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SEMIOLOGY

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SEMIOLGY

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1. BASIC SEMIOLOGY CATEGORIES

SEMIOLOGY (grec. semeion = sign, symptom) is the science that studies signs/symptoms of a disease, but also the techniques used to emphasize these signs/symptoms.

A symptom once revealed is named, characterized and interpreted through semiology (e.g.: named - cough, characterized – repetitive cough, interpreted – in what disease it appears?)

Semiology contains:

A general part:

1. Basic semiologic categories: Prodrome, Symptom, Syndrome, Diagnosis, Prognosis
2. Clinical examination methodology:
 - examination methods: general and special;
 - examination plan.
3. General examination of the patient:
 - Present general appearance: Habitus;
 - Examination of skin and hair;
 - Examination and semiology of the superficial lymphatic system
 - Examination and semiology of the mucosa

A special part: Examination and semiology of apparatus, organs and systems: digestive, respiratory, circulatory, urinary, genital, locomotor, nervous system, endocrine glands.

Fundamental semiology notions:

- 1.1. **Prodrome** (pro=before + dromos=road) to understand this notion, the disease must be discussed along with its evolution (Figure 1):

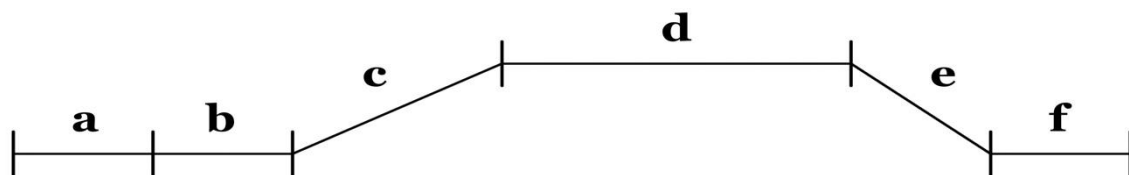


Figure 1. Graphic representation of the clinical evolution of an animal

a. Healthy

b. Latent period – (in infectious diseases = invasion, incubation), without any clinical sign of the disease, variable in time (hours – virus, days – bacteria, months or years – tuberculosis), but they can be present in laboratory tests (antibodies titer)

c. Prodromal state – the first sign of the disease, the general signs, nonspecific to one condition, when the animal is “not himself” (prefers to lay down, trembles, changes in appetite). The diagnosis cannot be decided in this phase.

d. Clinical period – with specific disease signs which allow establishing the diagnosis of the disease (internal disease, infectious)

e. Final period (healing, chronicity, death)

f. Healthy

1.2. **The sign/the symptom** – one manifestation (only one) present in the the evolution of the disease.

This manifestation is classified

- by nature:

- functional (symptom): – modification of organ function: sneeze, cough, dyspnea;

- physical - morphological, structural, anatomical (sign) –edema, hematoma, fracture, scar, varices, exostosis;

- by area, the signs can be:

- local – a limited manifestation: vesicle, aphthae, abscess, wound
 - general – hyperthermia, horipilation, perspiration
 - by the possibility of establishing the diagnosis there are:
 - pathognomonic signs: – through which the diagnosis is established: positive retrograde venous pulse, open bone fracture;
 - typical signs (specific) – constantly encountered in a disease or in a group of diseases with resembling etiology (but for establishing the diagnosis they must be combined with other signs) e.g. the mouth ulcer in some viral disease;
 - atypical signs (nonspecific) – signs encountered in a variety of diseases with variable etiology (anorexia can occur in digestive, nervous, respiratory diseases, cough with central origin in intoxications or respiratory origin – bronchitis, pulmonary edema);
 - strange signs (confusing) – in the prodromal phase: muscular tremble as a result of fear.
 - by consistency of apparition:
 - constant signs – orifice stenosis blast in mitral disease
 - inconstant signs – vomiting in gastric dyspepsia, gastritis, ulcer;
 - by animal way of expression:
 - direct signs (local) – at the point of infliction; e.g. wound, femur fracture, prolapse;
 - indirect signs – far from the point of infliction; e.g. paralysis in renal diseases, disc hernias;
 - by how they are perceived by the doctor:
 - objective signs – obtained after examination: numbers, values (temperature, respiration, pulse), normal or pathological pulmonary blasts
 - subjective signs – deduced by the medic through the animal's behavior (defense reaction in pain)
 - symptoms with person names:
 - Babinski sign – extension of fingers in the appreciation of plantar reflex (in ataxia);
 - Romberg sign – accentuations of imbalance after covering the eyes;
 - signs with names of objects of anatomical regions:
 - thermometer sign/arm sign – with mucus;
- 1.3. **Syndrome** (syn = together) is a group of signs, always the same, but that can be found in diseases with variable etiology:
- fever syndrome = hyperthermia with functional modifications - digestive, urinary, nervous, circulatory, tachycardia, tachypnea, perspiration;
 - colic syndrome = painful manifestation expressed through digestive, nervous, respiratory signs (the animal expresses the pain)
 - jaundice syndrome = jaundice of skin and mucosa with or without pain:
 - *jaundice*: - *hepatic (real)*: - hepatocellular which occurs by excessive production of bile, or obstruction at the bile duct level (mechanic)
 - *hemolytic* occurs as a result of massive red blood cells lysis;
 - *false* – nutritional (excessive carrots consumption), drug induced;
 - syndromes with person names:
 - Hoflund (result of lesions affecting the ventral vagus nerve);
 - Cushing (metabolic disorder caused by overproduction of corticosteroid hormones by the adrenal cortex).

1.4. **Diagnosis** - the notion that defines the clinical state – healthy or diseased – of an examined animal (conclusion established only after an examination):

Classification of diagnosis:

- *by the certainty degree:*
 - certainty diagnosis - 100% precision

- probable/possible diagnosis – difficult cases; it needs supplementary investigations;
- by the degree of *participation of the doctor in establishing the diagnosis*:
 - positive diagnosis – after the clinical examination of the animal by using the medical knowledge;
 - passive diagnosis (group diagnosis) – without examination of every animal, but by resemblance of signs (infectious diseases of birds and swine)
 - negative diagnosis – an incomplete examination or without the examination of the animal;
- by the *degree of disease knowledge*:
 - symptomatic: - based on the signs and syndromes of the animal in evolution of the disease (e.g. jaundice syndrome: jaundice and colic)
 - topographic - by revealing the affected area; e.g. abdomen;
 - anatomic - by revealing the affected organ;
 - functional – determines the affected function;
 - pathogenetic – the evolution of the disease
 - etiologic: cause of the disease.

This type of establishing the diagnosis cannot be used for every disease.

A complete diagnosis it can only be certain, positive and etiologic.

- by the *method used by the doctor in establishing the diagnosis*:
 - direct/ by deduction – based on the presented symptoms and compared with the known symptoms specific to the disease;
 - differential – by elimination of specific sign that are not present.
 - therapeutic – when is established a treatment and it's observed how the animal reacts to the treatment; if the animal is cured that means the treatment was good for the disease;
 - through waiting – when the animal is kept under observation for a while just to observe the clinical signs.
- By the *administrative procedure* used:
 - clinical (on the animal) – identification of the disease and specific treatment;
 - necropsy – after death;
 - laboratory – on alive animals (urine, blood, tissue) or dead animals (histology)

1.5. **Prognosis** (pro= before; gnosis= to know) =anticipative appreciation on the disease/patient evolution.

In veterinary medicine is appreciated a vital prognosis (the possibility of remaining alive) but also from the economic point of view (cost of treatment/medication, restoring the capacity of production) and it can be:

- favorable – complete remission/ regains productive capacity
- reserved – saving the animal (80%)/ but also saving the production capacity
- critical – the animal is left with sequelae (20% chances of recovery)/mutilated (not cured);
- not favorable – death

Inconsistencies between vital and economic prognosis for example– mastectomy is critical – economic, but favorable – vital.

2. THE METHODOLOGY OF ANIMAL CLINICAL EXAMINATION

Includes knowledge and application of the examination methods (general and special) and writing the Clinical observation Sheet (clinical examination plan).

To be able to complete the first two initial stages, the veterinarian must come close to the animal (approach - absolutely necessary) and if needed to partially or totally immobilize it (contention – not necessary always)

2.1. Clinical examination methods

These are techniques (means) to gather data on the animal (inspection and palpation: identification, gestation, fat tissue), but also of disease signs with the purpose of establishing symptomatology (clinical tableau of the disease).

These methods can be:

-general methods (mandatory, primary) – used mandatory in the examination of an animal (inspection, palpation, percussion, auscultation, temperature measurement).

-special methods (complementary)– used to complete the investigation obtained through the general methods: physical, biochemical and biological methods (e.g. of laboratory methods – testing blood sugar in the laboratory, but also at the bedside; mobile radiology, mobile ultrasound – become clinical)

2.1.1 Mandatory methods – these are used in the order given; change of this order in some cases is done only after inspection (e.g. febrile diseases), then the examiner returns;

2.1.1.1. *Inspection (observation)* – this stage refers to gathering data on the animal signs of disease with the aid of some senses (sight – skin, hearing – cough, smell –putrid).

It can be done an inspection from the *distance* which continues with an inspection *near* the animal. Inspection can be direct (done by direct examination) or mediated inspection when are used some medical tools (e.g. endoscope) to observe the cavitory organs (nose, trachea, esophagus, stomach, colon, urinary bladder).

2.1.1.2. *Palpation* – this stage refers to gathering data on the animal and disease signs with the aid of tactile sense. The examiner gathers data on: dimension, shape, position, humidity, consistency, mobility, integrity, temperature, sensibility (thermic, tactile, painful), special sensations (crepitus).

- It can be: external and internal (e.g. rectum and uterus)
- It can be manual or instrumental
- In two stages: superficial (slight touch) and then profound (progressive pressure).
Profound penetrating palpation can be done in small animals.

2.1.1.3. *Percussion* – this stage refers hitting (knocking, percussion) of the body area (by hand or with an object) with the purpose of producing sounds (simple – musical notes or complex – in medicine), with some qualities; these allow the appreciation of physical status of the percussed structures (normal or modified structures).

- ❖ Sounds – through percussion, etc. (e.g. musical instruments) = uniform
- ❖ Noises – through auscultation: heart, digestive, respiratory = variable

E.g. Percussion of thorax: o complex noise is obtained, as a result of many tissues vibrating.

By the percussion place and structure, sounds can be:

- hyperresonant - air under pressure (in tympany);
- resonant - areas with air in their tissues (lung);
- ❑ Basic
 - subdull – intermediary between resonant and dull;
 - dull:
 - femoral dullness (muscle);
 - absolute dullness (hydric);

- ❑ With a particular resonance: broken pot, metallic, undefined.

Classification of percussion sounds based on their qualities:

- Frequency = number of vibrations/second
 - very high = high-pitched sounds = resonant;
 - very low = low-pitched sounds = dullness;
- Intensity/ strength / amplitude = the size of the vibration that gives strength to the sound:
 - high (in powerful sounds) = resonant;
 - low (low sounds) = dullness;
- Length = propagation in time, after a single percussion:

- long - resonant
- short - dullness

➤ Harmony / nuance = makes possible the differentiation of sounds with the same basic harmony

✓ the pulmonary resonant sound – in small and large animals

(overlap of supplementary/secondary vibrations, due to species, weight, age):

- harmony:
 - tympanic / harmonic – small animals;
 - atympanic / disharmonic – large animals;

➤ Resonance = refers to the amplification of the sound (increase of intensity and duration of the vibration) – when the percussion area contains air in large quantities (caverns, pneumothorax, pneumoperitoneum, subcutaneous emphysema)

2.1.1.4. *Auscultation* – requires reception of physiological or pathological noises made by some components of the respiratory, digestive, circulatory system, as well as those from the gestational uterus.

Auscultation can be done direct and indirect (with a stethoscope).

2.1.1.5. *Appreciation of body temperature*:

It can be done: - subjective: - indirect: history (inspection, auscultation);
 - direct : palpation (local and general temperature);
 - objective : thermometry – measured from the rectum;

The normal temperature (appreciated objectively – at rectum level) has a superior and an inferior limit. The superior value is normal at young animal, females, after effort and the inferior value is normal at old animals, males, in the morning.

Tables with more specific values can be found: species, age, sex, physiological states. The most correct value is given by individual appreciation and is recommended to avoid measurement: after drinking, feeding, defecation, effort, local rectal modifications.

Semiotics of body temperature includes *thermic symptome and syndrome*.

- Thermic symptome: - hyperthermia;
 - normothermia;
 - hypothermia.
- Thermic syndrome: - fever syndrome;
 - hypothermia syndrome;

Classification of fever syndrome:

- By hyperthermia value:
 - latent fever – normal temperature but with functional modifications;
 - relative fever – superior limit temperature with functional modification;
 - adynamic fever – a few divisions above normal but with functional modifications;
 - slight fever – temperature increases with maximum 1°C, with modifications;
 - medium fever – temperature increases with 1-2°C, with modifications (chronic diseases, local inflammations);
 - high fever – temperature increases with 2-3°C, but occur the other modifications;
 - extreme fever – temperature increases with more than 3°C, but occur the other modifications (antrax).
- ❖ By fever period duration:
 - ephemeral fever – hours or 1- 3 days;
 - acute fever – maximum 2 weeks (most infectious diseases);
 - subacute fever – between 2 weeks and 1 month (distemper);
 - chronic fever– lasts for months (tuberculosis);
- ❖ By the appearance of the thermic curve (in the state period of the disease):
 - continuous fever (in plateau) – with daily variations under 1°C;
 - remittent fever (in chainsaw) – with daily variations of over 1°C;

- recurrent fever – alternations between febrile periods and normal temperature periods;
- intermittent fever – with short febrile spurts and in large period of time;
- atypic fever – does not respect any of the patterns mentioned above.

❖ By fever origin:

- septic fever – produced by bacteria, viruses, parasites;
- aseptic fever – produced by drugs, proteins, nervous type, by some foods.

• **Hypothermia syndrome**

Decrease of body temperature with great function modifications (generally with a grim prognosis for the animal's life). Occurs in massive hemorrhage, coma, paralysis, liver and kidney failure, places with very low temperature.

2.1.2. Special methods (complementary):

2.1.2.1. Physical methods

Measurements – length, width, temperature through special techniques, density, weight, tension.

Physical laboratory techniques - cytometry, pH, count of red or white blood cells, microscopic examination.

Catheterism – examination by catheters of some normal (natural) or pathological ducts.

Exploratory punctions – puncturing some tissues or organs with needles, for diagnosis or therapeutic purposes.

Openings (tomias) – of some cavities or cavitary organs (laparotomy, rumenotomy).

Scraping – on skin / curettage – on mucosa = scraping the skin or the mucosa of some natural cavity (uterus) or pathologic cavity (ulcer).

Biopsy – harvesting a piece of tissue (organ, tumor) from an animal for histopathological examination.

Electrographies – intake and graphic registration of biocurrents produced by some organs or tissues (ECG, EEG, EMG).

Electrophoresis – separation of seric muscular protein fraction, through an electric field.

Ultrasound examination – registration of ultrasound echoes passing through different structures of the body.

2.1.2.2. Biochemical methods (highlight quantitative and qualitative organic or anorganic components of the organism) can be:

-qualitative: the presence or absence of a component (in normal conditions proteins are absent in urine);

-quantitative: measurement of a component, there are some normal limits.

Applies for ruminal content, gastric juices, feces, blood, urine, milk.

2.1.2.3. Biological methods:

-microbiological methods: isolation, identification of bacteria, viruses, parasites, fungus;

-immunological methods: serology determinations: antibodies or specific titre in infectious diseases;

-allergic reactions;

IMAGISTIC TECHNIQUES:

Imagistic – the science that deals with reception, processing and storage of images.

Medical imagistics – imagistic used for establishing a diagnosis or for following the result of a treatment.

A. Techniques that capture radiations (non invasive) :

- photography (classic or digital) – macro and micro aspects;
- video recording (classic or digital) – semiotic aspects;
- microscopy (optic, electronic);
- endoscopy: with classic endoscope, optic or video;
- thermography: on thermographic film or with a digitalized system.

B. Techniques that issue and capture radiations (some extremely invasive):

- ultrasound – ecography, Doppler technique;
 - ionizing radiations (X, gamma) - radiology techniques
 - rontgendiagnosis – classic or digital;
 - tomographic techniques: classic tomography, digitalized.
 - scintigraphy
 - magnetic nuclear resonance under the action of a magnetic field;
1. Endoscopy (endo = inside + skopein = to see) – technique of visual exploration (through mediate inspection, intermediate, indirect) of the interior of a cavitory organ (stomach), cavity (abdomen) or conduct (urethra, esophagus) with an endoscop or fiberscope (optic fiber). The purpose is to diagnose (inspection, for biopsy) or treatment.
- Technique and endoscopy names:
- Digestive: oroscopy, pharyngoscopy, gastroscopy, ruminoscopy, duodenoscopy, colonoscopy, rectoscopy;
 - Respiratory: rhinoscopy, laryngoscopy, tracheoscopy, bronchoscopy;
 - Cavities: thoracoscopy, laparoscopy, arthroscopy;
 - Urinary: urethroscopy, cystoscopy;
 - Genital : colposcopy (vagina and uterus)

2. Thermography (thermos, therme = warm + graphein = to write) measuring and recording technique for the thermic radiations (infrared) emitted by an organism at skin level. Skin heat depends on the local blood flow resulting warm areas/spots. Circulatory disturbances through increase in blood quantity: inflammations (tendons, ligaments, joints), tumors (e.g. cutaneous tumors), trauma, after effort, congestions (in horses). Circulator disturbances through decrease of blood flow quantity – nutritional and metabolic disturbances (atrophy, dystrophy, ischemia).

Usually, is not established a disease diagnosis, just a localization of the condition.

3. Ecography- (gr. Ekho = echo + graphein = to write)

Ultrasonography (lat. Ultra = beyond + sonus = sound + graphein) is a complementary technique used to examine an organ or tissue for imagistic diagnosis (echography, Doppler technique→to examine blood vessels in movement) or with a therapeutic purpose (ecographic guidance) having as a base the echo effect of the ultrasounds.

Physical properties of the ultrasounds

Ultrasounds are mechanic vibrations identical to the sound vibrations, but with a frequency that exceeds the perception possibilities of the human ear, that is over 20 000 Hz (20 KHz). Ultrasounds need a solid structure because aren't propagated in void. The displacement speed depends of the crossed environment, of temperature, wave length, intensity and energy. Ultrasound is propagated in straight line, in an homogenous environment and in heterogeneous environment and it reflects (echo) as the sound.

Components: - transducer – produces ultrasounds through piezoelectric phenomena (deformation of a body under the action of an electric field). It has various dimensions and frequencies.

- display – with a modulation system (calculator).

After the display modality of showing image, echography can be: monodimensional (eco 1D)- in A (Amplitude Mode), B (Brightness Mode) or M (Motion Mode)/MT (Time Motion Mode).

Preparing the animal for echography assumes: the animal should receive food with 6-10 hours before examination (exception emergencies); for a correct examination is necessary the elimination of gases from the digestive tract level and the urinary bladder should be full of urine. The animal position is important and also the area of examination will be shaved and covered with special gel for echography.

Image interpretation: - after echodensity (echogenity) – intensity:

- a. *hyperechogen* = white – ultrasounds are reflected in their whole (fat, bones, lithiasis)
- b. *echogen* = light grey (landmark = liver)
- c. *hypoechogen* = dark grey (kidney, muscle)
- d. *anechogen* = without echo = black – ultrasounds are absorbed liquids: e.g. urine with calculi

Ultrasound effects on tissues: for mature tissues ultrasounds have no direct action.

- Thermic: - in pregnant animals in first stage (nidation)
- during ultrasonotherapy (e.g. lithiasis)
- Mechanic: - molecular destructions (cellular lysis)
- cavitation phenomena – gas bubbles which are normally found in tissues,

break to the ultrasounds action – producing cavities in organs – risk in ultrasounds therapy

- Chemical: oxidation and protein denaturation.

Doppler echography

Doppler principle = reflected ultrasounds by a moving body return to the transducer under the form of an echo, but with a different frequency as the initial one (this technique uses at least 2 separate transducers).

This principle is used for examination of: blood flow, movement of blood vessels walls, differentiation between artery and vein, examination of cardiac cavities obstruction in blood vessels (thrombosis, aneurisms, atheroma)

RADIOLOGICAL TECHNIQUES (techniques that have a certain amount of risk, some very invasive).

Radiology = the science that studies radiations (generation, classification, characterization, use).

General radiology: the atom, radioactive isotopes, radioactivity, electromagnetic radiations, radiation classification, radiation sources.

Special radiology: use of radiations (in industry, biology, astronomy, medicine).

Electromagnetic radiations (waves) - radiation with an electric component and a magnetic one.

Energy freed at atom level: from the *nucleus* (gamma radiations) or from the *electrons* (X radiations)

They appear due to:

- unstimulating atoms (loss of energy)
- the stop of electrons by the magnetic field of the atomic nucleus (X)
- electron movement in a magnetic field

Radiations are characterized by: frequency, lifetime, wave length, pulsation

Radiations classification:

- By *origin*: natural and artificial;
- By *nature*:
 - corpuscular (particles): alfa, beta;
 - electromagnetic (waves): gamma, X, UV, IR.
- By the *effect*:
 - ionizing: gamma, X, alfa, beta;
 - non-ionizing: visible, IR, radio, microwave.

Classification of electromagnetic radiation by wave length:

- | | | |
|------------------------------|-------------------------|--------------------------|
| o Radio waves (Hertz) | - 0,5 - 10 m | → RMN |
| o Microwave | - 0,1 nm - 0,5 m | - the oven |
| o Infrared (thermic, IR) | - 0,76 μ m - 0,1 mm | → thermography |
| o Visible radiation (light) | - 0,40 - 0,76 μ m | - photosynthesis |
| o Ultraviolet radiation (UV) | - 0,01 μ - 280 nm | - sterilization |
| o X radiation (rontgen) | - 0,01 - 100 Å | → diagnostic, therapy |
| o Gamma radiation | - < 0,01 Å | → diagnostic and therapy |

The radiation sources can be: closed sources (enclosed radioactive material - in the industry), open sources (radioactive isotopes), radiation generators (Rontgen, particle accelerators).

SPECIAL RADIOLOGY: Rontgen diagnosis, CT, Nuclear medicine – radioactive isotopes, MRI

RADIODIAGNOSIS – use of ionizing radiations with a diagnosis purpose (X, gamma)

1. Rontgen diagnosis– classic or digitalised – uses X radiations

X-rays can be generated by an X-ray tube, a vacuum tube that uses a high voltage to accelerate the electrons released by a hot cathode to a high velocity. The high velocity electrons collide with a metal target, the anode, creating the X-rays.

There are two types of X radiation:

a. Break X radiation (large quantities) = This is radiation given off by the electrons as they are scattered by the strong electric field near the high-Z (proton number) nuclei. These X-rays have a continuous spectrum. The intensity of the X-rays increases linearly with decreasing frequency, from zero at the energy of the incident electrons, the voltage on the X-ray tube.

b. Characteristic X radiation (small quantities) = If the electron has enough energy it can knock an orbital electron out of the inner electron shell of a metal atom, and as a result electrons from higher energy levels then fill up the vacancy and X-ray photons are emitted. This process produces an emission spectrum of X-rays at a few discrete frequencies, sometimes referred to as the spectral lines. The spectral lines generated depend on the target (anode) element used and thus are called characteristic lines.

X radiation description:

- speed of light
- spread rectilinear
- penetrates or not the bodies: some are radio transparent, some radiopaque
- Produces fluorescence in some substances = radioscopy

- Photochemical effects - radiography
- biological effects: somatic and genetic

Rontgendiagnosis has two basic techniques with many variables:

- *radioscopy* / fluoroscopy: classic (on a screen), with an image intensifier (monitor), interventional;
- *radiography*: classic (on film) digital (with X radiation detector): on film, on CD, on paper.

2. Computed tomography (CT)

X ray densitometry = combinations of many X-ray images taken from different angles to produce cross-sectional (tomographic) images (virtual "slices") of specific areas of a scanned object, allowing the user to see inside the object without cutting. Allows radiographic images on organ sections.

3. Radioactive isotopes radiodiagnosis (nuclear medicine)

Radioactive isotopes – emit radiations (gamma, alpha, beta) that can be detected and measured; they are used in research, diagnostic and treatment. Are known over 100 isotopes (30 frequently used) – Calcium, Sodium, Potassium, Iodine, Iron, Strontium, Cesium. For diagnostics – the specific radioactive isotope is administered (intravenous) and after a period of time (standard) the captured image is examined through different techniques:

A. gamma camera = a machine that is able to detect and make images from the very small amounts of ionised radiation emitted from patients having a nuclear medicine study. The gamma camera usually has a table, often narrow, on which the patient lies. The images are taken using the camera 'head'.

B. Scintigraphic Scanning – establishes the distribution of radioactive isotopes in tissue = radioisotope is attached to drugs that travel to a specific organ or tissue (radiopharmaceuticals) are taken internally and the emitted radiation is captured by external detectors (gamma cameras) to form two-dimensional images in a similar process to the capture of x-ray images. Used for: heart, circulatory system, liver (tumors), cholangiography, thyroid (iodine) – nodules, tumors, bone, lungs, kidneys, pancreas.

C. Computerized tomography with positronic emission (tomoscintigraphy) (Positron Emission Tomography = PET) - observe metabolic processes in the body. The system detects pairs of gamma rays emitted indirectly by a positron-emitting radionuclide (tracer), which is introduced into the body on a biologically active molecule. The radioactive substance is marked with emitting positron isotopes (1 positron + 1 electron = 2 quanta of gamma radiation).

D. Computerized tomography through singular photonic emission (Single Photon Emission Computed Tomography = SPECT). The technique requires delivery of a gamma-emitting radioisotope (a radionuclide) into the patient, normally through injection into the bloodstream. Most of the time, though, a marker radioisotope is attached to a specific ligand to create a radio-ligand, whose properties bind it to certain types of tissues. This bound allows the combination of ligand and radiopharmaceutical to be carried and bound to a place of interest in the body, where the ligand concentration is seen by a gamma camera (for bones, heart, brain, can offer 3D imaging)

4. Magnetic resonance imaging (MRI) (since 1985). This technique is based on H atoms nuclei (protons) capacity to resonate (vibrate) due to electromagnetic radiation action with a certain frequency (radio radiation).

Stages:

1. In a magnetic field – *hydrogen protons* are aligned in the direction of the magnetic field (as a compass needle on N-S)
2. If these magnetized protons (aligned) from the tissues receive an electromagnetic radiation (e.g. radiofrequency) – with a certain *resonance frequency*, the received energy will cancel the longitudinal magnetization, achieving a transversal magnetization.
3. After *stopping radiofrequency*, protons in the transversally magnetized tissues return to the initial state – but giving *energy* (through longitudinal and transversal *relaxation*), energy caught by a receptor as a *MRI signal*.
4. Each *tissue* has *different relaxation tempos* (fat, muscle, liquids, white matter, grey matter) - thus *different MRI signals* (characteristic) – on an atom level.
5. These signals, different in intensity, will form the *MRI image* of the examined tissue.

RADIOTHERAPY used in bone and articular inflammations, tumors, degenerative affections (cutaneous). This technique can be used in 2 ways:

- with radioactive isotopes (open sources) which generate gamma radiations a limited time
- with X ray beam direct on the damaged tissue for minutes, repeated with the purpose to destroy the tissue (in tumors)

RADIOPROTECTION (protection from harmful effects of exposure to ionizing radiation).

It can be:- general (collective): legal provisions regard placement, construction, authorizations, isolated chambers (20 m²), ventilation, distance, periodical checking;

- individual of the people in charge: costume, personal dosimeters, work schedule, periodical examination;
- animal – no special needs, is recommended to avoid x ray examination at short time period (at least 3 months)

RADIOINTOXICATION is produced after nuclear accidents, as a professional disease, after repeated examinations.

The signs of radiological intoxication and the most sensitive tissues are: on skin – when radiation is coming from the outside – congestions, dermatitis, dermatosis, ulcers, cancer, young cells and those in accelerated division (sexual cells – gametes, hematofomator tissues - marrow, spleen), young stages of an animal - egg, embryo, fetus, blood, mucosa (digestive, respiratory, female genital, urinary), mammary gland.

2.2. CLINICAL OBSERVATION CHART

A document in which are written data regarding the animal (inspection, palpation, history) and data regarding the disease (symptoms, syndromes, numbers, diagnosis, prognosis, evolution, treatment, recommendations). This document is necessary in veterinary hospitals and university clinic; in some small unit data is written in a Consultation and treatment register.

It has a significant importance: medical (for diagnosis), scientific (improves medical knowledge), juridical (to justify the diagnosis and treatment in case of misunderstandings) and even administrative.

Clinical observation chart is formed by signalment sheet and clinical chart.

- Signalment sheet – animal identification: species, breed, age, color and color particularities, microchip, based on animal's health book and the data received from the owner.
- Clinical chart (clinical examination plan) allows to gather all the signs of disease of the examined animal. It has 2 stages:
 - subjective examination (history and anamnesis);
 - objective examination (general examinations of apparatus, systems and organs).

Anamnesis or clinical interrogation is practically a dialogue between the doctor and the owner of the animal, or the person who knows the animal the best. The dialogue should be set at the appropriate level of knowledge because not all the owners have medical knowledge.

Anamnesis precedes the clinical examination and can continue with it and has some basic principles.

- a. Animal proprietary: verification of the animal's papers and identification is an obligation of the doctor for cases of litigation and to observe if there are acquisitions from unknown areas (leucosis, infectious anemia).
- b. Motivation of medical assistance. Generally, the animal is presented to the doctor when it is not feeling well, and when the disease evolves, the owner can describe clinical signs like spots on the skin (shape and color), hair loss, blood and parasites in feces, vomiting.
- c. The time of occurrence of the disease signs and evolution until the day the animal is presented to the doctor is very important especially for "group" examinations, when disease occur in groups of animals. Is very important to know if the clinical signs appeared just at one animal or in others too, if the disease was transmitted to humans, when the symptoms appeared, if there are animals deceased. Some owners wait until is too late for therapeutic intervention and the mortality is imminent. Questions about the clinical signs are following:
 - skin and mucosa: modified color and spots, hair changes, presence of abscesses, ulcers, papilloma, tumors, hematoma, lymph nodes modifications (shape, size, sensitivity, temperature, mobility, consistency);
 - digestive system: changes of appetite, mastication, swallowing, rumination, vomiting, colic syndrome, defecation and feces;
 - respiratory system: presence of cough, sneezing, nasal discharges (serous, pus, blood);
 - urinary system: quantity of urine, color changes;
 - nervous system: attitude, motility, presence of paralysis;
 - genital system of male and female: discharges and edema, changes of color, changes at mammary gland level.
- d. Macro- and microclimate conditions and hygiene are responsible for the occurrence and evolution of a lot of diseases. Is good to know if the disease appeared when the meteorological condition changed (passing from autumn to winter, or from winter to spring). In this period can occur a lot of respiratory and digestive diseases. Is well known in spring,

temperature and rain determine increased prevalence of fasciolosis. Poor hygiene conditions from shelters (temperature, humidity) cause a lot of diseases especially in animal groups.

- e. Exploitation conditions of animals for physical work or for productions (meat, eggs, milk) can affect in time animals health. Animals become more sensible at environmental conditions. Overcrowding can determine, due o lack of fodder and poor maintenance condition, weight loss, decreased production, and increased sensibility to pathogens.
- f. Feeding conditions. Pathological problems depend also of feeding conditions, quantity and quality of fodder, type of fodder. Suddenly changes of feeding conditions determine digestive disorder; for example fermentable fodder can determine tympany. Is also necessary to ask about the drinking water, because it can be polluted with chemical agents.
- g. Prophylaxis, past examinations and intervention are part of the medical history. Is good to know about prophylactic vaccinations, if clinical signs appeared after vaccinations or serum treatments, how many animals are affected.

In conclusion, the first step in animal examination is taking anamnesis, because this informations are indispensable in establishing the diagnosis.

Objective examinations - the result of the veterinarian activity, following the general and special methods of examination and has 2 stages:

- General examination: habitus (conformation, constitution, maintenance, facies, attitude), skin and hair examination, superficial lymphatic system examination, apparent mucosa examination and also temperature, pulse, respiration.
- Apparatus, systems and organs examination (analitical): physical (structural, anatomical) and functional examination of all segments starting with the affected apparatus (system), then all others are examined. Examination is carried first through general methods and then by special methods.

The chart is concluded with recommendations, observations, discharge date and document authentication by the veterinarian (signature, stamp).

3. EXAMINATION AND GENERAL SEMIOTICS

- 3.1. Examination of present general status = Habitus
- 3.2. Examination of skin and hair
- 3.3. Examination and semiotics of superficial lymphatic system
- 3.4. Examination and semiotics of surface mucosa

3.1. EXAMINATION OF PRESENT GENERAL STATUS = Habitus (exterior aspect – through inspection)

Contains: Conformation, Constitution, Maintenance Status, Facies, Attitude and also data referring to skin, surface mucosa, superficial lymphatic system.

a) Conformation – physical aspect (morphologic) *as a whole* of an animal body; dependent on breed, age, sex, productive type. Depending on clinical aspects can be:

- normal conformation (good) – characteristic of species, breed;
- abnormal conformation (defective, bad) – everything that is not normal for conformation.

Conformation is definitive (some aspects can be congenital or acquired): e.g. hunchback, exostosis, narrow chest, all malformations and monstrosities.

Breed particularities are not included: horses, small dogs, prognatism, curved members in some dog breeds like Teckel, Basset.

b) Constitution – the ratio between an animal conformation and its capacity of reaction, resistance and adaptation to the environment.

In order to determine the constitution type in animals will be examined conformation, breed, age, sex, hair and skin, attitude.

In animals can be found 4 constitution types – 2 normal and 2 abnormal:

- 2 normal constitutions (sex related):

- delicate characteristic for females, found in dairy cattles, horses, egg laying chicken breeds, hunting dogs, with less muscular mass, respiratory physiological type, smooth hair, lively temperament.

- robust characteristic for males, found in beef cattle and meat sheep breeds, meat chicken; with digestive physiological type, developed muscular mass, thick skin.

- 2 abnormal constitutions:

- feeble: - extra delicate female;

- effeminate male.

- crass: - too robust male;

- masculine female.

c) Maintenance status – general morpho-functional aspect of an animal, as a result of fattening degree and hygiene. The degree of fattening can be appreciated by inspection (hair, skin, muscular mass), palpation (fatty deposits) or by weighing.

The maintenance status can be:

- In accordance (good) – with developed muscular mass, smooth hair and good hygiene;

- Inadequate: - bad: - weight loss = muscles reduced;

- cachexia = muscular atrophy;

- marasm = atrophy and reduced physical functions .

- very good (exaggerated) = obesity – characterized by disease

in adults as a result of overeating and bad metabolism or in order to human consumption (e.g. fatty liver).

d) Facies – face expression as a result of some morphological or functional changes. To appreciate facies it is considered the morphology of the face, ears, nose, lips, eyes position and face muscular tonus.

A. Fixed facies – immobile (mask) through:

- functional changes: - sad (typhous) –leaned head, no reactions

- peritoneal (Hippocratic) – enophtalmia, fixed gaze

- tetanic – contracted face muscles

- structural changes: - large head, hippopotamus head, senile head

- crooked snout etc.

B. Changing facies – mobile (MIMMIC): through move

e) Temperament – physical and/or motor reaction of an animal towards different stimuli.

- in humans: sanguine (vivid), phlegmatic (lymphatic, impulsive, melancholic)

- in animals (specific to each individual): - vivid (nervous) – in youth: horse, dog;

- lymphatic (lazy) – in adults; cattle, sheep.

Changes: - exaggeration or disappearance of the temperament.

- appearance in other species that does not manifest it normally.

f) Attitude – position of an animal towards the environment (posture of the body as a whole or segments).

Normal attitude: - in repose: stationary and in recumbency

- in movement: - walk, trot, gallop (hard or soft terrain)

- swim

- flightensts of the face muscles (grimaces):

- agitated (furious)

- trumpet nostrils

- oral respiration

Abnormal attitudes:- inert (passive) – decrease of movements in repose, as in movement: staying in recumbence or stationary, leaned head, sleepiness, lameness

- forced (active) – disproportioned reactions (exaggerated) stationary, in recumbence or in movement; due to functional nervous or morphological changes.

Classification: Stationary (most frequent):

Head:- torticollis;

- opisthotonus;

- emprostotonus;

- tics: - repetitive movements of the head;

- can appear in other body segments.

