

SUBJECT	GENERAL RADIOLOGY AND PHYSICAL MEDICINE					
CREDITS	Total	6.5	Theory	3	Practical	3.5

GENERAL OBJECTIVES

As part of the syllabus of the Faculty of Medicine, *Radiology and Physical Medicine* deals with the clinical application of physical agents for the purposes of diagnosis, therapy and rehabilitation. It covers four medical specialties: radiodiagnosis, radiotherapeutic oncology, nuclear medicine and rehabilitation.

The general aim is that students who complete the course will have acquired basic knowledge about the physical foundations of the techniques used in radiology and physical medicine, and be familiar with both the imaging diagnosis procedures used in the study of different organs and systems, as well as the therapeutic applications of physical agents.

This will enable them, in the second cycle, to acquire more specific knowledge about diagnostic, therapeutic and rehabilitation procedures applied to each of the pathologies associated with different organs and systems.

SPECIFIC OBJECTIVES

RADIODIAGNOSIS

Students will be able to:

- Name the radiological procedures commonly used in the study of each organ or system, as well as the basic details of the technique involved.
- Identify an image and be able to place it correctly in the corresponding viewing equipment.
- Identify the different projections of an image.
- Recognize technical errors in the procedure that could lead to erroneous images
- Recognize and describe the organs and structures observable in a radiological image
- Distinguish between a normal and a pathological radiograph
- Recognize and describe basic images and their characteristics
- Formulate the radiological procedures relevant to a given case of clinical suspicion, evaluating the technical and socio-economic characteristics of the examination
- Evaluate whether the results obtained are sufficient to enable a diagnosis to be made

NUCLEAR MEDICINE

Students will be able to:

- Explain the physical and biological foundations of the most widely used techniques in nuclear medicine
- Name the procedures used in the study of each organ or system, and explain why they are used
- Identify a procedure based on images obtained from it
- Recognize and describe the organs and visible structures in images, as well as the data that can be evaluated or calculated on the basis of visual recordings
- Identify a normal visual recording
- Recognize the different types of abnormal image
- Identify the different therapeutic applications of nuclear medicine

RADIOTHERAPY

Students will be able to:

- Define the terms associated with basic radiotherapy
- Name the radiotherapy techniques which may be applied, including their advantages and disadvantages
- Evaluate the possibility of combining radiotherapy with other treatments (surgical, chemotherapy, hormone therapy and immune treatments)
- Evaluate the possible reactions and/or sequelae associated with each treatment

REHABILITATION

Students will be able to:

- Describe the systems of assessment, functional diagnosis and therapeutic procedures in rehabilitation
- Name and describe the most widely used techniques for different levels of disability
- Name the diagnostic procedures normally used in physical medicine in the study of each organ or system, as well as the basic details of the technique itself

SYLLABUS

Theory

Topic 1. Definition and objectives of the subject module

Medical specialties included in the subject module *Radiology and Physical Medicine*. Radiology in medicine today. Definition and limits of radiological science and physical medicine. The subject module as part of the syllabus of the Faculty of Medicine of the University of Barcelona. Course syllabus.

Topic 2. Physical bases of ID (1)

Bases of ultrasonography. Ultrasound (US). The Doppler effect. Interventionist ultrasonography.

Topic 3. Physical bases of ID (2)

Types of ultrasound image: Indications and applications of ultrasonography.

Topic 4. Physical bases of ID (3)

Production of X-rays. Elements of an X-ray tube. The radioscopic image. Image amplifier and image transmission via television. The radiographic image. Evaluation of image formats from radiographic plates to the present day. Contrast materials in radiology.

Topic 5. Physical bases of ID (4)

The role of computers with respect to the image in radiodiagnosis. Computed axial tomography. Digital radiography. PACS. Digital subtraction angiography. Magnetic resonance.

Topic 6. Introduction to nuclear medicine

Mechanisms of radionuclide production. Radiological drugs: characteristics and mechanisms of localization. Instruments and techniques in nuclear medicine. Types of detector.

Topic 7. Radiological examination of the thorax (1)

Radiological anatomy of the thorax. Conventional examinations: Technique. Radiological projections. Thoracic wall. Diaphragm. Pleura. Mediastinum. Airways. Pulmonary vascularization. Computed tomography: Technique. Anatomical relationships. Magnetic resonance: Technique. Anatomical relationships.

