Biomedical Laboratory Techniques

INSEGNAMENTO INTEGRATO: ONCOLOGY AND BLOOD DISEASES
SSD: MEDS-09/A, MEDS-09/B, MEDS-22/A
DOCENTE RESPONSABILE: EMILIANO FABIANI E-MAIL: emiliano.fabiani@unicamillus.org/
Number of CFU: 11

MODULO: MEDICAL ONCOLOGY
SSD: MEDS-09/A
PROFESSOR (2 CFU) : GIORGETTI GIAN MARCO e-mail: gianmarco.giorgetti@unicamillus.org
DOCENTE (2 CFU): GIOVANNI BATTISTA GRASSI e-mail:giovannibattista.grassi@unicamillus.org
DOCENTE (1 CFU): MARIA LETIZIA CECERE e-mail: fabiana.cecere@unicamillus.org
NUMBER OF CFU: 5

MODULO: BLOOD DISEASES, ONCOHEMATOLOGY:
SSD: MEDS-09/B)
PROFESSOR: EMILIANO FABIANI e-mail: emiliano.fabiani@unicamillus.org/
NUMBER OF CFU: 5

MODULO: DIAGNOSTIC IMAGING
SSD: MEDS-22/A
PROFESSOR: FEDERICO MIDIRI e-mail: federico.midiri@unicamillus.org
NUMBER OF CFU: 1

PREREQUISITES
The following basic concepts are needed:

- Knowledge of the general principles of medical terminology.
- Knowledge of normal and pathological human anatomy.
- Basic concepts of cell biology and primary notions on the structure and functions of nucleic acids (DNA and RNA) and proteins
- Basic knowledge of pathophysiology.
- Knowledge of the principles of biology and immunobiology of tumors, and of the cellular and molecular pathogenetic mechanisms that lead from neoplastic transformation and growth to invasion and metastasis.
- Knowledge of the principles of the physics of ionizing and non-ionizing radiation.

LEARNING OBJECTIVES
The essential objectives of the integrated course of "MEDICAL ONCOLOGY AND BLOOD DISEASES" are knowledge of the predisposing conditions and clinical characteristics of the solid and haematological neoplastic disorders, as well as, the prognostic and predictive factors of response according to the specific characteristics of both neoplasm and patient, as such as, the understanding of the haematolymphopoietic system and the pathophysiological alterations related to it, as well as the biological mechanisms mediated by cytokines and adhesion molecules that regulate innate and mediated immunity.
The aim of the integrated course will also be to learn the principles of primary, secondary prevention and chemo-prevention in the field of solid and haematological tumors.

Emphasis will be placed on the role of tumor markers and molecules that can help to well define the diagnostic assessment, as well as the importance of malnutrition and the role of microbiology related to the intestinal microbiota.
It is also required to learn the main laboratory analysis systems, cell isolation and molecular biology methods, biological sample preservation techniques and the application of biotechnology in the diagnosis and prognostic evaluation of the hematological patient. Students will have to possess the notions and principles relating to Diagnostic Imaging (including interventional radiology) to integrate the knowledge of the professional profile with those relating to diagnostic imaging technologies.
These objectives will be achieved through lectures aimed at improving students' learning capabilities in order to achieve useful skills for collaboration with multidisciplinary teams.
These objectives will be verified through intermediate and final evaluation tests.

LEARNING OUTCOMES

Knowledge and understanding
At the end of the integrated course of "MEDICAL ONCOLOGY AND BLOOD DISEASES" the student will have to demonstrate knowledge and understanding within the topics covered, as well as demonstrate autonomy in studying and understanding the research protocols and laboratory methodologies applied to them.

At the end of the course the student will be able to:

- be familiar with the definitions and classification criteria of benign and malignant tumors
- be confidant with the main pathological conditions; appropriately use laboratory techniques and investigations to diagnose, stage and classify tumors;
- be familiar with the main classification and therapeutic response evaluation systems; intercept the needs of the oncology patient;
- Know the various surgical strategies
- Know the new interventional radiology strategies
- be confident with the principles of molecular biology, with modern molecular typing techniques of the main tumors, especially from an application point of view;
- be confident with modern treatment strategies and the main therapeutic tools.
- correctly analyze the medical history according to the diagnosis and treatment, with specific emphasis on the aspects that can predispose to cancer according to frailties;
- evaluate the state of malnutrition and the concept of neoplastic cachexia
- know the role of the microbiota and prevention through proper nutrition
- interact with medical specialists in order to share the most appropriate diagnostic-therapeutic path and in particular the diagnostic choices;
- appropriately identify the most appropriate clinical and laboratory tests for tumors;
- diagnose the main neoplasms (differential diagnosis with non-neoplastic conditions) and to share therapeutic decisions;
- identify the main elements of the hematopoietic system
- identify the main disease affecting the lymphohematopoietic system
- manipulate, amplify and store eukaryotic cells
- evaluate the human karyotype using conventional and molecular cytogenetic methods
- understand the flow cytometry data in the haematological field
- isolate nucleic acids (DNA and RNA) and proteins for haematological tests