Head and neck: - pleurostotonus – head and neck deviated laterally;

- auto-auscultation – head and neck resting on thorax;

Limbs: - camping:

- underneath;

- semi flexion;

- adduction.

Spine: - kyphosis;

- lordosis;

- scoliosis;

- kyphoscoliosis.

Tail: - in S, inert, raised, between the legs

Whole body: - orthopnea;

- tetanic – generalized tetanic contractions;

- sitting dog position;

- penguin position;

- kangaroo position.

Recumbence: - sterno-abdominal;

- lateral;

- dorsal;

- barrel roll.

Movement: - pulsions (antero-, latero-, retro-);

- dromomania;

- manege – in circle;
- inebriated;
- pivoting;
- seal walk, dog walk, hyena walk.

3.2. EXAMINATION OF SKIN AND HAIR

3.2.1. Skin – changes encountered at this level:

- functional: smell, secretions, elasticity, temperature, sensitivity, color, pruritus;
- morpho-functional: eruptions = efflorescence;
- morphologic: - reversible deformities;
 - irreversible deformities = cutaneous dystrophies.

3.2.1.1. *Smell* – changes when the level of metabolic compounds are eliminated (in metabolic, renal diseases, intestinal parasites) and which in normal conditions are eliminated through other ways, or in skin diseases (dermatologic diseases: parasites, infections, mycosis)

- putrid smell (puss, cadaver) – streptococcal/staphylococcal infections, multiple furunculitis, infected lesions;
- uremic smell (ammonia) – severe kidney disease;
- chlorophorm smell – ascarids.

3.2.1.2. *Cutaneous secretions*: can be sudoripary and sebaceous.

- *sudoripary* – ensures skin humidity:
 - normal = normohydrosis;
 - modified = dishydrosis:
 - elevated = hyperhidrosis: - generalized perspiration, - epihydrosis, hemathydrosis;
 - lowered = hipohydrosis;
 - absent = anhydrosis.
- *sebaceous* – ensures skin lubricity:
 - normal;
 - modified: - seborrhea = increase: oily appearance;
 - sebum dryness – seborrheic pityriasis, (resembling dandruff);
 - foreskin sebum – smegma;
 - asteatosis – decrease/absence of sebaceous gland secretion, translated through dry skin = xeroderma
 - acne = retaining sebum at the hair root level; - infection = furunculosis;

3.2.1.3. *Skin elasticity*: - normal = elastic;

- modified (decrease in elasticity) – cutaneous diseases, dehydration.

3.2.1.4. *Skin temperature* (increase/decrease): - local changes – abscess, localized paralysis;

- general changes – as a response to generalized diseases.

3.2.1.5. *Sensitivity*: tactile, thermic, painful.

a. Exteroceptive: - superficial (skin and mucosa) – thermic, tactile, painful;

- telereceptive: sight, hear, taste, smell;

b. Proprioceptive

c. Interoceptive - verified with specific stimuli;

- disorders = dysesthesia (hyper-, hypo-, anesthesia).

3.2.1.6. *Skin color* can be: - normal – due to: - melanin pigment;

- vascularization and blood flow;
- cutaneous layers thickness.

- modified – 3 causes: - melanin pigment = melanin dyschromia – hyperchromia / hypochromia

- circulatory – circulatory dyschromia;
- miscellaneous (medication, food) – false dyschromia.

Melanin dyschromias (real): - hyperchromia: - generalized: - tannin disease - in Addison's disease;

- horse melanoderma.

- localized: - lentigo = brown or black spots, which sometimes deform the skin –moles;
- ephelids = freckles.

- hypochromia: - congenital: - generalized: albinism (acromia);

- localized - acquired: - vitiligo, frog skin; frog snout;

leukoderma.

Circulatory dyschromia (vascular): - cutaneous hemorrhage;

- vascular nevi;
- active congestion (large amount of blood) ≠ erythema (red skin);
- paleness – in anemia;
- cutaneous cyanosis – in passive congestions, intoxications.

False dyschromia:

- medication;
- food pigments e.g. carrots;
- endogenous pigments: biliary, hematic - yellow-green coloring;

3.2.1.7. *Pruritus* – itchiness expressed through scratching, licking, sledging: spontaneous (in cutaneous diseases) or induced (through scratching in dogs, sheep, pigs).

Pruritus can be localized (e.g. nasal, anal pruritus) or generalized (hepatitis, diabetes)

- by cause: - idiopathic pruritus (essential, pruritus – disease);

- symptomatic pruritus (sign in many diseases);

- by duration and intensity of scratching and lesioned skin:

- vague – light;
- intense – accentuated;
- biopsiant – expressed through superficial or profound lesions of the skin or self mutilation.

3.2.1.8. *Cutaneous efflorescence* - ephemeral morpho-functional changes (they appear suddenly and disappear the same way), have an eruptive, invading character and disappear without leaving scars. Eruptive diseases – are characterized by eruptions and reversible deformities

- macula – any patch of color, neat, pigmentary or circulatory,

localized or diffuse - vascular spots – color patches, neat, but only of circulatory origin.

CLASSIFICATION:

- circumscribed congestions:- erythema – pink spot – red or cyanotic;

- roseola – small spots, erythematous.

- circumscribed hemorrhage = purpura – purpura spots:

- by spread:
 - exantemic (exantema) simple – only on skin;
 - hemorrhagic – on skin and mucosa.
- by size:
 - small dots;
 - petechial – lentile size;
 - ecchymosis – large hemorrhagic spots (bruises);
 - suffusions – large subcutaneous hemorrhages.
 - linear hemorrhage = vibice – due to lightings strikes, whiplashes

3.2.1.9. *Cutaneous morphologic changes* (deformities): - reversible: papula, vesicle, pustula, scabs, squamous, edema, hematoma, cyst, abcess, subcutaneous emphysema, lesions;
 - irreversible (cutaneous dystrophies): scars, sclerodermia, ichthiosis, parakeratosis, acanthosis nigricans, nodule, vegetation, tumors, pachydermia, gangrene, crevasses, ulcers.

Papula - cutaneous deformity, non painful, hard, circumcised, size of a walnut, as a result of liquid infiltration of the derma. When presents pruritus is called hives plaque.

Vesicle – cutaneous growth, due to liquid accumulation in the epidermis.

Herpes = small vesicles, in large number, with oral, nasal, genital, thorax localization.

- by size:- aftice – smallest visible vesicles;
 - aphthae – size of a pin head;
 - real vesicles – pea size;
 - bubble = flicene – peanut size;
 - pemfigus – apple size.

Pustula- purulent collection due to vesicle infection.

Scab – drying of secretions after the break of vesicles of pustulas.

Squamous - different sized pieces, detached from the corneous layer of the epidermis:

- pitiriazis = dandruff – small lamella;
- furfural – 0,5 cm;
- lamellas – 1- 4 cm;
- flaps – very large.

Cutaneous edema – liquid accumulation in the skin and the subcutaneous conjunctive tissue:

- cold edema: - stasis edema: - generalized (cardiac and renal);
- localized (head and posterior limbs):
 - cachectic edema – replacement of fat;
- hot edema: - inflammatory;
 - angioneurotic (in nervous diseases, allergic diseases);

Hematoma – blood accumulation.

Cutaneous cyst – liquid accumulation or solid contents, in a space circumscribed by a reaction wall. Can be: serous, sero-sanguinolent, hematic, retention, caseous (not puss).

Cutaneous abscess - purulent localized collection. When the puss collection is grand and invading = phlegmon

Subcutaneous emphysema – gas or air present in the subcutaneous conjunctive tissue:

- through aspiration (thorax fissures or skin lesions) – air;
- septic – gas;

Lesion – continuity solution (discontinuity) in the skin – due to physical, chemical or biological factors.

Scars are appearing after healing of a lesions (conjunctive tissue).

Scleroderma – thickening and hardening due to chorion fibrosis.

Ichthiosis – hyperplasia of the epidermis corneous layer, giving a fish scale appearance

- Lichenification – large thickening, lichen appearance.

Parakeratosis – calf and piglets – scale like, but with nucleate cells of the corneous layer.

Acanthosis nigricans – hyperplasia of the mucous layer, with a black bark appearance.

Nodule – localized hypertrophia and hardening of the chorion, present in cutaneous tuberculosis (cat, dog), parasites infestations (hypoderma).

Vegetations – cutaneous deformities resembling a cauliflower, simple or multiple (e.g. papillomatosis).

Cutaneous tumors can be benign or malignant.

Pachidermia (elephantiasis) – thickening of the limbs due to chronic edema through lymphatic stasis.

Skin gangrene – wet or dry necrosis of the skin.

Crevasses (fissure) – cracks of the skin.

Ulcers – loss (melting) of tissue, without healing tendencies:

- Ulceration – when the lesion is superficial (e.g. excoriation)
- Real ulcers (profound) – on large areas and profound:
 - By aspect: - crater like ulcers - vegetant ulcers
 - By evolution: - phagedenic ulcer – it deepens;
- serpiginous ulcer – disappears in one area and reappears in another.

3.2.2 Hair - objectives, methods (general and special) and semiotic aspects.

- Horripilation – bristly hair;
- Hyperkeratosis – thickening and length growth of the hair:
 - normal / natural – mane, tail;
 - pathological – some endocrine diseases;
- Trichorrexia nodosa – nodules on the hair shaft, resulting in its breaking.
- Hypotrichosis – hair loss that can be:
 - normal (molting)
 - pathologic = alopecia – can be primary/essential or secondary/symptomatic or hereditary = atrichia;
- can be: - calvescence = thinning of hair;
 - when only on the head – balding– can lead to baldness;
 - hair shaved on a circular area;
- Color changes: - noggin – whitening of the hair;
 - erythrism – usually genetic – red hairs on some areas, underneath non pigmented skin. Can appear in some parasite infestations or following local treatments.
- Wool: – malopecia = loss;
- Feathers: - horioplumation;
 - defeathering = avulsion of feathers;
 - plumopecia = pathologic loss;
- Hoofs:

- Deformities: full hoofs, bulging hoofs, dull hoofs, beveled hoofs, crooked hoofs;
- Size: - thinning of the hoof ;
 - keloid (massive growth of the hoof)
 - Consistency: - luscious hoofs;
 - brittle hoofs;
 - Smoothness: - seima = crack (longitudinal or transversal).
 - Sensitivity and temperature:
 - street nail;
 - pododermatitis;
 - bleima – localized inflammation of the pododermis;
 - furbura – cheratogene membrane congestion;
 - nail infection – cattle, sheep, pigs;
 - Horns: - circular bumps (age), inflammations
 - Beak: breaking
 - Claws, nails, scales in fish and reptiles, wings in bees.

3.3. EXAMINATION AND SEMIOTICS OF THE SUPERFICIAL LYMPHATIC SYSTEM

The lymphatic system is formed by lymph nodes, lymphatic vessels, lymph.

Superficial lymph nodes are always examined: examined in pathologic conditions

Profound: lymph nodes - e.g. through particular/special methods (trans-rectal, ultrasonography, radiography, CT, MRI, laparotomy)

Following objectives: size, shape, surface appearance, temperature, sensitivity, consistency, mobility.

3.4. EXAMINATION AND SEMIOTICS OF SURFACE MUCOSA

Because the skin is pigmented and covered with hair, it is highly important the mucosa examination.

Following objectives: color, volume, shape, integrity, secretions.

- Color (general or partial):
 - Local congestion (in a mucosa) is usually traumatic;
 - General congestion – in infectious diseases.

Enanthema = congestive spot – in eruptive diseases;

Cyanosis – in asphyxia;

Paleness – in anemia, internal/external bleeding – massive;

Capillary injection – vessel dilatation;

Hemorrhage;

Yellow color – jaundice.

- Shape/deformities – produced by edemas:
 - Chemosis – fatty eye, shiny mucosa;
 - Prolapse.
- Integrity – different aspects (lesions, ulcers)
- Secretions: Increase of secretions = leakage:
 - Epiphora = tearing.
 - Hypersalivation: - ptialism = hypersecretion;

- sialorrhea .
- Lack of secretion → mucosa dryness:
 - Xerophthalmia;
 - Xerostomia.

4.SEMIOLOGY OF THE DIGESTIVE SYSTEM

The digestive system is formed from the digestive tract which has three-parts: the ingestive part – the mouth, pharynx and esophagus, the digestive part (four-compartment stomach in ruminants, stomach, small intestine) and the ejective part (rectum, anus) and also the adjacent glands are attached: salivary glands, liver and pancreas.

Semiotic aspects of the digestive system may be:

- functional order, which refers to the changes of: - appetite, preening (grasping), mastication, insalivation, deglutition;
 - rumination and eructation (in ruminants);
 - defecation and flatulence,
 - vomiting; - or the occurrence of false vomiting
- of physical (morphological) order at the level:
 - of supradiaphragmatic organs (mouth, salivary glands, pharynx, guttural pouch, esophagus and crop);
 - abdomen
 - retro diaphragmatic organs (four-compartment stomach in ruminants, stomach, small intestine, large intestine, rectum, anus, liver and pancreas),
 - feces.

4.1. SEMIOLOGY OF SUPRADIAPHRAGMATIC DIGESTIVE ORGANS

4.1.1. Functional examination and semiotic aspects

4.1.1.1. *Appetite* or hunger is checked by testing with food (feeding, lunch) when administering to the animal a normal ration in small quantity and of good quality starting always with less appetizing feed (for herbivore starts with the rough fodder) following the way the animal feed (preening, mastication and swallowing).

Appetite can be normal or altered both quantitative (low or high) and qualitative (taste perverted).

Quantitative changes in appetite:

- appetite loss, which may be:
 - *anorexia* when the animal refuses the feed (in acute disease);
 - *relative anorexia* (inappetence) when the feed is consumed incomplete;
 - *hyporexia (oligophagia)* when the appetite is low for all kinds of foods;
 - *capricious appetite* involves alternations between periods of appetite and anorexia (chronic digestive diseases);
 - *selective appetite* when the animal consumes only certain feeds (eg, liquid food)
- the absence of thirst (without thirst)

- exaggeration of appetite
 - *polyphagia* when the animal eats a lot during the period of convalescence to recover weight loss after long-term suffering (normal polyphagia);
 - *bulimia*, exaggerated appetite (permanent hunger), but poor maintenance status (in psychoses, diabetes, chronic enteritis);
 - *greed* when the animal eats the feed very quickly (in rabies)
- the exaggeration of thirst = *polydipsia* in febrile illness, edema, insipid diabetes, after hemorrhages, purgative.

Modified appetite = *alotriophagia* when the animal consumes foreign food such as:

- coprophage consumption of feces;
- xylophagia consumption of wood material;
- geophagia soil consumption;
- lithophagia stones consumption (it is normal only for birds);
- aerophagia when animal swallows air that penetrates and accumulates in the stomach;
- cannibalism - consumption of tissues and organs from congee animals (with which it cohabitates)
- lichomania the tendency to lick hair clumps, the navel of congeners, walls;
- trichophagia - hair consumption;
- malophagia - wool consumption;
- plumofagia pecking, plucking feathering;
- placentophagia - placenta consumption;
- ovophagia egg consumption;
- fetophagia - consumption of their own baby
- caudophagia consumption of own tail;
- otophagia - ears consumption.

Paradipsia = perversion of thirst, when the animal consumes dirty water, urine.

Qualitative changes in appetite are encountered in lack of metabolism, food mistakes, nerve disorders.

4.1.1.2. *Prehension* is the way the animal intakes the food or water into the mouth, demonstrating the presence of appetite.

Prehension can be normal (depending on the species with the lips, with the tongue) or altered (prehension dysphagia). Prehension can't be achieved in diseases of chewing muscles, tetanus, fractures, or when it is done, it is done with other parts than normal, such as with incisors in ruminants with tongue lesions, without grabbing the feed. Prehension disturbances can also be found for liquids.

Dysphagia means a disturbance of prehension, mastication or swallowing food.

4.1.1.3 *Mastication* is the tearing of the teeth, as well as the mixing with the saliva of the food and the formation of the food bowl in order of swallowing. It's followed the duration, frequency, symmetry and it can be normal or altered. There are situations when mastication is absent and accompanies anorexia. In this case the herbivores can catch a quantity of fodder between the lips, remaining in this position with them, giving the appearance of an animal that "smokes" or "drips."

In other situations, chewing may be:

- *continuous* (encephalopathy);

- *suddenly interrupted* when the mastication causes a strong pain (dental caries, stinging with a sharp body);
- *in blank* when the animal makes mastication in the absence of food. This type of mastication is commonly found in ptyalism, when there is also the crackling noise (“kissing” or “drinking” noise) characteristic of the stomatitis;
- *on one side* in unilateral pain;
- *lazy mastication* with rare and irregular movements in depressive nerve disorders; - *superficial mastication* in painful conditions (stomatitis, pharyngitis). Frequently, the food is not swallowed, leaving between the dental arch and cheeks, forming a repository called “storehouse” (in horses, cattle).

4.1.1.4. *Insalivation* is the process of mixing well-cut foods with saliva. Insalivation may be normal or altered when the amount of saliva is increased (ptyalism) and is leaking outside or, when the amount of saliva is reduced and is followed by difficulties of insalivation and swallowing.

4.1.1.5. *Deglutition* is the swallowing of the food bowl and this function can be verified by following the esophageal peristaltic wave formed on the left side of the esophagus jugular through.

Under normal conditions deglutition has three phases (buccal, pharyngeal and esophageal). Swallowing changes are called dysphagia of swallowing (and are considered the true dysphagia) and may be: oral dysphagia, pharyngeal dysphagia and esophageal dysphagia.

- Oral dysphagia is characterized by swallowing efforts while mastication prolongs, food falls out of the mouth and in front of the animal is formed a conical form bunch of feed.
- Pharyngeal dysphagia is characterized by the expulsion of food and liquids from mouth and nose, immediately after swallowing (in pharyngitis).
- Esophageal dysphagia may be proximal (anterior) that is similar to pharyngeal dysphagia or distal when is expressed by false vomit (elimination of well-cut food from the esophagus that is not mixed with gastric contents). Esophageal distal dysphagia is encountered in puppies with esophageal achalasia, immediately after weaning or in adult animals with esophageal dilatations (these dilatations are acquired during life in paralysis, esophageal obstruction) and food accumulates in large quantities in these diverticula.

4.1.1.6. *Rumination and eructation*

Rumination is a physiological action specific to ruminants which involves regurgitation of the forage and other feedstuffs that are forced back to the mouth for further chewing and mixing with saliva.

Rumination may be normal or altered:

- uninterrupted (continuous) - depression in nerve disorders (cenurosis, listeriosis);
- intermittent - with longer or shorter breaks;
- leep and prolonged (superficial and rare) with many remakes to form a food bowl
- the lack of rumination accompanied by sad facies.

Disturbances of these are a serious sign for the animal (occurs in the digestive system or other systems, as well as in poisoning).

Eructation (routine elimination) occurs in normal conditions also in dogs, being pathological to other species (occurring in gastric diseases and other diseases).

In ruminants can be normal (as frequency, intensity, duration, smell of the air) or modified.

The disturbance of the eructation like low frequency occurs in the prestomach atones, in the overload of the rumen, the lack of eructation occurs in esophagus obstructions or ruminal meteorism and the frequency can increase when the animal consumed ferocious fodder.

4.1.1.7. *Vomiting*, also known as emesis, puking and throwing up, among other terms, is the involuntary, forceful expulsion of the stomach contents through the mouth and sometimes the nose that appears the in a pathological content (ingestion of a large volume of food, food that is too hot, gastric motility, gastritis, specific or non-specific diseases, poisoned feed as self-defense). The animal has a feeling of nausea, after which it begins to start its own explosive disposal of gastric contents.

Characteristics of gastric vomiting (vomited content):

- quantity depends on the amount food eaten and the vomiting frequency
- the smell of the vomited content it is generally sour but it may be fetid, intestinal, ammoniacal (in uremia), hypochlorite;
- pH - generally neutral but may be alkaline (in hypochloride dyspepsia) or acid (in hyperchloride dyspepsia);
- color - depends on the composition of the vomited content;
- compound – food, mucus, gallbladder compound when the color is yellow-green, feces compound in intestinal obstructions, foreign bodies, parasites, blood. Hematemesis means that only blood or clots are removed by vomiting.

The vomited compound can be examined biochemically (to identify toxic and microscopic evidence for bacteria, viruses, parasites).

Vomiting can be unique, repetitive or incoercible (continuous). Vomiting is relative common and without effort in dogs, cats and pigs but with great efforts in ruminants. The vomiting has severe prognosis in most cases in horses.

Vomiturition is the feeling of nausea, with a tendency to vomiting, but without eliminating any gastric contents (encountered in pigs, cats and dogs).

4.1.2 Physical examination and semiology

4.1.2.1. *The examination and the semiology of the mouth* involves examination of the mouth (external examination of the mouth) and of the oral cavity (internal examination of the mouth), as well as changes at this level.

External examination of the mouth

Assume a careful examination of the lips, muscles, maxillary and temporomandibular joint by general methods (inspection, palpation, percussion) and special methods (scratching, punctures, biopsies, radiological examinations) Semiological aspects encountered may be morphological (structural) and functional. Morphological changes: abrasions, excoriations (in wounds, scars, ectoparasites), vesicles (in virosis, intoxications), pustules (demodicosis), tumefaction (tumors, infectious disease), epithelial deposits, ulcers (in mumps).

Functional changes:

- lips pruritus (parasitosis, rabies, Aujeszky disease);
- impossibility of closing the mouth (in the trigeminal paralysis, implanted foreign bodies, joint dislocation, fracture);
- lateral deviation of the mouth;
- the fall (lowering) of the lower lip (of the old animals, in paralysis);

- salivary leakage (ptyalism, sialorrhea), normal in small amounts only in ruminants and dogs;
- low muscle tone in amyotrophiea, increased in tetanus;
- increased or low skin temperature;
- increased painful sensation in localized inflammation;
- hyperkinesia - tonic or clonic muscle contractions:
 - trismus - tonic contraction, continuous of masseter muscles and the impossibility of opening the mouth (incrustation of the mouth), in tetanus encephalitis;
 - teeth chattering - clonic contraction (myoclonus), short, repeated of some masseter muscle groups and the noise produced by hitting dental tablets (in nerve disorders)
 - convulsion - involuntary muscular contractions, in the form of clonic or tonic-clonic muscle twitch;
 - facial changes: sad, peritoneal, tetanus facies.

Oral cavity

After opening the mouth (manual or instrumental), the oral cavity is examined (tongue, teeth, gums, palatine mucosa, palatine velum, cheeks) by general methods (inspection, palpation and dental percussion) and special methods (fistula and cavities sondage, biopsy, radiological examination, microbiological, histological, biochemical examinations).

The first semiological aspects can be encountered at the opening of the mouth: trismus - difficulty in opening the mouth in dislocations, as well as the smell of the oral cavity (normal, rancid - food remains, putrid - in ulcers, necrosis, teeth cavities, ammoniacal in uremia, acetone in ketosis).

Other semiological aspects will be analyzed on anatomical structures:

- tongue:

- color - same change as in the mucosa of the oral cavity:
 - cyanosis - the appearance of black tongue (in poisoning)
- dimension (volume):
 - macroglossia - hypertrophy, tumors, edema;
 - microglossia – frequently inborn;
- motility and position:
 - tongue paralysis - with or without alteration of the tongue size;
 - tongue tic - encountered in cattle and horses by pulling the tongue outside the mouth and performing rotation movements;
- tongue surface:
 - coated tongue - the tongue with white-gray deposit (in some digestive disorders)
 - tongue with scars on its surface (in bovine stomatitis);
 - pellicula linguae - hard deposits on the tongue of the bird, in infectious choryza;
- integrity: present wounds, vesicles, nodules,
- sensitivity and temperature: increased temperature in tongue inflammation (glossitis);
- tonus of the tongue: increased (accompanied with increased tongue volume) in actinobacillosis and low in atones;

- teeth:

- delayed in change of baby teeth – rachitic animals;
- polyodontia - more teeth than the normal dental formula, congenital

- oligodontia -less teeth than the normal dental formula, congenital or acquired;
- distancing between teeth when the teeth are rotated and have a large space between them;
- paradontosis - infectious process of marginal periodontium (alveolar ligament, gum, cement) in dog, cat, sheep;
- teeth mobility - normal only in bovine incisors, at other species occur in alveolar inflammation;
- changes of position: torsion, oblique implants;
- prognathism: excessive growth, congenital, of the mandible or maxilla in the anterior part, with the appearance of the teeth outside the mouth;
- brevignatism insufficient growth, congenital, of the mandible or maxilla or underdevelopment of the incisors or teeth inward inclination.
- lateral, congenital, maxilla or mandibular deflection.
- tooth color:
 - dental tartar - deposits of calcium salts and organic substances;
 - dental caries - black color of the tooth and appearance of cavities following the breakdown of the enamel and dentin;
 - brown spots - consecutive to dental cavities demineralization
- irregularities of the teeth:
 - holes on the tooth surface;
 - teeth growth irregularities;
 - wearing down irregularities that result on the surface of the teeth, especially in molars;
- oral mucosa and gums:**
 - changes of color:
 - pale mucosa in ischemia, anemias, internal hemorrhages;
 - congestion in the form of spots (enanthem) or the entire surface (in inflammation);
 - cyanosis in poisoning;
 - yellow mucosa in hepatic jaundice, hemolytic jaundice;
 - hemorrhage in the form of petechia, ecchymosis;
 - a blue line of demarcation on the gum, occurs in intoxications;
 - deformations:
 - edema – when is inflammatory accompanies: stomatitis (general inflammation of the mucous membrane of the oral cavity) gingivitis (inflammation of the gums), inflammation of the internal part of cheeks, palatine mucosa inflammation, cheilitis - inflammation of the lips;
 - vesicles (foot-and-mouth disease, smallpox);
 - pustules - in horse pustular stomatitis;
 - “storehouse” = storage =deposit of food, candida;
 - tumors –papilloma, fibroma, sarcoma (in horse, dog, cattle) epulis (in dogs);
 - foreign body infiltrated into the mucosa (needles, bones, woods);
 - erosions can lead to gangrenous stomatitis;
 - temperature and sensitivity – increased in inflammations (stomatitis, glossitis)
 - humidity – ptyalism, sialorrhea;
 - radiological examination of the mouth – bone structure and foreign bodies at this level.

4.1.2.2 *Examination and semiology of salivary glands*

Salivary glands are secretory acini, ducts, exocrine, disseminated (on lingual mucosa, palatine, labial) or major glands (sublingual, submandibular, parotid and molar glands) have the role of producing saliva. Saliva contains 98% water and also chlorides, bicarbonates, sodium phosphates, potassium, magnesium, calcium, mucin, albumin, globulin (salivary Ig A), enzymes (ptyalin - salivary amylase that hydrolyzes cereal starch and glycogen from meat in glucose and maltose, salivary maltase that cleaves maltose in glucose) all with an important role in mastication, swallowing, digestion and taste.

Their examination is done by general methods (inspection and palpation) and special methods (gland puncture, duct irrigation, biopsy, radiological examination). Salivary gland inflammation is called sialadenitis (sialoadenitis).

The sublingual gland – formed of mucous acini, is located on the lateral sides of the tongue and has two portions: oral opening through the Rivinius duct and caudal opening through the Bartholin duct. Inflammation of the gland is called sialitis and the formation of a glandular cyst is known as ranula and frequently appears in horses, cattle and dogs.

The submandibular gland (submaxillary gland) - formed of mixed acini, opens under the tongue through the Wharton duct at the sublingual caruncle. Inflammation of this gland is called maxillitis, and the formation of glandular cyst is known as submandibular ranula and appears in equine, bovine and dogs.

The parotid gland -formed of serous acini, is located between the recurrent mandibular branch and the atlas and opens on the external jaw near the molar 3 through the Stenon duct. At this gland can be encountered edema, collections, fistula, tumors, inflammation (parotitis). Mumps is a viral infectious disease encountered in humans and accidentally in dog characterized by changes in the salivary gland (parotitis), the nervous system and the testicles.

4.1.2.3. *Examination and semiology of pharynx*

Pharynx a fibromuscular tube supported by the hyoid system has seven communications (2 nasal choana, 2 orifices between ears and pharynx, openings with mouth, esophagus and larynx).

The examination of the 3 parts (nasopharynx, oropharynx, laryngopharynx) is by general methods (external and internal inspection, external and internal palpation) and special methods (endoscopy, sondage, radiological examination).

Can be observed the following semiotic aspects:

- unevenness on the projection area of the pharynx - in pharyngitis, phlegmons, abscess, localized tumors, changes in salivary glands;
- local temperature and palpation sensitivity - present in inflammation
- pharynx pain – expressed by orthopneic position;
- swallowing dysphagia of mouth or pharynx - occurs in inflammatory disease (pharyngitis), paralysis;
- dyspnea - edema, inflammation, paralysis;
- cough - food obstruction, stenosis, foreign bodies;
- the laryngeal cornage is an inspiring or expiratory whistle following the paralysis of the palatine velum or in stenosis, pharyngitis;

- foreign body syndrome - the animal's attempt to release the pharynx with paws (dog and cat);
- by direct internal inspection or pharyngoscopy can be highlighted: congestion, hemorrhage, pseudomembranes, abscesses, phlegmons, edema, gangrene, inflammation (pharyngitis), pharyngeal paralysis (rabies, Aujeszky), foreign bodies;
- radiological examination allows to highlight foreign bodies by x-ray examination and swallowing by radioscopy with contrast agents.

4.1.2.4. *Examination and semiology of horse guttural pouches*

Guttural pouches are two membranous formations (sacs of air that expand from the Eustachian tube) located on both sides of the horse pharynx. Their examination is done by general methods (inspection and palpation) and special methods (radiographic examination and puncture).

The unilateral or bilateral purulent collection is called guttural pouch empyema and is clinically manifested by a deformation of the guttural area and purulent discharge when pressing this collection or when the animal swallows.

4.1.2.5 *Examination and semiology of the esophagus*

Esophagus is a muscular tube formed by three parts (cervical, thoracic, abdominal) and three strictures (at the chest entrance, above the heart and at the diaphragm) and three dilatations (the cervical area, the pre-cardiac part and the pre-cardia front area). The easy area to examine is the cervical part (deviated to the left) and is examined by general methods (inspection and palpation) special methods (sondage, radiological examination), while for the other segments are used the complementary methods.

At the esophagus level, we can encounter the following semiotic aspects:

- esophageal dysphagia following obstructions or achalasia
- deformations (dilatations) – short (sacciform) or long (cylindrical):
 - sacciform deformations (diverticula) – small dimensions, encountered in obstructions (foreign bodies, tumors, external compressions) esophagus rupture with hernia of the esophageal mucosa;
 - cylindrical deformations (megaesophagus - esophageal ectasia), of large dimensions due to lack of contraction of the esophageal muscles;
 - esophageal achalasia, frequent in dogs (genetic) with retro-cardiac localization and in severe situations pre-cardiac localization, produced by incomplete relaxation of cardia opening;
- antiperistaltic movement - in vomiting, eructation;
- obstructions - with food, foreign bodies, accompanied by tympanism in ruminants;
- stenosis - through compressions from the outside (tumors, adenopathy);
- esophagitis (inflammations), but also abscesses;
- esophagospasm – with “string” appearance due to esophagus spastic contraction (rabies, tetanus).

4.1.2.6 *Examination and semiology of crop (in birds)*

Crop is an esophageal diverticulum in birds examined by general methods (inspection, palpation, percussion) and special methods (puncture, radiological examination, flushing to collect content, biochemical and microscopic examination)

Semiotic aspects:

- pendulum crop – large crop with pendulum moves when the bird moves, encountered in overloads, especially in turkeys and chicken;
- crop ptosis when the crop is so large that it reaches the ground;
- crop inflammation;
- crop rupture – traumatic;

4.2. ABDOMEN SEMIOLOGY

The abdomen is composed of a wall and an abdominal cavity in which are encountered the digestive organs (rumen, reticulum, omasum, abomasum – in ruminants, stomach, small and large intestine, liver and pancreas) and non-digestive organs (urinary system, female genital system, spleen, endocrine glands) connected by ligaments, mesentery and epyplon. The peritoneal cavity is a virtually cavity with small amount of liquid consisting of two serous membranes (the peritoneum): one that covers the abdominal wall (the parietal peritoneum), the other covering the organs (visceral peritoneum).

Changes expressed on the abdomen can be from the abdominal wall or abdominal cavity, from the digestive or non-digestive organs in the cavity. The abdominal cavity can be examined from the outside by general methods (inspection, palpation, percussion, auscultation) or special methods (radiological or ultrasound examination) or from the inside through transrectal palpation, endoscopy (laparoscopy), laparocentesis, laparotomy.

Inspection: In animals, the abdomen has symmetrical half, with the exception of bovines showing asymmetry of the left flank (fullness of rumen), and on the right, ventral part in gestation. In the other species only in pregnant females in the last part of gestation is observed an enlargement of the lower abdominal half (abdominal ptosis).

Semiotic aspects:

- at bovine in the left flank and at horses in the right flank:
- tension - leveling of the hollow of the flank;
- bloating - when the distension reaches the external angle of the ilium;
- tympany when the distension exceeds the external angle of the ilium;
- the abdomen of “the greyhound” occurs in diarrhea, tetanus, chronic disease, or is a breed characteristic in horse, dog,
- “straw” abdomen - increases the transverse diameter of the abdomen in overload, hepatomegaly;
- abdomen and thorax “in barrel” when the transverse diameter of the abdomen and chest increases, and it appear also lung emphysema along with the “straw” abdomen (gastric stomach dilatation in horse);
- “pear” abdomen - appears as a result of the decreased abdominal muscular tone, fluids in the abdomen;
- “batrachian” abdomen - where the large amount of fluid accumulated in the abdominal cavity overcomes the tone of the muscles of the abdominal wall and the animal stay with the abdomen on the ground.
- hydroperitoneum (ascites) accumulation of fluid (transsudate) in the peritoneal cavity, occurs in the disturbance of the local circulation, general circulation (heart failure) or dysproteinemia, consecutive to nephropathy (kidney failure). Rarely, hydroperitoneum may be produced by the accumulation of exsudates (in peritonitis), urine (in bladder rupture), lymph, pus (pyoperitoneum), blood (hemoperitoneum).

The ascites aspect can be simulated by the liquid collections in some organs: pyometra, hydronephrosis, bladder dilation, large ovarian cysts;

- pneumoperitoneum - gas accumulation in the dorsal side of the peritoneal cavity or artificially induced for diagnosis purposes;
- changes of the abdominal wall (generally localized) like edema, phlegmon, hematoma, abscess, hernia, tumors;
- presence of abdominal movements produced by:
 - digestive organs (vomiting);
 - respiratory movements (at the hypochondrium level);
 - myoclonus;
 - fetal movements in pregnant females.

Abdominal palpation can highlight:

- painful sensitivity and increased tension of the abdominal walls in inflammation of the peritoneum and is associated with “woody belly” (abdominal defense, acute abdomen) –tetanus, constipation;
- modified temperature - local or sent to the abdomen from the internal organs;
- abdominal movements –respiratory or digestive;
- particular touch sensations:
 - at superficial palpation – muscular tremor;
 - collections give the sensation of wave
 - baling – in gestation or tumors – the sensation of “ice block in water”

Percussion of the abdomen in normal conditions has a resonant percussion sound in the upper third, impaired resonance in the middle third and a dull percussion sound in the lower third of the abdomen.

In pathological situations can be encountered in the upper third a dull sound (in overloads) or hyperresonant sound (in tympany) or in the lower third a stony dull sound in ascites.

Auscultation of the abdomen can highlight, in pathological situations, sounds produced in the abdominal cavity:

- noise of liquid in movement – in ascites;
 - “drop” noise in hydropneumoperitoneum (liquid mixed with gas), in pyoperitoneum (pus mixed with gas) when suspended drops from the abdominal wall fall into the mass of fluid in the lower abdomen.
 - peritoneal friction noise (Bright sign) - occurs when the peritoneal layers are harsh, following the deposition of fibrin or in congestive peritonitis.

Other normal or pathological noises received from the abdomen but produced by the digestive organs (rumen, reticulum, omasum, abomasum, stomach) or pregnant uterus (the fetal heartbeats) will be described in the following chapters.

Radiological examination (radioscopy and radiography) is useful especially for small animals, for the detection of foreign bodies and peritoneal collections.

Abdominal ultrasound allows the examination of the peritoneal space (collections, tumors) and organs located in the abdominal cavity.