Topic 8. Radiological examination of the thorax (2)

Radiological signs in the lungs: alveolar pattern. Interstitial pattern. Nodules and pulmonary masses.

Topic 9. Radiological examination of the thorax (3)

Radiological signs in the mediastinum: lesions of the anterior, middle and posterior mediastinum. Vascular pathology. Radiological signs in the pleura and diaphragm.

Topic 10. Radiological examination of the abdomen (1)

Simple abdominal radiography. Techniques. Radiological anatomy. Radiological signs. Radiological examination of acute abdomen. Radiological signs of intestinal obstruction. Radiological signs of inflammatory processes. Radiological signs of intestinal perforation.

Topic 11. Radiological examination of the abdomen (2)

Computed tomography: description of the system, manipulation of the image, artefacts. Technique and indications of abdominal computed tomography. Magnetic resonance in abdominal examinations.

Topic 12. Radiological examination of the digestive tract

Contrast materials. Technique. Radiological anatomy of the oesophagus, stomach, small and large intestine. Radiological signs.

Topic 13. Radiological examination of the head and neck

Simple cranial radiography. Current value and most common projections. Basic images. Examination of the sella turcica. Common projections in the cranial sinuses and nasopharyngeal region. Role of computed tomography and magnetic resonance in examining the head and neck.

Topic 14. Radiological examination of the CNS

Cranioencephalic computed tomography and magnetic resonance. Normal radiological anatomy and basic lesions. Computed tomography and magnetic resonance of the spinal cord. Normal radiological anatomy and basic lesions. Angiography of the supra-aortic, carotid, vertebral and medullary trunks. Digital angiography. Diagnostic and therapeutic radiological techniques. Current value of myelography.

Topic 15. Angiography of the extremities and body

Angiographic techniques. Role of digital subtraction angiography. Seldinger technique of catheterization. Indications, risks and complications of the different angiographic techniques. Basic angiographic images. Diagnostic and therapeutic angiographic procedures. Radiological examination of the venous tree. Phlebography. main techniques. Lymphography. Thermography. Role of ultrasound in the radiological study of vessels.

Topic 16. Radiological examination of the skeletomuscular system (1)

Ultrasonography. Conventional radiology.

Topic 17. Radiological examination of the skeletomuscular system (2)

Computed tomography. Magnetic resonance.

Topic 18. Radiological examination of the genito-urinary apparatus

Examination techniques: simple X-ray, IV urography, retrograde cystourethrography, ultrasound, computed tomography, hysterosalpingography. Signs of the main ureteral-renal and vesico-prostatic disorders. Testicular examination. Examination of the uterus and adnexa.

Topic 19. Radiological examination of the breast

Mammography. Techniques. Normal and pathological images. Breast ultrasound. Magnetic resonance of the breast. Galactography.

Topic 20. PET: positron emission tomography

Positron emission tomography. Instruments: camera, cyclotron. Techniques, methods and radiological drugs. Quantification. Main clinical applications: oncology, neurology, psychiatry, cardiology.

Topic 21. Therapeutic applications of nuclear medicine

Radiological drugs in use. Metabolic treatment. Intracavitary treatment. Measures of radioprotection.

Topic 22. Radiobiology (1)

Modern concepts of the action of radiation: theory of impacts, theory of indirect action, theory of the double ionization component. Fundamental concepts in radiobiology. Concept of radiosensitivity: law of Bergonié and Tribondeau.

Topic 23. Radiobiology (2)

Action of radiation on cells: restoration and accumulation of the dose. Action of radiation on tissue: tissue restoration. Factors which alter radiosensitivity. Action of radiation on the organism as a whole. General irradiation: aetiology, clinical forms, diagnosis and treatment. Local irradiation: radiation sickness, its prophylaxis and treatment. Consequences of chronic irradiation.

Topic 24. Radioprotection

Fundamental concepts in radioprotection: magnitudes and units. Period of biological breakdown. Natural and artificial sources of radiation. International and national radioprotection bodies. General safety rules. Means of protection: physical means, pharmacological protection. Spanish legislation on radioprotection.

