JAGIELLONIAN UNIVERSITY MEDICAL COLLEGE

Nuclear Medicine

Educational subject description sheet

Basic information

Department Faculty of Medicine	**Didactic cycle** 2016/17
Field of study Medical Program	**Realization year** 2019/20
Study level long-cycle master's degree program	**Lecture languages** English
Study form full-time	**Block** obligatory for passing in the course of studies
Education profile general academic	**Mandatory** obligatory
Disciplines Medical science	**Examination** graded credit
	Standard group E. Clinical non-procedural medical disciplines

Subject coordinator	Małgorzata Trofimiuk-Müldner
Lecturer	Małgorzata Kieć-Klimczak, Anna Sowa-Staszczak

Periods Semester 7, Semester 8	**Examination** graded credit **Activities and hours** seminar: 12	**Number of ECTS points** 1.0

Goals

C1	Introduction to nuclear medicine imaging techniques (planar imaging, SPECT, SPECT/CT, PET/CT). Understanding the indication and contraindications to radionuclide imaging, and the role of such imaging in clinical practice. The introduction to radionuclide therapy, including the most common indications, side effects and efficacy. Introduction to radiation protection.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	methods of diagnostic and therapeutic procedures appropriate for specific disease states	O.W3	test
W2	the causes, symptoms, principles of diagnosis and therapeutic management of the most common internal diseases and their complications in adults: 1) cardiovascular diseases, including ischemic heart disease, heart defects, endocarditis, myocardial infarction, pericardial infarction, heart failure (acute and chronic), diseases of arteries and venous vessels, arterial hypertension - primary and secondary, pulmonary hypertension, 2) respiratory system diseases, including respiratory tract diseases, chronic obstructive pulmonary disease, bronchial asthma, bronchial dilatation, cystic fibrosis, respiratory infections, interstitial diseases of the lungs, pleura, mediastinum, obstructive and central sleep apnea, respiratory failure (acute and chronic), respiratory tumors, 3) diseases of the digestive system, including diseases of the mouth, esophagus, stomach and duodenum, intestines, pancreas, liver, bile ducts and gallbladder, 4) diseases of the internal secretion system, including diseases of the hypothalamus and pituitary gland, thyroidism, parathyroidism, adrenal cortex and medulla, ovaries and testicles, and neuroendocrine tumors, polyglandular syndromes, various types of diabetes and metabolic syndrome – hypoglycaemia, obesity, dyslipidemia, 5) diseases of the kidneys and the urinary tract, including acute and chronic renal failure, glomerulonephrine and interstitial kidney diseases, kidney cysts, kidney stones, urinary tract infections, urinary tract neoplasms, in particular of bladder and kidney neoplasms, 6) hematopoietic diseases, including bone marrow aplasia, anemia, granulocytopenia and agranulocytosis, thrombocytopenia, acute leukemia, myeloproliferative and myelodysplastic-myeloproliferative tumours, myelodysplastic syndromes, mature B and T lymphocytes tumors, bleeding diatheses, thrombophilia, life-threatening conditions in hematology, blood disorders in other organ diseases, 7) rheumatic diseases, including systemic connective tissue diseases, systemic vasculitis, joint inflammations involving spinal cord, metabolic bone diseases, osteoporosis and osteoarthritis in particular, gout, 8) allergic diseases, including anaphylaxis and anaphylactic shock and angioedema, 9) water-electrolyte and acid-base disorders: dehydration conditions, overhydration conditions, electrolyte, acidic and alkaline disorders	E.W7	test