Transrectal exploration in large animals and *rectal palpation* in small animals allows a brief examination of pelvis, of pelvic organs as well as of the internal abdominal walls in mammals and abdominal organs in birds.

Exploratory laparoscopy (abdominal cavity endoscopy) involves the insertion of the endoscope in the abdominal cavity through a small incision in the abdominal wall and examining the internal abdomen and the abdominal organs. Recently, laparoscopy is used for surgery (laparoscopic surgery) of the abdominal organs (cholecystectomy).

Exploratory laparocentesis (abdominal puncture) is performed in the dorsal side when it is intended to remove gas or in the ventral part (in hydroperitoneum) when is removed the fluid content of the peritoneal cavity (fluid can be ascites, lactic, hemorrhagic, pus, gastric, intestinal, bile) and after will be physically, biochemically and microscopically examined.

Exploratory laparotomy (abdominal wall section) - allows examination of the abdominal cavity and abdominal organs through inspection and palpation.

4.3 SEMIOLOGY OF THE RETRODIAPHRAGMATIC DIGESTIVE ORGANS

4.3.1. The gastric compartments in ruminants

Rumen

Compared to the monogastric animals, in polygastric (ruminants) mechanical, physical and biochemical processing of the feed is produced by the flora and fauna at the level of rumen, reticulum and omasum. Rumen, the largest gastric compartment of the ruminants makes connection to the esophagus through a large esophageal wide orifice (12-13 cm) and with the reticulum through the rumino-reticular opening.

The examination of the rumen can be done from the outside by general methods (inspection, palpation, auscultation) special methods (recording the motility, transrectal exploration, exploratory laparotomy, examination of ruminal content, radiological examination) or from the inside (ruminal sondage, endoscopy, rumenotomy, rumenocentesis).

Inspection reveals changes in left ventral or ventral abdomen (Hoflund's syndrome) as well as rumination disturbances. As more important semiological aspects we can encounter:

- the overloading of the rumen with a large amount of undigested fodder (indigestion by overloading) or by gas accumulation (tympany) following the consumption of a large amount of fermentable fodder;
- ruminal paresis (atony) involves the reduction of ruminal tone and movements (atony and akinezia);
- reduction of rumen volume in chronic diarrhea.

Palpation may be superficial and profound:

- the superficial palpation of the abdominal wall can express signs from the rumen at this level, such as:

- increased rumen temperature (inflammation of the rumen mucosa);
- low temperature in atony;
- increased painful sensation in peritonitis, overload;
- ruminal contractions in the left flank.

- the profound palpation of the abdominal wall to reveal the ruminal content consistency:

- in the upper third consistency is elastic (the rumen gas chamber), in the middle third is pasty and in the lower third is tough;

- in pathological conditions the consistency is firm (in overload) or under tension (in tympany) in the upper third of the rumen.

Percussion reveals under normal conditions a resonant sound (tympanic, depending on the amount of gas in the rumen) in the upper third, impaired resonance in the middle and a dull sound in the ventral third of the rumen. In pathological situations, the percussion sound becomes hyperresonant (in tympany) or dull (in overloads, atony) in the left flank.

Auscultation gives the possibility to appreciate the ruminal functionality through the presence of the three normal noises at this level:

- the noise produced by the contraction of the rumen is similar to the noise produced by a distant thunder or a carriage that passes on a wood bridge, it lasts 5-10 seconds and repeats every 50 seconds;
- the shaken liquid noise – movement of the liquid in the rumen;
- noise caused by gas bubbles crepitation - gas displacement.

Frequently, the distant thunder noise overlaps the liquid noise, resulting in a very powerful noise similar to water gurgling over a gravel bed.

In pathological situations, the ruminal pillar contraction may be accelerated (in ruminal indigestion) or reduced (in ruminal atony). The intensity of the noise of gas crepitation increases with the use of vigorously fermentable fodder.

The *recording of ruminal motility* is done using the ruminograph which allows to highlight the reduced or accelerated movements of the rumen (in the case of tympany, atony, Hoflund's syndrome).

Transrectal exploration allows obtaining data on the dorsal cone vesicle of rumen (in tympany, overloading).

Exploratory laparotomy allows a careful examination of the rumen exterior.

Examination of ruminal content is done for physical assessment (color, smell, consistency, composition, sedimentation rate, flotation), biochemical (pH, nitrite reduction, glucose fermentation, cellulose digestion) and microscopic (quantitative and quality of ruminal microbial community). The content is harvested by sampling, rumenocentesis or rumenotomy.

The *ruminal sondage* is used to check esophagus permeability or to remove ruminal gas or content;

The ruminal *endoscopy* allows examination of ruminal mucosa and visualization of changes at this level (paracheratosis).

Rumenocentesis is used for diagnostic purposes (harvest and examination of ruminal content, differentiation of foamy indigestion from gas indigestion) or treatment (in tympany).

Exploratory rumenotomy allows internal examination of ruminal mucosa and therapeutic intervention in the presence of foreign bodies in the rumen and in the reticulum.

Radiological examination possible only for sheep, goats and calves, allows the establishment of topography, shape, dimensions, integrity and presence of foreign bodies in rumen.

Reticulum

Reticulum is the smallest pre-stomach compartment with a mucosa similar to a bee honeycomb. The contraction of the reticulum takes two times (both last 8 to 12 seconds) at a range of 40-70 seconds; its motility is synchronized with the motility of rumen (rumino-reticular cycle), the first contraction begins in the reticulum after it starts in the rumen with the dorsal sac.

Due to the intense activity, the reticulum forms a strong magnetic field around it, allowing it to magnetically retain inside the metallic foreign bodies swallowed by the cattle

with the fodder. If the metallic foreign bodies are sharp they are producing traumatic reticulitis or sometimes, they penetrate the wall of the reticulum advancing to the cord (the organ with the strongest magnetic field in the body) producing reticulo-pericarditis or to the thorax (producing traumatic reticulo-peritonitis). Practically, the examination of the network due to general and special methods is used to highlight the traumatic reticulitis.

Examination by general methods

Inspection can reveal direct signs (very rare) from the reticulum level (the metal body at the level of the chest projection area, or when this metal body has fallen or get rusty, the hole where it was present) but the most common are indirect signs: substernal edema, nervous signs (cortical excitation or inhibition), respiratory signs (sneezes, coughs, polypnea), cardio-circulatory signs (arrhythmias), cutaneous signs (sweating, horipilation), digestive signs (lack of appetite, defecation disturbance), position changes (repeated lifts, avoidance of a slope), muscle signs (tremor of the triceps), scared facies, reduction or stopping of dairy secretion of milk.

Palpation can be superficial and profound:

- superficial palpation - for temperature, humidity, sensitivity;
- deep palpation through intercostal spaces 6 and 7 to highlight the painful deep sensitivity of the reticulum (the animal recedes during palpation).

Percussion of the projection area of the reticulum highlights a sub-dull sound. The percussion area is increased in the case of traumatic reticulitis.

Auscultation allows the reception of a noise similar to "grains given through the sieve" under normal conditions, noise that can be diminished or abolished in reticulitis.

Examination of the reticulum by special methods

Methods that highlight *painful sensitivity*:

- deep palpation with the fist in the costoxiphoid angle;
- the stick test (Gotze);
- the rope test (strap, belt);
- the test of diet and overload with food or water of the rumen;
- the test of air blowing into the rumen;
- drug exacerbation of the motility of the pre-stomach;
- the test of the slope.

Direct percussion of the umbilical area can reveal a modified sound of percussion (Nicow test). The test is positive when instead of a dull sound it appears a resonant sound (pneumoperitoneum following traumatic reticulitis).

Methods to highlight *viscerocutaneous reflexes*:

- milking sample;
 - test of pinching the skin;
 - Falke test;
 - Kalchschmidt test;

Methods that allow the detection of *metal foreign bodies*:

- radiological examination;
- metal detection.

Laboratory methods:

- leukocyte count (neutrophilia);

- determination of iron from faeces;
- puncture fluid examination (peritoneal).

Surgical methods:

- exploratory laparotomy;
- rumenotomy and extraction of the foreign bodies from the reticulum by the rumeno-reticular orifice

Data about the reticulum can also be obtained by functional examination of the reticulum or of other organs that can be influenced by its modified function (the noises from reticulum auscultation, data about appetite, rumination, faeces, evaluation of the general condition)

Omasum

Omasum, the third gastric compartment is characterized by a mucosa with very large surface area (lamellae of various sizes) and play a key role in the absorption of water.

This compartment connects to reticulum through the reticulo-omasal orifice and to abomasum through the omaso-abomasal orifice. The omasum is not suitable for physical examination because of its topography, but it can be done on the right side by general methods (inspection, palpation, percussion, auscultation) and complementary methods (puncture, exploratory laparotomy):

- *Inspection* - indirect signs: spine position, bloating of the right hypochondrium in dilatation of the omasum, the general condition of the animal;
- *Palpation* - intercostal spaces 7-9 for the profound painful sensitivity present in inflammations, obstructions or consecutive lesions produced by foreign bodies;
- *Percussion* - normal percussion sound is sub-dull. In the case of obstruction, inflammation, the percussion area is increased, but sometimes the percussion sound may also change (resonant in tympany);
- *Auscultation* - in normal conditions is highlighted the liquid noise (drooping) or gas crepitation;
- *Puncture* is practiced in exceptional situations;
- *Exploratory laparotomy* allows direct examination of the omasum (shape, volume, consistency, motility) as well as therapeutic intervention.

Omasum disturbances are rare, and when they are present, their clinical signs are confusing. Its inflammation is called omasitis.

Abomasum (the "real" stomach)

The abomasum has a mucosa with spiral folds containing glands that secrete gastric juice (with lower acidity than the monogastric stomach). It opens to duodenum by pylorus orifice. The abomasum is easily examined in calves and difficult in adult ruminants by general methods (inspection, palpation, percussion and auscultation) and special methods (sondage, puncture, laparoscopy, radiological examination):

- *Inspection* – in the right hypochondrium can be highlighted its swell in tympany, overloads, but also changes in attitude, rumination;
- *Palpation* – under the right hypochondrium in calves and intercostal spaces 9-11 in adults to reveal the painful sensitivity and the consistency of the organ;
- *Percussion* – on the right side, between intercostal spaces 9-11 allows to highlight the normal percussion sound (sub-dull), sound that can be modified in overloads (dull) or tympany (resonant);
- *Auscultation* – in normal conditions reveals the noise of gas crepitation or water movement;

- *Puncture* – rarely used;
- *Laparoscopy* – allows to highlight the abomasum displacement;
- *Laparotomy* – allows the direct examination of the abomasum (shape, size, consistency, motility) and therapeutic intervention;
- *Radiological examination* – with good results in young bovine

Abomasum pathology is rare, except for the abomasum displacement or abomasal volvulus. In 80% the abomasum displacement is on the left, but can be also on the right with severe signs of abdominal colic. Abomasum inflammation is known as abomasitis and occurs specially in young ruminants.

4.3.2 Stomach in monogastric animals

The stomach is a muscular organ supported in the diaphragmatic dome by ligaments and connects with the esophagus by cardia orifice and with the duodenum by pylorus.

The stomach mucosa contains cardiac glands (that secrete mucus and gastrin), gastric glands (that secrete pepsin and hydrochloric acid - HCl) and pyloric glands (that secrete mucus).

Stomach digestion occurs due to mechanical activity (homogenization and peristaltic movements) and biochemical (gastric acid). This gastric acid, or colloquially known as gastric “juice,” will work to break down the bonds within the food particles at the molecular level and it is possible by the action of free HCl and enzymes: pepsin (activated by the HCl from pepsinogen, role in protein digestion), gastrin (protein digestion), gastric rennin (chymosin – coagulation of milk), gastric lipase (low lipid hydrolysis), lysozyme. The gastric juice also contains mucus with role in mucosa protection. All these actions contribute to formation of the gastric chyme (with acid pH) neutralized by the pancreatic secretion and bile to intestinal chyle.

Horse

The horse stomach is hard to examine because is covered by the ribs. However, can be examined by general methods (inspection) and complementary methods (transrectal palpation, gastric sondage, examination of the gastric juice)

- inspection allows the reception of indirect signs from the stomach such as:
 - chest and abdomen in “the barrel” - in acute gastric dilatation;
 - dyspnea;
 - appetite changes, mastication, swallowing;
 - severe gastric colic (described at the intestine);
- transrectal palpation allows reaching the stomach in gastric dilatation;
- gastric sondage for diagnostic and therapeutic purposes, allows gas, liquids, gastric content elimination;
- physical, biochemical and microscopic examination of gastric juice.

Swine

The swine stomach is difficult to examine in adults, the examination can be done only in young animals and animals with a bad maintenance (skinny) by general methods (inspection and palpation) and special methods (radiological examination, gastric sondage, laparotomy):

- *inspection* highlights:
 - sterno-abdominal position, predilection on cold places;
 - gastric dilatations;

- extremity cyanosis due to cardio-circulatory insufficiency (large gastric dilatation);
- the presence of vomiting and examination of vomited content;
- changes in appetite, mastication, swallowing
- *palpation* of the epigastrium area - especially in dilatation and gastralgia (gastric pain) present in gastritis;
- *gastric sondage* - examination of gastric juice,
- *radiological examination* - allows appreciation of size, position, shape and gastric motility;
- *exploratory laparotomy* allows direct examination of stomach, but also therapeutic intervention

Rabbit, nutria (swamp beaver) and mink

Examination is done very easily by general methods (inspection and palpation) and sometimes by complementary methods (sondage, puncture, radiological examination):

- *inspection* - epigastric deformations in tympany, overloads;
- *palpation* reveals size, position, consistency of the organ, painful sensitivity at this level;
- *sondage*- followed by the gastric juice examination;
- *puncture* -gas dilatation;
- *radiological examination* - easy to achieve, allows the determination of shape, position, size and motility of the stomach.

Dog and cat

Dog and cat stomach is also examined easily by general methods (inspection and palpation) and special methods (sondage, laparoscopy, laparotomy gastroscopy, gastrotomy, radiological examination, ultrasound examination):

- *inspection* reveals data about the deformations in the epigastrium area (gastric dilatations, displacements), long term decubitus position, and vomiting as a result of gastric dyspepsia (the gastric digestion is difficult and painful). Gastric dyspepsia can be motor due to changes in motility or secretory. Motor gastric dyspepsia can occur as a result of decreased gastric motility (hypotonia, gastric hypoperistalsis in overloads) or increased gastric motility (hypertonia, gastric hyperperistalsis). Secretory dyspepsia is the result of decreased gastric juice secretion (hypo-secretory dyspepsia – vomiting occurs immediately after feeding because of overloading) or increased gastric secretion (hyper-secretory dyspepsia – characterized by permanent hunger and vomiting occurs between meals and only contains gastric juice).
- *palpation* – reveals shape, position, size, consistency, painful sensitivity - occurs in stomach inflammation (gastritis), gastric hemorrhage;
- *gastric sondage* - allows taking samples of gastric juice and physical, biochemical and microscopic examination. A pre-diet of at least 24 hours, a lunch and taking samples of gastric juice are required to assess the amount of gastric juice, the hydrochloric acid and HCl concentration.
 - the amount can be:
 - high (hyper-secretion of gastric juice);
 - low (hypo-secretion of gastric juice);
 - absent;

- hydrochloride (free hydrochloric acid):
 - hyper-chloride increased amount of hydrochloric acid;
 - hypo-chloride reduced amount of hydrochloric acid;
 - an-hydrochloride – absence of hydrochloric acid;
- concentration (total acidity of gastric juice)
 - hyperacidity- increased total acidity;
 - hypoacidity (sub-acidity) decreased total acidity
 - anacidity – absence of total acidity;
 - *radiological examination* commonly used as radiosopic technique (barium transit) and radiographic technique, using the dorsoventral and lateral (profile) position allows obtaining objective data on the shape, position, size, motility and presence of foreign bodies in the stomach.
 - laparoscopy, laparotomy, gastroscopy, ultrasound examination – used in some pathological situations.

Birds

Birds stomach consists of two compartments (glandular stomach and muscular stomach) that can be examined by general methods (inspection and palpation) and sometimes by special methods (laparotomy, radiological examination). Semiotic aspects encountered are the lack of pebbles in the muscular stomach (reduced consistency) and the presence of nodular deformations perceptible to palpation.

4.3.3. The intestines

Intestine is a tube of varying length and thickness depending on the species. It has two segments with very different structure and functionality, respectively:

- small intestine (duodenum, jejunum, ileum);
- large intestine (cecum, colon, rectum).

In duodenum open the cystic duct (with the bile component), the pancreatic duct (pancreatic secretion), and accessory pancreatic duct (only in horse and dog).

Bile is the secretion of the liver stored in the gall bladder and contain biliary salts, cholesterol, mucus, phosphates, sulphates, carbonates with important role in the digestion and absorption of lipids (biliary salts role is to emulsify lipids), fat-soluble vitamins. Bile pigments do not have digestive function.

Pancreatic juice (exocrine function) contains only enzymes strictly necessary for digestion like: trypsin and chymotrypsin (cleaves albumins and peptones), pancreatic amylase (cleaves starch and glycogen), pancreatic lipase (cleaves lipids), carboxypeptidase (cleanses amino acids), esterase (cleaves cholesterol).

The intestinal juice produced by the Brunner and Lieberkühn glands present on the entire mucosa of the small intestine contains mucus, serotonin, IgA and enzymes (glycolytic, proteolytic, lipolytic).

Apart from these three components, digestion in the small intestine is completed by the presence of peristaltic movements (accelerated or diminished), mucosa villi with role in absorption of amino acids, monosaccharide, fatty acids, triglycerides.

The large intestine does not have villi and yet it plays a big role in the absorption of vitamins and water, electrolytes, but also in digestion in herbivores (through glycolytic flora), omnivores and carnivores (through proteolytic flora).

For the examination of intestines can be used general methods (inspection, palpation, percussion, auscultation) and special methods (laparoscopy, laparotomy, laparoscopy, enterocentesis, radiological examination, echography, enema).

Ruminants

- *Inspection* - allows obtaining data about:
 - appetite, defecation, faeces;
 - presence of intestinal tympany;
 - colic syndrome (faded in ruminants);
- *Transrectal palpation* useful for the detection of intestinal obstructions and intestinal tympany;
- *Percussion* - is performed in the right flank and allows in normal conditions the detection of a resonant sound in the dorsal half and dull sound in the abdominal ventral half; it can change in pathological conditions;
- *Auscultation* reveals the presence of gas crepitation in the intestines, and if the peristalsis and intestinal secretions are accentuated occurs liquid movement noises (in enteropathy)
- Enterocentesis can only be performed when large gas dilatations are present;
- Laparoscopy, laparotomy and radiological examination are rarely practiced in ruminants.

Horses

Inspection - changes in symmetry and diameter of flank and presence of colic syndrome (latin dolor coli = colon pain).

Colic syndrome present in all species has a dramatic evolution in horse and dog, while in other species evolve easy or inapparent, therefore it has been extensively studied in this species. Colic can be true and false. The true colic appears after the damage of the gastrointestinal tract and is expressed through brutal, dramatic digestive manifestations (anorexia, vomiting, constipation, diarrhea, caudal mimics), nervous signs (agitation, hyperkinesis), respiratory (tachypnea), urinary (anuria), cardiovascular (arrhythmia), skin (sweating, horripilation, muscle tremors), mucosa (congestion), ocular (exophthalmia, photophobia), attitude changes (camping, self-auscultation, repeated lifting) hypothermia or hyperthermia.

False colic occurs when the modifications occur at the liver, abdominal vascular system, peritoneum (abdominal colic) or in heart diseases, respiratory, nervous.

Palpation

- Trans-abdominal - is difficult to perform, can provide data on painful sensitivity or the presence of coprostasis.
- Transrectal - is performed after a careful examination of the anus and defecation and can establish the topography of intestinal segments, as well as the presence of mucus, pus, blood on the arm (arm mark);

Percussion reveals in normal conditions resonant or sub-dull percussion sound.

Auscultation – is performed on the right side for the cecum and the ascending colon (for the anses I and IV) and on the left for the anses II and III, where gurgling, liquid noise, tangles,

cascade noise, noises that in pathological conditions may accelerate, diminish or may be absent.

Enterocentesis is practiced with the purpose of diagnosis or treatment of cecum (cecocentesis), frequently in tympany.

Swine

Intestine examination in swine can be performed only in young swine and very skinny animals:

Inspection:

- indirect signs: changes in appetite, defecation, attitude or feces;
- sometimes bloating in the flanks;

Palpation:

- jejunum, cecum and colon palpation allows detection of tympany, coprosthesis, nodular deformations (mesenteric lymph nodes increased in volume in tuberculosis), the presence of painful sensitivity;

Percussion in normal conditions reveals resonant sound. Hyperresonance occurs in tympany, dullness in constipation

Auscultation highlights the presence of liquid noise;

Rectal palpation allows examination of the pelvic cavity, rectum and the rectal sphincter;

Laparotomy - commonly used in group enteropathies (in the large units of animals);

Radiological examination – to determine intestine position as well as the motility (by barium transit);

Puncture, laparoscopy and ultrasound are rarely used.

Dogs and cats

Intestine examination is easy to perform and allows to highlight a variety of semiotic aspects (most of these changes occurring in other species):

-inspection allows to obtain data on:

- bloating in tympany and constipation;
- abdomen sucked - in enteritis, dehydration;
- localized deformations: hernias (when the intestines are under the skin but covered by the peritoneum), eventration (when the intestines pass through the peritoneum under the skin);

- appetite, vomiting, defecation, faeces;
- abdominal respiration in trans-diaphragmatic hernia;

- palpation allows the examination of each individual part: it is mainly concerned on the presence of the painful sensitivity as a result of inflammation: enteritis (general term used for inflammation of the intestinal mucosa), duodenitis (duodenum inflammation), jejunitis (jejunum inflammation), ileitis (ileum inflammation) colitis (colon inflammation), proctitis (rectum inflammation);

- other semiotic aspects: coprosthesis, fecalomas, tumors, intestinal spasms, volvulus (intestinal torsion), intussusception (intestinal intrusion into itself);

-percussion in normal circumstances percussion sound is resonant, hyperresonance occurs in intestinal tympany, dullness in constipation;

-auscultation highlights the noise of liquid, gas crepitation, but weak as intensity

- *rectal palpation* allows, especially in dogs, detection of perianal abscesses, rectal tumors, coprostasis, pelvis fractures;
- *enema* - diagnostic purposes (sampling and examination of the intestinal content), but also as treatment (in constipation);
- *laparocentesis* – sampling and examination of the puncture fluid allows diagnosis of intestinal perforation;
- *laparotomy* - practiced in exceptional situations, allows direct examination of intestines;
- *radiological examination* (radioscopy, radiography) commonly used, allows the detection of many semiotic aspects:
 - megacolon – colon dilatation (congenital or acquired), expressed by rebellious constipation;
 - aerocoly- gas accumulation in colon;
 - foreign bodies;
 - coprostasis;
 - permeability of the intestinal tract (through barium transit).

Introduction of contrast agents in the rectum is called irrigoscopy (barium enema).

- *ultrasound examination* - allows to highlight a large number of semiotic aspects: intussusception, hydro-peritoneum.

Rabbit, nutria (swamp beaver) and mink

The intestines of these species are very easy to examine, show a pathology similar to dog and cat. However, a greater frequency of pathology is due to colon overloading in rabbit.

Birds

The intestines can be examined through transabdominal palpation (for volume and consistency changes), radiological examination (with contrast agents), laparotomy (especially in group enteropathies)

4.3.4. The perianal area and anus

The perianal area is examined by inspection, palpation, sondage, scraping, microscopic examination. In this area can be highlighted: depilations, excoriations, wounds, crusts, ulcers, fistulas, perianal abscesses, phlegmons, pruritus (movement of the animal on the butt, rubbing the surrounding objects) deposits of faeces with the formation of an anal deposit, mucus discharges (mucus - anus sign), the presence of blood, parasite eggs, bleeding of the scallop (birds as a result of cannibalism).

Anus

The anus is examined by inspection, palpation, rectal palpation, rectoscopy.

Specific semiotic aspects encountered are:

- anus atresia is congenital and occurs in piglets, chicken, lambs; rare rectum atresia;
- anus paralysis – lack of anal sphincter tonus and continuous defecation;
- clogging of anus in animals with poor maintenance condition
- anus prominence - inflammation of surrounding tissues;
- anal respiration – anus movements synchronized with breathing (severe dyspnea), sometimes with excessive flatulence;
- presence of hemorrhoids – inflammation of vascular structures in the anal canal
- thermometer sign – mucus/blood on the thermometer after examination.

4.3.5. Defecation, faeces and rectal exploration

4.3.5.1. Defecation

Defecation involves the discharge of faeces through anus. At this function is observed the animal's position, frequency, duration and intensity.

Semiotic aspects encountered are:

- Tenesmus- painful, dramatic defecation, without elimination of the feces. These efforts can be accompanied by rectal prolapse. Occurring in proctitis, infectious enteritis.
 - Involuntary defecation (incontinence) – defecation without effort and without taking the position of defecation (in walking), in nervous diseases. In horses and bovine during work, defecation is normal;
 - Diarrhea – frequent and rapid elimination of faeces with liquid (low consistency, soft) and non-digested food residues (in enteritis, dyspepsia).
 - considering its content, diarrhea can be: serous, mucous, bile, fatty;
 - after clinical expression may be:
 - mildly- short;
 - intense -for a few days;
 - continuous- dehydration in chronic enteritis
- Dysentery - blood diarrhea with bad smell, following the putrefaction caused by specific infectious germs (*Sigella*, *Amoeba*, *Clostridium*);
- Constipation - a rare, painful defecation with hard feces and in small amounts (in intestinal hypokinesia, in reduced intestinal secretions, in enteritis, dehydration);
- Coprosthesis - feces accumulated in the colon or rectum as a fecaloma (large quantity and hard) or coprolite (when feces are saturated with calcium salts, having the appearance and consistency of the stones).

In the same time with defecation is examined also flatulence – elimination of gas accumulated in the intestine, due to normal digestive processes (small amount) or pathological (when flatulence is abundant or can be absent in intestinal obstruction).

4.3.5.2. Faeces

Faeces can be examined physical (quantity, shape, appearance, consistency, color, odor, composition), biochemical (presence of blood, bile pigments, proteins) and microscopically (the presence of starch, fats, cellular elements, bacteria, parasite eggs, parasites).

Two physical objects with special semiotic significance will be further analyzed:

- The feces color - in pathological conditions can be: dark, yellow, white, black, red.

The presence of blood in feces should be discussed. It may give two characteristic semiotic aspects:

- black / melena when blood comes from the anterior level of the digestive tract (esophagus, stomach, small intestine);
- red - when blood originates from hemorrhages in the posterior sections of the digestive tract (large intestine)
- The composition of the feces: food residues, foreign bodies (sand, mud, stones, plastic, metals), mucus, parasites (eggs, adults), pus, blood.

The presence of mucus gives particular aspects of faeces depending on its place of origin:

- mucus faeces - when the faeces are mixed with mucus (the mucus comes from small intestine);
- faeces with mucus on their surface (the mucus is from the colon);
- sometimes mucus is eliminated without faeces (false membranes).

4.3.5.3 Rectal examination

This examination can be done by:

- rectal palpation (in large animals) by insertion of hand in the rectum, elimination of feces and examination of rectum and colon mucosa;
- rectal touch examination (small animals) using a finger to perform the rectal mucosa examination;
- rectoscopy - rectus endoscopy.

When is performed the examination of the organs and tissues around the colon or rectum (located in the pelvic cavity and abdomen) the technique is called transrectal palpation.

Rectal examination can provide data on the anal sphincter (increased tonus – spasm, decreased tonus - paralysis), rectal or colon mucosa, local temperature and sensitivity, presence or absence of feces, presence of tumors, rupture of the walls. After rectal exploration on the finger or arm, there may be deposits of mucus, blood, pus, false membranes, known as *the arm / finger sign*.

4.4. SEMIOLOGY OF THE LIVER AND PANCREAS

4.4.1. Liver

The liver is formed by several lobes (right, quadrate, left, caudate) depending on species and located retro-diaphragmatic. It is covered by a serous coat derived from the peritoneum, and this firmly adheres to the inner Glisson's capsule and crossed by blood vessels (portal vein, hepatic artery), hepatic duct.

Hepatic parenchyma consists of hepatic lobules (plates of hepatocytes) crossed by arteries, veins, bile capillaries.

Duct system - intrahepatic bile ducts (intercellular, perilobular and interlobular bile ducts) and extrahepatic bile ducts formed by union of several interlobular pathways, the hepatic duct, bile duct with cystic duct which opens in duodenum by Vater ampoule provided with a sphincter – Oddi. The only species that does not have a gallbladder is the horse.

In the hepatic cell (hepatocyte) are found:

- liver enzyme:
 - LDH (lactic dehydrogenase);
 - transaminases (aminotransferases):
 - TGP=GPT=SGPT=ASAT (alanine transaminase)
 - TGO=GOT=SGOT=ALAT (aspartate transaminase)
 - ALP (alkaline phosphatase);
 - cholinesterase;
 - LAP (leucine-amino peptidase);
 - CPK (creatin phosphokinase, creatine kinase);
 - GGT (Gamma-glutamyl transpeptidase);
 - ornithine-carbamyl-transferase;
- Cholesterol, phosphatides, fatty acids, pigments (bilirubin), glycogen (glucose storage form)

All of these components contribute to the hepatic functions, namely:

- bile production;
- metabolism (protein, lipid, carbohydrate, enzymatic, vitamin, mineral);
- synthesis of plasma proteins (prothrombin, fibrinogen);
- bile pigment excretion, cholesterol, urea

- deposit of vitamins, hormones, glycogen, enzymes and blood.

Considering the complexity and intensity of hepatic function, at this level is inevitable also a significant destruction of hepatocytes, destruction which is annihilated by the high regenerative capacity at of liver tissue (it can recover even if it is destroyed in a proportion of 70%, only if the destructive factor stops the action - non-specific infections, toxins).

The liver is *physically* examined by general methods (inspection, palpation, percussion), special (radiographic examination, scintigraphy, cholangiography; taking liver tissue samples followed by histological examination, ultrasound, laparotomy) as well as *functional* (tests of hepatic activity).

Physical examination and semiotic aspects:

Inspection - gives direct and indirect signs:

- direct signs- deformations in the right hypochondrium (hepatomegaly);
- indirect signs: colic and liver jaundice, skin pruritus, changes in appetite, faeces, presence of ascites, visceral-skin reflexes;

Palpation – is possible only in small animals and allows to reveal the shape, position, consistency and sensitivity.

Liver sensitivity is obvious in inflammatory processes: hepatitis (inflammation of the liver), cholangitis, angiocholitis (inflammation of the extrahepatic bile ducts), cholecystitis (inflammation of the gallbladder) as well as cholelithiasis – lithiasis in the bile ducts and in the gallbladder;

Percussion - the right side of the abdomen allows to reveal the normal percussion sound (dull) and to establish the percussion area, which can be increased in congestion, tumors, echinococcosis;

- *Radiological examination* in small animals is done by:

- *radiography* following the size, shape and degree of radio-absorption of the liver;
- *scintigraphy* with experimental character in dog;
- *cholangiography* – allows examination with artificial contrast (eg Odiston) of intra - and extra hepatic ducts, by intravenous or oral administration;
- *cholecystography* allows to determine the shape, position, motility and contents of the gallbladder;
- *ultrasound examination* allows to highlight the dimensions of hepatic lobes, the gallbladder content;

- *laparotomy* allows to reveal shape, size, position, color but also intervention on liver in case of liver rupture.

Functional examination and semiotic aspects:

Functional examination allows the testing of four large groups of liver functions:

a. Testing *gallbladder function* (production and elimination of bile in the duodenum) involves the use of tests for the determination of:

- cholemia - presence of bile pigments in blood:
 - hyper-cholemia: increased amount;
 - hypo-cholemia: decreased amount;
 - acholia – absence of bile secretion;
 - bilirubinemia – presence of bilirubin in blood;
- choluria the presence of bile pigments in urine:

- hyper-choluria – increased quantity;
- hypo-choluria - decreased quantity;
- pigments and bile salts in the feces.
- b. Testing the *hepatic cell function in metabolism*:

- testing the liver's participation in protein metabolism

Holoprotein genesis involves the production of own proteins, such as:

- albumins (albuminemia);
- globulins (globulinemia) eg. β -globulinemia;
- fibrinogen - fibrinogenemia (coagulation factor I);
- prothrombin - prothrombinemia (coagulation factor II).

For all these types of proteins, kit tests for protein can be used to measure the increased or decreased level, sometimes is target the total proteinemia, sometimes only certain serum protein fractions.

- testing the liver's participation in lipid metabolism – measurement of the cholesterol level in blood and urine;
- testing the liver's participation in carbohydrate metabolism:
 - glycogenesis - glycogen production;
 - glycolysis - glycogen transformation in glucoses, in case of hepatic modifications can occur hyperglycemia, hypoglycemia, ketonemia, glycosuria;
- testing the liver's participation in water metabolism

c. *Hepatic cytolysis* testing (hepatic enzyme diagnosis)

Periodically the used hepatic cells are destroyed (cytolysis) releasing enzymes and iron in the blood. In certain situations, the number of cells destroyed is increased (in hepatitis), which implies an increase in the amount of enzymes like GPT, ALP, GOT and iron in the blood. In serious liver deficiencies, enzymatic changes are accompanied by a decrease in body temperature.

d. Testing the *plasma purification function* (antitoxic):

This test allows verification of plasma purification capacity of the liver by some toxic substances and the applied sample is called *clearance* (applied for renal function check also). The test consists in measuring the time required to remove a known substance (Congo red) from the blood plasma that passes to the liver, and the evaluation is made according to the elimination of the known substance through the bile and the amount of this substance that remains in the liver. Remaining dye for more than 45 minutes in plasma is a sign of intoxications, hepatic parenchymal lesions, hepatic tumors or leptospirosis.

Hepatic disease diagnosis requires the concomitant use of several liver tests, tests that will necessarily be repeated to determine the progression of hepatic disease. Clinically, hepatic dysfunctions are hepatic failure syndromes and extrahepatic syndromes.

Hepatic failure syndrome - involves altered liver function, which is expressed by:

- auto-intoxication syndrome (endogenous intoxication);
- hemorrhagic syndrome.

Hepatic failure occurs in hepatitis, cirrhosis, neoplasms.

Extrahepatic syndromes are generally expressed by jaundice, which is caused by two causes:

- obstructions (lithiasis, parasites, tumors, trauma, spasms) at gallbladder level or ducts and the bile does not flow into the duodenum, but passes into the blood, bile pigments yellowing the skin and mucosa.

- toxins – when occurs a bile hyper-production due to acute inflammatory processes (viral hepatitis).

4.4.2. Pancreas

Glandular organ consisting of lobules with two types of glands:

- exocrine glands (serous acini) - producing pancreatic juice which contains digestive enzymes:
 - proteolytic (trypsin having the precursor trypsinogen, chymotrypsin) hydrolyzing polypeptide;
 - lipolytic (pancreatic lipase) cleaves glycerides in fatty acids and glycerol;
 - amylolytic (pancreatic amylase) cleaves starch in maltose and dextrin;
- endocrine glands (Langerhans islands) -producing pancreatic hormone and insulin.

Physical examination can be performed by general methods (inspection and palpation) and special methods (radiological examination, ultrasound examination, laparotomy) especially in small animals:

- *Inspection* - indirect signs: changes in appetite, defecation, faeces, pancreatic colic;
- *Palpation* - the presence of pain sensitivity (in pancreatitis), increasing in volume (in tumors, pancreatic abscesses)
- *Radiological examination* after pneumoperitoneum
- *Exploratory laparotomy* allows direct examination of the gland shape, size, color, position.

Functional examination:

-exocrine function:

- dosing pancreatic enzyme involved in digestion at the level of duodenum (taking samples of pancreatic juice by sondage)
- the clinical signs of exocrine dysfunction – appetite, faeces, general condition, colic, fever, diarrhea or constipation;
- laboratory examinations: urine, feces, blood;
- endocrine function – measuring the insulin and glucose level from blood and urine.

Clinically, at the pancreas level can occur:

- pancreatic failure syndrome;
- the acute and chronic pancreatitis syndrome;
- compression syndrome produced by other organs on the pancreas;
- cancer of the pancreas in dog;
- endocrine syndromes:
 - hyperglycemic (diabetes mellitus) due to lack of insulin
 - hypoglycemic (permanent hunger) - caused by insulin hypersecretion.

