

Module title:	Advanced imaging techniques	ECTS	2
Polish translation:	Nowoczesne techniki obrazowania		
Course:	Veterinary Medicine		

Module language: English		Stage: JM-FVM	
Form of studies: <input checked="" type="checkbox"/> intramural <input type="checkbox"/> extramural	Type of module: <input type="checkbox"/> basic <input checked="" type="checkbox"/> directional <input checked="" type="checkbox"/> mandatory <input type="checkbox"/> elective	Semester: 8	<input type="checkbox"/> winter semester <input checked="" type="checkbox"/> summer semester
Academic year:		Intake 2022/2023	Catalogue number: FMV-V-JMSS-08S-D50_22

Module coordinator:	Prof. Zdzisław Gajewski Dr Sc., PhD, DVM; Maria Sady, PhD, DVM			
Teachers responsible for the module:	Academic teachers of Center for Translational Medicine (CMT), PhD students, visiting professors and other specialists in the field of study.			
Assumptions, Goals, and Course Description	<p>The aim of the course is to familiarise students with modern imaging techniques that provide veterinarians with a wide range of tools that significantly expand diagnostic capabilities in clinical practice — both in companion, farm, and laboratory animals.</p> <p>One of the key assumptions of the course is to raise students' awareness of differences in the quantity and quality of data obtained using advanced imaging methods such as computed tomography, magnetic resonance imaging, and positron emission tomography, compared to classical radiography and ultrasonography. Students are also prepared to make informed and accurate decisions when selecting the most appropriate technique from a wide range of available methods, taking into account their clinical and scientific applications. This goal is achieved through active participation in imaging examinations performed using latest-generation equipment. Unique opportunities in this field — the only ones of this kind in Poland — are provided by the Centre for Translational Medicine of SGGW in Warsaw, equipped, among others, with CT, MRI, DWI MRI, MRI-FUS, PET-MR, as well as a top-class angiography system and ultrasonography units.</p>			
Teaching forms, number of hours:	<p>a) Lectures; hours 8; b) Clinical laboratories; hours 22;</p>			
Teaching methods:	<p>Lectures: original informative and problem-based lectures supported by multimedia presentations Clinical exercises: prelections combined with discussion, preparation and conduct of imaging tests using modern equipment like CT, MRI, PET-MR, angiography, endoscopy, ultrasound; clinical case-based presentations and discussion; analysis of results; supplementary materials. Detailed schedule will be defined by the coordinator of the course at the beginning of semester. Detailed organization of consultations will be defined by the coordinator of the course at the beginning of semester.</p>			
Formal prerequisites and initial requirements:	Passing the courses: Animal anatomy, Animal physiology, Biophysics, Biochemistry, Veterinary pharmacology, Pathomorphology.			
Learning effects	Course outcomes:	Learning outcomes relative to the course outcomes	Impact on the course outcomes*	
Knowledge:	1	Student knows the physical interactions used in modern imaging methods.	B.W.4, B.W.6	3
	2	Student knows the principles of preparing the patient for imaging under general anesthesia.	B.W.4, B.W.5	3
	3	Student knows the safety rules and procedures during the CT examination including the use of contrast media.	B.W.4, B.W.6	3
	4	Student knows the safety rules and procedures during the MRI examination including the use of contrast media.	B.W.4, B.W.6	3
	5	Student knows the rules and safety procedures during the PET / MR examination including the use of contrast media and radioactive isotopes.	B.W.4, B.W.6	2
	6	Student knows the rules and safety procedures during angiographic, endoscopic and ultrasound examinations.	B.W.4, B.W.6	2
Skills:	1	Student can conduct an interview and a clinical trial aimed at selecting or excluding the use of modern imaging techniques.	B.U.1, B.U.2, B.U.3	3
	2	Student can choose a modern imaging technique for the clinical situation.	A.U.1, B.U.7, C.U.3	3
	3	Student can prepare the patient for CT, MRI, PET / MR examination.	A.U.1, B.U.1, B.U.7, B.U.11	2
	4	Student can assess the basic results of CT, MRI, PET / MR examination.	A.U.1, B.U.7, C.U.3	2
	5	Student can use scientific sources in assessing the results of an imaging study.	A.U.1, A.U.21, B.U.7, C.U.3	2