W3	causes, symptoms, principles of diagnosis and therapeutic management in the most common diseases of the nervous system, including: 1) headaches: migraines, tension headaches and headache syndromes and neuralgia of the nerve V, 2) cerebral vascular diseases, in particular stroke, 3) epilepsy, 4) infections of the nervous system, in particular meningitis, borreliosis, herpetic encephalitis, neurotransmission diseases, 5) dementia, in particular: Alzheimer's disease, frontal dementia, vascular dementia and other dementia syndromes, 6) basal ganglia diseases, Parkinson's disease in particular, 7) demyelinating diseases, multiple sclerosis in particular, 8) diseases of the neuromuscular system, lateral atrophic sclerosis and sciatic neuralgia in particular, 9) craniocerebral injuries, cerebral palsy in particular	E.W14	test
W4	possibilities of modern neoplastic therapy, including multimodal therapy, perspectives of cellular and gene therapies and their adverse effects	E.W25	test
W5	principles of combination therapies in oncology, algorithms of diagnostic and therapeutic procedures in the most common human cancers	E.W26	test
W6	principles of diagnosis and therapeutic management in the most common problems of palliative medicine, including 1) symptomatic treatment of the most common somatic symptoms, 2) cachexia management and the prevention and treatment of bedsores, 3) the most common emergencies in palliative medicine	E.W27	test
W7	principles for the treatment of pain, including cancer and chronic pain	E.W29	test
W8	development, structure and functions of the human body in normal and pathological conditions	O.W1	test
W9	principles for palliative treatment of terminal patient	E.W28	test
Skills – Student can:			
U1	plan the diagnostic procedure and interpret its results	O.U3	test
U2	plan diagnostic, therapeutic and prophylactic procedures	E.U16	test
U3	define the concepts of nuclear medicine, radiopharmacy and radioimmunology	E.U44	test
U4	describe the physical processes that are the basis for radiopharmaceutical imaging	E.U45	test
U5	list radiopharmaceuticals used for scintigraphic diagnostics and PET, indicate indications for various types of diagnostic tests and the principles of interpretation of the obtained images	E.U46	test
U6	list the radioactive isotopes used for nuclear medicine therapies and justify their selection, as well as the basic isotope therapies, the indications for radionuclide therapy, how to assess the effectiveness of the therapy, the possible complications following the therapy	E.U47	test

U7	identify ways in which the ALARA radiological protection principle can be implemented in practice with regard to nuclear medicine	E.U48	test
U8	identify medical problems and prioritize medical management	O.U1	test
U9	implement appropriate and safe therapeutic treatment and predict its effects	O.U4	test
U10	plan own learning activities and constantly learn in order to update own knowledge	O.U5	test
U11	inspire the learning process of others	O.U6	test
U12	communicate with the patient and his family in an atmosphere of trust, taking into account the needs of the patient	O.U7	test
U13	communicate and share knowledge with colleagues in a team	O.U8	test
U14	critically evaluate the results of scientific research and adequately justify the position	O.U9	test
U15	carry out a medical history with an adult patient	E.U1	test
U16	conduct a full and targeted physical examination of an adult patient	E.U3	test
U17	maintain patient's medical records	E.U38	test
Social competences – Student is ready to:			
K1	respect medical confidentiality and patients' rights	O.K3	test
K2	formulate conclusions from own measurements or observations	O.K8	test
K3	use objective sources of information	O.K7	test
K4	to establish and maintain deep and respectful contact with patients and to show understanding for differences in world views and cultures	O.K1	test
K5	to be guided by the well-being of a patient	O.K2	test
K6	take actions towards the patient on the basis of ethical norms and principles, with an awareness of the social determinants and limitations of the disease	O.K4	test
K7	perceive and recognize own limitations and self-assessing educational deficits and needs	O.K5	test
K8	implement the principles of professional camaraderie and cooperation in a team of specialists, including representatives of other medical professions, also in a multicultural and multinational environment	O.K9	test
K9	assume responsibility for decisions taken in the course of their professional activities, including in terms of the safety of oneself and others	O.K11	test
K10	promote health-promoting behaviors	O.K6	test
K11	formulate opinions on the various aspects of the professional activity	O.K10	test

Calculation of ECTS points

Activity form	Activity hours*
seminar	12
preparation for classes	5
preparation for examination	5
case analysis	5

Student workload	**Hours** 27
Workload involving teacher	**Hours** 12
Practical workload	**Hours** 5