5. SEMIOTICS OF THE RESPIRATORY SYSTEM

The respiratory system is composed by the upper and lower airways (nasal passages, pharynx, larynx, trachea, 2 bronchi) and the lungs. The functions of this system are: external breathing (inspiration and expiration), internal breathing (haematosi) and adjustment of the body temperature.

The examination of the respiratory system includes a functional examination (with general signs and specific organs signs) and a physical examination both for the prethoracic airways and the thoracic-pleuro-pulmonary segment using general and special methods of examination.

5.1. FUNCTIONAL EXAMINATION OF THE RESPIRATORY SYSTEM

This examination allows the physician to emphasize some alterations of the respiratory system physiological functions or to reveal some new pathological signs (cough, sneeze).

➤ 5.1.1. General signs

- Fever
 - Mild fever – tuberculosis, pneumoconiosis;
 - Continues fever (plateau fever) – lobar pneumonia of the horse;
 - Remittent fever- bronchopneumonia of the cattle, nephritis;
 - Atypical fever - abscesses with pulmonary localization;
- Progressive weight loss
- Sweating and shivering
- Reduced productivity and effort capacity

➤ 5.1.2. Organ signs

5.1.2.1. *Respiratory noises perceived away from the animal*

- **Sneezing**- sudden spasmodic audible expiration of breath through the nose and mouth especially as a reflex act – specific for irritation or inflammation of the mucosa in the nose or nasopharynx (rhinitis, dust, foreign body)
- **Snoring**- a rough noise made on inspiration due to the vibration of the soft palate. It is specific for the horse
- **Sighs** – a long, deep audible expiration - in pleuritis, meningoencephalitis, coastal fractures.
- **Groans**- specific for satiated animals or pleuritis, colic, bronchopneumonia
- **Labial blast** – breathing through tightly pressed lips after effort or in dyspnea
- **Blasting respiration** – caused by narrowing of the nostrils or nasal cavities (pig and dog)
- **Snoring respiration** – similar to the snoring sound, caused by large stenoses of the airways
- **Snorting respiration**- the specific noise is generated by the presence of secretions (for coma and agony). In the presence of secretions with false membranes, the air column that passes creates a noise like the one produced by the movement of a flag
- **Crackles** (rales)- occurs when airways are filled with secretions with small bubbles of gas that are being broken by the air column
- **Wheezing** (stridor) - is a continuous, coarse, whistling sound produced in the respiratory airways during breathing. For wheezes to occur, some part of the respiratory tree must be narrowed or obstructed (inflammation or tumours). Wheezing classification:
 - By the time of onset: inspiratory, expiratory or mixt wheezing
 - By the localisation:
 - Nasal wheezing – is a mixt wheezing
 - Laryngeal wheezing (the real wheezing)- specific for racing horses, when during the race the recurrent nerve is injured and vocal cords are paralyzed. It also occurs in stenosis with different etiology.
 - Tracheal wheezing
 - Bronchial wheezing
- **Vocal noises** – specific for every species. Modification of the voice are caused by laryngeal injuries. The lack of voice is called aphonia.

- **Hiccup** - a quick, involuntary inhalation that follows a spasm of the diaphragm and is suddenly checked by closure of the glottis, producing a short, relatively sharp sound.
- **Cough** – a rapid expulsion of air from the lungs suddenly with a sharp, short noise.

Cough classification:

- By its origin:
 - respiratory cough- generated by the excitation of the pneumogastric nerve
 - peripheral cough- generated by extrapulmonary excitations (from the uterus, stomach, intestine, peritoneum, middle ear)
 - central cough- generated by the excitation of the cough centre in the brain (in medulla oblongata)
- By the way it is produced – spontaneous or by stimulating the larynx or the trachea
- By its frequency:
 - Unique cough – when coughing produces the elimination of the foreign body that generated it.
 - Repeated cough- can be rare, frequent or permanent (in acute inflammation)
- By its rhythm:
 - Simple cough – a single expulsion
 - Coughing fits – multiple clustered expulsions
- By its intensity:
 - heavy cough
 - mild cough
 - recurrent cough- when the cough is followed by an audible inspiration
- By its tonality:
 - High cough
 - Low cough
- By its timber:
 - Dry cough – only the expulsion
 - Productive cough – after expulsion, secretions of the respiratory tract are being eliminated
 - Rough cough – when vocal chords are affected
- By its length:
 - Short cough - in pleuritis
 - Long cough – in painless conditions
- By association with other signs:
 - Painful cough
 - Emetic cough

5.1.2.2. *Pain*

The pain from the respiratory system is shown by the animal through by changes of facies, attitude, discomfort of respiratory movements, painful sensibility at palpation and so on.

Pain from the upper respiratory airways (pharynx, larynx, trachea) is expressed by orthopneic position, immobility of neck and head, worried facies, dyspnea, defence reactions at the palpation of the affected segments.

Thoracic pain (pleurodynia) is present when the thoracic wall, pleura or mediastinum are affected. Signs for thoracic pain are: mild cough, kyphosis, increased distance between olecranon, thoracic and respiratory asymmetry, defence reactions at the palpation of the thorax.

5.1.2.3. *Dyspnea (heavy respiration)* – is characterised by modification of frequency, rhythm, amplitude, duration and type of respiration. Clinically, the animal is cyanotic (skin and mucous membrane), with an orthopneic position, scared facies and a tendency to collapse.

Normal breathing= eupnea, abnormal breathing= dyspnea.

Classification of dyspnea:

- By its frequency:
 - Tachypnea – high breathing rate (Pneumonia, tumours, fever, pain, pulmonary atelectasis, anemia)
 - Bradypnea – slow breathing rate (airways stenosis, poisoning, meningoencephalitis, coma)
 - Apnea- suspension of breathing during a period of time
- By its rhythm:
 - 2 times rhythm breathing – implies prolonged expiration executed in two times rhythm due to fatigue by overloading of the diaphragm. Contraction and decontraction of the diaphragm are done suddenly, causing movement of the abdominal organs in the anterior area of the abdomen or into the abdominal wall.
 - cogwheel respiration (several times rhythm breathing) - a breathing pattern characterized by a repeated series of brief interruptions of inhalation and exhalation.
- By its amplitude:
 - Superficial – in pleuritis, pleurodynia, diaphragmatic inflammation
 - Profound – after effort, in lung diseases
 - Asymmetrical – respiratory dysmetry of one hemithorax (pleuritis, unilateral lung diseases, pleural collections).
- By its length:
 - continuous or discontinuous – for a certain amount of time;
 - paroxysmal – with unknown cause;
- By the respiratory type:
 - The normal respiratory type in animals is costoabdominal respiration;
 - Thoracic respiration - common for diaphragmatic or abdominal lesions;
 - Abdominal respiration- common for pulmonary emphysema, pulmonary atelectasis;
 - Pendulous respiration- when the function of the diaphragm is lost, inspiration is no longer accompanied by bulging of the abdomen. Common for diaphragm paralysis, diaphragmatic hernia, pleurisy;
- By the respiratory time: inspiratory dyspnea, expiratory dyspnea, mixed dyspnea;
- Other complex types of respiration:
 - Kussmaul's respiration- A very deep, repetitive, gasping respiratory pattern associated with profound acidosis, renal failure, coma, agony;
 - Cheyne-Stokes respiration - breathing characterized by rhythmic waxing and waning of the depth of respiration; the animal breathes deeply for a short time and then breathes very slightly or stops breathing altogether. Periodic breathing of this type is caused by disease affecting the respiratory centers, usually heart failure or brain damage.
 - Biot's respiration - characterized by irregular periods of apnea alternating with periods in which four or five breaths of identical depth are taken; seen in patients

with increased intracranial pressure associated with spinal meningitis and other central nervous system disorders.

Dyspnea can also be produced by other causes that restrain hematoses in the respiratory system, like:

- asthmatic conditions (bronchial hypersecretion, bronchospasm, laryngospasm);
- cardiovascular diseases – they generate reduction of the tissue oxygenation (hypoxia).

5.1.2.4. *Expired air* – the air stream is examined at the nostril level. Attention should be given to the presence (at one or both nostrils), the frequency, the intensity, the temperature, and the smell of the odor of expired air.

- **presence**- when the air stream is present on a single nostril, the suspicion is that the other nostril or nasal cavity is obstructed (by secretion, inflammations, tumours).
- **frequency**- is higher in tachypnea, lower in bradypnea or absent in apnea (clinical death) or when the animal is breathing only through the mouth;
- **intensity**- higher in dyspnea, lower in superficial breathing;
- **temperature**- higher in generalised hyperthermia or only at the respiratory level, lower in generalised hypothermia, circulatory collapse;
- **odor** - is an important quality of the expired air.
 - normal – odourless or tasteless;
 - modifications:
 - aromatic odor (sweetish, acetone like) – in ketonemia, ascaridiasis;
 - tooth decay smell- in bones gangrene and dental caries;
 - putrid (fetid)- in pulmonary gangrene;
 - urine odor (ammonia)- in uremic syndrome.

5.1.2.5. *Nasal discharge* – involves elimination of secretions (blood, pus, food) with various origins through the nasal passages. Seromucous fluid in small amount is normal in healthy animals after effort, and in cattle permanently.

Pathologically, the nasal discharge appears:

- suddenly (in airways irritations), intermittent (from collections on airways or lungs) or continuous (in airways inflammations).
- after the cough (when the collections are on deep airways), after bending the head (when the collection is present in maxillary sinuses), during deglutition or by palpation of laryngeal sacs in horses (in laryngeal sacs empyema).
- unilateral (in conditions that affect a single nostril or obstruction of the other nostril) or bilateral (in conditions that affect the nasal passages bilaterally or the post-pharyngeal segments).
- in small amount (in mild inflammations- catarrhal inflammation) or in large amount (in exudative diseases- rhinitis, sinusitis, pulmonary edema or from pulmonary collections).

By its composition, the nasal discharge can be:

- serous- in pulmonary edema;
- mucoid- in catarrhal inflammations;
- seromucous- stringy (filant) and transparent, sometimes white-yellow.
- purulent- white-green colour, in bacterial inflammations;
- gangrenous- grey-green colour, brown or blackish;
- alimentary- from the esophagus (because of the pharyngeal dysphagia or esophageal dysphagia, false vomiting) or stomach (after vomiting).

-haemorrhagic (bloody) – when the blood is dripping from the nose is called epistaxis, when the bleeding is profuse and continuous is called rhinorrhagia;

-haemoptysis (a mixture of saliva- sputum and blood) which is generated by pulmonary haemorrhage (pneumorrhagia).

The microscopic examination of the nasal discharge can be done directly on the microscope slide (for erythrocytes, leukocytes, bacteria, parasites, parasites eggs, fungus) or by insemination for bacteriological examination.

5.1.2.6. *Expectoration*- elimination of secretions from the deep airways or from pulmonary collections up to the pharynx, from where those can be swallow or can be eliminate in the mouth- sputum or in the nasal passages (nasal discharge).

5.2. PHYSICAL EXAMINATION OF THE RESPIRATORY SYSTEM

5.2.1. Examination of the prethoracic respiratory airways

The prethoracic respiratory airways include: nose and nasal cavities, pharynx, larynx, trachea and possibly, the two main bronchi. The role of those segments is in external breathing. At this level, the air is being heating, saturated with water vapours and cleaned by dust. Any modification on long term of this segments it implies alteration of the internal breathing (haematosi).

5.2.1.1. The nose.

The examination of the nose can be both external – using the general methods of examination (inspection, palpation, percussion, auscultation), special methods of examination (scraping, sounding, puncture, trepanation, radiological examination), and internal – examination of nasal cavities using general methods of examination (inspection and palpation of the nasal mucosae) and special methods of examination (rhinoscopy, sounding, scraping).

The external modifications can affect the volume, the shape, the symmetry, the presence of noises, discharges, painful sensitivity. Examples: edema, hippopotamus head, bone deformities, lateral deviation of nose in atrophic rhinitis of pig, depilated areas, wounds, dermatitis, scars, nasal discharge, fistula, noises perceived from a distance (nasal stridor, cough), nasal pruritus, enlargement or narrowing of the nasal cavities, modifications of the normal sound of percussion (nasal blast), modification of bone structure on radiological examination etc.

The internal modifications can affect the nasal septum, nasal concha, pituitary mucosa- respiratory and olfactory or the false nostril in horse. The semiological aspects are: enanthem, pallidity, jaundice, cyanosis, haemorrhages, ulcers, vesicles, vegetations, tumours, parasites, inflammations (rhinitis). At the same time with the examination of the nose, the examination of the expired air is performed.

5.2.1.2. The sinuses

In normal conditions, the sinuses that can be examined are the frontal and the maxillary sinuses (in horse, superior and inferior maxillary sinus) using the general methods of examination (inspection, palpation, percussion) and complementary methods (nostril lightening, catheterisation, puncture, trepanation, radiological examination).

Modifications: nasal discharge when bending the head, painful sensitivity at palpation in sinusitis or pansinusitis (inflammation of all sinuses), deformations and dullness in collections, areas of radio absorption in radiological examination etc.

5.2.1.3. *The larynx*

The examination of the larynx can be done from outside (inspection, palpation, percussion, auscultation, radiological examination) and internal (inspection - in birds, dog and cat, laryngoscopy, laryngotomy, sounding).

Semiological aspects:

- **inspection** – orthopneic position with extension of the head and neck, alteration or lack of the voice (aphonia), cough with pharyngeal origin, real cornage (roaring), dyspnea due to laryngeal stenosis. Using direct inspection, the physician can highlight congestion, false membranes, foreign bodies, tumours etc.
- **palpation**- laryngeal deformities, position changes (displacement), painful sensitivity, coughing caused very easy by examiner in laryngeal inflammations (laryngitis).
- **percussion**- normal sound is sonorous, in panlaryngeal edema the sound is dull;
- **auscultation**- normal laryngeal blast, perceived both in inspiration and expiration. The blast can become whistling, rough and loud in stenosis, spasm, laryngeal edema. The presence of the exudate or blood allow perception of laryngeal rales in auscultation, and when the secretions are dry the characteristic noise generated by the false membranes is flag noise – perceived even in inspection.
- **radiological examination**- used to detect foreign bodies stuck at laryngeal level or adjacent tissues, changes of position, volume, symmetry etc.

5.2.1.4. *The trachea*

Is an aerophore conduct composed by tracheal rings, with two segments: cranial segment and thoracic segment. The cranial segment can be examined externally using general methods of examination (inspection, palpation, percussion, auscultation) and special methods of examination (tracheal lighting-for birds, radiological examination) and internal (tracheal catheterisation, tracheoscopy, tracheotomy).

Semiological aspects: deformations of the cervical projection area of the trachea (Pasteurellosis, stasis oedema), tracheal deviation, tracheal cough, tracheal cornage, painful sensitivity in inflammations (tracheitis), tracheal rales when secretions are present, foreign bodies (radiological examination), parasites (tracheal lightning-for birds) etc.

5.1.2.5. *The Bronchi*

The bronchi can be examined using special methods of examination: endoscopy (bronchoscopy) and radiological examination. Semiological aspect are: inflammations (bronchitis), dilatation (bronchiectasis), obstructions, volume modifications (bronchoconstriction and bronchodilatation).

5.2.2. Semiology and examination of the lungs

Examination of the lungs can be performed using general methods of examination (inspection, palpation, percussion, auscultation) and special methods of examination (bronchoscopy, radiological examination, tomography, nuclear magnetic resonance, thoracocentesis and examination of the fluid sample).

5.2.2.1. *Inspection of the thorax*

The objectives of inspection are thorax conformation and respiratory movements:

- Thorax conformation includes information related to size, shape, symmetry and local aspects of the thoracic wall. Semiological aspects are:
 - o Symmetrical dilatation (barrel-shaped thorax) – chronic pulmonary emphysema, mild pleurisy (exudative inflammation of the pleura)

- Barrel-shaped thorax and abdomen;
- Reduction of the transversal diameter (flat thorax)- in rickets, osteodystrophy;
- Thoracic asymmetry- due to deformation of a hemithorax, in one-sided pleural collections, one-sided pneumothorax etc
- Localised deformities:
 - Swells – in oedemas, hematomas, abscesses, tumours, fractures, costal calluses etc. When these swells look like beads and are localised at chondrocostal junction in young animals, they are called chaplet and are specific for rickets;
 - Retraction – represents a deformation of the intercostal spaces, which are aspirated in dyspnoea or a localised thoracic deformity in case of rib fractures;
- Respiratory movements – important elements for respiratory movements are frequency, rhythm, amplitude, duration of inspiration and expiration, respiratory type. The main semiological aspects are:
 - Frequency: tachypnoea, bradypnea, apnea;
 - Rhythm
 - 2 times rhythm breathing – for dog and horse:
 - contraction and relaxation of the diaphragm;
 - contraction and relaxation of the abdomen;
 - cogwheel respiration (several times rhythm breathing);

Those respiratory types often accompany the recurrent airway obstruction (broken wind syndrome) which includes chronic pulmonary emphysema (alveolar and interstitial). Chronic pulmonary emphysema is produced by replacement of elastic tissue with non-elastic connective tissue that breaks down during breathing producing crepitant dry rales. The emphysema does not imply fever and it appears at geriatric animals or after specific pulmonary diseases. Cogwheel respiration can also be produced by pleuritis or pneumothorax.

 - Other complex types of respiration: Kussmaul's respiration, Cheyne-Stokes respiration, Biot's respiration;- Amplitude:
 - Superficial movements – in pleuritis, fractured ribs;
 - Deep movements (ample, large) - in dyspnoea;
 - Asymmetrical movements, ample on a hemithorax and superficial on the other hemithorax-in unilateral thoracic conditions;
- Length of inspiration and expiration:
 - Prolonging inspiration or expiration-in airways stenosis, inflammation of the diaphragm;
 - Shortening inspiration or expiration- in painful conditions;
- Respiratory type:
 - normal respiratory type in animals is costoabdominal respiration, with costal predominance in dog and horse and abdominal predominance in cattle;
 - Modified respiratory type:
 - Thoracic respiration (costal respiration) - common for abdominal lesions;
 - Abdominal respiration- common for pulmonary emphysema, pulmonary atelectasis;
 - Pendulous respiration;

5.2.2.2. *Palpation of the thorax*

The modifications found using palpation of the thorax are:

- Increased temperature- in diseases that affect the lungs, the thoracic wall or other organs;
- Painful sensitivity- vibrations (rustles) of the thoracic wall in pleural diseases, bronchial rales, when the animal moans etc;
- Shape and aspect of the thorax surface (ribs and soft tissues)- deformations produced by swells, fractures, calluses, tumours etc;
- Consistencies- different in modifications of the thoracic wall (abscesses, phlegmons, subcutaneous emphysema etc);
- Deep painful sensitivity (pleurodynia)- ribs fracture, pleuritis, pleurisy or can be reflected from the abdominal organs;

5.2.2.3. *Percussion of the thorax*

Percussion can be done directly, on bone structure in order to discover periosteal painful sensitivity or indirectly, on intercostal spaces, in order to determine the sound and the area of percussion (normal or modified).

Pulmonary sound of percussion

- The normal pulmonary sound of percussion- is clear, sonorous, with tympanic tone in small animals and a non-tympanic sound in large animals.
- Modified pulmonary sound of percussion – it can be detected when the alterations affect the cortical area of the lung:

Dullness on the pulmonary percussion area:

- localized thickening of the thoracic wall (edemas, abscesses) or generalized thickening (fattening in cattle and pigs);
- modifications of the pleura and interpleural space:
 - thickening and inflammation of the pleura (pachypleuritis);
 - exudative inflammation of the pleura (serous pleurisy) – with exudate in the pleural cavity;
 - fibrinous inflammation of the pleura (fibrinous pleurisy);
 - Hemothorax (hematothorax) – blood in the pleural cavity;
 - Hydrothorax – small amount of transudate in the pleural cavity;
 - Densifications of the pulmonary parenchyma – when the air from the lungs is replaced with pus, liquid, fibrin, connective tissue, neoformation tissue in pneumonia, bronchopneumonia, cysts, oedemas, inflammations, pulmonary tumours.

Pulmonary inflammation is called pneumonia (bronchopneumonia) and depending on the extension, modification and species, it can be:

- Lobar – which affects a pulmonary lobe, common for horse and dog and evolves with various phases:
 - Congestive phase – with an excess of capillary blood and tympanic sound in percussion;
 - Red hepatization phase, and then grey hepatisation - characterised by a pulmonary block, dull sound of percussion and tubal respiration in auscultation;
 - Resolution phase - healing phase;
- Lobular (bronchopneumonia) – affects a single bronchus and the afferent pulmonary tissue, specific for cattle and characterised by a slightly dull tone.
- Interstitial- interstitial tissue sclerosis and slightly dull tone in percussion;
- Suppurative- when pus is present, the sound of percussion is dull; when the pulmonary abscess has emptied by coughing, the sound of percussion is hypersonor;
- Gangrenous – permanent dullness in percussion.

Absolute dullness (hydric dullness)- present in case of major accumulations of fluid in the ventral area, whose dorsal border is always parallel to the ground. Often, above this border, separated by a narrow section of slightly dull tone, appears an area of hypersonority (skodism). The skodism appears around pulmonary densifications and is generated by the compensatory activity of the pulmonary parenchyma (vicariant emphysema).

The term of hydrothorax it is used when the fluid that forms the collection is noninflammatory (transsudate) or is lymph. For other types of fluids, specific terms are: hemothorax, pyothorax, chylothorax (due to thoracic duct rupture).

Slightly dull tone – is present when pulmonary densifications are minor or the amount of fluid from the pleural space is very small.

Hypersonority – is present in thin animals, in pulmonary emphysema, large caverns, unilateral pneumothorax. Bilateral pneumothorax produces very soon the death of the animal. Due to a main bronchus obstruction, the pression of the fluid form the pleural cavity is increasing and it produce pulmonary atelectasis.

Hypersonority with metallic tone – present when gas is accumulating under pressure in cavities with the diameter larger than 5 cm, but in the cortical area (large caverns, pneumothorax).

Broken pot sound – is present when beyond the main sound overlaps and additional vibration – like the case of caverns that are communicating with a bronchus or in case of subcutaneous emphysema, when the air moves under the skin.

Sonor atympanic sound – pathologic in small animals;

Sonor tympanic sound - pathologic in large animals;

Pulmonary percussion area

- The normal pulmonary percussion area – is the surface of the thorax whereon a normal sound of percussion is obtained. This is triangle shape, with some characteristics depending on the species:
- The modified area of percussion can be:
 - o Enlarged:
 - The dorsal and anterior border – in case of animal weight loss;
 - The ventro caudal border: in pulmonary emphysema, pneumothorax;
 - o Decreased:
 - Due to external modifications (hypertrophy of adjacent organs, meteorism, ascites);
 - Due to internal modifications (dullness, slightly dullness etc.).

5.2.2.4. Auscultation of the thorax

Is the most important general method of examination- it allows directly or indirectly reception (with the stethoscope) of the normal or pathological sounds that are produced in the thorax.

The classifications of sounds that can be perceived in the thorax is:

- Respiratory sounds
 - o Main sounds (murmurs): normal and pathological;
 - o Intercurrent (over added) sounds: rales and pleural sounds;
- Thoracic sounds produced by the examiner using transonance and phonometry;
- Extrathoracic sounds.

Normal main respiratory sounds (normal murmurs)

These sounds can be perceived both from the airways level (nasal, laryngeal and tracheal blast and in certain situations bronchial blast- is localized prescapular, only in young and thin animals) and from lungs level (vesicular murmur/breath sound or bronchi-alveolar breath sound).

In order to appreciate the morpho-functional integrity of the pulmonary parenchyma very important is the bronchoalveolar breath sound. This pulmonary sound is similar to pronunciation through aspiration of letters v or f.

The qualities of the vesicular murmur are different depending on the species, age, body condition, and in pathological situations can present modifications of:

- Intensity:
 - Intensified vesicular murmur (exaggerated) – in dyspnoea, fever, effort;
 - Decreased vesicular murmur – in superficial breath, stenosis, emphysema, pleuritis, pleurodynia;
 - Abolished vesicular murmur: usually on circumcised areas or instead the vesicular murmur another main, but pathological sound is present (tubular sound, pleuritic sound etc)
- Rhythm and length:
 - Cogwheel vesicular murmur – specific for cogwheel (several times rhythm) breathing;
 - Increased or decreased inspiration or expiration length of the vesicular murmur is specific for modifications of length of two phases of breathing (inspiration and expiration);
 - Timbre- implies roughening of vesicular murmur in bronchial stenosis, bronchitis, pulmonary congestion, acute pulmonary emphysema;
 - Area of auscultation of the vesicular murmur – it has the same shape like the area of percussion, but is a little increased, especially on the ventro-caudal border.

Pathological main respiratory sounds (pathological murmurs)

The presence of these pathological respiratory sounds on a certain area necessarily implies the lack of the vesicular murmur on that area. These sounds are:

- **Tubal breathing (bronchial respiration)** – is a laryngeal blast transmitted to the thoracic wall through the cartilaginous structure of the trachea, bronchi and through the densifications of the pulmonary cortex. Those pulmonary densifications lead to disappearance of the elastic membranous structure, which allows transmission of the laryngeal blast to the thoracic wall. The tubal respiration has a whistling timbre and is present in the hepatization phase of the lobar pneumonia, in pulmonary tumours etc;
- **Pleuritic breathing** - is also a laryngeal blast transmitted to the thoracic wall, but through cortical pulmonary densification and through the fluid accumulated in the interpleural space. This sound is audible only in the declivitous areas of thorax, where an important amount of fluid is accumulated. Sometimes, the pulmonary densification can be produced by the large amount of accumulated fluid that is pressing on the pulmonary parenchyma. In this situation, the pleuritic blast is audible only in the superior border of the fluid, while in the ventral area is present "null respiration", like in case of hydrothorax or pleurisy.
- **Cavernous breathing (Cavitary)** – appears when an empty cavity (cavern) is situated cortically and it has a diameter larger than 2-5 cm and it communicates with a bronchus. This sound is similar to a whistling with high resonance.

- **Amphoric breathing** – similar to the cavernous breathing, but the cavern diameter is larger than 6 cm. The difference between the two is given by the timbre of the sound;
- **Undefined breathing**- when the modified pulmonary areas are reduced, in auscultation a vesicular murmur mixed with pathological sounds or over added sounds is audible. In cattle is specific for bronchopneumonia.

Intercurrent (over added) respiratory sounds

Those sounds are always pathological and they are over added on one of the normal or pathological main respiratory sound. Over added respiratory sounds are: sounds that are produced on the airways (rales/ rhonchi) and sounds that are produced at the pleural level (extrapulmonary sounds).

Rales (rhonchi) – are sounds (snorts) produced by the passing of the air column through secretions or narrowing that affect the airways (nose, larynx, trachea, alveoli) or the caverns.

Rales classification:

- Wet rales – crackles, bronchial, cavernous and amphoric;
- Dry rales – alveolar and bronchial.

Wet crackling rales (wet alveolar or vesicular rales) – are present at the alveolar level when they are filled with fluid (oedema, exudative inflammation etc.). These rales are produced by the infiltration of air and detachment of the alveolar walls that are bound by a thin layer of fluid. The noise is similar to rubbing a lock of hair between the fingers. These sounds are fixed, continuous and are audible only in inspiration.

Wet bronchial rales are present at the bronchial level when they are filled with fluid. They sound like the noise. These rales are movable (are moving along the bronchus together with the air column), discontinuous (are present only while the bronchi is filled with exudate) and they are audible both in inspiration and expiration. By the bronchi diameter, the rales can have large, medium or small bubbles. Bronchial rales are specific for bronchitis, in the starting and final stage of the pneumonias, oedemas, pulmonary haemorrhages etc.

Wet cavernous and amphoric rales – are audible in small or large caverns, filled with hydrogases content and communicating with a bronchus.

Dry alveolar rales (dry crackling rales, crack noise) – noise similar to a fine crackle produced after the breakage of the alveolar walls, due to the loss of elasticity of the alveolar membrane or connective tissue (pulmonary emphysema). After the breakage of the alveolar walls, the air penetrates in interstitial spaces and forms very large alveolar cavities, which are hyperresonant in percussion.

Dry bronchial rales – specific for bronchial stenosis produced by inflammatory processes, abscesses, cysts, tumors. These rales are fixed and permanent. By the bronchi diameter, the rales can be sonorous (ronflant) — like a snore, for large and medium bronchi and sibilant (like a whistle, for small bronchi). If pseudomembranes are present at the bronchus level, they produce the flag sound.

Pleural sounds (extrapulmonary sounds)- these sounds are produced by modifications of the pleura or interpleural space. Classification: dry pleural sounds (sound of pleural friction rub, valve sound) and wet pleural sounds (sound of liquid, dripping sound, pulmonary fistula sound).

The sound of pleural friction rib – similar to the rubbing of rough surfaces, is synchronous with respiratory movements. This sound is present in congestive and resolution phase of the pleural inflammations (pleuritis = dry inflammation, without exudate of the pleura), in chronic fibrinous inflammations of pleura (pachypleuritis).

The valve sound – is produced when the valve closes (when the pleura is hitting the fistula of the bronchopleural hole) or in case of open pneumothorax.

Sound of liquid – is produced when the fluids from the pleural hydro-gas collections (pleurisy) are moving or rarely, in caverns collections.

Dripping sound- present when the drops of liquid, that are in suspension on the modified pleura, fall into the mass of liquid (hydropneumothorax- mixed of air and fluid, pyopneumothorax- mixed of pus and air).

Pulmonary fistula sound- is present when the air is entering through a broncho-pulmonary fistula under the collection of fluid from the pleural cavity. The sound is similar to the one produced by blowing into a drinking straw in a glass of water.

Thoracic sounds produced by the examiner

These sounds are produced by combining some methods of examination, like percussion or vibrations of a tuning fork with auscultation, resulting transonance and phonometry;

Transonance implies modification of the laryngophony from the human medicine in order to be used in veterinary medicine. For this, the percussion of larynx and trachea is performed and the produced sound is heard at the thorax level or the percussion is realised on a hemithorax and the sound is heard on the other hemithorax.

In normal conditions, the sounds produced by percussion of larynx or trachea are not at all or very little transmitted to the thorax. In pulmonary densifications, these sounds are very well transmitted to the thorax.

The thoracic transonance is useful for detecting extended and deep situated pulmonary densifications, very large caverns and pleural collections. In case of large caverns, if the percussion is realised with 2 coins, a metallic sound is obtained called the sound of brass. In case of pleural collections, if the percussion is realised with 2 coins, a specific sound is obtained on the dullness area called the sound of silver.

Phonometry – implies vibration of a tuning fork on the thorax and auscultation with the stethoscope at a small distance around the tuning fork. Phonometry allows delimitation of a densified pulmonary area.

Extrathoracic sounds

These sounds are produced in other areas than the respiratory system, but because they are perceived at the thorax level, there is the possibility to be confused with the ones produced by the respiratory system. Extrathoracic sounds are:

- Cardiac sounds (first and second cardiac sounds, additional sounds)
- Sounds of the gastrointestinal tract – produced during mastication, deglutition, rumination, eructation, borborygmi;
- Muscular tremors;
- Vocal sounds transmitted to the thorax;
- Sounds produced by rubbing the stethoscope on the animal's hair, etc.

5.2.2.5. *Special methods of examination of the thorax*

- bronchial endoscopy (bronchoscopy) – is important for analysing the colour, the integrity, the volume of the main bronchi mucosa, the presence of secretions, blood, foreign body etc.
- radiological examination:
 - o radioscopy- for the volume modifications of the pulmonary hills, apical lobes, costodiaphragmatic sinuses, also the dynamics of the respiratory activity;
 - o radiography – provides information concerning the normal or modified pulmonary morphology (emphysema, oedema, collections, caverns, tumours);
 - o computerised tomography (CT) – allows detecting of position and size for pulmonary lesions (tumours);
 - o bronchography- involves utilisation of radio-opaque contrast substances and allows examination of the bronchial tree;
 - o scintigraphy- rarely used in veterinary medicine;
 - o nuclear magnetic resonance (NMR) – allows identifications of the smallest structural modification affecting the lung, pleura, mediastinum and thoracic wall;
- Thoracentesis- puncture of the thorax, fluid removal with physical examination of it (serous fluid, haemorrhagic fluid, purulent fluid), biochemical and microscopic examination. Is very important to differentiate the exsudate form transsudate.
- Transsudate – extravasated fluid from the plasma to the pleural cavity. Is serous, non-inflammatory, and it contains 2,5% albumin. Is specific for hydrothorax;
- Exsudate- extravasated fluid from an inflammatory source; is viscous, it contains leukocytes and over 2,5% albumin.

5.2.3. **The diaphragm**

Very difficult to be examined (palpation, radiological examination, laparoscopy, exploratory laparotomy). Semeiological aspects are rare: diaphragm paralysis, hiatal hernia, diaphragm hernia (often in cats and dogs), diaphragmatitis (diaphragm inflammation), diaphragmatic myoclonia (the spasm of the diaphragm, the hiccup).

6. SEMIOTICS OF THE CIRCULATORY SYSTEM

The role of the circulatory system consists in transport (nutritive elements, O₂, metabolites, hormones, humoral and cellular elements of the immunity system etc.) and temperature regulations. The circulatory system includes:

- The cardiovascular apparatus: heart, blood vessels (arteries, veins, capillaries), lymphatic vessels;
- Blood and lymph;
- Hematopoietic organs: bone marrow, spleen, thymus, bursa of Fabricius, lymph nodes etc.

6.1. EXAMINATION AND SEMIOLOGY OF THE CARDIOVASCULAR APPARATUS

The examination starts with the history of the animal which can make the examiner suspect a cardiovascular disease. Important elements are:

- Age – especially for dog, cat and horse;
- Overloading (effort) – for animals used for production or traction;
- Living conditions;

- Favoring conditions:
 - Infectious diseases that can affect the heart, the blood vessels or the blood (erysipelas, aphthous fever, leukosis)
 - Respiratory and chronic renal diseases (pulmonary emphysema and edema, glomerulonephritis);
 - Endocrine diseases (that affects thyroid, adrenal glands etc.);
 - Metabolic and nutrition diseases.

6.1.1. Functional examination and semiology of the cardiovascular apparatus

The functional examination highlights some important aspects, like:

- General symptoms (symptoms perceived at a distance):
 - Nervous signs:
 - Dizziness – loss of balance and abnormal gait;
 - Syncope – collapsing of the nervous reactions (consciousness, motility, reflectivity, sensibility), stopping of the heart and breath due to cardiovascular diseases (the cardiac syncope can be fatal – deadly or transient, called lipothymy or swoon), respiratory or nervous diseases;
 - Circulatory signs: venous ectasia, retrograde venous pulse, cold extremities, peripheral pitting edema affecting especially the pelvic limbs and the chest, circulatory collapse.
 - Digestive signs: vomiting, nausea;
 - Modifications of facies (scarred facies) and posture (kyphosis, orthopneic position);
 - Decreased effort capacity;
- Organ symptoms:
 - Dyspnea of exertion (cardiac dyspnea) – with lack of air (suffocation), initially during effort, but then also in repose, tachypnea, cyanosis (mucosas, muzzle, limbs, ears, tail);
 - Pain – can be expressed locally (cardiac pain) or at a distance (projected and referred pain). In animals, cardiac pain is expressed by kyphosis, moving away the left olecranon away from the thorax, brachial triceps tremors, horripilation, sweating, high sensitivity of the area in palpation or percussion etc.;
 - Cardiac palpitation – movements (tremors) of the left thorax, due to paroxysmic (unexpected) cardiac contractions.

6.1.2. Physical examination and semiology of the cardiovascular apparatus

6.1.2.1. The Heart

The heart is an organ with a very well developed musculature (myocardium), protected externally by the pericardial sac (pericardium) and coated on the inside by endocardium, which forms the cardiac valves. This organ is formed from four chambers (right and left atrium, right and left ventricle), connected with the major blood vessels.

The cardiac activity – atrial and ventricular systole and diastole- is rhythmic and autonomous (heart automaticity) which implies producing stimuli (bathmotropic function), conduction (dromotropic function), and contraction of the heart muscle (inotropic function).

The heart can be examined using general methods of examination (inspection, palpation, percussion, auscultation) and special methods of examination (cardiac functional test, electrocardiography, pericardiocentesis, cardiac catheterization, radiological

examination, computerized tomography, nuclear magnetic resonance, phonocardiography, cardiac telemetry, echography, Doppler technique).