- qualitatively and quantitatively amplify nucleic acids
- evaluate the diagnostic and prognostic role of gene mutations in oncohaematology
- understand the data achieved from the use of both old and new generation sequencing

Applying knowledge and understanding
At the end of the integrated course of "MEDICAL ONCOLOGY AND BLOOD DISEASES" the student will be able to:

- use the knowledge acquired to evaluate the most appropriate methodological approach to obtain the results required for the correct diagnostic and prognostic classification of the hematological and oncological patients.
- apply and develop new methodologies useful in the disciplinary context
- carry out precise and documented observations and make a correct critical analysis of them in order to draw verifiable generalisations.
- discuss and resolve, in collaboration with Colleagues, problems that arise during work procedures and experimental protocols.
- use the knowledge acquired for the independent study of aspects relating to the specific field to which the student will dedicate himself as part of his professional activity

Therefore, the course aims to promote in the student the ability to carry out precise and documented observations and to carry out a correct critical analysis with the aim of drawing verifiable generalizations.

Communication skills
At the end of the integrated course of "MEDICAL ONCOLOGY AND BLOOD DISEASES" students must be able to adequately describe the disorders studied and the specific technologies applicable to them, demonstrating that they have learned an appropriate scientific language for the purposes of correct and rigorous communication, in an interdisciplinary mediation perspective.

Making judgements
At the end of the course, the student will be able to independently develop the logical procedures and methodological strategies that allow to obtain, analyze and correctly interpret the experimental data required in the hematology and oncology fields. This autonomy will have to be reflected not only in the scientific field, but also in the ethical/social field.

Learning ability:
At the end of the course, the student will have acquired skills and learning methods suitable for deepening and improving their skills within the topics studied, also by consulting the available scientific literature.

COURSE SYLLABUS

Syllabus MEDICAL ONCOLOGY (Professor Giorgetti Gian Marco)

- Role of the Microbiota in the pathogenesis of cancer
- Nutritional aspects in cancer patients
- The molecular basis of carcinogenesis
- Innate and mediated immunity in cancer

- The malignant tumor phenotype
- Genetic alterations underlying tumors
- Causes of tumors
- Prevention and cancer
- Definition and classification criteria
- General characteristics of benign tumors
- General characteristics of malignant tumors
- Differentiation, growth rate and invasion-metastasis
- Inflammation and cancer
- Hypertrophy - hyperplasia - atrophy - metaplasia - dysplasia
- Oncogenes - precancerous conditions
- Esophageal tumors (clinical picture - diagnosis - therapy - staging)
- Gastric tumors (clinical picture - diagnosis - therapy - staging)
- Complications of gastrectomy (dumping syndrome - impaired digestion of fat)
- Colorectal tumors
- Hereditary forms
- Clinical picture staging therapy
- Exocrine pancreas tumor (classification - diagnosis - therapy - staging)
- Endocrine pancreas tumor (classification - diagnosis - therapy)
- Lung tumors (classification diagnosis therapy on topics covered)
- Urinary tract tumors (classification diagnosis therapy)
- Lymphomas (classification diagnosis therapy)
- Liver and gallbladder tumors (classification diagnosis therapy)

Syllabus MEDICAL ONCOLOGY (Professor Giovanni Battista Grassi)

- General concepts of oncology
- Prevention in oncology
- Risk factors
- Breast neoplasms: anatomy, causes, symptoms, diagnosis, prognosis, prevention, therapy
- Thyroid neoplasms: anatomy, causes, symptoms, diagnosis, prognosis, prevention, therapy
- Gastrointestinal tract neoplasms (stomach and colorectal): anatomy, causes, symptoms, diagnosis, prognosis, prevention, therapy
- Urogenital neoplasms: anatomy, causes, symptoms, diagnosis, prognosis, prevention, therapy

Syllabus MEDICAL ONCOLOGY (Professor Fabiana Letizia Cecere)

- Epidemiology
- Carcinogenesis
- Risk factors
- Spreading
- Initial approach
- Prognosis
- Staging
- Therapy
- Lung neoplasms

- Laboratory abnormalities
- Tumor markers

Syllabus BLOOD DISEASES AND ONCOHEMATOLOGY (Professor Emiliano Fabiani)

- Bone marrow nice
- Haematopoietic stem cell
- Haematopoiesis
- Anemia
- Clonal haematopoiesis
- Myelodysplastic syndrome
- Acute myeloid leukaemia
- Acute lymphoblastic leukaemia
- Myeloproliferative disorders
- Chronic myeloid leukaemia
- Lymphoma
- Peripheral blood sampling and bone marrow aspirate
- Haematological cell culture technics
- Peripheral blood and bone marrow smear
- Isolation of mono and polymorphonuclear cells
- Stem cell isolation: culture, amplification and cryopreservation
- Cytofluorimetry
- Karyotype aberrations: conventional and molecular cytogenetics (FISH)
- Diagnostic and prognostic role of molecular biology in oncohaematology
- Extraction and storage of nucleic acids (DNA and RNA) for haematological tests
- Basic techniques in molecular biology: nucleic acids amplification
- Qualitative analysis (PCR and RT-PCR), diagnostic approach
- Minimal residual disease
- Qualitative analysis (PCR and RT-PCR), prognostic approach
- Gene mutations
- Sanger sequencing
- New generation sequencing and personalized medicine: applications, progress, costs and benefits

