

# Diagnostic Imaging

**(3 CFU; 45 hours: 32 frontal lessons and 13 labs)**

**Learning Outcomes:** the student will have to understand the operating principles of ultrasound imaging instrumentation, application of Doppler and contrast media . The student will have to obtain a method of analysis and interpretation of ultrasound images , recognize the signs related to diseases of various organs and systems , and finally make a list of differential diagnosis.

## Lessons

Target skills and knowledge acquired	Topics	Course unit contents	
<p style="text-align: center;"><b>1. ULTRASOUND TECHNIQUE:</b> <b>(TOT.5 HOURS)</b></p> <p><i>[acquisition of : knowledge of the operation of instrument , the capability to adjust the main display parameters]</i></p>	<b>2D Ultrasound</b>	Settings tools, characteristics of probes dedicated to internal medicine and cardiology applications, spontaneous artifacts and artifacts from incorrect adjustment; data storage; reporting .	
	<b>Doppler Effect</b>	Physical principles of the Doppler effect , detection mode (pulsed, continuous, Color, Power, tissue Doppler) and representation of the Doppler effect; Flowchart; Fields of application of cardiac, vascular , internal medicine.	
		spontaneous artifacts and artifacts from incorrect adjustment.	
	<b>Interventional ultrasound</b>	Interventional technique of drainage , ultrasound-guided needle aspiration and biopsy.	
		Cystocentesis and needle biopsies of abdominal parenchymal organs.	
<b>Contrast media</b>	Features of contrast media and applications in diseases of pets.		
<p style="text-align: center;"><b>2. THORAX</b> <b>(TOT.8 HOURS)</b></p> <p><i>[acquisition of : a) ability to identify sonographic signs of major intrathoracic diseases b ) ability to make a list of differential diagnosis]</i></p>	<b>Chest wall, pleura, lungs and mediastinum</b>	Normal appearance of the pleura and lung ; pleural effusions ; pleurocentesis ; inflammatory lung diseases and neoplastic disease.	
		Mediastinal effusion, lymphadenomegaly and mediastinal masses.	
	<b>Heart</b>	Parasternal scans from right and left chest and retrosternal scan . M -mode representation . Evaluation of the morphology of the heart chambers and valves ; indices of cardiac function; left atrium/aorta ratio ; reliefs of transvalvular flow with Pw and colorDoppler.	
2D Aspects , M -mode , Pw , Cw and colorDoppler aspects of the major congenital and acquired disease.			
<p style="text-align: center;"><b>3. ABDOMEN</b> <b>(TOT.15 HOURS)</b></p> <p><i>[acquisition of : a) ability to identify sonographic sings of major abdominal diseases ; b ) ability to make a list of differential diagnosis]</i></p>	<b>Peritoneal space</b>	Features of peritoneal effusions, paracentesis .	
	<b>Liver and gallbladder</b>	Morphological characteristics , focal and diffuse disease, caval and portal flow assessment; morphological characteristics and main pathological features of the gallbladder.	

	<i>Kidneys, ureters, bladder and urethra</i>	Morphological characteristics , Doppler vascularity; focal and diffuse kidney disease .	
		Focal and diffuse bladder disorders ; cystocentesis.	
	<i>Adrenal glands</i>	Morphological characteristics , retrieval technique , measurement ; focal and diffuse morphological alterations .	
	<i>Stomach and intestines</i>	Morphological characteristics, retrieval technique; focal and diffuse abnormalities of the stomach, pylorus, duodenum, jejunum, ileum, colon, caecum .	
	<i>Spleen and lymph nodes</i>	Morphological characteristics, retrieval technique; focal and diffuse splenopathy; focal and diffuse abnormalities of the lymph nodes.	
	<i>Male and Female reproductive tract</i>	Morphological characteristics and pathological features of the female reproductive tract.	
Morphological characteristics and pathological features of the male reproductive tract.			
<b>4. SUPERFICIAL PARTS</b> <b>(TOT.4 HOURS)</b> <i>[ acquisition of : a) ability to identify sonographic findings related to major diseases of superficial organs ; b ) ability to make a list of differential diagnosis ]</i>		Morphological characteristics , retrieval technique of the salivary glands , thyroid gland , parathyroid glands and great vessels.	
		Morphological characteristics , retrieval technique of superficial lymph nodes.	
		Notes on the ultrasound evaluation of the eye .	
		Notes on the ultrasound evaluation of the tendons and joints .	
<b>Practical exercises (individual work) with n° 2 sonographic instruments or with video projection (collective work in classroom)</b>			

Target skills and knowledge acquired	Topics	Course unit contents	Hours
<p><b>5. ABILITY TO PERFORM, ANALYZE, SYNTHESIZE, AND EVALUATE (TOT. 13 HOURS)</b>  <i>[acquisition of : a) ability to perform ultrasound scans of the major abdominal parenchymal organs ; b ) ability to understand ultrasound study ; c ) the ability to make an ultrasound report ; d ) ability to propose a diagnostic protocol]</i></p>	<i>Abdomen</i>	Ultrasound examination of hospitalized patients and relevant to abdominal diseases.	3
		Ultrasound studies derived from the archive and relevant to abdominal diseases.	2
	<i>Thorax</i>	Ultrasound examination of hospitalized patients and relevant to thoracic diseases.	2
		Ultrasound studies derived from the archive and relevant to intrathoracic diseases.	2
	<i>Superficial parts</i>	Ultrasound examination of hospitalized patients and relevant to superficial organs diseases.	2
		Ultrasound studies derived from the archive and relevant to superficial organs diseases.	2

# Veterinary Radiology and Nuclear Medicine

(2 CFU; 30 hours: 20 frontal lessons and 10 labs)

**Learning Outcomes :** the student will have to acquire a method of analysis and interpretation of radiographic images , recognize the signs related to diseases of various organs and systems and finally make a list of differential diagnosis . The student will learn the operating principles and clinical applications of the most important advanced imaging techniques such as computed tomography , nuclear magnetic resonance and scintigraphy .