6.1.2.1.1. *Inspection of the heart*

The inspection of the heart area of projection is made on the thorax, on the left side, in the lower third (left axillary area). The objectives are:

- The physical aspect of the area: conformation (diameter, shape, costal angle) and integrity of the thorax (ribs wall lesions, frequent in animals due to accidents or fights);
- The movements on this level:
 - Movement of the skin produced by cutaneous muscle (in warm seasons);
 - Rhythmic movements of the intercostal tissues - produced by the movements of the myocardium, visible especially in young, thin animals or animals that present during examination a very strong apex beat (after effort, in fearful animals, in some infectious or cardiac diseases). In cattle, a very strong apex beat is produced by the vibrations of the collections between the thoracic wall and pleura (pulsating empyema).

6.1.2.1.2. *Palpation of projection area of the heart*

Palpation allows appreciation of the local physical signs (temperature, humidity, deep painful sensitivity- in acute pericarditis, myocarditis; integrity and deformations – in costal fractures; lesions of the skin and intercostal muscles, foreign body etc.) and of the apex beat (ictus cordis).

Palpation is the only method of examination that allows appreciation of the normal or modified ictus cordis:

-the area over which is palpable – normally, is different depending on age and species. Modifications of this area are due to cardiac hypertrophy or displacement of the heart (congenital- dextrocardia or due to increased volume of other organs – lung, pleura and pleural space, diaphragmatic hernia, bloating etc.);

-the frequency of the ictus cordis is different depending on age and species, but is identical to the ventricular systole and arterial pulse frequency. Frequency modifications implies acceleration of the cardiac contractions (tachycardia) or thinning of cardiac contractions (bradycardia).

-the rhythm of the ictus cordis is regular (rhythmic) in the majority of species, exception is the dog in which, in normal conditions, is seen physiological respiratory arrhythmia;

-the intensity of the ictus cordis is different depending on species, age and body condition score. Modified intensity can be: diminished intensity due to cardiac conditions (cardiac insufficiency, cardiac dilatations, myocardosis) or extracardiac conditions (fattening, pericardium thickening, pericardial collections, subcutaneous edema or emphysema), or increased intensity in physiological conditions (effort, thin animals, fearful animals) or pathological conditions (heart hypertrophy, chronic myocarditis, infectious diseases etc.);

-particular aspects of the ictus cordis palpation:

- Cardiac palpitation – perceived when the intensity and the frequency of the ictus are simultaneously increasing;
- Cardiac erethism – an abnormal cardiac activity;

- Cardiac murmur – is a sound similar to the purring of the cat, present in valvular stenosis and pericardial or pleuro-pericardial friction rub.

6.1.2.1.3. *Percussion of projection area of the heart*

Percussion can be applied directly (for painful cardiac and costal sensitivity) or indirectly, finger-finger percussion (to detect the percussion sound and the cardiac area of projection).

The sound obtained in percussion is dull in most species, excepting cattle where the sound is slightly dull (because between the thorax and the heart a small part of the left lung apical lobe is interposed). Also, in horses, on a rectangular area of 3-4 cm located at the base of the heart (major vessels origin) the sound of percussion is slightly dull.

The cardiac area of projection – it is triangular shaped, with differences depending on species, especially regarding the size, or the shape- in dog. Modifications:

- Increased area – in cardiac dilatation and hypertrophy (due to insufficiency or valvular stenosis, hypertension, hypervolemia, chronic pulmonary emphysema), pericardial collections (hydropericardium, hemopericardium). The increasing can be also fake, when actually pulmonary modifications are present (pulmonary atelectasis, pulmonary densification etc.);
- Decreased area- pneumopericardium, pneumothorax;
- Displacement – due to compressions on the heart generated by pleurisy, pneumothorax, pneumonia etc.

6.1.2.1.4. *Auscultation of the heart*

Is the most useful general method of examination for the heart and it allows the examiner perceive the sound that are produced during the normal and pathological cardiac activity.

The sounds that are heard in auscultation are classified as:

A. Normal cardiac sounds (Main sounds):

- First cardiac sound (systolic sound);
- Second cardiac sound (diastolic sound).

B. Pathologic cardiac sounds:

a) Modification of the normal cardiac sounds:

- Modification of frequency: tachycardia, bradycardia, atrial stop;
- Modification of intensity: intensification and diminution of the sounds;
- Modification of timbre and tonality: metallization, amplification and blurring of the sounds;
- Modification of rhythm:
 - Reduplication of cardiac sounds:
 - Reduplication of the first cardiac sound;
 - Reduplication of the second cardiac sound;
 - Equalizing of the cardiac pauses and acceleration of the sounds frequency: embryocardia, pendulum rhythm);
 - Cardiac arrhythmias:
 - Bathmotropic arrhythmias - due to extracardiac additional stimuli (sinus tachycardia and bradycardia, respiratory arrhythmias) and intracardiac additional stimuli (extrasystole, fibrillation, flutter);

- Dromotropic arrhythmias: nodal rhythm and heart blocks.
- b) Additional cardiac sounds (murmurs):
 - Organic endocardial murmur;
 - Inorganic endocardial murmur.

C. Extracardiac sounds:

- Sounds of pericardial and pleural friction rub;
- Liquid sound.

A. Normal cardiac sounds (Main sounds)

The normal function of the heart implies the production of the cardiac main sounds during the ventricular activity, because the atrial activity can not be perceived in auscultation. These sounds are:

- First cardiac sound (systolic sound, Z_1) – is produced by the closing of the atrioventricular valves, the contraction of the valvular muscles and expulsion of the blood away from ventricles. Is a long, strong and with low tonality sound. This sound is specific for the ventricular systole and is synchronous with the ictus cordis and arterial pulse.
- Second cardiac sound (diastolic sound, Z_2)- is produced only by the closing of the valves from the base of the aorta and pulmonary trunk. Is a short sound with low intensity and high tonality. Is specific for the ventricular diastole.

Onomatopoeic, pronunciation of these two sounds is similar to the pronunciations of „dubb-lupp” syllables.

Important for these sounds are: the frequency, the intensity, timbre, tonality and rhythm, because modification of this elements lead to the production of the pathological sounds.

B. Pathologic cardiac sounds:

a) Modification of the normal cardiac sounds:

- Modification of frequency:
 - o Accelerated sounds – sinus tachycardia, with impulse from the sinus node. When the increasing and the recursion are quickly succeeded, it is called paroxysmal sinus tachycardia;
 - o Slower sounds: sinus bradycardia (in vagotonia);
 - o Atrial (sinus) stop – when the atrial chambers are not contracting any more. The modification is visible only in EKG.
- Modification of intensity (intensification and diminution of the sounds):
 - o Intensification of the first cardiac sound – in fever, acute anemia (posthemorrhagic anemia), equine infectious anemia;
 - o Intensification of the second cardiac sound – in hypertension;
 - o Intensification of both cardiac sounds – after effort, in thin animals or animals with a tight thorax, in cardiac hypertrophy, acute endocarditis;
 - o Diminution of the cardiac sounds: in cardiac insufficiency, myocardosis, pleural collections, pericardial collections, obesity, subcutaneous edema;
- Modification of timbre and tonality:
 - o Metallization of the first or both cardiac sounds: in cardiac hypertrophy, anemia, intoxication, anthrax – when the sounds are clear and sharp;
 - o Amplification of the cardiac sounds – in air accumulation (pneumopericardium);
 - o Blurring of the sounds – in decompensated cardiac insufficiency, acute endocarditis.

- Modification of the rhythm:
 - Reduplication of cardiac sounds- it is produced for a short period of time and the sounds are not accompanied by pulse waves; reduplication can affect the first or the second cardiac sound:
 - Reduplication of the first cardiac sound (the sound of „gallop’’) - appears when there is a lack of synchronization in the closure of atrioventricular valves (right and left), due to the different pressure between the minor and the major circulation and the tricuspid valve is closing later than the bicuspid valve. This sound can also be present in the left ventricular insufficiency. Sometimes, it does not have a pathological meaning (in anxious animals);
 - Reduplication of the second cardiac sound (the sound of quail): appears when there is a lack of synchronization in the closure of sigmoid valves. The causes for this phenomenon are the pulmonary emphysema and the pneumothorax, that are producing circulatory stasis, hypertension in the major or minor circulation, mitral insufficiency etc.;
 - Equalizing of the cardiac pauses and acceleration of the sounds frequency - modifications that are threatening the animal’s life, like:
 - Embryocardia (fetal rhythm) – the pauses between the cardiac sound are equal, but the timbre and the tonality of the two sounds are identical and the frequency is accelerated (tachycardia). Is present in circulatory collapse, severe infectious and toxic diseases, myocarditis etc. When the embryocardia is not accompanied by tachycardia, it is called pendular rhythm;
 - Cardiac arrhythmias: modification of the normal cardiac rhythm. Arrhythmias can be: bathmotropic or dromotropic.

Bathmotropic arrhythmias – can be produced by extracardiac additional stimuli (sinus tachycardia and bradycardia, respiratory arrhythmias) and intracardiac additional stimuli (real arrhythmias).

- Arrhythmias produced by extracardiac additional stimuli. In certain conditions, the extracardiac nervous impulses -sympathetic (that cause tachycardia) or parasympathetic (that cause bradycardia) impulses can have an effect on the sinus node, perturbing the cardiac automatism. The result is increasing or decreasing on a certain period of the cardiac frequency, like: paroxysmal sinus tachycardia or sinus bradycardia or respiratory arrhythmia on other species that the dog and young animals, produced by modification of the neurovegetative system and decreased frequency of the heart during respiration.
- Arrhythmias produced by intracardiac additional stimuli (real arrhythmias). This group includes extrasystole and permanent arrhythmia (fibrillation and flutter).

The extrasystole is a premature and additional cardiac contraction, due to the occurrence of an additional stimulus from the sinus node or from another component of the excito-conductor system. These arrhythmias can be found on auscultation or ECG and are not accompanied by an additional wave on arterial pulse. When the additional stimulus comes from the sinus node, the extrasystole affects the atria and when it comes from the other components of the excito-conductor system affects the ventricles. When the extrasystole is accompanied by bradycardia, between two ventricular systoles, is called interlaced systole. When the extrasystole appears in salves, repeatedly, is called regular extrasystole (regular arrhythmia, extrasystolic arrhythmia) the repetition can happen at two systoles (bigeminal

arrythmia-bigeminy, bigeminal rhythm) at three systoles (trigeminal arrhythmia-trigeminy, trigeminal rhythm) or at more systoles (occasional extrasystole).

The permanent arrhythmia is characterized by very frequent, but inefficient contractions of the atrial or ventricular muscle, produced by stimuli with different origins. *Fibrillation* is characterized by smooth and very fast contractions of a group of myocardial fibers. The most common is the atrial fibrillation and much rarer the ventricular fibrillation (which produces death). The flutter is similar to fibrillation, but with several groups of myocardial fibers. It can be localized both in atria and ventricles, and often is associated with the atrio-ventricular block, with a severe prognosis. The precise diagnosis is realized using ECG.

Dromotrope arrhythmias are characterized by slowing down or stop of the impulse transmission from the sinus node to the next components of the conducting system. The main characteristic of these arrhythmias is bradycardia. Dromotrope arrhythmias are:

- Junctional rhythm describes an abnormal heart rhythm resulting from impulses coming from a locus of tissue in the area of the atrioventricular node, the "junction" between atria and ventricles, and not from the sinus node. Junctional rhythm implies a thinning of ventricular contractions. The diagnostic can be established only by using ECG. The sinus bradycardia is also a junctional rhythm bradycardia.
- Sinoatrial block- the transmission of the nervous impulse from the sinus node to atria is very difficult or is missing;
- Atrioventricular block- implies a thinning or interruption of the nervous impulse transmission to the ventricles due to lesions that affect the atrioventricular node, His bundle or his branches. The atrioventricular block can be:
 - o Partial (incomplete)- First degree atrioventricular block (with a delay in stimulus propagation) or second degree (when the transmission of stimulus is inconstant, for example 2/1 or 3/1 block, when at 2 or 3 atrial contractions occurs a ventricular contraction);
 - o Total (complete)- third degree (implies the lack of stimulus transmission). The atrioventricular dissociation is present. The atria are contracting normally, while the ventricles are in bradycardia until they stop completely. The retrograde venous pulse at the jugular veins has a normal frequency, while the arterial pulse is very rare;
 - o Bundle branch block (right or left), fascicular block or arborisation block are difficult to diagnostic in animals.

The confirmation for dromotrope arrhythmias is made through ECG.

b) Additional cardiac sounds (murmurs).

This sounds overlap the normal cardiac sounds and they are:

- Organic endocardial murmurs (structural, anatomical, morphological) - are always pathological;
- Inorganic endocardial murmurs (functional) – rarely pathological.

The organic endocardial murmurs are produced due to interaction between blood and modified endocardium. That modification implies either enlarging or narrowing of the orifices or a malfunction of the valves. The narrowing of the cardiac orifices leads to **ORIFICES STENOSIS**, lack of perfect closure and **VALVULAR STENOSIS**. Considering that the heart has four orifices cover by valves, there are four murmurs of orifice stenosis and four murmurs of valvular insufficiency.

The diagnosis of murmurs is made by auscultation (assessing the timbre, the auscultation area, the time of onset and duration) and by checking the arterial pulse, the shock or the cardiac area and also the retrograde venous pulse.

The characteristics of the murmurs:

- Timbre – in stenosis is similar to pronunciation of the letter „r”, while in insufficiency is similar to pronunciation of the letter „f”;
- Area of auscultation – is the place on the thoracic wall where the cardiac orifice is projected, only if the murmur of stenosis or insufficiency is present. The areas of auscultation allow the examiner to establish a topographical diagnosis (which of the four orifices is affected);
- The time of onset and duration of murmur compared to the cardiac activity. The murmurs can be systolic (in ventricular systole) or diastolic (in ventricular diastole).

The systolic murmurs – this category includes the murmurs of right or left atrioventricular insufficiency (when the blood is returning from in atria from ventricles because the valves are not closing properly or the orifices are enlarged) and the murmur of pulmonary or aortic stenosis (due to the narrowing of aortic or pulmonary orifice or the presence of massive vegetations that are producing valvular stenosis). The murmur of atrioventricular insufficiency is similar to pronunciation of syllables „duff-lup”, while the murmur of aortic or pulmonary stenosis is similar to pronunciation of syllables „drrr-lup”.

The diastolic murmurs - this category includes the murmurs of aortic and pulmonary insufficiency (when the blood is returning from the aorta and the pulmonary artery into the ventricle, because the sigmoid valves are not closing properly or because the pulmonary or aortic orifice is enlarged) and the murmurs of right or left atrioventricular stenosis (due to the narrowing of atrioventricular orifices). The murmur of aortic and pulmonary insufficiency is similar to pronunciation of syllables „dupp-fffup” , while the murmur of atrioventricular stenosis is similar to pronunciation of syllables „dupp-rrrrp”.

Sometimes, in dog, cat and goat the mitral valve disease is present, similar to the one from the human medicine, when at the level of mitral orifice, in the same time are present both the murmur of orifice stenosis and the one of valvular insufficiency.

- Modification of the arterial pulse and the presence of retrograde venous pulse:
 - In mitral insufficiency – the pulse is low, irregular and intermittent;
 - In tricuspid insufficiency – the retrograde positive venous pulse is present (synchronous with the arterial pulse);
 - In mitral stenosis – the pulse is slightly modified;
 - In tricuspid stenosis- the retrograde negative venous pulse is present (asynchronous with the arterial pulse);
 - In aortic insufficiency - the arterial pulse is short, hopping and with low tension (Corrigan pulse), and in inspection of the angular artery of the eye the „arterial dance” is present;
 - In aortic stenosis- the pulse is long, slow, rough, with high tension („steel pulse”). The left heart is enlarging;
- Modification of cardiac shock and cardiac area:

Whenever the heart has to resist a high pressure generated by the blood flow through the cardiac orifices (orifice stenosis) or has to push a higher quantity of blood

(valvular insufficiency), it reacts through a elongation and then thickening of the myocardial fibres (cardiac hypertrophy) or only through a dilatation of the heart chambers. These modifications are specific for circulatory stasis or hypertension in minor or major circulation. The dilatation of the heart chambers is accompanied by reduction of the cardiac shock intensity, while the heart hypertrophy is accompanied by an increased cardiac shock:

- In left atrioventricular insufficiency – the left atrium dilatation is followed by concentric hypertrophy of the left ventricle;
- In left atrioventricular stenosis – the left atrium dilatation is followed by circulatory pulmonary stasis and then hypertrophy of the right ventricle;
- In right atrioventricular stenosis – accompanied by right atrium dilatation and major circulation stasis;
- In aortic insufficiency – dilatation, then concentric hypertrophy of the left ventricle;
- In pulmonary insufficiency - dilatation, then concentric hypertrophy of the right ventricle;
- In aortic stenosis - dilatation, then eccentric hypertrophy of the left ventricle;
- In pulmonary stenosis - dilatation, then eccentric hypertrophy of the right ventricle;

Inorganic endocardial murmurs (functional) – present after: effort (when the blood flows through heart with higher speed), when the temperature of the environment is changing (spring and falls), changes of the environment temperature (spring and falls) accompanied by vasoconstriction or vasodilatation, when the animal diet is changes with modification of the blood viscosity, when the atrioventricular orifices are enlarged, in infectious diseases, anemia, intoxications etc.

D. Extracardiac sounds:

- Sound of pericardial friction rub – is produced between pericardium and epicardium, is similar to the pleural friction rub and can be perceived at the middle of the ventricular systole; is present in the congestive phase of dry pericarditis;
- Sound of pleuro-pericardial friction rub – similar to the pericardial friction rub and is present also during breathing (is diminishing when the nostrils are covered and the respiration is interrupted). Appears when the lesions are between the pericardium and pleura (pleuro-pericarditis);
- The sound of liquid – is produced when the pericardial sac is filled with a hydro-gas content. Sometimes can also be present the sound of dripping (if the drops are suspended).

If the amount of fluid is too high, the cardiac sounds are diminishing or they disappear.

6.1.2.1.5. Complementary methods of examination for the heart

a) Cardiac stress test

This test can be applied to horse and dog, sometimes in cattle too. In order to perform this test, the qualities of the cardiac shock and the cardiac sounds are established, also the frequency and intensity of breathing, during rest and after a short effort (100-300 m running for a horse). The test is positive if the increased cardiac frequency is not coming back to normal after 3-7 minutes after the end of the effort, also the cardiac shock is exaggerated and the effort dyspnea is present. The test is also positive if the cardiac frequency it doubles in the first 20 minutes after effort (equine infectious anemia). A positive response is present in cardiac insufficiency, cattle traumatic pericarditis etc.

b) Electrocardiography (ECG)

The action of recording of the bioelectrical cardiac activity (atria and ventricles) is called electrocardiography, while the graphic result of this bioelectrical activity is called electrocardiogram.

The electrocardiogram represents the recording of the electric potential differences during the heart activity, using electrodes placed at the heart level or at a distance from the heart. The way the electrodes are arranged is called derivation. These derivations (leads) can be bipolar (D derivations) or unipolar (V derivations).

Standard bipolar deviations: when the positive electrode (+) and the negative electrode (-) are placed on the two out of three equidistant points from the heart (on the right thoracic limb, on the left thoracic limb or the left pelvic limb), resulting:

D I – with the positive electrode on the left thoracic limb, and the negative electrode on the right thoracic limb;

D II - with the positive electrode on the left pelvic limb, and the negative electrode placed on the right thoracic limb;

D III - with the positive electrode on the left pelvic limb, and the negative electrode placed on the left thoracic limb.

Bipolar derivations (leads) – only the positive electrode is functional, while the negative electrode is neutral. Unipolar leads can be placed on the legs or precordial:

-aVR – when the positive electrode is placed on the right thoracic limb;

-aVL – when the positive electrode is placed on the left thoracic limb;

-aVF – when the positive electrode is placed on the left pelvic limb.

Because the amplitude of the recorded current is low, it must be augmented, so an „a” is added to the recording.

- The unipolar precordial leads do not require augmentation, example: V₁, V₂, V₃, V_n

A normal ECG includes:

- The P wave - represents atrial depolarization.
- The QRS complex - represents ventricular depolarization.
- The T wave represents - ventricular repolarization.
- The U wave represents papillary muscle repolarization.

The atrial repolarization is masked by the QRS complex.

An abnormal ECG shows aberrant waves and segments and modifications of the cardiac rhythm, like: sinus tachycardia, sinus bradycardia, atrial stop, extrasystole, fibrillation, flutter, atrioventricular dissociation, atrioventricular block, cardiac hypertrophy, pericarditis, ischemic cardiopathy, heart attack etc.

The ECG only shows a modification that is visible in the recording moment. There are situations when in healthy animals the ECG is abnormal due to the age, gestation, obesity, breathing, body position during recording, fear etc.

c) **Puncture of the pericardium (pericardiocentesis)** – is a procedure where fluid is aspirated from the pericardium. The fluid is physically examined (yellow, hemorrhagic, purulent), biochemical, microscopic and bacteriologic examined.

d) **Radiological examination (radiography and radioscopy)** – useful in order to establish the position, the shape, the size and the ratio of the heart to the other organs. Using radioscopy, the examiner can assess the heart movements.

- e) **Phonocardiography** – diagnostic technique that creates a graphic record of the heart sounds using the phonocardiograph.
- f) **Cardiac telemetry** – is a diagnostic technique that implies recording the heart activity at a distance (useful from wild animals, zoo and for researching).

Cardio-circulatory syndromes

- **Pericardial syndromes** – dry pericarditis syndrome – present in the congestive phase of acute pericarditis, is characterized by symptoms like fever, dysphagia, pain sensitivity of the heart projection area, pericardial friction rub; chronic pericarditis syndrome- it implies thickening of the pericardium and the presence of adherents between pericardium and pleura (in tuberculosis, inflammations of the pleura and mediastinum) and is characterised by signs specific to cardiac insufficiency plus the sound of friction rub, absence of pain sensitivity of the heart projection area, absence of fever; the syndrome of cardiac compression – due to hydropericardium, hemopericardium, pulmonary tumours, pleurisy etc.
- **Myocardial syndromes** – acute and chronic myocarditis, myocardial infarct, myocardosis, heart hypertrophy or dilatation.
- **Endocardial syndromes** – the syndrome of stenosis and mitral insufficiency, mitral disease, the syndrome of stenosis and tricuspid valve insufficiency, the syndrome of stenosis and aortic insufficiency, the syndrome of stenosis and pulmonary insufficiency.
- **Cardiac insufficiency syndrome (cardiac failure)** – it implies the incapacity of myocardium to adapt to the effort, which has as a consequence reduction of blood quantity who reaches organs and tissues (lack of oxygenation) or venous stasis (passive congestion):
 - **Left** cardiac insufficiency – effort dyspnea, cough, pulmonary edema, cyanosis;
 - **Right** cardiac insufficiency – venous stasis, hydrothorax, hydropericardium;
 - **Global** cardiac insufficiency – which can be compensated (when clinical signs can be observed only in case of effort) or decompensated (when clinical signs can be observed both in rest and effort).

6.1.2.2. Blood vessels (arteries, capillaries, veins)

Semiology of arteries.

The arteries can be examined using the general methods of examination (inspection, palpation, auscultation) and the special methods of examination (blood pressure measurement, radiological examination, catheterisation, Doppler technique).

Inspection – it gives the examiner few information, because most of the arteries have a deep localisation. In young and thin animals, the jugular vein pulsation can be seen, due to transmission of the pulse movements from the carotid artery. Also, in aortic insufficiency, pulse movements from the superficial arteries (especially angular artery of the eye) can be observed, movements that are called „arteries dance”.

Palpation - offers general information concerning the tract, calibre and uniformity (aneurysm – a localised weak spot on a blood vessel, frequently in horses on the mesenteric artery), stirring (on the middle uterine artery in gestation period on cow and mare), temperature and sensitivity (specific for angiopathy/vasculopathy – any modification of the blood vessels; in arteries, they are called arteriopathies, like arteritis- inflammation of the artery, arteriosclerosis/atherosclerosis – thickening and fibrosis of the arterial walls,

atheromatosis- a fatty deposit called atheroma on the internal wall of arteries, that can be calcified or ulcerated). This technique is the only one who can offer relevant information concerning the **arterial pulse** and its qualities:

- The rate of the arterial pulse is identical to the heart rate. Modifications of frequency are: accelerated pulse (tachycardic pulse rate) – specific for fever, rare pulse rate (bradycardic pulse rate) – specific for vagotonia, absence of the arterial pulse on terminal arteries of the limbs in arteritis. When extrasystoles are present, they are accompanied by a dissociation between the arterial pulse and the cardiac pulse (the heart contractions are inefficient, so there is not a sufficient amount of blood in the arteries to create the arterial pulse);
- The pulse rhythm – is regular (rhythmic) in most species, excepting the dog and young animals in which the pulse is irregular. In pathological conditions, irregular pulse is present in mitral insufficiency, in extrasystoles etc.
- Speed of the pulse wave - is related to how fast the pulse wave is perceived under the finger (fast or slow) or for how long the pulse wave is perceived under the finger (short or long duration). Modifications of speed or duration are present in valvular insufficiency or orifices stenosis, like:
 - o Long duration (low speed) – is called plateau pulse and is specific for aortic stenosis;
 - o Short duration (high speed) – is called hopping pulse (fast pulse, Corrigan pulse) specific for aortic insufficiency, miocardosys etc.;
- Amplitude (Height) of the pulse wave – it represents the oscillation of level that is produced by the pulse wave, like:
 - o Ample pulse (magnus) or high (Altus) is specific for aortic insufficiency and left heart hypertrophy;
 - o Low pulse – is present in aortic stenosis, in atrioventricular insufficiency. When the amplitude is very low, is called filiform pulse and is present in haemorrhages, in vascular paralysis. There are situations when the pulse is missing (imperceptible pulse);
 - o Different pulse- it implies asynchrony of the pulse in two symmetrical arteries (in arteritis, aneurism, thrombosis, external compressions);
 - o Inequal pulse – it implies the appearance from time to time of a pulse wave with a higher amplitude than the normal amplitude and is specific for cardiac arrhythmias;
 - o Alternant pulse – the examiner notes a pattern of a strong pulse followed by a weak pulse over and over again. Pulsus bigeminus is an alternant pulse, but at equal intervals (in bigeminus extrasystole);
- Tension (hardness) of pulse wave is the resistance which the pulse wave opposes when the examiner is pressing the finger, until it disappears:
 - o A high-tension pulse (steel pulse) – in aortic stenosis, in hypertension;
 - o A low-tension pulse (soft pulse) – in vasodilatation, collapse, haemorrhages – specific for filiform pulse.

Auscultation of arteries is realised with the stethoscope and only for detecting the sounds produced by stenosis in carotid artery, femoral artery, abdominal aorta, and for measuring the blood pressure.

Arterial pressure is most commonly measured via a sphygmomanometer, which uses the height of a column of mercury, or an aneroid gauge, to reflect the blood pressure by auscultation. The most common automated blood pressure measurement

technique is based on the so-called "oscillometric" method. Blood pressure values are generally reported in millimetres of mercury (mmHg), though aneroid and electronic devices do not contain mercury.

The normal arterial pressure is the value measure between a minimum (diastolic pressure) and a maximum (systolic pressure) limit.

Increasing of the arterial pressure higher than the minimum or maximum limit of the species is called arterial hypertension, while decreasing of the arterial pressure is called arterial hypotension.

Radiological examination of arteries is realised with opaque contrast substances and is useful for determining the trajectory, calibre, uniformity, thickness of the arterial walls, obstacles in the arteries, tumours of the blood vessels.

Catheterisation is used only for arteries with high and medium calibre, using special catheters. Are useful for diagnosis, but also therapeutic purpose in case of blood clots or atheroma.

Semiology of veins.

The veins can be examined using inspection, palpation and radiologic technique.

Inspection – useful for determining the trajectory, calibre, uniformity and the presence of pathological movements in jugular veins (retrograde venous pulse). Semiological aspects are:

- Venous turgescence (a higher volume of the vein due to blood intake) that can be localised or generalised, due to:
 - Cardiac, hepatic or pulmonary disorders
 - Compressions or inflammations (phlebitis – inflammation of the veins wall, periphlebitis – inflammation of the external layer of the vein and the surrounding conjunctive tissue, thrombophlebitis – inflammation of the vein wall and blood clotting);
 - Pulmonary emphysema – the intrathoracic pressure is increased and it produces circulatory stasis and turgescence in the pastern veins of the horse;
 - Hydro, pyo or hemopericardium with turgescence in the jugular veins;
 - Diffuse venous dilatations (phlebectasia) or limited and irregular dilatations (varicose veins) on limbs, oesophagus or hemorrhoidal veins;
- Wave movements on jugular veins, especially for large animals, like: retrograde venous pulse (similar to arterial pulse, with direction from the heart to the head) that can be positive (when is synchronous with the arterial pulse – in right atrioventricular insufficiency) or negative (when is asynchronous with the arterial pulse – in right atrioventricular stenosis, normal only for cattle). The venous pulse can also be present in the pulmonary veins, in insufficiency or left atrioventricular stenosis, but is not visible from the outside.

Palpation - useful for modification of temperature and sensitivity (phlebitis, thrombophlebitis etc.) and for venous dilatations pressure.

Radiological examination of the veins with contrast substances is called phlebography. Is used for examination of the trajectory, calibre, uniformity, thickness of the vein walls, as well as the transit of the contrast substance.

Semiology of capillaries.

In order to detect any modifications of the capillaries, the examination must be made on areas with depigmented skin, apparent mucous, the auricle, crest or interdigital membrane for web-footed. Modifications present at inspection include:

- Color modification – wanness (local anemia – ischemia), hyperemia (congestion) in arteries (active – light red color) or veins (passive – purple blue color)
- Presence of hemorrhages, cyanosis and others specific modifications for mucosa.

6.2. EXAMINATION OF THE BLOOD, LIMFA AND INTERSTITIAL FLUID

6.2.1.The blood

The blood is composed by plasma, in which are suspended red white cells, white blood cells and platelets.

When the blood sample it does not contain anticoagulant, in a short time the blood is clotting, resulting the clot and the serum. So, the serum represents the plasma without the fibrinogen which is transformed into fibrin.

Examination of blood is mandatory in pathological situations, because the blood reflects both alterations of its own components, but also alterations of other tissues or organs.

6.2.1.1. Physical examination of blood

Blood volume – the volume of blood in the circulatory system, volume that varies depending on the species, age, individual, diseases of the blood, liver or hematopoietic organs:

- Normovolemia – a normal volume of blood in the body:
 - Simple normovolemia – a normal volume of blood and a normal ratio between plasma and blood cells;
 - Oligocythaemic normovolemia - a normal volume of blood, but a reduced blood cells number (mild anaemia);
 - Polycythaemic normovolemia- a normal volume of blood, but an increase number of blood cells (mild polyglobulia);
- Hypovolemia – a decreased blood volume:
 - Simple hypovolemia – when both the plasma volume and blood cells are decreased (haemorrhages);
 - Oligocythaemic hypovolemia- when the decreased volume of blood is caused by a decrease in blood cells number (diseases of hematopoietic organs);
 - Polycythaemic hypovolemia- when the decreased volume of blood is caused by a decrease in plasma level (dehydration);
- Hypervolemia- an increase blood volume:
 - Simple hypervolemia- when both the plasma volume and blood cells are increased;
 - Oligocythaemic hypervolemia – when the increased volume of blood is caused by an increased plasma volume (hydreemia);
 - Polycythaemic hypervolemia - when the increased volume of blood is caused by an increased number of blood cells (leukaemia).

Hemostasis - represents the blood capacity of clotting and stopping the haemorrhages. In the clotting process, three components are involved:

- Vascular component – lesion of the blood vessel, followed by a decreased volume of blood in the affected area;
- Platelet component -adhesion of platelets to the lesioned vascular wall;
- Plasmatic component – clotting factors like fibrinogen, prothrombin, tissue factor or thromboplastin, proaccelerin, proconvertin (a total of 23 clotting factors).

Semeiological aspects are:

- Hemorrhagiparous syndromes (vascular, thrombocytes, plasmatic) – is characterized by the spontaneous hemorrhages in skin, mucosae (bruising, petechiae), blood loss (epistaxis, hematuria, melena) or absence of blood clotting in case wounds;
- Thromboses- blood intravascular clotting, due to various causes (lesions of endothelium, in prolonged stasis etc).

The colour- of the blood, plasma and serum:

- Normal - arterial blood is light red, while venous blood is dark red;
 - plasma and serum– yellow, with shades depending on species;
- Modified – black blood (in asphyxia, anthrax);
 - plasma and serum – greenish in jaundice;
 - opalescent – with high albumin content.

The taste – normal, slightly salty.

Erythrocyte sedimentation rate- is accelerated in nephrosis, anaemia, acute or chronic infectious diseases, tumours and is decreased in hepatic disorders, haemoconcentration, collapse, allergies.

Hematocrit- is the volume percentage of red blood cells in blood. Is high in polycythaemias, haemoconcentration, emphysema and low in hydremia, oligocythaemic anaemia, splenomegaly etc.

Blood ph. – is slightly alkaline.

6.2.1.2. Biochemical examination of blood

Biochemical determinations of the blood can be systematized in:

- Organic:
 - Nitrogenous proteins (albumin, globulin, fibrinogen, amino acids);
 - Nitrogenous non-proteins (urea, uric acid, creatine, creatinine, nucleotide, purine, bilirubin, xanthine, NH₃ etc.);
 - Non-nitrogenous (carbohydrates, lipids);
- Inorganic:
 - Electrolytes: - cation (Na, K, Ca, Mg), -anions (Cl, HCO₃, HPO₄, SO₄);
 - Microelements: Fe, Cu, Zn, Ni, Co, Fl, Br, I, Se, Mn, Mo, Si, St, vanadium, chromium;
 - Complexes: vitamins, hormones, enzymes.

Proteinemia – the level of total or fractionated protein in the blood. Dysproteinaemias are modifications of the total serum protein level (*hyperproteinaemia*- increased level of total serum protein, specific for haemoconcentration due to diarrhoea, vomiting, hyperproduction in liver diseases, tumours, allergies, diabetes and hypoproteinaemia in food or absorption deficiencies, parasitism, hydremia, ascitic cirrhosis, chronic glomerulonephritis) or of the protein fractions like:

- Serum albumin (albuminemia) – the level can be increased (Hyperalbuminemia) or decreased (hypoalbuminemia – in cirrhosis, malnutrition, neoplasia etc.);
- α_1 -globulin (alpha 1- globulinemia)- the level can be increased (hyperalpha-1 globulinemia) or decreased (hypoalpha-1 globulinemia);
- α_2 -globulin (alpha 2-globulinemia) - the level can be increased (hyperalpha-2 globulinemia) or decreased (hypoalpha-2 globulinemia);
- β -globulin (beta-globulinemia)- the level can be increased (hyperbeta- globulinemia) or decreased (hypobeta-glubulinemia);
- γ -globulin (gamma-globulinemia) (immunoglobins, antibodies)- the level can be increased (hypergamma- globulinemia) or decreased (hypogamma-glubulinemia);
- fibrinogen (fibrinogenaemia)- the level can be increased (hyperfibrinogenaemia) in pulmonary infections, pulmonary tumours or decreased (hypofibrinogenemia) in severe hepatic injuries;
- amino acids;
- abnormal proteins (paraproteinemia) – abnormal serum globulins, like: macroglobulin, cryoglobulin, Bence Jones protein.

Azotaemia (uraemia) – is the final compound of the protein metabolism, the level of urea from blood can be increased (hyperazotemia – in kidney failure, tumours, irradiations, after certain drugs or decreased (hypoazotemia – in hepatitis).

Uric acid (uricemia) – is resulted from the purine catabolism, in the liver and the level can be increased (hyperuricemia) in gout, renal diseases or decreased (hypouricemia) in severe hepatitis.

Ammonia- increased in liver diseases.

Creatinemia and creatininemia increased in muscular lesions in birds.

Haemoglobinemia – the level of haemoglobin from the blood serum that can be increased in haemoconcentration (diarrhoea, vomiting) or decreased (oligochromia) in oligochrome anaemia, iron deficiency etc.

Bilirubinaemia (cholema) – the level of bilirubin from blood serum, increased in haemolytic, hepatocellular or mechanical jaundice.

Cholalemia- the level of bile salts from blood serum, is increased in mechanical jaundice.

Glycemia – the level of carbohydrates from blood serum can be increased (hyperglycaemia) in diabetes or decreased (hypoglycaemia) in malnutrition or after insulin administration.

Pyruvic acid – is a product of carbohydrates metabolism, is increased in B₁ hypovitaminosis.