Topic 25. Applied radioprotection

Protection in radiotherapy. Selective protection of critical organs: dose levels. Protection of professional staff exposed to radiation, as well as the general public. Radioprotection in radiodiagnosis. Radioprotection in nuclear medicine.

Topic 26. Physical bases of radiotherapy

Concept of radiation. Nature of radiation. Main types of radiation. Defining parameters of electromagnetic radiation. Interaction of photons with matter.

Topic 27. Instruments used in radiotherapy

Technical basis of the equipment used in external radiotherapy: telecobalt therapy, linear accelerators, cyclotrons. Elements associated with teletherapy equipment: collimator, gantry, isocentre, telemeter, centerers. Technical basis of brachytherapy equipment. Sources of high and low dose rate. Interstitial and endocavitary brachytherapy. Deferred radioactive charge equipment.

Topic 28. Radiotherapy (1)

Foundations of anti-cancer radiotherapy. Biological bases of anti-cancer radiotherapy. Radiosensitivity and radiocurability.

Topic 29. Radiotherapy (2)

External radiotherapy: concept. Technical basis of telecobalt therapy equipment. Foundations and main characteristics of electron accelerators: linear accelerator, betatron, cyclotron. Brachytherapy: main isotopes used. Interstitial and endocavitary brachytherapy.

Topic 30. Radiotherapy (3)

Classification of tumours according to treatment indications. Multidisciplinary treatment of cancer. Biological foundations of radiotherapy for benign processes. Techniques and indications.

Topic 31. Introduction to physical medicine in rehabilitation

Systems for evaluating the disease consequences. Functional and disability diagnosis. Therapeutic procedures in rehabilitation.

Topic 32. Diagnostic and therapeutic applications in physical medicine

Different interactions of physical agents: biothermal, bioelectric and feedback. Analgesic agents. Different interactions of physical agents: electromagnetic bioenergetic, mechanical or vibratory bioenergetic, and photobiological (light radiation).

Topic 33. Diagnostic and therapeutic applications in rehabilitation

Functional assessment. Therapeutic procedures: Kinesitherapy, and techniques of forced mobilization and gait retraining.

Practice

Seminar 1. Radiological anatomy of the thorax

Seminar 2. Pulmonary patterns

Seminar 3. CT and MR of pulmonary mediastinum

Seminar 4. Pulmonary gammagraphy

Seminar 5. Simple abdominal radiology

Seminar 6. Contrast studies of the digestive apparatus

Seminar 7. Abdominal ultrasound

Seminar 8. Abdominal CT

Seminar 9. Nuclear cardiology

Seminar 10. Isotopic studies in endocrine system

Seminar 11. Ultrasound/vascular Doppler

Seminar 12. Ultrasonography of thyroid glands, testes and soft parts

Seminar 13. Brain CT and MR

Seminar 14. Brain SPECT

Seminar 15. Angiography of the extremities and the body

Seminar 16. Bone gammagraphy

Seminar 17. Radiological signs in bone (1)

Seminar 18. Radiological signs in bone (2)

Seminar 19. Radiological signs in the spine

Seminar 20. Renal gammagraphy and renogram

Seminar 21. Imaging diagnosis in the genitor-urinary apparatus

Seminar 22. Mammography

LEARNING RESOURCES ANDS TEACHING METHODS

Teaching method

The course objectives will be met through a combination of theory teaching and practical classes.

The theoretical program will be based on theory classes for all students at the times established in the general course timetable.

The practical program will be run during the same period in the mornings (8.00-9.00 a.m.). Practical work will be carried out in groups as small as possible and will involve showing students slides, videos and images from imaging diagnosis (radiographs, ultrasounds, CT, MR, gammagraphs). These classes will not take the form of a teacher-led presentation of a given subject but rather will encourage the active participation of students, who must ask questions, make comments and share any doubts.

The methodology used will be:

1. Description by the teacher of:

The findings in normal examinations, as well as the possible variations from normality.

The basic images and their characteristics, and the different types of pathological image.

2. Description by students of the findings observed in different examinations, both normal and pathological.

3. Joint discussion between students and teacher regarding the observed data in order to arrive at a diagnosis.