* hour means 45 minutes

Study content

No.	Course content	Subject's learning outcomes	Activities
1.	Principles of nuclear medicine 1: definition of nuclear medicine; ionizing radiation, types of radiation, radioisotopes for diagnostics and treatment, production of isotopes, radiotracers/radiopharmaceuticals.	W1, W2, W3, W4, W5, W6, W7, W8, W9, U1, U10, U11, U12, U13, U14, U15, U16, U17, U2, U3, U4, U5, U6, U7, U8, U9, K1, K10, K11, K2, K3, K4, K5, K6, K7, K8, K9	seminar
2.	Principles of nuclear medicine 2: imaging principles – scintigraphy including SPECT, PET, hybrid systems SPECT/CT, PET/CT, PET/MRI.	W2, W3, W4, W5	seminar
3.	Principles of nuclear medicine 3: radiation protection.	W3, W4, W5	seminar
4.	Neuroendocrine neoplasms (NEN): role of nuclear medicine in diagnostics and therapy (PRRT).	W1, W5	seminar
5.	Nuclear imaging of bones (bone scintigraphy, NaF PET/CT). Therapy of bone metastases. Radionuclide synovectomy.	W1	seminar
6.	Central nervous system imaging (dementia, degenerative movement disorders (Parkinson’s disease and Parkinsonian syndromes), epilepsy).	W1	seminar
7.	Nuclear cardiology (myocardial perfusion imaging – SPECT, PET; myocardial viability imaging).	W1, W2	seminar
8.	Thyroid cancer: from diagnosis to therapy and follow up.* (90 minutes)	W1, W5	seminar
9.	Immunoscintigraphy: research and implementation.	W1	seminar
10.	PET-CT in oncology.	W1, W4	seminar

11.	Parathyroid imaging: SPECT and PET.	W1	seminar
12.	Benign thyroid diseases and nuclear medicine (diagnostics and therapy).	W1	seminar
13.	Urogenital system imaging (focus on kidney scintigraphy and PET in prostate cancer). Imaging of liver haemangiomas.	W1, W5, W7	seminar

Course advanced

Teaching methods:

case study, brainstorm, classes / practicals, clinical classes, demonstration, discussion, case study method, group work, lecture with multimedia presentation, practical classes

Activities	Examination methods	Credit conditions
seminar	test	Test at the end of classes Attendance - 80% of classes Test - minimum 60% of positive answers