Lactic acid- is a product of anaerobe glycolyze, in increase in hepatic diseases.

Lipidemia (lipemia) – the level of blood serum lipids:

- total lipids – the level can be increased (hyperlipemia) in bile ducts diseases, Addison disease or decreased (hypolipemia) in malnutrition;
- total cholesterol (cholesterolemia) the level can be increased (hypercholesterolemia) in arteriosclerosis, obesity, diabetes mellitus or decreased (hypocholesterolaemia) in severe hepatic injuries;
- esterified cholesterol;
- phospholipids;
- triglycerides;
- free fatty acids.

Ketone bodies (acetoacetate, beta-hydroxybutyrate, acetone) result from the oxidation of the excessive fatty acids due to the reduced use of carbohydrates. The increased level is called ketonemia, and the disease is called ketosis. Ketosis is present in malnutrition, excess fat, diabetes mellitus or renal diabetes, hyperthyroidism, Cushing disease.

Serum iron – is increased in erythrocytes lysis, acute hepatitis, and decreased in iron deficiency anaemia.

Serum copper- increased in infections, tumours and decreased in deficiencies, nephrosis.

Calcemia – the of calcium from the blood serum, is increased (hypercalcemia) in hyperparathyroidism and decreased (hypocalcaemia) in hypoparathyroidism, tetany, D vitamin deficiency.

Phosphatemia- the level of phosphor from the blood serum, is increased (hyperphosphatemia) in hypoparathyroidism, acromegaly, renal failure and is decreased (hypophosphatemia) in hyperparathyroidism, osteomalacia and rickets.

Magnesiumemia – the level of magnesium from the blood serum, is increased (hypermagnesiumemia) in Cushing disease and decreased (hypomagnesiumemia) in rickets, tetany.

Kalemia (potasemia) – the level of potassium from the blood serum, it can be increased (hyperkalaemia, hyperpotassaemia) after burns, haemolysis or decreased (hypokalaemia, hypopotassaemia) in diarrhoea, vomiting.

Chloremia – the level of chlorine from the blood serum, it can be increased (hyperchloremia) in metabolic acidosis or decreased (hypochloreaemia) in renal failure, metabolic alkalosis.

Vitamins. The level of vitamins in the blood serum can be increased (hypervitaminosis) or decreased (hypovitaminosis), like:

- beta carotene (provitamin A) – precursors of vitamin A;
- Vitamin A (antixerophthalmic, retinol) – hypovitaminosis produces impaired vision, reproduction and nervous disorders, lesions of mucosae;
- Vitamin C (antiscorbutic vitamin) – deficiency of this vitamin produces scurvy (haemorrhages on skin and mucosa);
- Vitamin D (antirickets) – hypovitaminosis affects the phosphor and calcium metabolism (rickets and osteomalacia);
- Vitamin K (antihemorrhagic) – deficiency of this vitamin produces haemorrhages;
- Vitamin E (tocopherols) – E hypovitaminosis is associated with hypo selenosis and it generates muscle atrophy, hepatic degeneration etc.;
- Vitamin B complex:
 - o B₁ (thiamine) – hypovitaminosis produces polyneuritis and cardiac disorders;
 - o B₂ (riboflavin) - hypovitaminosis produces growth and reproduction disturbances, skin problems;
 - o B₃ (pantothenic acid) - hypovitaminosis produces pellagra;
 - o B₆ (pyridoxine) - hypovitaminosis produces growth disturbances;
 - o B₉ (folic acid) - hypovitaminosis produces somatic disorders;
 - o B₁₂ (cobalamin) - hypovitaminosis produces nervous disorders;
- H vitamin (biotin) - hypovitaminosis produces cutaneous and nervous disorders;
- F vitamin (essential fatty acids)- - hypovitaminosis produces necrosis and eczema;
- PP vitamin (nicotinic acid) -- hypovitaminosis produces cutaneous and digestive disorders.

Serum enzymes. Important enzymes present in blood serum are:

- Aldolase – increased in viral hepatitis, hepatic cancer, leucosis;
- Amylase – increased in pancreatitis;
- Creatine phosphokinase – increased in muscle lesions, nervous system diseases;
- Alkaline phosphatase – increased in hyperparathyroidism, rickets, osteomalacia, bones tumours, biliary disorders;
- Acid phosphatase- increased in bones metastases, prostatitis;
- Lactate dehydrogenase – increased in hepatitis, tumours;
- Lipase- increased in pancreatitis;
- Transaminases:
 - aspartate transaminase (AST) – increased in myocardial infarction, toxic and viral hepatitis;
 - alanine transaminase (ALT) – increased in toxic and viral hepatitis, cirrhosis.

6.2.1.3. *Microscopic examination*

The complete blood count (CBC) is a test performed in order to measure blood cells number, the concentration of haemoglobin and to assess possible qualitative modifications (morphological, structural) of the cells.

a) Quantitative modifications of the blood cells

Erythrocythaemia (erythraemia) is the number of erythrocytes in 1 mm³ of blood. The increased number of erythrocytes is called polycythaemia (hyperglobulia, polyglobulia) and can be due to an increased number of red blood cells (absolute polycythaemia) or a decrease in a volume of plasma (relative polycythaemia). The decreased number of erythrocytes is called oligocythaemia (hypoglobulia, hypocythemia) or anaemia.

Anaemias can be caused by the reduced number of erythrocytes (erythrocytic anaemia) due to the absence of erythropoiesis or due to haemolysis, haemorrhages, B₁₂ deficiency, or to the decreased level of haemoglobin (hypochromic anemia) - due to a decreased level of serum iron, protoporphyrin or globin.

Leucocythemia- is the number of leukocytes in 1 mm³ of blood. The increased number of leukocytes is called leucocytosis and is specific for animal's leucosis - can be due to an increased number of leukocytes (absolute leucocythemia) or in localised infections (relative leucocythemia). The decreased number of leukocytes is called leukopenia, that can be absolute (in leukolysis) or relative leukopenia.

Thrombocythemia – the number of thrombocytes in 1 mm³ of blood. The increased number of thrombocytes is called thrombocytosis and it has as a consequence a high coagulability (after acute haemorrhages, in splenic atrophy, after splenectomy) while the decreased number is called thrombocytopenia and it has as a consequence a hypocoagulability (in infectious diseases, anaphylactic shock, spleen diseases).

b) Qualitative modifications of the blood cells

Erythrocytes can have modifications of:

- Shape (poikilocytosis): acanthocytes – spike erythrocytes, leptocytes- thin erythrocytes, drepanocytes- sickle cells, stomatocytes- mouth cells, spherocytes, elliptocytes;
- Size (anisocytosis): megalocytes (12-15 µ), macrocytes (8-12 µ), microcytes (4-6 µ), schistocyte (2-3 µ);

- Colour (anisochromia): hyperchromia (high level of haemoglobin), hypochromia (low level of haemoglobin).

Leukocytes – these cells can present modifications of the ratio between different types (assess by leukocytes count -WBC) or the appearance of immature elements or pathologically modified elements in the blood.

The increased number of leukocytes (leucocytosis) is produced by an increased number of a single or of all types of leukocytes. There are situations when at a constant number of leukocytes, only the ratio between them is modified.

The increased percent of polynuclear leukocytes (granulocytes) is called polynucleosis (granulocytosis) and can be:

- Neutrophilic polynucleosis (neutrophilia) – specific for generalised or localised infections, malign tumours;
- Eosinophilic polynucleosis (eosinophilia)- specific for diseases produced by parasites, dermatologic or allergic diseases (asthma);
- Basophilic polynucleosis (basophilia) – rare in animals.

The increased percent of mononuclear leukocytes (agranulocytes) is called mononucleosis (agranulocytosis) and can be:

- Lymphocyte mononucleosis (lymphocytosis) -in chronic diseases (tuberculosis);
- Monocyte mononucleosis (monocytosis) – monocytes leukosis, diseases produced by parasites, acute articular rheumatism.

The decreased number of leukocytes (leukopenia) can be:

- Neutropenia – in bacterial and viral infections;
- Eosinopenia – in stress, after corticosteroids treatment;
- Basophilopenia
- Monocytopenia
- Lymphocytopenia (lymphopenia) – after glucocorticoids administration, sarcoma, uraemia.

6.2.2. The lymph.

The lymph contains blood plasma, leukocytes (especially lymphocytes) and antibodies, and is formed from the interstitial fluid. The lymph circulation is realised through lymphatic vessels and is filtered by lymph nodes.

The lymph examination can be: physical, biochemical and microscopic.

6.2.3. The interstitial fluid

The interstitial fluid is also a plasmatic component, but is localised between cells and it has an important role in nutritional exchanges between blood and cells. The volume of interstitial fluid is increased in oedema.

6.3. EXAMINATION AND SEMIOLOGY OF THE HEMATOPOIETIC ORGANS

6.3.1. The bone marrow

In order to be examined, a fragment of the bone marrow has to be aspirated using puncture (osteocentesis) of the bone tissue - long or flat bones (sternum, ribs, vertebrae, femoral head, ilium). The quantitative and qualitative assessment of the bone marrow cells is done by interpretation of the myelogram (bone marrow examination).

Modifications of the percentage ratio between the bone marrow cells are produced by the bone marrow hyperplasia, hypoplasia or aplasia.

Comparing with the blood cells, the cells from the bone marrow are more intense coloured, so they are young elements (blastic).

6.3.2. The thymus

The thymus is a hematopoietic organ very well developed in young animals and it represents the organ within the T Lymphocytes mature. Also, the thymus secretes various hormones with role in cytodifferentiation, adjustment of the immune response and body growing. It can be examined using palpation and radiological examination in young animals.

6.3.3. The Bursa of Fabricius

The Bursa of Fabricius is a lymphoepithelial organ specific for birds and it has an important role in B cells maturing. Modification of the humoral immunity are present in the thymus in case of several infectious diseases (avian infectious bursitis).

6.3.4. The spleen

The spleen has an important role in removing the old cells (especially red cells – haemolysis and recycle of iron from it), in immunity (hematopoietic organ and microbial filter) and is also an important reservoir of blood.

The spleen can be examined using palpation in small animals (dog and cat) and more difficult in large animals. Another method of examination is puncture followed by biopsy of the spleen tissue. Additionally, the examiner can use exploratory laparotomy and ultrasound. Pathologic aspects are: splenomegaly, purulent splenitis, spleen hemorrhage, spleen tumors.

6.3.5. The lymph nodes of mammals – are the site of the immunocompetent lymphocytes.

Examination is realized using general methods and special methods (puncture, radiological examination).

6.3.6. The tonsils (pharyngeal tonsils) are present only in dog and pig. They can be examined using inspection, palpation, puncture and biopsy. Inflammation of the tonsils is called tonsillitis. The surgical removal is called tonsillectomy.

7. SEMIOTICS OF THE URINARY SYSTEM

The excretory function is realised mainly by the urinary apparatus (urine), but also through skin (sweating), respiratory apparatus (CO₂), digestive tract and liver (faeces and biliary pigments resulted from hemolysis).

The importance of the urinary apparatus in excretion is given by its multiple functions:

- Blood purification of metabolites resulted from protein oxidation and urine elaboration;
- maintaining the blood acid-base balance;
- maintaining the blood electrolyte level;
- endocrine function- realised by hormones and enzymes secreted by the modified muscle cells from the renal glomerule arteriolar walls, like: renin (lowers the blood pressure), renal erythropoietic factor (that stimulates the erythropoietin production), urokinase, prostaglandins (with antihypertensive action), various enzymes.

It is very important to mention that if other organs or systems of the body are malfunctioning, this fact is reflected on the urinary tract (especially in the urine composition). Also, the urinary system can be affected by external factors (cold and excessive heat, humidity, fatigue, overloading, malnutrition, lack of water, permanent stress, allergies, skin

burns and external intoxications) and also internal factors (toxically products resulted from endocrine and metabolic disorders, cardiovascular, respiratory, digestive, hepatic diseases, infectious, parasitic and autoimmune diseases).

The examination of the urinary apparatus is functional (assessment of the general and specific organs signs: urination, urine, renal contrast enhanced-sonography) and physical (on segments: the kidney, renal pelvis, ureters, urinary bladder and urethra) using general and complementary methods.

7.1. EXAMINATION AND FUNCTIONAL SEMIOLOGICAL ASPECTS

7.1.1. General signs

Important general signs for the urinary apparatus are:

- uremic syndrome (due to urea retention in the blood) – is present in the majority of the kidney diseases, is characterised by: excessive sweating, pruritus and eczematous lesions on the skin, chronic bronchitis due to urine excretion on the pulmonary level, the smell of urea (ammonia) of the exhaled air and skin;
- renal colic (pain) - expressed by the pseudo lumbago syndrome. Lumbago (lumbar myalgia) implies pain and contraction of the lumbar muscles, due to neuromuscular lesions;
- oedema – localised on eyelids, chest, ventral area of the abdomen, scrotum etc.

7.1.2. Organ signs

7.1.2.1. Micturition (urination) and semiological aspects

The micturition (release of urine from the urinary bladder through the urethra to the outside of the body- action coordinated by nervous centers from the cortex, medulla oblongata and sacral spine) and it must be differentiated from diuresis (urine elaboration in the kidney and elimination in the urinary bladder), a complex process that implies filtration of the blood on the renal glomerulus (primary urine -the fraction of filtered blood plasma, without proteins), tubular reabsorption and secretion of H in case of acidosis or NH₂ in case of alkalosis, in also urine concentration realised under the action of the antidiuretic hormone (ADH). The absence of ADH produces diabetes insipidus, while the excess produces oliguria.

Semiological aspects of micturition implies: the frequency of urination, the amount of eliminated urine and the way urination is realised (the presence of urination difficulties or involuntary urination).

- Frequency:
 - Pollakiuria or pollakisuria – implies a frequent micturition and a small amount of urine. Present in cystitis (inflammation of the bladder mucosa), vesical lithiasis (calculosis) etc.;
 - Oligokiuria or oligokisuria – implies a decreased urination frequency. Present in acute nephritis;
 - Excretory anuria – absence of urination and appearance of the urinary retention;
- The amount of urine in 24 hours (depending on urine production-diuresis) can be:
 - Normuria – the normal amount of urine;
 - Polyuria – large amount of urine. Present in diabetes mellitus and insipid diabetes, nephrosis (dystrophies of the renal tissue);
 - Oliguria – small amount of urine – present in glomerulonephritis;

- Secretory anuria – absence of urination due to an absent diuresis (urine is not present in the bladder);
- Urination difficulties (dysuria):
 - Vesical tenesmus – the animal is in the specific position to urinate, it present urinary efforts, followed by stranguria or urinary retention;
 - Stranguria - difficulty in micturition in which the urine is passed only drop by drop or as a thin jet (in diseases that affect the urethra: urethritis, urethral calculosis);
 - Urinary retention- implies production and retention of urine in the bladder (clinically with anuria) and is specific for urethral spasm, spinal, cord lesions etc;
 - Enuresis (urinary incontinence) – implies continuous urination, without the specific position for urination and can be: permanent (continuous) or periodical (from times to times). Regarding the amount of urine, the enuresis can be: total (when the volume of urine from the bladder is totally eliminated) or partial (when the volume of urine from the bladder is partially eliminated);

7.1.2.2. *Urine and semiological aspects*

Urine examination allows appreciation of the kidney (diuresis) or other organs function (liver, pancreas, muscle etc), as well as the morpho-functional condition of the urinary tract. In practice, is performed a physical, biochemical, microscopic and bacteriologic examination of the morning urine, using a group of tests called urinalysis.

Physical examination

Colour and transparency

- In all species, the urine is clear (transparent) and yellow (with different shades depending on the species), excepting the horse in which the eliminated urine is turbid (carbonates and calcium phosphates);
- Red colour – present in haematuria (erythrocytes in the urine), haemoglobinuria (haemolysed blood in the urine), myoglobinuria (muscle pigment in the urine);
- Yellow brown or yellow green colour – elimination of pigment in a high amount (in jaundice);
- Black brown colour – in melanuria, alkaptonuria;
- Opalescent aspect – in lipuria (lipids in the urine);
- Turbid aspect – in case of salts, pus, mucus, bacteria, epithelium in the urine;
- Colourless – in insipid diabetes.

Density

- Normosthenuria- the normal urine density;
- Hypersthenuria- urine with high density (concentrated) – in dehydration, diabetes mellitus;
- Hyposthenuria- urine with low density (diluted) – in diabetes insipidus;
- Isosthenuria- urine with density and composition similar to plasma – in chronic renal failure;

Viscosity and cryoscopic point – are determined in the laboratory and is different depending on species.

The odour

- Normal is specific for each species;

- Pathologically – ammonia odour in cystitis, acetone odour in ketonuria, fetid odour in purulent inflammations of the urinary system.

Biochemical examination

A complex determination which implies quantitative or qualitative assessment of the organic and inorganic, normal or abnormal components in the urine, such as:

Albuminuria (proteinuria) – the quantity of albumin (protein) in the urine. Normally, the quantity of albumin is insignificant (practically is missing), while in pathological situations is present in high amount, with prerenal origin (of filtration- from plasma), renal (of the renal parenchyma) or postrenal (of the urinary tract).

Paraproteinuria- present in the heavy chains disease, myeloma etc.

Haematuria, haemoglobinuria, myoglobinuria – present in diseases of the urinary system, but also from muscle diseases.

Glycosuria – the amount of glucose in the urine. The amount of glucose is increased in diabetes mellitus or in renal filtration disorders.

Ketonuria- the ketone bodies (acetoacetate, beta-hydroxybutyrate, acetone) are present in diabetes, inanition, toxicosis.

Azoturia – the amount of urea in the urine. Azoturia can be normal, increased (hyperazoturia) – in infectious diseases, diabetes, intoxications, decreased (hypoazoturia) - in chronic nephritis, hepatic diseases or absent (anazoturia) in uremic coma. For a good interpretation of this test, is important to determine the Ambard's index = the ratio between azotaemia/azoturia which normally is 1/60-1/200. In renal failure, azotaemia is very high.

Uric acid – increased in gout (dog and birds), leukaemia, burns;

Creatine (creatinuria), creatinine (creatininuria)- increased in muscle atrophy;

Hippuric acid, lipuria, phenoluria- are modified in pathological conditions.

Choluria - bile pigments in urine. Normally, in urine is present urobilinogen that can be increased (in hepatic or haemolytic disorders) or decreased (in biliary obstructions). Bilirubin is present in jaundice.

Cholaluria – biliary salt in urine, especially in mechanical jaundice.

Pyuria - pus in the urine.

Aminoaciduria- free amino acids in urine. Normally, the quantity of free amino acids is very little, but it increases in some congenital diseases. Determination of free amino acid is made using chromatography.

Microscopic examination (examination of the urinary sediment)

The urinary sediment can be:

- Inorganic (mineral) - in the form of specific crystals (Ca carbonate, Ca sulphate, Ca oxalate, Ca phosphate, ammonia-magnesium phosphate) or amorphous - present under normal or pathological conditions;
- Organic:
 - Unorganised- in the form of specific crystals (uric acid, hippuric acid, sodium or ammonium ureas, amino acids - cystine, leucine, tyrosine, xanthine etc.) or amorphous;
 - Organised - in the form of isolated cells (epithelial cells, leukocytes, erythrocytes, spermatozoa, bacteria), urine cylinders (cylindruria)- cellular or precipitated protein derived from the distal tubes (hyaline, granulose, fibrous, epithelial, leucocyte, biliary, bacterial cylinders), cylindroids (very large cylinders) or pseudocylinders.

Examination of the urinary sediment allows assessment of two categories of components:

- Normal components (uric acid, urea, ureas etc.) – that can become abnormal when their amount increases or decreases beyond normal limits;
- Pathological components (the presence of cystine, tyrosine, leucine crystals) – that in normal conditions, are not present in the urine.

Bacteriological examination (uroculture) – the test is performed from the morning urine, sterile collected. Is very useful in bacterial infections of the urinary system, because it allows isolation and identification of the pathogenic agent, and also the determination of the antibiotic resistance (antibiogram).

7.1.2.3. *Measurement of renal clearance (functional capacity of the kidney)*

Taking into consideration the fact that this test is aggressive for the whole organism and especially for the kidney, is recommended that the test be performed at the end of the physical examination of the urinary apparatus.

Practically, is verified the time the blood needs to free from a certain substance iv administrated, which has to be excreted by the kidney, so has to be found in the urine (chromodiagnostic). The substances used for chromodiagnostic (methylene blue, inulin, sodium thiosulphate, paraaminohippuric acid, etc.) must have certain properties:

- Must not have renal threshold (not be resorbed in the renal tubes)
- Elimination must be realised only in the kidney;
- Must not be reabsorbed by tissues;
- Must not be metabolised in the body;
- Must not be toxic;
- Should be able to be dosed in blood and urine.

The clearance is low in acute and chronic glomerulonephritis, chronic pyelonephritis, acute renal failure etc.

Now, the clearance can be realised by dosing the urine normal components (dosing of urea or creatinine from blood and urine).

7.2. EXAMINATION AND SEMIOLOGICAL ASPECTS OF THE URINARY APPARATUS (KIDNEY, URETERS, URINARY BLADDER, URETHRA)

7.2.1. The kidneys

Inspection- useful for indirect signs, like:

- pseudolumbago (renal pain) – stiffing gait, hindquarters deviated laterally, kyphosis;
- paraplegia- due to increased kidney that presses on the solar plexus;
- gout - in birds, dog – present when the proteins metabolism is modified, and uric acid in high amount is crystallised in certain areas (ex. joints);

Palpation- it can be done transabdominal (in small animals) or transrectal (in large animals) in order to assess:

- high pain sensitivity in: nephritis (kidney inflammation), pyelitis (renal pelvis inflammation), pyelonephritis (kidney and renal pelvis inflammation), glomerulitis (renal glomerulus inflammation), glomerulonephritis (glomerulus and the others renal components inflammation);

- shape and dimension, modified in: nephromegaly (enlarged kidney), hydronephrosis (fluid accumulation in the renal pelvis), renal tumours, renal cysts (polycystic kidney disease), urolithiasis, renal sclerosis (small kidney);
- kidney position- frequently occurs unilateral or bilateral renal ptosis (displacement of the kidney) – in renal tumours, hydronephrosis, massive calculosis of the renal pelvis or after a prolonged effort – when a certain kidney can be confused with coprolite, testicle or an ectopic ovary;
- kidney consistency- higher in tumours, renal sclerosis, lower in hydronephrosis.

7.2.2. The ureters

Examination of the ureters is quite difficult and can be realising only using transrectal palpation (in large animals) or transabdominal (in small animals). Modifications are: deformations due to calculosis (ureteral lithiasis), fibrin, blood clots, or high pain sensitivity in inflammations (ureteritis).

7.2.3. The urinary bladder

Inspection – assess the abdomen deformation (especially for small animals), lumbar kyphosis, terminal haematuria, pollakiuria, turbid urine etc.

Palpation – transabdominal (for small animals) and transrectal (for large animal) allows determination of the position, size, shape, pain sensitivity (in inflammations – cystitis) and consistency (elastic in urinary retention, hard in vesical lithiasis). At bladder pressure, micturition starts. This procedure doesn't have to be realised brutally because the bladder walls can be traumatised.

Increasing size of the bladder is present in vesical retention and can be produced by: urethral and vesical calculosis, spasm of the urinary bladder, paralysis of the bladder walls.

Thickening of the urinary bladder walls is present in chronic cystitis, tumours (papillomatosis, carcinoma etc.).

7.2.4. Urethra – is examined using palpation both males and females. Inflammation of the urethral mucosa is called urethritis.

Urolithiasis – is a general term that refers to the calculi presence (solid concretions formed by agglomeration of organic or mineral substances) in the urinary apparatus. Urolithiasis can be present in: the kidneys (nephrolithiasis), renal pelvis (pyelolithiasis), ureters (ureterolithiasis), urinary bladder (cystolithiasis), or urethra (ureterolithiasis).

Examination of the urinary apparatus using special methods of examination

- urinary catheterisation- examination with flexible plastic catheters of urethra and urinary bladder, both in males and females. Is useful for detecting urethral spasms or calculi;
- endoscopy of the urinary bladder (cystoscopy) – only in females, allows internal examination of the urinary bladder;
- radiological examination - urography can be done ascending (when introduction of the contrast substance is made through the urinary bladder) or descending (when introduction of the contrast substance is made iv);

- ultrasonography – frequent used in small animals (cat, dog), it allows a good examination of the kidneys and urinary bladder, detecting modification of topography, size, structure, lithiasis etc.
- exploratory laparotomy – rarely used and only in small animals.

8. SEMIOLOGY OF THE GENITAL APPARATUS

8.1. MALE REPRODUCTIVE TRACT

The examination of the male reproductive tract is functional (using reflexes check) and physical, on segments, that is:

- Gonads (testicles) and scrotum:
 - Testicle – it has an exocrine function (gametogenesis/spermatogenesis – sperm production) through seminiferous tubes, function that is coordinated by the *hormones* secreted by *gonadotrope* cells of the anterior pituitary and a exocrine function – producing of androgen sexual hormones (testosterone, aldosterone) with role in defining the male sexual characters, in sexual behaviour, in spermatogenesis and in activation of accessory sex glands;
- Genital tract (spermatic tract) - ductus epididymitis (epididymis), deferent ductus and ejaculatory duct; deferent ductus with blood vessels, nerves and cremaster muscle form the spermatic cord;
- The urogenital common segment: urethra and penis:
 - The penis- is the external male intromittent organ. The main parts of the penis are the body (corpus) and gland penis, covered by skin (foreskin). The bull and boar penis are having a sigmoid flexure, while in male dog and tomcat is present the penis bone (baculum);
 - The vesical glands (seminal vesicle) – are secreting some sperm components (glycoproteins, fructose, citric acid) and are a reservoir from sperm between two ejaculations. Are missing in carnivores;
 - The prostate- secrets glycoproteins, lipids, pigments, phosphatases, lecithin, spermine;
 - The bulbourethral gland (Cowper glands) – are secreting a mucoproteic fluid. Are not present in dog.

8.1.1. Functional semiological aspects

Checking the male sexual functions implies checking the reflexes, the presence of psychopaths and sperm examination.

Checking the reflexes is mandatory made in the presence of female in heat, assessing:

- The erection reflex – a physiological phenomenon in which the penis becomes firm, engorged, and enlarged under the action of the sacral nervous centres:
 - Absence of this reflex appears due to stress, exhaustion, malnutrition, infectious diseases;
 - Exaggeration of this reflex (priapism) implies a permanent and painful erection, caused by nervous system diseases, urethritis, cystitis;
- Hugging reflex (the jump on the female):
 - Absence or difficulties in accomplish this reflex are due to posterior limbs or spinal cord disorders;

- Mating reflex (copulation, intromission):
 - The reflex is not realised in penis disorders (inflammations, tumours) or is realised but deviated (sexual perversions);
- Ejaculation reflex – the sperm discharge inside the female genital tract, under the action of the lumbar nervous centres:
 - Absence of ejaculation – in nervous disorders, obstructions on sperm ducts or when the animal is too young or too old;
 - Premature or delayed ejaculation;
 - Spermatorrhea - frequent and involuntary emission of semen, without sexual contact;
 - Spermaturia- high amount of sperm in the urine;
 - Sexual exhaustion (temporary) – in reproduction bulls.

Sexual psychopaths

- Satyriasis – exaggerated male sexual instinct, with a tendency to violence. The male is becoming aggressive for the female and for the owner;
- Sexual perversions, like masturbation (onanism) - obtaining ejaculation by artificial stimulation (frequent in dog, stallion, boar and bull) and homosexuality – sexual relations with a same sex partner;

Masculine sterility (sexual impotence):

- True (proper) when the testicle does not produce sperm (in genital infantilism, testicle inflammation, after neutering);
- False, when sperm is not deposited in female genital organs.

Testicular functionality is also verified by sperm examination, that includes a physical examination (quantity, color, density, odor), biochemical (ph, organic and inorganic substances, enzymes, vitamins), microscopic (spermatozoid counts and movements) and bacteriological (pathogenic germ). Important semiological aspects are:

- Aspermia – the complete lack of semen;
- Oligospermia – low sperm count;
- Azoospermia - semen contains no sperm;
- Oligozoospermia- low sperm in the semen;
- Necrozoospermia- the sperm from the semen are dead;
- Aspermatogenesis- a quantitative (reduced number of sperm) and qualitative disorder (abnormal sperm) in the semen;
- Abnormal sperm – especially with modification in the sperm head (micro and macrocephaly) and tail (double tail or lack of the tail).

8.1.2. Physical semiological aspects

- Scrotum - dermatitis, hematoma, wounds, inguino-scrotal hernia, hydrocele (scrotum serous collection);
- Testicle - orchitis (inflammation of the testicle) anorchia (congenital absence of both testes), monorchia (the presence of a single testis), unilateral or bilateral cryptorchidism (the lack of descendance from the abdomen in the scrotum of one or both testicles), spermatocele - a cystic dilatation of epididymis or testicle with sperm accumulation;

- Epididymis – epididymitis (inflammation), orchiepididymitis (inflammation of epididymis and testicle);
- Spermatic cord: funiculitis (inflammation of the cord especially after castration), hemorrhages (after castration- orchidectomy);
- Penis – balanitis (penis inflammation), balanoposthitis (inflammation of the penis and foreskin), penis paralysis, penile bone fracture, wounds, tumors;
- Foreskin- phimosis (narrowing of the preputial orifice), posthitis (inflammation of the foreskin), leakages (blood, mucus, pus);
- Glands:
 - Seminal vesicle – spermatocystitis – inflammation;
 - Prostate – prostatitis (inflammation), prostatomegaly (gland hypertrophy), prostate adenoma, cysts, abscess;
 - Bulbourethral glands – cowperitis (inflammation).

8.2. FEMALE REPRODUCTIVE TRACT

The examination of the female reproductive tract is functional (sexual cycle, gestation, lactation, milk) and physical, on segments:

- The vulva (vulvar labia, clitoris, vestibule) and perivulvar area, the pelvis, croup and buttocks;
- The vaginal vestibule (mucosa and major and minor vestibular glands);
- The vagina (mucosa, hymenal membrane);
- The uterus - "neck of uterus" (cervix), body, uterine horns– with mucosa (endometrium), muscular layer (myometrium) and serous layer (perimetrium);
- The oviduct (salpinx): body and infundibulum;
- Ovaries: with exocrine function (gametogenesis – ovules production) and endocrine function (production of oestrogen and progesterone) – with role in ovulation and onset of oestrus, the development of feminine sexual characters, of mammary gland and maintaining gestation.
- Annexe glands: mammary gland is covered by skin and is attached to the body by the median and lateral suspensory ligaments. The milk, produced by the mammary epithelium (lactogenesis) flows through galactophorous ducts in the galactophorous sinus, from which through the papillary duct is eliminated outside through the mammary papilla.

8.2.1. Semiological functional aspects

8.2.1.1. *Sexual cycle (oestrus)*

The female reproductive tract it has a cyclic sexual activity (ovarian cycle, sexual cycle, estrous cycle) – when ovulation is accompanied by genesis instinct (libido). In most domestic animals the sexual cycle is monthly (polyoestrous females), excepting the queen and the bitch that have two sexual cycles per year (dioestrus females). Wild animals have a single cycle per year (monoestrous females).

In animals, the sexual cycle has two phases:

- Follicular phase (with proestrus and oestrus) – in this phase, is present libido and the spontaneous or induced ovulation. In this phase are secreted oestradiol and folliculin.

- Luteal phase (metestrus) – implies corpus luteus and progesterone secretion.

The checking of the genesis instinct is realised in the presence of the male. Important aspects are:

- Anaphrodisia (frigidity – absence of mating desire) – generated by hormonal disorders and clinically express with unregular heat periods, absence of heats or quite heats (indifference to the male);
- Nymphomania- exaggeration of mating desire, present in hormonal and psychiatric disorders.

8.2.1.2. *Gestation*

Gestation is the period between nidation (implantation of the embryo in the uterus mucosa) and parturition.

Semiological aspects are:

- female sterility (infertility)- impossibility of reproduction, due to ovarian hypoplasia, intersex (hermaphroditism- presence in the same animal of both male and female genital organs), freemartinism (a genetically female foetus masculinised in the presence of a male co-twin), anovulation.
- Prolonged gestation- can be physiologic or pathologic (in dystocia);

An easy and on time parturition is called eutocia, while a difficult parturition is called dystocia, that can be produced by maternal causes (narrowing pelvis, faulty fractures of the pelvis) or fetal causes (large fetus, abnormal positions, fetus death etc.);

- Shortened gestation- due to premature delivery (when the foetus is viable) or abortion (when the foetus is born dead or alive, but is not viable). The abortion can be: egg, embryo or foetus abortion.
- False pain – premature efforts of delivery, but without foetus externalisation;
- Placentae retention – retention of placenta after parturition, frequently complicated with uterus infections.

8.2.1.3. *Lactation and milk*

Lactation – production and elimination of milk/colostrum from the mammary glands after parturition.

Semiological aspects are:

- Agalactia – the mammary gland is not secreting milk, although is in lactation period (Contagious agalactia of sheep);
- Hypogalactia – elimination of a small amount of milk;
- Milk retention – retention of milk in the gland cistern;
- Galactorrhoea – continuous elimination of milk (milk incontinence) due to disfunction of the papillary sphincter;
- Nervous lactation – a serous lactation, without gestation and parturition (in false pregnancy at bitch);

The milk- is the secretion of the mammary gland. Milk examination is realised in order to detect any modifications of its composition or modifications of the mammary glands. The examination of milk is physical, biochemical, microscopic and bacteriologic.

- Physical examination:
 - o Colour: normally white, can become yellow (in mammitis, jaundice) or red (when is blood in the milk);
 - o Odour: of urine, oil, drugs;

- Taste – salty in heat period;
- Viscosity – watery in mammitis, mucous when is pus;
- Coagulability- is appreciated by boiling;
- Biochemical examination:
 - The amount of proteins, lipids, carbohydrates;
 - The presence of lactic enzymes.
- Microscopic examination:
 - Red cells in haemorrhages;
 - High number of leukocytes in infections;
- Bacteriological examination:
 - Normal lactic bacteria;
 - Pathologic bacteria (E. coli, M. tuberculosis, streptococci etc.).

8.2.2. Semiological physical aspects

Examination of the female genital tract can be performed from outside (external inspection, transrectal palpation) and from inside (internal inspection with speculum, palpation, sounding, biopsy, vaginal endoscopy, colposcopy, ultrasound etc.).

- External inspection of the perivulvar area, vulva, pelvis, buttocks and internal inspection of the vestibulum and vagina are useful for detecting:
 - Secretions:
 - Physiological – in heat, gestation, after parturition;
 - Pathological – in placenta retention or inflammation;
 - Modification of size, shape, position of the pelvis (narrowing) that leads to dystocia;
 - Vaginal stricture - diminishing of the vaginal lumen due to genital infantilism or scars generated by dystocia;
 - Modification of the vulvar, vestibular or vaginal mucosa – inflammation (vulvitis, vaginitis, vestibulitis), deformation (vulvar oedema, perivulvar infiltration, vaginal inversion, vaginal prolapse, uterine prolapse), fistula, wounds, ulcers, cysts, tumours.
- External palpation (transrectal) of the cervix, uterus, uterine horns, oviduct, ovaries and internal palpation (exploration and vaginal touch) of the vulva, vaginal vestibules, vagina and cervix allows the examiner to establish the shape, size, position, consistency, pain sensitivity, temperature, humidity of this segments, and also establish the gestation diagnosis.

Semiological aspects:

- Modifications of pain sensitivity and temperature specific for inflammations: cervicitis (cervix inflammation), endometritis (endometrium inflammation), metritis (uterus inflammation), salpingitis (oviduct inflammation), pyosalpingitis (purulent inflammation of the oviduct), ovaritis (ovary inflammation), salpingoovaritis (adnexitis) (inflammation of the ovary and oviduct);
- Modifications of size, shape and position:
 - in the uterus: pyometra (purulent inflammation of the uterus), scars, tumours and deformities generated by gestation;

- in ovaries: follicle, luteus bodies, persistent luteus bodies, follicular cyst, ovaries hypoplasia;
- Sounding – for fistula and wounds;
- Biopsy – for histopathological examination;
- Colposcopy – for examining the vaginal and uterine mucosa;
- Photocolposcopy- photography of the vaginal and uterine mucosa;
- Exploratory laparotomy- used in pathological conditions;
- Radiological examination and ultrasound- useful for detecting dead foetus and for gestation diagnostic.