Competences:	1	Student is ready to choose a modern imaging technique based on specialist knowledge.	KS.1, KS.2, KS.5	3
	2	Student is aware of their knowledge and benefits of using modern imaging techniques.	KS.1, KS.2, KS.4, KS.5	2
	3	Student is aware of the need for continuing education and is ready to deepen knowledge using scientific sources.	KS.4, KS.8	2
	4	Student acquires competence in cooperation with a radiologist in the selection and evaluation of the results of modern imaging tests.	KS.3, KS.5, KS.6, KS.7, KS.9	3
Objectives of the module required to obtain learning effects:	<p>The lecture content provides the theoretical basis for understanding and recognising contemporary imaging methods, taking into account their physical foundations and the operating principles of selected techniques (computed tomography, magnetic resonance imaging, positron emission tomography, hybrid methods). The main objective of the clinically oriented practical classes is to prepare students for the practical performance of examinations and the interpretation of the obtained results using state-of-the-art diagnostic imaging equipment.</p> <p>Lectures: Physical principles, safety rules, examination methodology, and clinical applications of modern imaging techniques — a comparative overview. Computed tomography (CT) imaging — fundamentals and clinical applications. Magnetic resonance imaging (MRI) — fundamentals and clinical applications. Imaging and therapy using Magnetic Resonance-guided Focused Ultrasound (MRg-FUS). Hybrid methods — Positron Emission Tomography combined with Magnetic Resonance Imaging (PET-MR), PET-CT, SPECT-CT. Digital systems for angiographic examinations — imaging principles and clinical applications. Imaging using modern endoscopic techniques (3D endoscopy, cystoscopy) and ultrasonographic techniques (3D ultrasonography, elastography) — principles and clinical applications.</p> <p>Clinical laboratories: Preparation, performance, and interpretation of computed tomography (CT) examinations. Discussion of patient preparation, examination procedures, and analysis of obtained images. Preparation, performance, and interpretation of magnetic resonance imaging (MRI) examinations. Practical familiarisation with MRI techniques, safety principles, sequence protocols, and data acquisition techniques. Preparation and interpretation of results from positron emission tomography combined with magnetic resonance imaging (PET-MR) and other hybrid methods. Discussion of the specifics of methods combining structural and functional imaging. Preparation, performance, and interpretation of examinations using modern ultrasonographic and endoscopic techniques, as well as digital systems for intraoperative imaging (CT, angiography). Practical interpretation of clinical material from various diagnostic methods. Comparison of clinical applications of selected imaging techniques — indications, contraindications, and the role of contrast agents and radiopharmaceuticals. Analysis of the selection of appropriate imaging methods depending on the clinical case.</p>			
Assessment methods:	<p>Entrance tests, Written exam.</p> <p>In case of unforeseen, unusual circumstances mandatory remote teaching and remote assessment methods might be adopted.</p>			
Detail description of assessment methods; Formal documentation of learning outcome:	<p>During classes, a written test (so-called "entrance test") in the form of a short open questions may be performed to check the student's preparation for the topic of the classes. The results of these tests will be a part of the final grade. Unexcused absence at classes results in 0 points from the entrance test.</p> <p>A minimum of 51% of the entrance tests are required to complete the exercises and take the exam.</p> <p>If a student does not obtain the required number of points from the entrance tests, he/she is obliged to take the exit test covering the whole material of the classes. A student who has not obtained the specified minimum number of points from the exit tests is not allowed to take the exam and does not receive credit for the course.</p> <p>The final exam covers all the learning content of the course (classes and lectures). Written exam in the form of a mixed test (open questions and/or fill-in and/or single/multiple choice). Minimum pass mark is 51%.</p> <p>Term I and Term II of exams take place in the same format.</p> <p>In the case of a top-down suspension of the realization of classes at the University and the need for remote/hybrid teaching, other forms of verification of learning outcomes are permitted in a manner adequate to the situation.</p> <p>No extra assessment methods are anticipated.</p> <p>Record into the eHMS system and documentation contained in the 'Course File' (i.e. individual student assessment cards, attendance lists, database of questions for written forms, students' essays)</p>			
Elements impelling final grade:	<p>A student who has not obtained a minimum acceptable number of points from the evaluation of short written (so-called entrance) does not obtain credit for the course.</p> <p>The final course grade is influenced by the following elements:</p> <ul style="list-style-type: none"> - the short written tests - final written exam 			
Teaching base:	Classrooms, lecture halls, laboratories of CMT and FVM			
Mandatory and supportive materials :	<ol style="list-style-type: none"> 1. „Textbook of Veterinary Diagnostic Radiology”, D. E. Thrall, Elsevier, 2018. 2. „Veterinary Computed Tomography”, T. Schwarz, J. Saunders J. Wiley-Blackwell, 2011. 3. „Atlas of Small Animal CT and MRI”, E. Wisner, A. Zwingenberger, Wiley-Blackwell, 2015. 4. „Diagnostic MRI in dogs and cats”, W. Mai, CRC Press, 2018. 5. „Handbook of Small Animal MRI”, I. Elliott, G. Skerritt , Wiley-Blackwell, 2010. 6. „Atlas of Small Animal Ultrasonography”, D. Penninck , M.-A. D'anjou, Wiley Blackwell, 2015. 			

7. „Diagnostic Radiology and Ultrasonography of the dog and cat“, H. McAllister , J. K. Kealy , J. P. Graham, Elsevier Saunders 2010.

Relevant scientific publications including those of the module coordinator.

ADNOTATIONS

Protective clothing is required during clinical classes.

* 3 – complete and detailed, 2 – moderate, 1 – basic.

Quantitative summary of the module:

Estimated number of work hours per student (contact and self-study) essential to achieve presumed learning outcomes of the module - base for quantifying ECTS:	60 h
Total ECTS points, accumulated by students during contact learning:	2 ECTS