Entry requirements

Literature

Obligatory

1. Lecture materials Nuclear Medicine ed. Fred Mettler – supplementary reading

Optional

1. Guidelines of EANM

Standard effects

Code	Content
E.U1	carry out a medical history with an adult patient
E.U3	conduct a full and targeted physical examination of an adult patient
E.U16	plan diagnostic, therapeutic and prophylactic procedures
E.U38	maintain patient's medical records
E.U44	define the concepts of nuclear medicine, radiopharmacy and radioimmunology
E.U45	describe the physical processes that are the basis for radiopharmaceutical imaging
E.U46	list radiopharmaceuticals used for scintigraphic diagnostics and PET, indicate indications for various types of diagnostic tests and the principles of interpretation of the obtained images
E.U47	list the radioactive isotopes used for nuclear medicine therapies and justify their selection, as well as the basic isotope therapies, the indications for radionuclide therapy, how to assess the effectiveness of the therapy, the possible complications following the therapy
E.U48	identify ways in which the ALARA radiological protection principle can be implemented in practice with regard to nuclear medicine
E.W7	the causes, symptoms, principles of diagnosis and therapeutic management of the most common internal diseases and their complications in adults: 1) cardiovascular diseases, including ischemic heart disease, heart defects, endocarditis, myocardial infarction, pericardial infarction, heart failure (acute and chronic), diseases of arteries and venous vessels, arterial hypertension - primary and secondary, pulmonary hypertension, 2) respiratory system diseases, including respiratory tract diseases, chronic obstructive pulmonary disease, bronchial asthma, bronchial dilatation, cystic fibrosis, respiratory infections, interstitial diseases of the lungs, pleura, mediastinum, obstructive and central sleep apnea, respiratory failure (acute and chronic), respiratory tumors, 3) diseases of the digestive system, including diseases of the mouth, esophagus, stomach and duodenum, intestines, pancreas, liver, bile ducts and gallbladder, 4) diseases of the internal secretion system, including diseases of the hypothalamus and pituitary gland, thyroidism, parathyroidism, adrenal cortex and medulla, ovaries and testicles, and neuroendocrine tumors, polyglandular syndromes, various types of diabetes and metabolic syndrome – hypoglycaemia, obesity, dyslipidemia, 5) diseases of the kidneys and the urinary tract, including acute and chronic renal failure, glomerulonephrine and interstitial kidney diseases, kidney cysts, kidney stones, urinary tract infections, urinary tract neoplasms, in particular of bladder and kidney neoplasms, 6) hematopoietic diseases, including bone marrow aplasia, anemia, granulocytopenia and agranulocytosis, thrombocytopenia, acute leukemia, myeloproliferative and myelodysplastic-myeloproliferative tumours, myelodysplastic syndromes, mature B and T lymphocytes tumors, bleeding diatheses, thrombophilia, life-threatening conditions in hematology, blood disorders in other organ diseases, 7) rheumatic diseases, including systemic connective tissue diseases, systemic vasculitis, joint inflammations involving spinal cord, metabolic bone diseases, osteoporosis and osteoarthritis in particular, gout, 8) allergic diseases, including anaphylaxis and anaphylactic shock and angioedema, 9) water-electrolyte and acid-base disorders: dehydration conditions, overhydration conditions, electrolyte, acidic and alkaline disorders
E.W14	causes, symptoms, principles of diagnosis and therapeutic management in the most common diseases of the nervous system, including: 1) headaches: migraines, tension headaches and headache syndromes and neuralgia of the nerve V, 2) cerebral vascular diseases, in particular stroke, 3) epilepsy, 4) infections of the nervous system, in particular meningitis, borreliosis, herpetic encephalitis, neurotransmission diseases, 5) dementia, in particular: Alzheimer's disease, frontal dementia, vascular dementia and other dementia syndromes, 6) basal ganglia diseases, Parkinson's disease in particular, 7) demyelinating diseases, multiple sclerosis in particular, 8) diseases of the neuromuscular system, lateral atrophic sclerosis and sciatic neuralgia in particular, 9) craniocerebral injuries, cerebral palsy in particular
E.W25	possibilities of modern neoplastic therapy, including multimodal therapy, perspectives of cellular and gene therapies and their adverse effects
E.W26	principles of combination therapies in oncology, algorithms of diagnostic and therapeutic procedures in the most common human cancers
E.W27	principles of diagnosis and therapeutic management in the most common problems of palliative medicine, including 1) symptomatic treatment of the most common somatic symptoms, 2) cachexia management and the prevention and treatment of bedsores, 3) the most common emergencies in palliative medicine

Code	Content
E.W28	principles for palliative treatment of terminal patient
E.W29	principles for the treatment of pain, including cancer and chronic pain
O.K1	to establish and maintain deep and respectful contact with patients and to show understanding for differences in world views and cultures
O.K2	to be guided by the well-being of a patient
O.K3	respect medical confidentiality and patients' rights
O.K4	take actions towards the patient on the basis of ethical norms and principles, with an awareness of the social determinants and limitations of the disease
O.K5	perceive and recognize own limitations and self-assessing educational deficits and needs
O.K6	promote health-promoting behaviors
O.K7	use objective sources of information
O.K8	formulate conclusions from own measurements or observations
O.K9	implement the principles of professional camaraderie and cooperation in a team of specialists, including representatives of other medical professions, also in a multicultural and multinational environment
O.K10	formulate opinions on the various aspects of the professional activity
O.K11	assume responsibility for decisions taken in the course of their professional activities, including in terms of the safety of oneself and others
O.U1	identify medical problems and prioritize medical management
O.U3	plan the diagnostic procedure and interpret its results
O.U4	implement appropriate and safe therapeutic treatment and predict its effects
O.U5	plan own learning activities and constantly learn in order to update own knowledge
O.U6	inspire the learning process of others
O.U7	communicate with the patient and his family in an atmosphere of trust, taking into account the needs of the patient
O.U8	communicate and share knowledge with colleagues in a team
O.U9	critically evaluate the results of scientific research and adequately justify the position
O.W1	development, structure and functions of the human body in normal and pathological conditions
O.W3	methods of diagnostic and therapeutic procedures appropriate for specific disease states