Physical examination of the mammary gland

- Inspection – important for the size, shape and colour of the skin that covered the mammary gland, in resting and lactation period;
 - Increased mammary gland – in mammary oedema, abscesses, phlegmons, tumours, milk retention, inflammation (mamitis/mastitis);
 - Decreased mammary gland: in resting period, chronic mamitis (atrophy);
 - Localised deformities- rashes, scars, wounds, hematomas, cystitis, milk calculi, papillomas;
 - Colour: red in congestion and inflammation, black in gangrene;
- Palpation – it detects high pain sensitivity in inflammations, increased volume and pain of the retromammary lymph nodes in acute or chronic inflammation;
- Milking test – allows checking of the galactophore duct, papillary duct and papillary sphincter permeability using milking. In pathological situations, are present obstructions, narrowing or congenital imperforation;
- Sounding- allows checking of the papillary duct permeability using cannulated probes;
- Puncture- used only in special situations;
- Radiological examination with contrast substances (mammography) – examination of the mammal especially for detecting tumours.

9. SEMIOLOGY OF THE LOCOMOTOR SYSTEM

The locomotor system plays an important role in animals supporting and movements and it includes bones, joints, tendons, ligaments, sheaths, muscles, blood vessels, nerves, hooves, claws, nails.

Examination of the locomotor system is functional, when the animal position is evaluated during movement (for lameness, remaining behind the flock, pain) and at rest (limbs position according to the ground, lack of support on the ground) and physical (examination on segments of the locomotor system).

9.1. BONES

Bones examination is realised using inspection (direct and indirect signs), palpation (integrity, resistance, segments mobility, presence of the bones crepitation and high pain sensitivity, deformities of the covering tissues), radiological examination (shape, position, structure and fractures), biopsy (histopathological examination), examination of the blood and urine (Ca/P ratio).

Semiological aspects:

- Osteopathy – any disorder that affects the bone;
- Bone fracture- breaking or tearing of the bone; Fractures classification:
 - Clinically:
 - Opened (when the bone is perforating the skin) and closed;
 - Total or partial;
 - Epiphyseal, diaphyseal, apophyseal, articular fracture;
 - By compression (in short bones);
 - By the separation line:
 - Complete:
 - Opened (when the bone is perforating the skin);
 - Closed (without wound): transverse, oblique, longitudinal, with displacement (by angulation, by rotation, by overlapping) with fragments (eschiles) called cominutive fractures;
 - Incomplete: cracks, greenstick fractures, fractures by clogging.

The treatment of fractures involves either immobilisation of the fractured bone (with splints or gypsum) or surgical intervention (metal osteosynthesis). The fractured bone heals by forming the bone callus. When immobilisation of the bone is defective, a cartilaginous callus is formed, which allows the movement of the fractured fragments and the appearance of pseudarthrosis. There are situations when this bone callus can become vicious or exuberant.

- Periostitis (periosteal reaction) – periosteum inflammation due to trauma or by a spreading infection, localised or generalised;
- Osteitis – inflammation of the bone tissue (inflammation of the vertebra-spondylitis);
- Osteomyelitis - inflammation of the bone tissue and bone marrow;
- Osteochondritis - inflammation of the bone tissue and articular cartilage;
- Osteodynia – pain of the bones in fractures, rickets;
- Osteodystrophy- dystrophy of the bone (spondylosis – bone and intervertebral disc degeneration);
- Osteoporosis- bone scarring due to insufficient osteogeneses and widening of the medullary cavity;
- Osteofibrosis - chemical osteopathy dystrophia characterised by the absence of osteoclasts and fibrous metaplasia of the marrow;
- Osteonecrosis- necrosis of the bone tissue;
- Osteolysis – bone lysis (bone tissue resorption) due to mineral or bone tissue deficits (empty spaces are present);
- Rickets - chemical osteopathy dystrophia of young animals characterised by vitamin D deficit and lack of the bones mineralisation (on Rx -, glass bones’’);
- Osteomalacia- - chemical osteopathy dystrophia of adult animals characterised by bone demineralisation;
- Hyperostosis – hypertrophy or hyperplasia of bone tissue;
- Osteophytosis- the formation of bone spurs, especially near joints (frequent on spinal cord – ossification of the intervertebral ligament in old animals);
- Exostosis - outgrowth from the surface of a bone (,dead bones’’ especially on limbs);
- Enostosis - delimited bone proliferation within the cavities (cranial cavity, vertebral cavity);

- Dyschondroplasia- Early ossification of growth cartilage (in birds is due to the magnesium deficit, in other species is hereditary);
- Achondroplasia – is a congenital defect of enchondral ossification (nanism);
- Osteodysplasia- bone abnormality characterized by either bone rarefaction or bone condensation with irregularities (especially in the skull and the spine);
- Bone agenesis – the congenital absence of a bone segment or of an entire bone;
- Bone hypogenesis- insufficient development of a bone segment;
- Osteoma – benign bone tumour;
- Osteosarcoma- malign bone tumour.

9.2. JOINTS

The junction between bones is provided by the joints (mobile, semi-mobile, immovable) that are composed by articular cartilage and articular capsule. Joints examination is realised using inspection (size, mobility), palpation (position of the bone ends, temperature and sensitivity), simple radiography or using contrast substance - arthrography, ultrasound, joint aspiration (arthrocentesis) and examination of the synovial fluid.

Semiological aspects:

- Arthropathy- any disorder that affects the joint;
- Arthritis – acute inflammation of the joint;
- Polyarthritis- several joints inflammation;
- Rheumatoid polyarthritis - deforming and ankylosing joints due to beta haemolytic streptococcal infection;
- Periarthritis- inflammation of the tissues surround the joint;
- Arthrosis – chronic inflammation, degenerative of the joint (coxarthrosis, gonarthrosis);
- Ankylosis - prolonged immobilization of a joint
- Arthralgia – articular pain;
- Hydrarthrosis – hydric accumulation (serous exudate or serous-fibrinous);
- Hemarthrosis – blood in the articular cavity;
- Sprain (joint effort) - articular heads displacement with the breaking or tearing of the joint ligaments, followed by the return to normal (clinically with oedema and pain);
- Luxation- displacement of the articular heads without returning to normal (clinically with deformity and oedema);
- Dislocation - stretching and unraveling of the articular ligaments, with an excessive articular mobility;
- Disjunction – separation of two synarthrotic bones (sacroiliac disjunction);
- Articular wounds.

9.3. TENDONS AND SYNOVIAL TENDON SHEATHS

Semiological aspects:

- Tendinitis – inflammation of the tendon;
- Tenoperiostitis- An inflammation at the point where a tendon inserts into or originates from bone;
- Tenosynovitis- inflammation of the tendon and tendon sheaths;
- Tenalgia- pain in the tendon;
- Tendon luxation

- Rupture and disinsertion of the tendon;
- Tendon necrosis;
- Tendon retraction.

9.4. THE MUSCLES

Examination of the skeletal muscles is realized using inspection (volume, integrity, active and passive movements), palpation (muscle tonus, sensitivity, temperature), examination of blood and urine (to detect myoglobin), biopsy.

Semiological aspects:

- Muscles volume:
 - Increased muscle volume (hypertrophy) can be real (in animals used for work, by training) or false (due to certain diseases);
 - Decreased muscle volume (hypotrophy);
 - Exaggerated diminishing of the muscle volume (muscle atrophy, amyotrophy, myotrophy) can be caused by:
 - Neuropathies- after paralysis;
 - Myopathies – in muscle diseases;
 - Vascular disorders – due to circulation stops because of thrombosis;
 - Functional diseases – in case of prolonged immobility, fractures;
- Muscle tonus- normal (normotonic); increased (hypertonic), decreased (hypotonic), absent (atony, amyotony, muscle paralysis);
- Muscle movements:
 - Myoclonia- multiple short, fast, involuntary contractions;
 - Myotonia- prolonged tetanic contractions;
- Myopathy- any disease that affects the muscles;
- Myositis – muscle inflammation;
- Dermatomyositis- inflammation of the muscle and covering tissue;
- Myodystrophy- muscle dystrophy (white muscle disease);
- Myotenositis – inflammation of the muscle and its tendon;
- Myalgia (myodinia)- muscle pain;
- Myasthenia- fast muscle fatigue;
- Myofibroma- benign tumor of the muscle;
- Myosarcoma- malign tumor of the muscle;
- Muscles rupture and tearing.

9.5. SEMIOLOGICAL ASPECTS OF THE WHOLE LIMB AND PHALANGES

Polymelia- additional limbs;

Amelia – limb/ limbs absence;

Polydactylies- additional phalanges;

Syndactyly – phalanges absence.

10. SEMIOLOGY OF THE NERVOUS SYSTEM

The nervous system is composed of tissues which play a role in the integration of the body in the surrounding environment. The nervous system is divided into the central nervous system (CNS) and the peripheral nervous system (PNS). The peripheral nervous system could be subdivided into the somatic nervous system and autonomic nervous system (which is responsible for involuntary responses to control physiological functions).

The central nervous system consists of two components: the brain and the spinal cord. The encephalon (cerebral hemispheres, diencephalon, cerebellum and brainstem) is localized in the skull and is protected by the cranium. The spinal cord is formed from motor and sensitive nerve fibers (nerves) which leave the medullar canal and connect the spinal cord to skin, joints, muscles and organs.

The examination of the nervous system consists in the physical and functional examination which is divided into:

- a) Physical examination of skull and spine (bone tissue);
- b) Physical examination of the cerebrospinal fluid (CSF);
- c) Radiological examination (cerebrum, spinal cord) and electrography;
- d) Functional examination of the CNS:
 - Behavior: cortical inhibitions and excitations;
 - Motility: muscular tonus, contractibility, movement coordination
 - Neuromuscular excitability (reflexes)
 - Sensibility (exteroceptive, proprioceptive, interoceptive);
- e) Functional examination of the autonomic nervous system:
 - Clinical signs;
 - Pharmacodynamics testing
 - Autonomic reflexes

10.1. PHYSICAL EXAMINATION OF SKULL AND SPINE

10.1.1. Skull

Inspection: size, shape, symmetry and integrity:

- Head trauma: depression fractures, periostitis, hemorrhage, subcutaneous edema;
- Deformities: development of pathological process in the skull and bone tissue: hydrocephalus (collection of pathological CSF within the skull), brain or skull tumors, coenuruses, encephalocele (cephalocele, craniocoele) - congenital herniation of the brain, meningocele (hydro-meningocele) – the herniation of the meninges through a congenital fissure of the skull or spine, meningoencephalocele (herniation of the brain and the meninges through a congenital fissure of the skull), skull osteofibrosis, exostosis.

Palpation: sensibility, temperature, integrity, the resistance of skull bone on deep palpation and the neurological clinical manifestations of deep palpation (this is why is recommended to do the palpation after radiological examination):

- Sensitivity to pain (hyperalgesia): bone fractures, contusions periostitis, hematoma, edema and inflammations: meningitis (inflammation of the meninges), pachymeningitis (dura mater inflammation), leptomeningitis (pia mater inflammation), encephalitis (brain inflammation), meningoencephalitis (brain and meninges inflammation), internal and media otitis, frontal sinusitis;
- Temperature: high temperature due to conditions that affects bone and subcutaneous tissue;

- Integrity: bone resistance is modified in fractures, bone crepitation at deep palpation, tonic-clonic contractions, seizures consecutively due to nervous substance compression.

Percussion: Sensitivity to pain.

Radiological examination: the thickness, form and shape of the skull which can highlight bone deformities such as: exostosis, enostosis, fractures, ossification disorders.

Trepanation and skull puncture (craniocentesi): used rarely for diagnostic purpose, more frequently used for therapeutically purpose.

Computed tomography (CT) and Magnetic resonance imaging (MRI): used for bone structure and nervous structure (cerebral bleeding, tumors etc).

10.1.2. Spinal cord

Inspection: form, position, direction, integrity and flexibility. Positional changes could be temporarily (functional, reversible) – changes that disappeared with the cause that generated them or definitive changes (conformation, morphological, structural, irreversible) – this change can cause damage to the spinal cord.

Semiological aspects:

Cervical spine:

- orthotonus - a form of spasm in which the head and the neck are fixed in a straight line
- ophistotonus – hyperextension of the head, neck and spinal column in an “arcing position”;
- emprostotonos- a form of spasms in which the head and limbs are brought together;
- torticollis- a condition the head becomes persistently turned to one side;
- pleurosthotonus: bending of the body to one side, especially as a result of muscle spasm;

Lumbar spine:

- kyphosis: abnormally excessive convex curvature of the spine;
- gibbus: structural kyphosis (definitive change);
- lordosis: the abnormal inward lordotic curvature;
- scoliosis: the spine has a sideways curvature;
- kyphoscoliosis: association between kyphosis and scoliosis;
- lumbago: neuromuscular lombar pain and characteristic position (thoraco-lumbar rigidity).

Palpation: sensibility, shape, temperature, integrity, mobility.

Pain sensitivity is present in different pathological conditions such as skin, muscle, vertebrae, ligaments and intervertebral disks (dermatitis, myositis, spondylitis, myelitis, ossification of the of the intervertebral disks and ligaments).

Temperature: high temperature in some localized area where there is a localized lesion.

Shape: changes that appear in fractures, luxations, edema, hematomas, callus, richets;

Radiological examination: latero-lateral and dorso-ventral positioning, it can highlight the position, shape, size, integrity and structure of the vertebral column. The most frequent changes are: fractures, luxations, intervertebral disk hernias, spondylosis, spondylarthrosis, anchyloses, osteophytosis, tumors.

Rachiocentesis (spinal puncture): collection and examination of CSF.

Computer tomography (CT) and nuclear magnetic resonance imaging (MRI): fractures, disk hernias, tumors etc.

10.2. THE EXAMINATION OF THE CEREBROSPINAL FLUID

The cerebrospinal fluid is found between the arachnoid and pia mater. The CSF role is to buffer the nervous tissue between the skull and the vertebral spine. The CSF can be examined: physically, biochemical, microscopical and bacteriological.

Physical examination:

- the quantity varies depending on the species and individual (1-80 ml)
- the pressure is appreciated at the speed which the needle drips
- the color: -the normal color is transparent;
 - modified: red (hemorrhage), yellow-green (hemolysis);
 - turbid (in meningitis and purulent meningoencephalitis);
- smell: -normal: no smell;
 - -odoriferous smell: meningeal suppuration;
- density increases when there is present albumin, globulin, erythrocytes, leucocytes, thrombocytes;
- cryoscopic point: same as plasma;
- superficial tension: low values present in anemia;
- viscosity: increases in hemoconcentration;

Biochemical examination:

- Ph: same as blood Ph (7,4-7,6);
- CSF albumin levels: increases in meningoencephalitis;
- CSF globulin levels: increases in tumors, anemia, suppurative diseases, meningoencephalitis;
- CSF glucose levels: decreases in encephalitis and meningitis;
- determination of Cl, Ca, Mg, K, etc.: only examined in particular situations.

Microscopical examination:

- normal: 1-2 white blood cells /mm³, lack of red blood cells
- pathological: increased white blood cells (in listeriosis, viruses, canine distemper virus, rabies), red blood cells present (vascular accident).

Bacteriological examination: sowing on common or special cultures environment.

10.3. THE RADIOLOGICAL, COMPUTED TOMOGRAPHY, MAGNETIC RESONANCE IMAGING EXAMINATION OF THE BRAIN AND SPINAL CORD AND ELECTROGRAPHY

Radiological examination of the encephalus and spinal cord is done with the physical examination of the skull and spine. Radiological examination can also be done by administering sterile and tolerated contrast substances, in the medullary canal or intravenous. Using this technique, the shape and integrity of the nervous substance is highlighted and also components that can traumatize or compress the integrity of the nervous substance (eschilis, enostoses, spondyloses, disc hernias, tumors, etc.)

Computerized tomography (CT) and magnetic resonance imaging (MRI) represent cutting edge technologies in the examination allowing highlighting the changes of size, shape, density and position of the nervous substance.

Electrographs represent the recording of nerve substance bio-energies and it can be done through:

Electroencephalography: the technique of recording bio-energies by applying electrodes to the skin of the head. The recording device is called encephalograph and the

recording is called encephalogram (EEG). The interpretation of the wave type (alpha, beta, delta, theta) allows to highlight the normal and pathological states of the cerebral cortex.

Electrocorticography: the technique of recording bio-energies by applying electrodes directly to the cerebral cortex (after craniocentesis). The recording is called electrocorticogram.

Electrocerebelography: the technique of recording bio-energies of the cerebellum. The recording is called electrocerebelogram.

10.4. THE FUNCTIONAL EXAMINATION OF THE SOMATIC NERVOUS SYSTEM

10.4.1. Behavior

Behavior (cortico-subcortical activity, superior nervous activity, relational function, voluntary activity, conscious activity) presupposes how an animal manifests in relation to the environment in which it lives. Science that deals with the study of animal behavior in their native environment is called ethology, which has several sides: food behavior, sexual behavior, time and space orientation, self-defense, etc.

Generally, for examining the behavior of domestic animals, it is appreciated the orientation of the animal (in space, over time, to orders) and the intensity with which it responds to some excitements of the external environment. From this point of view, normal behavior in animals implies:

The animal's recognition of the owner or the caretaker immediate and correct response to orders (calls) correct orientation in space and time (entering the stable and finding its place, maintaining balance by correcting abnormal attitudes, etc.) specific manifestations in case of thirst, hunger, defecation, urination; specific manifestations in the presence of the opposite sex.

It must be noted that any disorder of the body influences more or less the upper nervous activity of the animal, these being expressed by states of inhibition (depression) or excitement of upper nervous activity (cortical).

10.4.1.1. The states of depression (inhibition) of the upper nervous activity (cortical)

Apathy (deviation, indifference) is the easiest form of cortical depression, characterized by lazy movements, slow response to commands, the animal generally responds to medium intensity excitations.

Torpor (indolence) is an advanced degree of environmental indifference, with the animal looking lost (with half-opened eyes), with the snout supported by the stool, the floor or the ground, immobile and with a low muscular tonus. He moves slowly, dragging his legs and he has moments when he is ready to fall. Response to strong excitations is given with great delay and incompleteness.

Drowsiness is the intermediate state between wakefulness and sleep, when the animal is only awakened by strong excitations, after which it returns to the initial state of sleepiness. Exaggeration of sleepiness is called *sopor*, when the animal is only awakened by inhalation of strong exciting volatile substances (vinegar, ammonia) or by bumping, stinging etc.

All these states are specific for infectious diseases (with fever), central nervous system disorders (encephalitis, meningitis, tumors), endogen and exogen intoxications.

Coma implies a long term (days, months or years) loss of the conscience, voluntary motility, sensibility, reflexes (excepting corneal and palpebral reflex), but maintaining the respiration and circulation on a low level and, as a consequence, hypothermia. Coma is present in severe diseases of the central nervous system (cerebral coma), liver (hepatic coma),

pancreas (diabetes coma), kidneys (uremic coma), endocrine glands (endocrine coma), in intoxications (toxic coma).

Cerebral concussion implies loss of the conscience for a short period of time, due to encephalon shock in accidents, but without craniocerebral lesions.

Syncope is the sudden and for short time (seconds, minutes) loss of the conscience, motility, sensibility, respiration, pulse and a minimal arterial pressure (the state of apparent death). It is caused by a blood circulation interruption on the brain (in cardia arrest, internal hemorrhages, by sudden decompression after punctures with gas or liquid elimination, reflex).

Faint- implies a sudden loss of conscience, for a short period of time; the other functions are reduced (respiration, circulation) and the smooth and striated muscle are relaxed (is present sweat, enuresis etc.). In general, is produced by a reduced quantity of blood in the brain.

Apoplexy - implies a sudden loss of conscience, motility, sensibility for a period of 20-60 minutes with the respiration and circulation intact. Frequently, is present in cerebral hemorrhages (ictus, cerebral attack), emboli or thrombosis on the cerebral arteries. When the animal survives the cerebrovascular accident, recovery is partial, the modification persists on the compressed area of the cortex by the hematoma or hypoxia (paresis, paralysis, lack of voice, localized anesthesia etc.)

Epileptiform access – implies sudden loss of conscience and sensibility, followed by the motor crises (clonic or tonic contractions) and vegetative crises (urinary, salivary, stertorous breathing - epilepsy) with the conscience recover after seconds or minutes. The epilepsy crisis can repeat during time (daily, monthly or annually). The epilepsy can be:

- By contractions: generalized (in all muscles) or localized;
- By cause:
 - o Essential (real) - without obvious cause, can be trigger by emotions, trauma, intoxications;
 - o False – with symptomatic origin (in various central nervous system diseases) or reflex, due to pathologies like otitis, sinusitis, parasites, perianal abscesses, strychnine etc.

Cataplexy – is the loss of conscience and the aspect of stiff animal, stoned, by tonic contraction of all muscles.

Stupor – implies absence of physical and mental activity (conscience) and is characterized by complete immobility, refuse of food or water. Present in meningoencephalitis, diabetes and uremia.

Immobility- implies a reduced conscience, is characterized by the animal's impossibility of orientation and movements. It remains in place when it is stopped and does not stop when it is put to move – these animals are called „automatic” and amnesic animals.

10.4.1.2. *The states of depression (inhibition) of the upper nervous activity (cortical)*

The states of excitation start with anxiety and evolve up to aggression or rabies accesses.

Hallucination – is a form of attack or defence manifestation of the animal to the visual, auditive, olfactory, gustatory or tactile excitants, that are not real. Is present in meningoencephalitis, hepato-encephalic syndrome, intoxications.

Rabies access – is a manifestation similar to rabies (furious phase with aggression, convulsions, salivation etc.), but caused by extreme pain from the kidneys (calculosis), liver (hepato-encephalic syndrome), intoxications (wing congestion and cortical oedema).

Wickedness is the permanent state of aggression to all the animals around. This aggressivity is also expressed for humans.

Unwillingness is expressed by the animal denial refusal to execute certain services. It is considered the animal's tick as a result of brutal or inadequate training.

After the period of time while it is expressed, it can be absolute (permanent) or relative (only for hard work).

By the cause, unwillingness can be symptomatic (pseudo-unwillingness) – in painful disorders produced by the yoke, harness, collar, chain, limb disorders, etc. and can manifest:

- Active – when the animal reactions to orders by attack or defence;
- Passive- when the animal refuses to execute orders irrespective of the means of constraint used.

Phobia (fear) – is the exaggerated anxiety, fear, obsessive and permanent for certain places, situations, objects or animals, without a real cause, like:

- Hydrophobia- fear of water (in rabies);
- Claustrophobia – fear of closed spaces;
- Autophobia – fear of being alone;
- Photophobia – fear of the light (in disorders of the eye or meninges);
- Nyctophobia- fear of the dark.

Hysteria is expressed by exaggerated nervousness (disproportionately high reactions to common stimuli) even aggressivity, hallucinations or epileptiform accesses caused by genital hormonal disorders (especially in heat period).

10.4.2. Motility

Motility is appreciated by checking the muscle tone, neuromuscular contractibility and movements coordination.

10.4.2.1. Muscle condition and tone

Muscle condition is appreciated using inspection (size, shape and position of muscles under the skin), and muscle tone (the mild and permanent tension state of the muscles that maintains the normal body position) using inspection (muscle response to flexion or extension of the examined area), palpation (muscle resistance to pression) and recording of the muscle electrical activity (EMG=electromyography).

The muscle tone can be normal (normotonic) or modified: Hypertonic (increased muscle tone), hypotonic (decreased muscle tone, false paresis) or atonic (absent muscle tone, muscle paralysis).

10.4.2.2. Neuromuscular contractibility

Contractibility is examined using inspection and can be normal (normokinesia) or modified (dyskinesia): increased, decreased or absent.

Hyperkinesia – abnormal increase of the frequency, duration or intensity of muscle contraction. Hyperkinesias can be *tonic* (spastic, continuous) when after an excitation the muscle tone is exaggerated increased and it remain in this condition for a longer or shorter period of time or *clonic (repeated, cyclic)* when muscle contractions have a high repeatability (ex. convulsions, chorea, tremors, muscle fibrillations).

Cramp is an involuntary, painful, short-term contraction, produced during an effort and can be located in a muscle, several muscles or a limb. It can also be found in the internal organs (stomach cramps). It is due to vitamin-mineral deficiencies, intoxications, local circulatory disorders.

Contracture (tonic convulsion) is an involuntary, tonic, rigid, painful, long-lasting contraction in a limb, region or organ, such as trismus (contracture of masseter muscles),

opisthotonos (contraction of dorsal cervical muscles), sardonic laughter (contraction of canine muscles), abdominal defense (contraction of abdominal muscles).

Clonic convulsions are involuntary, repetitive, rhythmical, temporary contractions, in the form of jerks (clustered contractions) localized to a muscle, a group of muscles or generalized. Between jerks contractions are present breaks that allow muscle relaxation. Tonic-clonic convulsions implies an alternation between the tonic and clonic forms of contractions, separated by breaks.

Myoclonus- involuntary, short, rapid, rhythmic, temporary (hours, days) or permanent (lifetime) contractions of the same intensity that do not disappear during sleep. In animals are present: phrenic myoclonus (diaphragmatic), abdominal myoclonus, limb myoclonus.

Chorea - involuntary, arrhythmic, localized contractions, which intensify at excitements and suddenly disappear when the animal is calm (during sleep or after medication).

Tremors (tremor) are involuntary, repeated, low-intensity contractions of muscle groups or the entire body. They appear in infectious diseases, intoxications, in cold or in fear.

Muscle fibrillations are involuntary contractions, rhythmic, cu low amplitude, localised only in a reduced number of muscular fibres.

Hypokinesia – is expressed by slow (diminished) contractions or rare contractions (bradykinesia).

Akinesia (real paralysis, plegia) – implies absence of movements (contractibility) due to the nervous influx absence. Paralysis can be on a long term or definitive when they are accompanied by amyotrophy.

Classification of paresis and paralysis

- By the way they develop: suddenly or progressive (slow- from paresis to paralysis);
- By the muscle tone:
 - Spastic: paralysis is associated cu hypertonic muscles; the affected region is in extension (ex. pelvic limbs are situated under the animal);
 - flaccid (soft) paralysis is associated cu hypotonic or atonic muscles (ex. pelvic limbs ore orientated backward and are dragged by the animal);
- By length: partial (in a muscle group) or diffuse (in al the muscles innervated by the affected nerve);
- By the region:
 - In a single limb (monoparesis, monoplegia);
 - In two symmetrical limbs (diplegia):
 - In thoracic limbs;
 - In pelvic limbs (paraparesis, paraplegia);
 - In three limbs: triplegia;
 - In four limbs: tetraparesis, tetraplegia;
 - In half of the body: Hemiparesis, hemiplegia. Hemiplegia can be homolateral (on the same side of the head and body) or alternate (paralysis of the head on one side and paralysis of the body in the opposite side). Limbs paralysis are usually produced by lesions of the spinal cord, and if they are associated cu hemiplegia, lesions are in the encephalon;
- By the involved phenomenon:
 - Organic paralysis (definitive)- when the nervous lesions are permanent;

- Functional paralysis (transitory)- when the modification involves the transmission of the nervous influx during a certain period (vascular disorders, intoxications, increased organs that press on nerve plexuses);
- By the lesion localisation:
 - Central paralysis – when the lesion is situated in motors centres in the cortex (haemorrhages, cerebral tumours, rabies);
 - Peripheral paralysis - when the lesion is situated in peripheral motor neurons or in the peripheral motor nerve. Peripheral paralysis are flaccid, osteotendinous reflexes are absent, amyotrophy is present. Is specific for trauma, circulatory disorders, tumours, compressions, intoxications, vitamin deficits, infectious diseases.

10.4.2.3. *Movements coordination*

The movements of the body are harmoniously coordinated by the nervous centers of the movement located in the encephalon. Any anatomical or functional change in the nervous system produces motion coordination disorders that can be expressed by passive (inertial) or active (forced) movements.

Passive movements (ataxias) – implies absence of the balance, both during the gait (locomotory ataxia) and the station (astasia).

Ataxia is a difficulty in the voluntary movements coordination (during the gait), and is characterised by dysmetria (disproportionate movements: large steps -hypermetria, small steps -hymetmetria), insecurity, tendency to fall.

- Cerebral (cortical) ataxia: is characterised by dysmetria plus behaviour changes due to disorders of the cortex. The Babinski sign is positive;
- Cerebellar ataxia: is characterised by disharmonic gait, permanent torticollis, tendency to fall. Sometimes is seen the absence of balance even at station (astasia) and forced movements;
- Vestibular ataxia: is characterised by dysmetria, permanent or periodic torticollis, tendency of vomiting; is similar to the cerebellar ataxia. Romberg sign is positive;
- Bulbar ataxia- is characterised by dysmetria plus signs of the bulbar paralysis due to dysfunction of the nervous centres (respiration, thirst, hunger, deglutition, mastication, cough, voice, circulation etc);
- Spinal ataxia – is produced due to lesions of the Goll and Burdach fascicles and is characterised by dysmetria and a steady gait. Romberg, Westphal and Argyll Robertson signs are positive;
- Vertigo or dizziness - is an equilibrium disorder, as a response to the sensation of false movement; is characterised by a mild reduction of the conscience, leaning, veering, stumbling and a tendency for circling;

Astasia is an impossibility to maintain normal balance in stationing position. Is characterised by a broad base and swinging limbs. Can be produced by anatomical and functional modifications similar to the ones from the spinal ataxia.

Active movements (forced movements): involve the tendency of adopting and execute, both during gait and station, of abnormal positions and movements. These movements are produced by circumscribed lesions of the nervous system and they are called focal signs, like:

- Manege (circle) movements: circle gait, in the same direction, due to lesions that affect a single side of the cortex (coenuruses, tumours, abscesses, haemorrhages, unilateral anacusis or amaurosis);
- Pirouette movement: circle movement on pelvic limbs, specific for lesions of the posterior cerebellar peduncles;
- Pulsion- the animal tendency to go in the anterior direction (anteropulsion), lateral (lateropulsion) or posterior (retropulsion) in encephalon lesions;
- Rolling barrel- rolling around the longitudinal axis, present in lesions of the middle cerebellar peduncles;
- Dromomania -the tendency to walk continuously, specific for psychopathies, meningoencephalitis.

10.4.3. Neuromuscular excitability

Excitability implies assessment of the reflex arc functionality by checking the neuromuscular response to the mechanical excitants (palpation, percussion) or electric excitants (electrical current).

The reflex implies excitation of a receptor and the response for this excitation, which requires the integrity of the reflex arc:

- Somatic receptors in the skin, muscles and tendons
- Afferent nerve fibers carry signals from the somatic receptors to the posterior horn of the spinal cord or to the brainstem
- An integrating center, the point at which the neurons that compose the gray matter of the spinal cord or brainstem synapse
- Efferent nerve fibers carry motor nerve signals from the anterior horn to the muscles
- Effector muscle innervated by the efferent nerve fiber carries out the response.

An interruption of the reflex arc in one of these components makes that the tested reflex be impossible to accomplish.

In animals are two types of reflexes: profound reflexes and superficial reflexes.

Profound reflexes

- Patellar reflex- is realized by percussion of the medial patellar ligament. An exaggerated reflex or the sudden extension of the other limb is specific for spinal cord lesions, neuralgia on the percussion area;
- Supracarpal reflex - is realized by percussion of the tendons passing over the carpal region (in small animals);
- Supratarsal reflex- is realized by percussion of the tendons on the anterior face of the tarsal region (in small animals);
- Brachial triceps reflex – rarely used;
- Calcaneus reflex (periosteal reflex)- realized by percussion of the calcaneus periosteum;
- Reflex of the hoof bone- percussion of the hoof.

The normal reflex in percussion implies flexion or extension of the limb depending of the percussion area. An exaggerated reflex is present in central progressive paralysis, in irritations of the reflex arc, while a decreased/absent reflex is specific for peripheric paralysis, infectious encephalitis. Abolition of all reflexes is present in coma, collapse, syncope and disorders of the locomotory apparatus.

Superficial reflexes

Cutaneous reflexes (are realized by stinging, pinching, folding of the skin):

- Withers reflex (in horse) – it causes contraction of the cutaneous trunci muscle;

- Dorsal reflex (in cattle) – it causes lordosis;
- Abdominal reflex (in horse) – it causes contraction of the abdominal muscle or cutaneous trunci muscle;
- Scratch reflex (in dog) – excitation is applied to the lumbar region and it causes pedaling movements of the upper posterior limb with the animal being in lateral decubitus;
- Gluteal reflex (in all animals) – it causes contraction of the gluteal muscles when the skin in the buttock area is pinched;
- Quadriceps reflex – it causes contraction of the quadriceps muscle when the dorsal area of the tail is being touched;
- Tail reflex – the animal is leaving the tail down when examiner finger's touches the underside of the tail;
- Perineal reflex- it causes sticking of the tail to the anal and perineal region if the skin from the perineal area is being touched;
- Anal and vulvar reflex- implies contraction of the anal or vulvar sphincter when the thermometer or finger is introduced in the anal or vulvar orifice;
- Scrotal and cremaster reflex- implies contraction of the scrotal skin or lift of the testicle if they are being stabbed;
- Mammary reflex- it implies kyphosis when the inferior quarters of the mammals are being touched;
- Plantar reflex (Babinski reflex) – implies flexion of the phalanges if the interdigital skin of the pelvic limb is being stabbed. Babinski reflex implies extension of the fingers;

Mucous reflexes

- Palpebral reflex (corneal reflex)- implies eyelids closure if the cornea is being touched. Absence of the corneal reflex is present in lesions of the trigeminal and facial nerve;
- Sneezing reflex – implies sneezing trigger after excitement of the pituitary mucosa;
- Deglutition reflex- implies deglutition if the base of the tongue is being touched. The reflex is absent in larynx paralysis;
- Mastication reflex – mastication appears when the buccal pouch is being touched;
- Palatine reflex- implies opening of the mouth when the soft palate is being touched;
- Vomiting reflex- implies vomiting trigger when the pharyngeal mucosa is touched.

Pupillary reflex (the pupil response to the light). The pupil is constricting (miosis) at the light and is dilatate to the dark, in both eyes, simultaneous, excepting rabbits and birds. The Argyll Robertson sign implies pupils inequality when this reflex is performed.

10.4.4. Sensibility (receptivity)

By the receptors type (sensory neurons) and their localisation, the sensibility can be:

- Exteroceptive sensibility (from outside):
 - Superficial – from skin and mucosa (tactile, thermic, painful);
 - Sensorial – visual, auditive, olfactory and gustatory sensibility;
- Proprioceptive: muscle, tendons, periosteum, joints sensibility;
- Interoceptive (visceral).

The checking for sensibility is realised by applying the specific excitant for every type of sensibility (touch, heat, cold, light, noise, percussion etc.).

10.4.4.1. *The superficial exteroceptive sensibility (of the skin and mucosa)*

Skin and mucosa sensibility are expressed as tactile, thermic and painful sensibility. Among the three, the painful sensibility is the most important and easy to examine.

Checking of the tactile sensibility receptors is realised by touching the hairs, skin and mucosa (internal surface of the auricular concha, nasal mucosa, vestibulo-vaginal mucosa), of the thermic sensibility by the use of warm or cold objects (hot water, ice etc.) and of the painful sensibility by pricking, pinching, pulling hair. In normal conditions, sensibility is expressed by contractions of the muscle of the affected area, rarely by reactions of attack or defense. In pathological conditions, the animal can respond with exaggerated reactions or not respond at all.

Modification of the sensibility is called dysesthesia and can be: hyperesthesia, hypoesthesia, anaesthesia, paraesthesia (abnormal sensations).

Hyperesthesia

Hyperesthesia (hypersensibility) implies very strong reactions of the animals to tactile, thermic or painful excitants, regular or very weak. Hyperalgia (hyperalgesia) is the hyperesthesia of the painful sensibility that can be expressed differently depending on where is produced:

- Local – when the painful sensibility is increased on the excitation area;
- Projected- when the painful sensibility is increased on the projected surface of the excited nerve;
- Irradiated- when the painful sensibility is increased on other branches of the excited nerve (ex. ear pain in laryngeal inflammations);
- Reflected- - when the painful sensibility is present on the dermatome (a cutaneous segment resulted from the partial segmentation of the embryonal body).

Hyperesthesia is present in:

- Neuralgias - periodic pain of a nerve, especially when pressed and low temperature;
- Neuritis – nerve inflammation;
- Polyneuritis- degenerative inflammation of several nerves;
- Sensitive radicular medullary syndrome – present in compressions, inflammations, sprains when the hyperesthesia is present of the entire area of the rachidian nerve affected;
- Cortical syndrome and thalamic excitation syndrome- characterized by generalized hyperesthesia plus behavior and motility disorders (cerebral congestion, meningoencephalitis).

