapeutic process in the treatment planning phase
The teaching program will address the following topics: Isotac and isocenter; Contouring and co-registration; Volumes according to ICRU 50 (treatment volume and irradiated volume); Principles of 3D planning and inverse planning (IMRT-VMAT); Acute tissues and late responders (toxicity); Organs in series and organs in parallel; DVH and Dose Constraints; Clinical evaluations of treatment plans.
Therapeutic process in the therapy phase
The teaching program will address the following topics: Evolution of the IGRT concept; Interfraction and intra-fraction control systems; Tracking systems; Concepts of adaptive and application methods.
Special techniques

Syllabus MEDICAL SCIENCES AND TECHNIQUES
introduction to nuclear medicine / molecular imaging methodologies
organization and management of a Nuclear Medicine department (environments, equipment, roles and functions);
Nuclear Medicine Equipment (gamma camera, PET and SPECT)
Main applications in diagnostics and therapy (according to international protocols and guidelines)
Radiopharmaceuticals, quality controls, good preparation practices, waste disposal
linear accelerator, linear accelerator with cone-beam ct system, iort, brachytherapy, simulator, mobile lasers, immobilization systems, stereotaxic brain treatment, brain treatment, treatment of respiratory tumors, treatment of mediastinal tumors, breast treatment, treatment of the digestive system, treatment of the prostate and urinary system, treatment of skin lesions, treatment of metastases, treatment planning system (tps), digital reformat reconstruction (drr) and with beam-ct, identification of the target volume and contouring (gtv- ctv-ptv), image fusion, 2d, conformational (3d) and imrt treatment, isodose curve, dose inhomogenization and superficialization (bolus)

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COURSE STRUCTURE

The teaching methods are identical for each module with lessons divided according to the didactic calendar in frontal meetings of 2-3 hours. The teacher uses Power Point support to present the topics of his program

COURSE GRADE DETERMINATION

The attainment of the learning outcomes will be evaluated through a written exam, followed by an oral exam. The written exam will consist of 15 multiple-choice questions. Each correct answer is worth 2 points. The final score will be given by the sum of the points from the individual answers. The access to the oral exam is conditional to the achievement of at least 14 points in the written exam.
During the oral exam the Commission will assess the student's ability to apply the acquired knowledge, the communication skills developed in the field of health organization and planning, and the basic autonomy of judgment on the topics covered according to the Dublin descriptors.

OPTIONAL ACTIVITIES

material written by the professor, referring to the lessons

READING MATERIALS

DIAGNOSTIC IMAGING AND RADIOTHERAPY

Calabria F., Schillaci O. (Ed.) Radiopharmaceuticals: A Guide to PET/CT and PET/MRI, Milano, Springer, 2019
Volterrani, D., **Erba**, P.A., **Carrio**, I., **Strauss**, H.W., **Mariani**, G., Nuclear Medicine Textbook, Milano, Spinger, 2019
Assadi, Majid, **Ahmadzadehfar**, Hojjat, **Biersack**, Hans-Jürgen, Principles of Nuclear Medicine, Milano, Springer, 2018
Radiation Therapy Study Guide: A Radiation Therapist's Review by Amy Heath. Springer, 2016.
Linee guida AIMN: https://www.aimn.it/site/page/attivita/linee-guida
EANM Technologist Guide: https://www.eanm.org/publications/technologists-guide
Nuclear Medicine and PET/CT Technology and Techniques – Paul E.Christian ; Kristen M. Waterstram-Rich

MEDICAL SCIENCES AND TECHNIQUES

External beam therapy, Peter Hoskin, Oxford

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