

SYLLABUS DEL CORSO

Image Diagnostics

2627-2-H4104D014

Aims

By the end of this course, students will be able to:

1. Acquire in-depth knowledge of instrumentation used in various diagnostic imaging techniques
2. Understand the principles, functioning, and clinical applications of X-ray systems, Ultrasound (US), Magnetic Resonance Imaging (MRI), Nuclear Medicine, and hybrid imaging modalities such as PET/CT and PET/MRI.
3. Evaluate the advantages, limitations, and specific uses of each technique in different clinical contexts.
4. Understand the technologies employed in radiotherapy
5. Gain familiarity with external beam radiotherapy equipment, including advanced techniques such as Intensity Modulated Radiotherapy (IMRT), Image Guided Radiotherapy (IGRT), proton therapy, and other innovative modalities.
6. Comprehend the role of integrated imaging in guiding and optimizing radiotherapy treatments.
7. Learn the pharmacological and regulatory aspects of radiopharmaceuticals and contrast agents
8. Understand the mechanisms of action, pharmacokinetics, pharmacodynamics, and safety profiles of radiopharmaceuticals and contrast agents used in diagnostic imaging and radionuclide therapy.
9. Acquire knowledge of legal and regulatory requirements related to the production, use, handling, and disposal of contrast agents and radiopharmaceuticals, including safety and procurement procedures.
10. Develop a solid foundation in clinical radiological anatomy
11. Recognize key anatomical structures through the study of conventional radiology, computed tomography (CT), ultrasound, and magnetic resonance imaging (MRI).
12. Use anatomical knowledge as an essential basis for clinical interpretation and diagnostic evaluation of imaging studies.

Cross-Disciplinary Competencies Developed

- Ability to integrate technical, pharmacological, and anatomical knowledge for the effective and safe use of imaging and radiometabolic therapy techniques.
- Critical skills in the interpretation and assessment of medical imaging related to diagnostic and therapeutic needs.

- Awareness of safety standards and regulatory frameworks governing the use of medical devices, radiopharmaceuticals, and contrast agents.

Contents

1. Diagnostic Imaging Modalities:
 - a. Ultrasound (US)
 - b. Computed Tomography (CT)
 - c. Magnetic Resonance Imaging (MRI)
 - d. Nuclear medicine imaging: scintigraphy, Positron Emission Tomography combined with Computed Tomography (PET/CT) and Positron Emission Tomography combined with Magnetic Resonance Imaging (PET/MR)
2. Principles of Radiobiology:
 - a. Biological effects of ionizing radiation
 - b. Radiobiological basis underpinning diagnostic and therapeutic applications
3. Radionuclide Therapy:
 - a. Fundamentals and clinical applications of radionuclide therapies
 - b. Safety and handling considerations
 - c. Radiotherapy Systems:
4. Overview of external beam radiotherapy systems
Advanced modalities including Intensity Modulated Radiotherapy (IMRT), Image Guided Radiotherapy (IGRT), and particle therapy
5. Role of Integrated Imaging Modalities for Image-Guided Therapy:
Importance of multimodality imaging in guiding surgical and radiotherapy interventions
6. Legislation of Diagnostic Medicinal Products:
 - a. Classification of diagnostic agents
 - b. Regulatory frameworks and production standards
 - c. Pharmacology of Diagnostic Medicinal Products:
7. Mechanisms of action, pharmacokinetics, and safety profiles
 - a. Normal Biodistribution and Pathological Patterns of Common Radiopharmaceuticals:
 - b. Understanding physiological uptake
 - c. Interpretation of abnormal patterns
8. Normal Anatomy Documented by Imaging:
Anatomical landmarks and structures as visualized by conventional radiology, CT, ultrasound, and MRI

*Knowledge and Understanding: - Mastery of imaging modalities, radiobiological principles, radionuclide therapies, pharmacology, and legislative frameworks.

Applying Knowledge and Understanding: - Ability to interpret diagnostic and therapeutic imaging studies, apply imaging data to guide treatment decisions, and utilize pharmacological knowledge in clinical contexts.

Making Judgments - Critical evaluation of imaging appropriateness, therapy suitability, and safety considerations in diagnostic and therapeutic pathways.

Detailed program

Please, refer to the specific Module

Prerequisites

Basic knowledge on chemistry, physics, human anatomy, physiology and pharmacology.

Teaching form

Lectures including videos of real facilities. Case examples and case studies. Small group activities.

Textbook and teaching resource

Slides illustrated and commented on during lessons.

General reviews from international literature.

Radiology Fundamentals. Introduction to Imaging & Technology. Editors: Jennifer Kissane, Janet A Neutze, Harjit Singh. Springer 2020

Nuclear medicine textbook, Methodology and Clinical Applications. Editors: Duccio Volterrani, Paola Anna Erba, Ignasi Carrió, H. William Strauss, Giuliano Mariani. Springer 2019. Chapters 1-11

Basic Radiotherapy Physics and Biology. Editors: David S. Chang , Foster D. Lasley , Indra J. Das , Marc S. Mendonca , Joseph R. Dynlacht. Springer 2021

Semester

Second semester of second year

Assessment method

The course exam consists of a written exam with multiple-choice questions or open questions.

The questions aim at verifying the student's knowledge. Each multiple-choice question is given a score between 0 and 1; each open questions is given a score between 0 and 5. Laude is assigned in case of particularly deserving tests.

Evaluation criteria: theoretical knowledge, synthesis skills, ability in the application of diagnostic methods to a specific clinical or experimental contest.

Office hours

By appointment fixed by e-mail

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING | QUALITY EDUCATION | GENDER EQUALITY