## Lessons

Target skills and knowledge acquired	Topics	Course unit contents	
<p><b>1. RADIOGRAPHIC TECHNIQUE: (TOT.3 HOURS)</b> [ knowledge about the instruments of traditional and digital radiology , image intensifiers , computed tomography , magnetic resonance imaging , scintigraphy and radiological protection ]</p>	<i>Traditional and digital radiology</i>	Features tools, analog and digital detection systems (CR and DR), setting exposure data, qualitative assessment of radiograms.	
	<i>Image intensifiers</i>	Notes on operation and main diagnostic applications.	
	<i>Computed tomography, NMR and scintigraphy</i>	Principles of operation , image formation , generations of instrument .	
		Main fields of application : skeletal diseases , neurological diseases , mediastinal and lung disease, abdominal diseases.	
	<i>Radiological protection</i>	Deterministic and stochastic effects of ionizing radiation, devices and rules of radiological protection.	
<p><b>2. THORAX (TOT.7 HOURS)</b> [ acquisition of : a) ability to identify radiographic signs of major intrathoracic diseases ; b ) ability to produce a list of differential diagnosis ]</p>	<i>Lungs , pleura , trachea and esophagus</i>	Radiographic technique ; identification and evaluation of the upper and lower airway ; pulmonary pattern ; main pathologies in small animals and horses ; pleural effusion , pneumothorax ; congenital and acquired abnormalities of the trachea ; hypoplasia , laxity and tracheal collapse .	
		Congenital and acquired abnormalities , motor dysfunction , segmental and total megaesophagus ; stenosis , foreign bodies .	
	<i>Heart and mediastinum , and diaphragm</i>	Topography , shape and size of the heart , major congenital and acquired diseases, pericardial effusion , pericardial - peritoneal hernia.	
		Mediastinal structures , mediastinal shift , pneumomediastinum , mediastinal masses , mediastinal effusions ; diaphragmatic hernias , hemiparesis and paralysis.	
<p><b>3.ABDOMEN (TOT.HOURS)</b> [ acquisition of : a) ability to identify radiographic signs of major diseases of the abdominal</p>	<i>Peritoneal space , stomach and intestines</i>	Contrastographic technique with opaque contrast media , peritoneal effusions , pneumoperitoneum . Gastric dilatation / torsion ; foreign bodies ; ulcers ; mechanical ileus and functional ileus, intussusception.	

organs ; b ) ability to produce a list of differential diagnosis ]	<b>Liver , spleen , pancreas , adrenal glands , and lymph nodes</b>	Variations in shape and dimensions , masses , splenic torsion ; pancreatitis , calcification and adrenal masses , abdominal masses.	
	<b>Kidneys , ureters , bladder and urethra , genitals.</b>	Excretory urography and main pathological features, X-ray contrast of the ureter, pneumocystography , nephrolithiasis , bladder lithiasis, urethrography , vaginocystourethography.	
<b>4. SKELETON (TOT.4 HOURS)</b> [ acquisition of : a) ability to identify radiographic signs related to major skeletal diseases ; b ) ability to produce a list of differential diagnosis ]		Axial and appendicular skeleton: congenital diseases and growth diseases, nutritional and metabolic diseases ; diseases of unknown origin ; degenerative joint diseases , inflammatory and neoplastic diseases ; fractures ; Aggressive and non-aggressive bone lesions in small animals and horses .	
		Myelography ; main myelographic pathological features.	

<b>Practical exercises to diaphanoscope (working in small groups of 2-3 students ) or video projection (collective work in classroom )</b>			
<b>Target skills and knowledge acquired</b>	<b>Topics</b>	<b>Course unit contents</b>	<b>Hours</b>
<p><b>5. ABILITY TO ANALYZE, SYNTHESIZE AND EVALUATE (TOT. 10 HOURS)</b>  [ acquisition of : a) ability to interpret radiographic study ; b ) the ability to make a report ; c ) ability to propose a diagnostic protocol ]</p>	<i>Thorax</i>	Radiographic studies derived from the clinical activity and relevant to intrathoracic diseases.	2
		Radiographic studies derived from the archive and relevant to intrathoracic diseases.	2
	<i>Abdomen</i>	Radiographic studies derived from the clinical activity and relevant to abdominal diseases.	1
		Radiographic studies derived from the archive and relevant to abdominal diseases.	2
	<i>Skeleton</i>	Radiographic studies derived from the clinical activity and relevant to skeleton diseases.	1
		Radiographic studies derived from the archive and relevant to skeleton diseases.	2