Hypoesthesia and anesthesia

Hypoesthesia and anesthesia imply a decreased or absent superficial tactile sensibility, thermic and painful sensibility. These modifications are due to damage or partial blockage (hypoesthesia) or total blockage (anesthesia) of the superficial receptors (tactile, thermic and painful). When hypoesthesia and anesthesia are used to express only the pain perception, the terms used are hypoalgesia or analgesia. In surgery, the term of anesthesia is used only for the artificial suppression of a certain area sensibility. When the anesthesia is general, is called narcosis.

Hypoesthesia can be generalized – in cortical inhibition states, when is also present the reduction of the sensorial sensibility (sight, hearing, smell) and also hypokinesia.

Hypoesthesia and anesthesia can affect half of the body (hemihypoesthesia/hemianesthesia) in unilateral brain peduncle lesions, medulla oblongata; white marrow. Hemihypoesthesia/hemianesthesia produced by the encephal lesions can be:

- Alternate – includes head on one side and the body on the opposite side;
- Heterolateral – when hypoesthesia or anesthesia is on a side of the head and body and the encephal lesion is on the opposite side;
- Homolateral - when hypoesthesia or anesthesia and the encephal lesion are on the same side.

Hypoesthesia and anesthesia produced by lesions of the spinal cord generated the medullary syndromes. The spinal cord can be lesioned (compression, sectioning) in any of its levels: cranial, cervical, thoracic, lumbar, caudal. The lesion can produce total transversal sectioning or only a partial sectioning.

Classification of the medullary syndromes:

- Total medullary syndrome;
- Dorsal medullary syndrome (superior);
- Ventral medullary syndrome (inferior);
- Lateral medullary syndrome (right or left);
- Leukomedullary syndrome: dorsal, ventral, lateral (right or left);
- Poliomedullary syndrome: dorsal, ventral, lateral (right or left);

Total medullary syndrome – occurs due to total transversal sectioning of the spinal cord (fractures of the spine) and is characterized by total tactile, thermic and painful anesthesia, symmetrical paralysis (spastic in thoracic and cervical regions and flaccid in lumbo-sacral regions), abolition of tendon reflexes, neurovegetative disorders (hypotonia or atonia of the sphincters), all situated behind the spinal cord injury.

Lateral medullary syndrome (Brown-Sequard syndrome): caused by a lesion situated in the lateral half of the spinal cord; is characterized by homolateral zonal hemiplegia, thermic and painful dissociation or anesthesia on contralateral side, all situated behind the spinal cord injury.

Dorsal leukomedullary syndrome: is does not affect the superficial sensibility, but only the profound sensibility (Goll and Burdach tracts) and is characterized by medullary ataxia.

Ventral leukomedullary syndrome: present in disc hernias, is characterized by exaggerated sensibility and reflexes plus spastic zonal paralysis.

Lateral leukomedullary syndrome: caused by a lesion situated in the lateral half of the spinal cord white matter, is characterized by zonal thermo-analgesic dissociation and heterolateral behind the spinal cord injury. Thermic and painful sensibility are absent, but tactile, tendinous reflexes and cutaneous reflexes are present.

Dorsal poliomedullary syndrome: implies lesions of the medullary dorsal horns. Radicular thermo-analgesic dissociation is present (thermic and painful sensibility are absent, but tactile and pressure sensibility are present);

Ventral poliomedullary syndrome: implies lesions of the medullary ventral horns. Myoclonus or partial motor paralysis occurs (only in affected metamer). This syndrome is specific for poliomyelitis in canine distemper, Teschen disease.

Cauda equina syndrome: implies lesion of the end of the spinal cord and is characterised by loss of the perianal, anal, vulvar, tail sensibility and sometimes, pelvic limbs sensibility.

Peripheral hypoesthesia and anesthesia can be:

Radicular - due to lesions of the sensitive or motor rachidian nerves roots. Is present in localised meningitis, spondylitis, spondylarthrosis, osteophytosis and are characterised initially by hyperesthesia and then, hypo or anaesthesia and paralysis of the area innervated by lesioned nerves.

Truncal – due to lesions of the nervous trunk, hypo or anaesthesia are present only on the area innervated by the lesioned trunk (disorders are both motor and sensitive);

Terminal- due to lesion of a peripheral nerve (ex. radial nerve paralysis).

Paresthesia- is a qualitative modification of the painful sensation, expressed by the animal by licking, friction, scarification, stinging, biting to self-mutilation, on an area where are not objective lesions. This is generated by lesions of the nervous nuclei receptors, ganglions or superior structures. In veterinary medicine it is known the pruritus from Aujeszky's disease, rabies, distemper or parasites.

10.4.4.2. *Sensorial exteroceptive sensibility*

10.4.4.2.1. *Visual sensibility*

Physical examination of the eye and periocular components is realised using inspection, palpation, *ophthalmoscopy*, *puncture*, *tensiometry*, *eye lavage*, *sounding of the lacrimal gland*. *Mandatory the pupillary and palpebral reflex is checked.*

Semiological aspects:

- Periocular area: tumefaction (posttraumatic or inflammatory), wounds, scars;
- Eyelids and ocular mucosa: epiphora (serous, seromucous, purulent, haemorrhagic), xerosis (absence of lacrimal secretion), xerophthalmia (corneal and conjunctival drying), blepharitis (eyelid inflammation), blepharoconjunctivitis (inflammation of the eyelid and conjunctive), meibomitis or blepharoadenitis (inflammation of the Meibomian gland), chalazion (meibomian adenoma), third eyelid prolapse;
- Modifications that can reduce the palpebral fissure: blepharospasm (eyelid spasm), blepharophimosis (reduced palpebral fissure due to eyelids scars), blepharoptosis (ptosis of the superior eyelid due to motor nerve paralysis), eyelid pseudoptosis (due to palpebral oedema), ankyloblepharon (partial or complete fusion of the eyelids in new-borns, or eyelids welding in adult);
- Modifications that can increase the palpebral fissure: paralysis of the inferior eyelid nerve, entropion (turning inward of the border of the eyelid against the eyeball), ectropion (eyelid is turned outwards away from the eyeball), palpebral coloboma (a missing tissue from the eyelid), symblepharon (adhesion of the palpebral conjunctiva of the eyelid to the bulbar conjunctiva of the eyeball);
- Eyelashes modifications: trichiasis (eyelashes are misdirected and grow inwards toward the eye), distichiasis (growth of two hairs in a single follicle);
- Lacrimal apparatus: dacryoadenitis (inflammation of the lacrimal gland), dacryocystitis (inflammation of the nasolacrimal sac), dacryolith (a concretion in the lacrimal duct);
- Eyeball:
 - Eye presence: anophthalmia (congenital absence of eyes), synophthalmia (cyclopia) – the foetal monster with a single orbit and a single eye;
 - Position: exophthalmia (eyeball protrusion), enophthalmia (clogging of the eyeball into the orbit), eyeball luxation (forward displacement of the eyeball), eyeball avulsion (complete protrusion of the eyeball from the orbit, with optic nerve

rupture), convergent strabismus (one or both eyes are orientated with the longitudinal axis through the nose), divergent strabismus (one or both eyes are orientated with the longitudinal axis outward);

- Movements: vertical, lateral or rotatory nystagmus (lateral, vertical, rotatory rhythmic movements of the eyeball);
- Size: microphthalmia (the eyeball is small, atrophic), hydrophthalmia or buphthalmia (exaggerated development of the eyeball), glaucoma (increased intraocular pressure, increased consistency, optic nerve atrophy, decreased eye sensitivity);
- Inflammations: panophthalmia (inflammation of all eye components, due to trauma, frequent purulent), keratitis (inflammation and opacification of the cornea), keratoconjunctivitis (inflammations of the cornea and conjunctiva), conjunctivitis (inflammation of the conjunctiva), ulcerous keratitis (corneal ulcer);
- Anterior chamber: hypopyon (pus in anterior chamber), hyphema (blood in anterior chamber);
- Iris and ciliary area: Heterochromia iridium (different colour of the two iris), uveitis (inflammation of the uveal tract), cyclitis (inflammation of the ciliary body), iridocyclitis (inflammation of iris and ciliary body);
- Pupil: miosis (constriction of the pupil), mydriasis (pupil dilatation), anisocoria (inequal pupils), hippus - also known as pupillary athetosis (spasmodic, rhythmic, but regular dilating and contracting pupillary movements);
- Crystalline: cataract (opacification of the crystalline), anterior or posterior dislocation of the crystalline, aphakia (the absence of the lens of the eye);
- Eye fundus: haemorrhages, retinal detachment, retinitis (inflammation of the retina);
- Other modifications: dermoid (an overgrowth of normal, non-cancerous tissue in the conjunctive surface), nevi (a white superficial spot on the cornea), leukoma (a dense, white corneal opacity), pannus (is an abnormal layer of fibrovascular tissue or granulation tissue), desmetocele (an area of extreme, focal corneal thinning where only Descemet membrane remains), wounds etc.

Functional examination of the eye (visual acuity)

The examination is realized with the alternative covering of every eye.

Semiological aspects:

- Amaurosis - loss of vision without detectable eye lesion;
- Cecity (unilateral or bilateral blindness) – loss of vision due to eyeball lesions;
- Nyctalopia (night cecity) – difficult vision in low light;
- Hemeralopia - is the inability to see clearly in bright light;
- Amblyopia - is a disorder of sight due to the eye and brain not working well together;
- Emmetropia - is the state of vision where a faraway object at infinity is in sharp focus with the eye lens in a neutral or relaxed state;
- Ametropia - an abnormal refractive condition of the eye in which images fail to focus upon the retina:
 - Hypermetropia – a reduced ability to focus on near objects, but very good vision for far objects (the image is formed behind the retina);

- Myopia- a reduced ability to focus on distant objects, while the image for near objects is clear (the image is formed in front of the retina);
- Astigmatism- is a type of refractive error in which the eye does not focus light evenly on the retina. This results in distorted or blurred vision at all distances.

10.4.4.2.2. Auditive sensibility (hearing)

Physical examination of the ear is realized using inspection, palpation, otoscopy, sounding and radiological examination.

Semiological aspects:

- External ear: modification of pinna, external ear canal or tympanic membrane, presence of foreign bodies, parasites, cerumen, fluid (serous, purulent, hemorrhagic) in the external ear canal, otorrhea (the leakage of fluid from the external ear canal), otorrhagia (bleeding from the ear), hematoma, otalgia (ear pain), inflammation of the external ear (extern otitis);
- Middle ear: inflammation of the middle ear (otitis media) coexists with the inflammation of the Eustachian tube and pharynx;
- Internal ear (responsible for balance and sound detection) is difficult to examine using general methods, important aspects can be obtained using radiological examination of the petrous part of the temporal bone. Inflammation of the internal ear (otitis interna, labyrinthitis otitis interna or labyrinthitis) is accompanied by balance and acoustic disorders.

Functional examination of the ear (hearing)

Semiological aspects:

- Hyperacusis – increased auditive perception;
- Hypoacusis – decreased auditive perception;
- Anacusis – complete loss of hearing (deafness), unilateral or bilateral.

10.4.4.2.3. Olfactory sensibility

Physical examination of the nose (in respiratory system)

Functional examination of the nose (the smell)

Difficult to assess in animals, semiological aspects are hyperosmia (increased olfactory acuity) or anosmia (decreased or absence of the olfactory acuity). The decreased olfactory acuity is a consequence of inflammation of the pituitary mucosa, nasal parasites presence and rarely due to central disorders (hippocampus and temporal lobe).

10.4.4.2.4. Gustatory sensibility

Physical examination of the tongue (in digestive system)

Functional examination of the gustatory cells (the taste):

Difficult to assess in animals, semiological aspects are, hypogeusia (reduced taste ability), ageusia (absence of the taste), but more frequent pica (perverted taste).

10.4.4.3. Proprioceptive sensibility

The proprioceptive sensibility is the sensibility that is responsible for keeping the normal relative position involving muscles, bones and joints, both in resting and active periods (the sense of balance). The proprioceptors are localised in the locomotor apparatus (muscle, tendons, periosteum and articular surfaces) and they have a functional connection with the cerebellum (for movements harmony), with the auricular labyrinth (for balance) and also with vision and hearing. The examination for proprioception is realised by checking the posture (normal or modified), both in rest and during movement, as well as returning capacity from unusual positions (after crossing the limbs).

Semiological aspects are: hypokinesia (decreased kinesthetic sensibility), akinesia (loss of the kinesthetic sensibility). Hypokinesia and akinesia are specific for encephalosis, lesions of the dorsal and lateral spinal cord horns,

10.4.4.4. Interoceptive (visceral) sensibility

Visceral sensibility is not present in healthy animals, but only in pathological conditions (when pain is present) and is produced by: spasms, inflammations, circulatory disorders, motility disorders, dilatations, torsions, invaginations of the organs.

The produced pain does not remain only in the affected organ, but also is transmitted reflex on certain areas of the body (especially on the metameric area – on skin they are called dermatomers). The metamer is an anatomical unit resulted from the partial segmentation of the embryonal body, every metamer including a cutaneous segment (dermatomer), nervous, vascular, muscular and visceral segment. The internal organs pain reflectivity on the skin surface area is due to metamerism. Pain reflectivity on the skin surface area is checked by pinching the skin on a specific area. In case of visceral hyperexcitability, the response can be a muscle contraction, sweating, horripilation on the examined area, moans, pollakiuria and even attack or defence reactions.

10.5. FUNCTIONAL EXAMINATION OF THE AUTONOMIC NERVOUS SYSTEM

The autonomic nervous system is coordinating the body functions (respiration, circulation, digestion, excretion, sexual function) and is subordinated to the central nervous system and regulated by hypothalamus.

The autonomic nervous system has three branches: the sympathetic nervous system, the parasympathetic nervous system and the enteric nervous system.

Examination of the autonomic nervous system is realized using clinical signs, pharmacodynamic tests and neurovegetative reflexes.

Action sympathetic and parasympathetic systems on organs and functions:

10.5.1. Clinical signs

Is important to assess the sympathetic or parasympathetic increased effect on various body organs and functions.

The normal autonomous tonus (eutonia) is maintain within physiological limits by a common action of the two branches of the autonomic system (sympathetic and ortosympathetic). When this tonus is unbalanced, the autonomic dystonia is present and can be:

- Sympathicotonia (increased sympathetic tonus)- characterised by excitation, exophthalmia, tachycardia, mydriasis, hypertension, dry skin and mucosae, constipation, hyperthermia, lymphocytopenia - the modifications are generalized to all sympathetic organs;

- Parasympathicotonia (vagotonia, increased vagal tonus) – characterised by somnolence, enophthalmia, bradycardia, miosis, hypotension, sweating, diarrhoea, frequent urination, hypothermia, lymphocytosis. There are situations when dystonia can be localised on a certain organ or a group of organs (gastro-pneumo-cardiac);
- Amphotonia - increased excitability of both sympathetic and parasympathetic systems;
- Hypotonia – decreased excitability of both sympathetic and parasympathetic systems (severe intoxications, coma etc.)

10.5.2. Pharmacodynamic tests

The pharmacodynamic testing implies administration of stimulating drugs (sympathomimetic, parasympathomimetic drugs) or inhibiting drugs (sympatholytic, parasympatholytic drugs) and following the effects on body functions.

Administration of sympathomimetic drugs (adrenaline, ephedrine) on in a sympathicotonic animal has as a result exacerbation of the sympathetic action (tachycardia), while administration of parasympathomimetic drugs (pilocarpine) in an animal with vagotonia has as a result exacerbation of the parasympathetic action (bradycardia, hypersalivation). Administration of sympatholytic or parasympatholytic drugs annihilates the sympathicotonia or parasympathicotonia of the animal.

10.5.3. Neurovegetative reflexes assessment

In animals, neurovegetative reflexes that can be assessed are: oculocardiac reflex (Aschner phenomenon) and oto-cardiac reflex (Roger reflex).

Before applying the stimulant, the frequency and heart rate, as well as the pulse frequency, are appreciated. The application of the stimulant involves pushing the eyeball with the fingers or creating a pressure on the auricular concha for 30 seconds, after which the

Organ/Function	Ortosympathetic action	Parasympathetic action
Heart	Tachycardia	Bradycardia
Coronary vessels	Dilatation	Constriction
Salivary glands and mucosa	Inhibition (Dry Mucosa)	Excitation (Hypersalivation)
Pupil	Mydriasis	Miosis
Bronchi	Dilatation	Constriction (Spasm)
Kidneys	Inhibition of secretion and excretion	Stimulation of secretion and excretion
Intestine	Inhibition of peristaltic movements, constipation	Increased peristaltic movements, diarrhoea
Liver	Gluconeogenesis	Glycogenolysis
Bladder	Retention by contraction of the vesical sphincter	Enuresis by relaxation of the vesical sphincter
Thermoregulatory centre	Hyperthermia	Hypothermia
Metabolism	Catabolism	Anabolism

heart activity and pulse are again measured.

Animals with normal neurovegetative tonus do not present significative change of values appreciated before and after the stimulant. Animals with sympathicotonia have a very high heart rate, while animals with parasympathicotonia have a very low heart frequency.

11. SEMIOLOGY OF THE ENDOCRINE SYSTEM

Examination of the endocrine system is physical (inspection and external palpation for testicle, thymus, thyroid, pancreas, transrectal palpation for ovary, radiological examination for hypophysis and thymus, scintigraphy for thyroid, CT and MRI for hypophysis and epiphysis, laparotomy for adrenal glands, pancreas, ovary), but especially functional, assessing:

- Clinical signs or syndromes generated by these glands:
 - General signs: nervous, muscular, digestive, urinary, ocular, cardiocirculatory, sexual, cutaneous, growth, body condition etc.;
 - Glandular signs: uniglandular (one-sided – that affects a single gland) or pluriglandular (complex – that affects more than one gland);
- Metabolism investigations:
 - Basal (cellular) metabolism - express by thermogenesis or thermolysis in case of hypophysis, thyroid or adrenal disendocrinosis;
 - Individual metabolism- protein metabolism (anabolism and catabolism), lipids (fats degreasing), carbohydrates (glycogenesis and glycogenolysis), hydric (of water and electrolytes), mineral (quantity and ratio between mineral elements), vitamins (the vitamin amount in the blood);
- Hormones dosage from blood and urine, with very good result, but difficult to accomplish for all the hormones (easier for the ovary hormones, adrenal and pancreatic hormones);
- Tissue reaction – is appreciated by inoculating in animals of serum or urine with hormones (especially ovary hormones) and observing in time, the tissue reactions (colour and size of the ovary, uterus and vagina of the inoculated animals).

The semiology of endocrinosis is clinically express by two types of syndromes:

- Uniglandular syndromes – can be expressed due to hormonal excess (hyperfunction, hypersecretion) or due to hormonal insufficiency (hypofunction, hyposecretion);
- Pluriglandular syndromes - produces by the common action of hormones from several endocrine glands.

11.1. UNIGLANDULAR SYNDROMES

11.1.1. *Hypophysis (pituitary gland)*

The hypophysis hormones have direct action on tissues: somatotrope growth hormone (SGH), prolactin (PRL), antidiuretic hormone (ADH), oxytocin, melanocyte–stimulating hormone (MSH) or is controlling other glands: thyroid (thyrotrope hormones), adrenal gland (corticotrope hormones-ACTH), gonads (gonadotrope hormones- LH and FSH).

Anatomic and histologically, this gland is composed of three lobes, with different function and structure:

Anterior lobe (anterior pituitary) it produces the following hormones:

- Growth hormone (STH) – that acts on tissues by increasing the protein, glucides, lipid and mineral metabolism;
- Prolactin (PRL)- acts on the mammary gland (producing lactation) and on the corpus luteum from the ovary (producing progesterone);

- Thyrotrope hormone (TSH) it stimulates the thyroid gland for biosynthesis of thyroid hormones;
- Luteinizing hormone (LH on female and ICSH on male) it acts on ovary (for follicular dehiscence, corpus luteum formation) and placenta. In males it stimulates the production of testosterone;
- Follicle stimulating hormone (FSH)- in female produces maturation of the follicles, and in males modulates spermatogenesis;
- Adrenocorticotropin hormone (ACTH) it acts on the adrenal gland (especially on glucocorticoid hormones);

Antero hypophysis syndromes – are produced by the hormone disorder (increased or decreased) described above:

- Hypoanterohypophyseal disorder (STH insufficiency) it produces:
 - In young animals – hypophyseal nanism – frequent in animals, is characterised by short, but proportional stature and normal behaviour. Instead, thyroid nanism is characterised by disproportion.
 - In adult animals – hypophyseal cachexia (Simmonds' disease)- is an global anterohypophysis hormonal insufficiency that has effects on the other endocrine glands (adrenal, thyroid, gonads atrophy);
- Hyperanterohypophyseal disorder (STH excess) it produces:
 - In young animals – hypophyseal gigantism plus genital infantilism;
 - In adult animals – acromegaly that implies exaggerated development of extremities (limbs, phalanges, ear, nose). When gigantism and acromegaly coexist, it is called acromegalogigantism.
 - Hyperanterohypophyseal disorder generated by adrenocorticotropic hormones hypersecretion - Cushing disease.

The intermediate lobe synthesizes and secretes melanocyte–stimulating hormone (MSH) that acts on melanocytes generating changes of the skin colour. Intermediate hypophysis syndromes are rare in animals.

The posterior lobe (neurohypophysis) it produces the following hormones:

- Antidiuretic hormone (ADH, vasopressin) – plays an important role in water absorption regulation in the *distal convoluted tubule and contraction of the arterial smooth muscle (hypertension)*;
- Oxytocin hormone – plays an important role in uterus smooth muscle contraction and also contraction of the mammary galactophor ducts;

Postero hypophysis syndromes – are produced by increasing or decreasing of the antidiuretic hormone and oxytocin.

Hyponeurohypophyseal syndrome implies:

- Diabetes insipidus characterised by polyphagia, polyuria, polydipsia with electrolyte elimination;
- Babinski-Frohlich syndrome (adiposogenital syndrome) in youth or tumours of the diencephalohypophysis, is characterised by obesity and genital infantilism;

Hyperneurohypophyseal syndrome implies apparition of the syndrome of inappropriate antidiuretic hormone secretion (SIADH) – Parhon syndrome, characterised by oliguria and oedemas.

11.1.2. Epiphysis (pineal gland)

The epiphysal hormones, are in general, antagonistic to hypophysal hormones: pinoline hormone (epiphysal hormone) with antigonadotrope function (sexual inhibition),

antithyrotrope, hypotensive, hypoglycaemic, hypocholesterolemic, inhibitor of the nervous system.

Hypoepiphyseal syndrome is characterised by macrogenitosomia (quick development of the genital organs and early sexual maturity), obesity, early ossification of the growth cartilages (stopping from growing).

Hyperepiphyseal syndrome is characterised by microgenitosomia (ovary and testicles hypoplasia, reduced gonadotropin secretion).

11.1.3. *Thymus*

Thymosins are hormones produced by the thymus. They are important for immune system development and function and also the development of other tissues.

Hypothyroidism is characterised by cryptorchidism, obesity or cachexia with depression (apathy, indifference).

Thymectomy (surgical removal of thymus in young animals) it has as a consequence the absence of growing and a deficit of T lymphocytes.

Athymia – congenital absence of functioning thymus tissue.

Hyperthyroidism is characterised by thymus hypertrophy and death of the thymus in piglets and chicken due to asphyxia (thymus compression on the trachea), presence of thyrotoxic tetani and an increased number of T lymphocytes.

11.1.4. *Thyroid*

The thyroid secretes two categories of hormones:

- Thyroxine (T4) and triiodothyronine (T3) – hormones that are containing iodine and have a role in modulating basal metabolism (growth acceleration), carbohydrates, lipids, hydromineral metabolism and also in growing and maturation of the nervous tissue;
- Calcitonin hormone with role in blood calcium and phosphorus regulation (hypocalcaemia and hypophosphatemia) inhibiting bones decalcification together with the parathormone.

The physical examination assesses:

- Simple goiter- increased volume of the thyroid due to connective tissue (without endocrine signs);
- Enzootic goiter – in goat, pig - increased volume of the thyroid due to iodine absence or due to food factors that are producing goiter;
- Thyroiditis – acute inflammation of the thyroid;
- Strumitis – chronic inflammation of the thyroid;

Functional examination for endocrinosis diagnostic.

Hypothyroidism – due to thyroidal hormones insufficiency, absence of iodine or food factors that are producing goiter. It is characterised by a decreased basal metabolism (hypothermia), bradycardia, difficult digestion (constipation) and goiter;

- In young animals – is present thyroidal nanism, disharmonic characterised by short limbs and neck, large joints, microgenitosomia and cortical functional modification (cretinism);
- In adults – is present myxoedema- infiltration and oedema in the skin from the head area, neck, limbs and on mucosa (larynx), alopecia (in the dog), reducing of the gonadotropin secretion, obesity, apathy.

Hyperthyroidism - produced by thyroidal hormone excess. Modifications are: increased basal metabolism (hyperthermia), tachycardia – specific for Basedow's disease (Graves

disease), characterised by goiter, exophthalmia, tachycardia, progressive weight loss, diarrhea, cortical excitation, tremors, sweating, epiphora etc.

11.1.5. *Parathyroid gland*

Parathyroid glands are small endocrine glands around the thyroid that produce parathyroid hormone. Parathyroid hormone acts on the bones and kidneys, maintaining a normal Ca/P ratio in the blood. In consequence, in order to evaluate the functional capacity of the parathyroid, is important to determinate the Ca/P ratio from blood and urine. Is important to mention that the calcitonin hormone is antagonist of the parathormone.

Hypoparathyroidism (spasmophilia) is characterised by serum hypocalcaemia, hyperphosphatemia, neuromuscular hyperexcitability (fibrillations, laryngeal spasm and asphyxia).

Hyperparathyroidism (osteofibrosis) is characterised by serum hypercalcaemia, hypercalciuria, hypophosphatemia, hyperphosphaturia, the disappearance of reflexes, asthenia, apathy. Excess of parathormone it generates mobilization of the bone calcium that is transferred in the blood. Osteofibrosis is a rapid osteoclasia, characterized by the exuberant growth of the fibrous tissue from the bone. This phenomenon is frequently followed by fractures on long bones.

11.1.6. *Endocrine ovary*

Can be examined physically (transrectal palpation, ultrasound and laparotomy) and functionally (heat presence, genesis instinct, hormone dosing from blood and urine). According to the sexual phases, in animals can appear:

- Follicular syndromes – generated by the follicular hormone (folliculin) , which in normal conditions produces libido and ovulation, and in pathological conditions - hyposecretion (frigidity) and hypersecretion (nymphomania);
- Luteal syndromes- produced by progesterone (secreted by corpus luteum) that in normal conditions is responsible for nidation, gout and activation of the mammary gland, and in pathological conditions – hyposecretion (sterility and abortion) and hypersecretion (persistent corpus luteum and temporary frigidity).

11.1.7. *Endocrine testicle*

Can be easily examined physically (inspection, palpation) and functionally (genesis instinct, sperm quality, hormone dosing). The hormones secreted by the Leydig cells (testosterone, androsterone) are important in developing the male genital system, secondary sexual male characters and sexual reflexes appearance.

The endocrine function can have two semiological aspects:

- Hypotesticular syndrome – having as a result endocrine anorchia in young animals (absence of one/both testicle) and endocrine hypoorchia in adults (atrophy of the male genital organs);
- Hypertesticular syndrome - having as a result endocrine hyperorchia, the male often becoming violent and with exaggerated libido.

11.1.8. *The adrenal glands*

The adrenal glands (also known as suprarenal glands) are endocrine glands that produce a variety of hormones including adrenaline and the steroids aldosterone and cortisol. They are found above the kidneys. Each gland has an outer cortex which produces steroid hormones and an inner medulla.

The adrenal cortex produces three main types of steroid hormones: mineralocorticoids, glucocorticoids, and androgens. The medulla produces the catecholamines adrenaline and noradrenaline (function - rapid response throughout the body in stress situations).

The adrenal glands are part of the hypothalamus hypophysis adrenal axis. The examination of the adrenal glands is physically using ultrasound, laparotomy and functional using hormone dosage from blood and urine.

Corticoadrenal syndromes – are generated by the modifications of the corticoid hormones quantity.

- Hypocorticism syndrome - on long term can produce Addison disease characterised by excessive pigmentation of skin due to melanocyte-stimulating hormone (MSH) plus asthenia, anaemia, hypotension, anorexia. On short term, hypocorticism produces non-Addison disease, without skin pigmentation, only with cardiac disorders (tachycardia), digestive disorders and hypoglycaemia.
- Hypercorticism syndrome – it generates partial syndromes:
 - Cushing syndrome- hyperproduction of glucocorticoids (tumours of adrenal glands or hypophysis) is characterised by osteoporosis and obesity of the head, diabetes mellitus slightly expressed, myasthenia, hirsutism, hypertension.
 - Pseudo- hermaphroditism of the young females (secondary sexual characters of males) and early sexual maturity in males;
 - Conn syndrome- sodium retention, but without oedema.

Meduloadrenal syndromes- – are generated by the modifications of the adrenaline (increased adrenaline produces hypertension, decreased adrenaline produces hypotension), modification that can be present a short time (fear, environment conditions, transport) or a long time (stress, hypotensive or hypertensive disease).

11.1.9. *Endocrine pancreas*

The pancreas is a gland with mixed secretion, with role in blood glucoses regulation by its hormones: insulin (that produces hypoglycaemia) and glucagon (that produces hyperglycaemia).

Examination can be physical (laparotomy, radiological examination and ultrasound) and functional (hormone and glucose dosage from blood and urine).

Hypoinsulinism syndrome – is characterised by diabetes mellitus – expressed by polyphagia, polydipsia, polyuria, hyperglycaemia, glycosuria, acidosis, obesity or cachexia, double cataracts followed by diabetic coma and death. In normal conditions, insulin takes the excess blood glucose and store it as glycogen in the liver.

Hyperinsulinism syndrome – it produces psychiatric disorders, restlessness, ataxia, epileptiform seizures, paraparesis, collapse and permanent hunger. Is frequent in dogs.

11.2. PLURIGLANDULAR SYNDROMES

- Diabetes mellitus – is produced by several gland insufficiency (pancreas, anterohypophysis, thyroid, adrenal gland). Diabetes is the name for diseases that are characterised by intense polydipsia and polyuria, like:
 - Diabetes mellitus – due to insulin absence, characterised by polydipsia, polyuria, hyperglycaemia, glycosuria;
 - Bronze diabetes – diabetes mellitus associated with melanoderma and hypertrophic cirrhosis;
 - Asymptomatic diabetes (latent) – without clinical signs, with hyperglycaemia;
 - Insipid diabetes- due to vasopressin absence, polydipsia, polyuria, without glycosuria;

- Renal diabetes (hereditary) – with permanent glycosuria due to renal absorption deficit;
 - Steroid diabetes- mild diabetes mellitus, due to corticosteroid hormones excess.
- The incidence of diabetes is higher in dogs and cats.
- The weight loss (subnutrition) in adult animals is due to endocrine disorders (pancreas, anterohypophysis, thyroid, adrenal gland, ovary, testicles) and implies reduction or absence of the fat reserves from the body that can lead to cachexia. Is due to quantitative and qualitative food insufficiency, absorption deficit (digestive disorders) or endocrine disorders;
 - Hypothrepsia (non-development of muscle mass in new-borns and youth, and lack of reactivity) can be associated with nanism and is produced by disorders of hypophysis, thymus, thyroid, adrenal glands, pancreas;
 - Obesity (excessive fat deposition) is caused by a complex of factors: metabolic, hereditary, nervous, endocrine (anterohypophysis, thyroid, pancreas, corticoadrenal, ovary, testicles), alimentary (excessive calories), sedentariness;
 - The general adaptation syndrome (stress) – is characterised by disorders of the hypophysis, thyroid, adrenal glands, gonads plus disorders of the neurovegetative system;
 - Cutaneous syndromes – can be caused by localised skin modifications (infectious diseases, parasites, burns etc.) or by neuroendocrine associated disorders:
 - Alopecia – present in vitamins and minerals deficits, thyroid, hypophysis, adrenal glands disorders;
 - Generalised hypertrichosis – disorders of adrenal glands, ovary and hypophysis;
 - Cutaneous dyschromia- in hypophysis and adrenal glands disorders;
 - Cutaneous pruritus - in endocrine-metabolic disorders, pancreas or adrenal gland disorders;
 - Psoriasis- chronic disease, recurrent, characterised by red patches covered with dry scales, localised or generalised, due to endocrine and metabolic disorders.

12. SPECIAL SEMIOLOGY: EXAMINATION OF BEES AND FISH

12.1. BEES SEMIOLOGY

Bees examination for collecting semiological aspects is realised in several stages:

- Melliferous flora and water source;
- The bees flight;
- The area around the hive and bee entrance;
- The bee hive:
 - Hive components: hive walls, roof, hive stand, frames, bottom board;
 - Bee products: honeycombs, honey, pollen, pasturage, royal jelly;
 - Evolutionary stages: egg, larvae, brood (nymphs), adults (workers, drone, queen).

Melliferous flora and water source. Melliferous flora has to be as close as possible from the hive, if this is too far pastoral beekeeping is practiced. Special attention is paid to sprayed forests or crops for combating pests (most pesticides cause rapid bee death). The water source has to be close to the hive and unpolluted.

The bees flight must be observable from a few miles of the apiary and must be very dense in the apiary proximity (a lot of bees, filled with pollen).

The area around the hive and bee entrance. Around the hive have to be as few dead bees as possible, and in the apiary a large number of bees, in continuous motion.

The bee hive. Opening of the hive is realised by the beekeeper and examination is realised by the veterinarian after taking specific protection measures (mask). Examination is realized on warm weather, without wind and rain, when many bees are away for collecting pollen. All frames are examined, the honeycombs, which have to be integral, with honey and pollen deposits, eggs, larvae and nymphs, many working bees, few drones and a single queen. The presence of several queens indicate that the bee family is ready for swarming. The honeybee cleanliness, the smell of the bees and the brood, as well as their color, are appreciated. When the workers bees are examined, is important to assess the body surface, the color and their mobility.

Semiological aspects:

- Absence of the flight or rare bees;
- Death bees (a high number) or dying in bee entrance;
- Disordered bee movements (in intoxications);
- The presence of diarrhea stains, colored differently, in the bee entrance or in the hive;
- Bees with enlarged abdomen or colored differently;
- Parasites on the bees body;
- Musty or eaten honeycombs;
- Eggs, larvae and brood scattered unevenly on the honeycomb;
- Death brood and with characteristic smell;
- Small number of bees in the hive;
- Queen absence;
- Honey, pollen, bee bread in small and unevenly distributed.

These aspects are present in European foulbrood, salmonellosis, septicaemia, varroosis, intoxications.

In special situations, the water, the flora, the honey, the larvae, or bees (death or alive) can be send to the laboratory for additional tests.

12.2. FISH SEMIOLOGY

In order to obtain the necessary dates for establishing a specific pathology, is important to examine the fish and their environment (ponds, pools, aquariums) following a plan that implies:

- A clinical investigation following ichthyologic records (for breeders):
 - geotopographic data - loft location, soil data, industrial pollution, presence or absence of vegetation;
 - hydrotechnical data: regarding the water source, water quality, the replacement rhythm;
 - the place and date of the disease;
 - data about the disease (morbidity, mortality, symptoms) and its evolution over time;
- Physical examination of the sick fish:
 - Examination of the swimming capacity (lack of swimming, dead fish, fish that breathe on the surface of the water, etc.);

- individual examination after fishing (live, sick and dead fish):
 - inspection: for the movement, shape and size of the body, surface aspect and colour of the body, the presence of scales and shine, of the eyes, fins and gills;
 - palpation: for consistency, mobility and deformations;
 - special exams: bacteriological, virological, mycological, haematological, histological examinations on samples sent to specialized laboratories;
 - examination of water and food: physical, biochemical and microscopic on samples sent to specialized laboratories.

Semiological aspects:

- functional - lazy movements on the water surface, upward abdominal movements, agitation etc.;
- morphological: enlarged abdomen, lesions on the body (wounds, ulcers), parasites on the body or gills, fallen scales, body color changes, hemorrhages, jaundice, pus, exophthalmia, enophthalmia, blood in the feces, modified-appearance eggs. These aspects are specific for hemorrhagic septicemia, pancreatic necrosis, smallpox, furunculosis, hydropisie.

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