Radiology diagnosting imaging and radiotherapy techniques

INTEGRATED COURSE: DIAGNOSTIC IMAGING TECHNIQUES III

CFU: 12
SSD: MED/50, MED/36
COORDINATOR: GUARNERA ALESSIA E-MAIL: alessia.guarnera@unicamillus.org

Diagnostic Imaging and radiotherapy
CFU: 6
SSD: MED/36
PROFESSOR: ARGIRO' Renato e-mail: renato.argirò@unicamillus.org
FIONDA Bruno e-mail: bruno.fionda@unicamillus.org
GUARNERA Alessia e-mail: alessia.guarnera@unicamillus.org

Medical Sciences and techniques
CFU: 6
SSD: MED/50
PROFESSOR:
SANTARELLI Federico federico.santarelli@unicamillus.org
DI LASCIO Antonio antonio.dilascio@unicamillus.org
CHIATAMONE RANIERI CARMINE carmine.chiatamone@unicamillus.org

PREREQUISITES

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

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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

- Computed Tomography Settings and Protocols
- Neuro CT
- Head and Neck CT
- Chest CT
- Cardio-CT
- Abdominal CT

- Pelvic CT
- Angio-CT
- CT in trauma

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)

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 exam is unique for the entire integrated course, it is not possible to take exam tests for the individual modules. The verification of the achievement of the educational objectives will be performed with a written exam, followed by an optional oral exam. The written test will consist of 30 questions with multiple choice answers. For each correct answer 1 point will be awarded and the final mark will be given by the sum of the scores of the individual questions. The oral exam is optional, to increase the grade of the written exam. To access the oral exam, the student must have achieved a mark in the written test of at least 18 points.

The final exam grade will be calculated according to the following criteria:

Not suitable: Poor or lacking knowledge and understanding of the topics; limited capacity for analysis and synthesis, frequent generalizations of the requested contents; inability to use technical language.
18-20: Just sufficient knowledge and understanding of the topics, with obvious imperfections; just sufficient capacity for analysis, synthesis and autonomy of judgment; poor ability to use technical language.
21-23: Sufficient knowledge and understanding of the topics; sufficient ability to analyze and synthesize with the ability to reason with logic and coherence the required contents; sufficient ability to use technical language.
24-26: Fair knowledge and understanding of the topics; discrete ability to analyze and synthesize with the ability to rigorously argue the required contents; good ability to use technical language
27-29: Good knowledge and understanding of the required contents; good ability to analyze and synthesize with the ability to rigorously argue the required contents; good ability to use technical language.
30-30L: Excellent level of knowledge and understanding of the required contents with an excellent ability to analyze and synthesize with the ability to argue the required contents in a rigorous, innovative and original way; excellent ability to use technical language

OPTIONAL ACTIVITIES

Given by the professor

READING MATERIALS

DIAGNOSTIC IMAGING AND RADIOTHERAPY

Nikolaou, Konstantin, Fabian Bamberg, Andrea Laghi, and Geoffrey D. Rubin. 2019. *Multislice CT*. Springer.

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

and material written by the professor, referring to the lessons

MEDICAL SCIENCES AND TECHNIQUES

External beam therapy, Peter Hoskin, Oxford