Syllabus DIAGNOSTIC IMAGING (Professor Federico Midiri)

- Physics of ionizing and non-ionizing radiation;
- Radiobiology: mechanisms of action of radiations on living matter (DNA effects and repair mechanisms, cell damage, radiosensitivity and effect on cellular cycle, repair and repopulation, response modifiers, oxygen effect);
- Contrast media: classification and characteristics; clinical applications; adverse reactions and

management;

- Functioning principles of diagnostic devices using ionizing radiations (conventional radiology and Computed Tomography);
- Ultrasound principles: physics and clinical applications;
- Physics of Magnetic Resonance;
- Vascular and interventional radiology equipment;
- Principles of nuclear medicine imaging;
- Notes on the main radiotherapy equipment;
- Main applications of diagnostic imaging with particular reference to oncology and blood diseases;

COURSE STRUCTURE

The integrated course of "MEDICAL ONCOLOGY AND BLOOD DISEASES" is divided into 110 hours of frontal and interactive lessons (50 hours of Medical Oncology, 50 hours of Blood Diseases and Onco-hematology and 10 hours of Diagnostic Imaging) carried out using teaching tools such as presentations organized in “Powerpoint” files with explanatory diagrams, graphs, illustrations and images designed to facilitate understanding of the topics covered.
The students' preparation and learning status will be continuously monitored during the lessons.
Journal club and clinical case discussion will be used to demonstrate the practical application of what has been learned.
Ongoing tests are planned to evaluate the level of understanding of the topics covered. Attendance is mandatory.

COURSE GRADE DETERMINATION

The examination includes a written and oral test of the entire teaching. The written consists of multiple-choice, single-answer questions on topics covered in class.
To enter the oral test, the student must have scored at least 18/30 in the written test.
In the oral tests of “Medical Oncology,” “Blood Diseases and Onco-Hematology,” and “Diagnostic Imaging,” the student is given the opportunity to demonstrate his or her preparation by discussing course topics, to reason about problems inherent to the topics covered in the lecture, demonstrating that he or she has acquired the ability to make connections and express himself or herself with adequate scientific language. The final grade will be the result of a weighted average between the outcome of the 3 modules, calculated in relation to the number of CFUs associated with each module (Medical Oncology 5 CFU, Blood Diseases and Oncohematology 5 CFU, and Imaging Diagnostics 1 CFU).

The result will be communicated to the student after the collegial judgment of the integrated course, determined according to the following criteria:

Ineligibility: major deficiencies and/or inaccuracy in knowledge and understanding of topics; limited ability to analyze and synthesize; frequent generalizations.
18-20: Barely sufficient knowledge and understanding of topics.
21-23: Fair knowledge and understanding of topics.
24-26: Good knowledge and understanding of topics.
27-29: Complete knowledge and understanding of topics.

30-30L: Excellent level of knowledge and understanding of topics.

READING MATERIALS

MEDICAL ONCOLOGY

- Chmielowski B., Territo M.C. Manual of Clinical Oncology. Ed: Lippincott Williams and Wilkins. ISBN 9781496349576
- Bianco, De Placido, Tortora & Conte, Core curriculum di Oncologia Clinica 2/ed Mc Graw Hill Education (Italy)
- Harrison, Principi di Medicina Interna, Ed CEA 2016- capitoli dedicati alle malattie neoplastiche
- The slides and the articles shown during the course will be made available to the student and will constitute the reading material for the course of Medical Oncology

MALATTIE DEL SANGUE E ONCOEMATOLOGIA/ BLOOD DISEASES, ONCOHEMATOLOGY

- Hematology: pathophysiology, diagnosis and treatment. Sante Tura, Michele Cavo e Pier Luigi Zinzani. Casa editrice Esculapio.
- Corso di Malattie del Sangue e degli Organi Emolinfopoietici. Sante Tura, Michele Cavo e Pier Luigi Zinzani. Società editrice Esculapio.
- The slides shown during the course will be made available to the student and will constitute the reading material for the haematological diagnostic techniques.

DIAGNOSTICA PER IMMAGINI/DIAGNOSTIC IMAGING

- Diagnostica per immagini e radioterapia di Cittadini Giorgio - Cittadini Giuseppe - Sardanelli Francesco Editore: EDRA – MASSON Edizione: VII 2015 Pagine: 1150 ISBN: 8821440001 ISBN-13: 9788821440007 Data pubblicazione: 2015
- The slides and the articles shown during the course will be made available to the student and will constitute the reading material for the course of Diagnostic Imaging