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## I. General considerations

A necropsy can be defined as the orderly, systematic dissection of a cadaver. It should have as its objective to determine the cause of death or nature of a disease process. A necropsy always should be thorough and complete to obtain the best possible answer to the cause of disease or death. A partial necropsy yields only partial answers. Gross examination alone frequently provides an incomplete diagnosis. Additional microscopic, toxicologic, parasitologic, bacteriologic, virology, or molecular biologic assays are ancillary tests to obtain the most accurate final diagnosis. There are many methods to perform a complete necropsy. Regardless of the choice, to generate the most accurate outcome, the approach should always be the same so that no organs or tissues are overlooked.

Equine necropsies can be divided into three types: the disease-oriented necropsy, the insurance necropsy, and the medicolegal necropsy, each of them requiring a modified approach. The events of a necropsy should be documented by records of the physical findings and by photography, radiographs, collected specimens, and laboratory findings. Protective attire and the right set of instruments are important prerequisites for the adequate performance of a necropsy, so is the optimal environment under field conditions. The necropsy should be conducted within a reasonable time frame after death to avoid tissue decomposition. If euthanasia is performed, the animal should be bled out before the postmortem examination is begun to avoid spilling of blood into organs to be examined.

At the end of the necropsy, all observations should be written down or recorded. All findings should be documented objectively because the signed necropsy record becomes a legal document. The results of all ancillary tests including histopathology should be accompanied by a narrative and interpretation of the findings.

The necropsy procedure described in this chapter is taught at the University of Florida. Other methods are described elsewhere.

## II. Techniques

### 1. Positioning, examining, and opening of the carcass

After the body weight is determined or estimated, the animal is positioned in left lateral recumbency. For identification purposes, a whole-body photograph is taken. If there is a tattoo or brand, these are recorded. The external examination involves all body orifices, mucous membranes including the lining, ocular sclera, the hooves, ears, eyes, and the condition of the hair coat. Valuable information concerning disease of internal organs can be obtained by observing color changes of visible mucous membranes. The gross examination should also include the nutritional status of the animal.

A ventral midline incision extending from the pelvis to the head facilitates the subsequent skinning of the carcass and reflection of the right front leg and hind leg. In the male horse the prepuce is reflected and testes removed from the scrotal sac. This is followed by opening of the abdominal cavity by incision through the abdominal wall.

## 2. Evisceration of the abdominal, pelvic, and thoracic organs

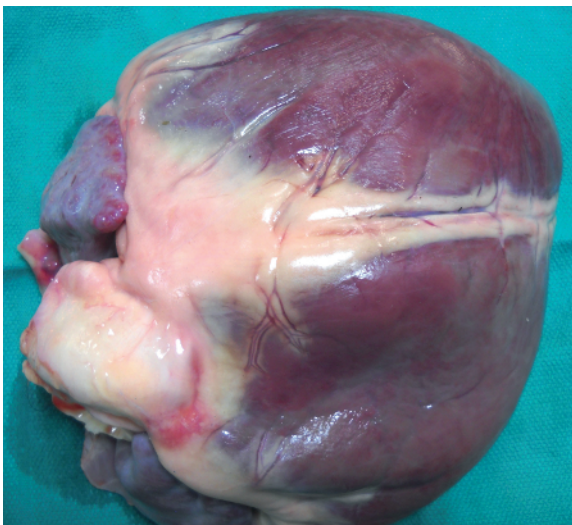
The abdominal viscera, in particular the intestinal tract, are checked for expected anatomic position. The amount and character of the peritoneal fluid (100–200 mL normal, clear, and straw colored) is assessed. After examination of the cranial mesenteric root, the entire gastrointestinal tract is removed to inspect and remove the remaining organs from the abdominal cavity. Individual organs are assessed for color, consistency, symmetry, and, where appropriate, aspect of the cut surface. Individual organs can be weighed and measured under certain circumstances.



**Figure 1.1.** Horse. Gastrointestinal Tract. The length of the gastrointestinal tract requires separation into four segments: stomach, small intestinal loops, large colon, cecum, and transverse small colon. (Reprinted with permission from *Equine Medicine and Surgery*, Colahan et al., Figure 3-55, Page 122, Copyright Elsevier, 1999.)

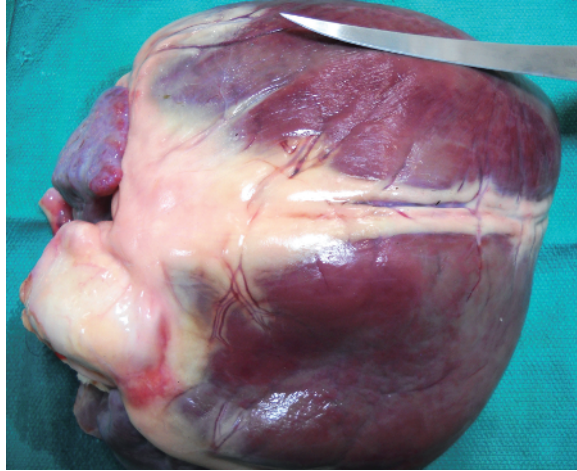
The bones of the pelvic cavity are cut with a handsaw for removal of the organs of the pelvic cavity including the urinary bladder, rectum, and genital tract.

The right rib cage is removed from the chest using strong rib cutters. The entire pluck is removed en bloc, starting with loosening of the tongue from the oral cavity. The tongue is left attached to the esophagus, which is cut at the diaphragmatic hiatus and removed from the opened thorax together with trachea, lungs, and the heart. Trachea, lungs, and heart are separately examined.

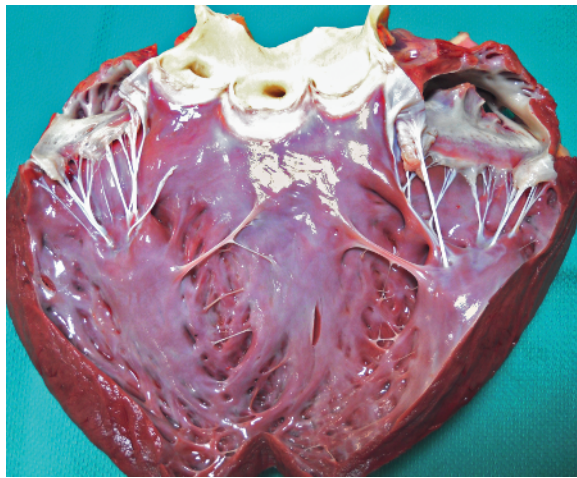


**Figure 1.2.** Horse. Normal Heart. There are several methods of orderly dissection of the heart. Care should be taken not to mutilate major anatomic structures and pathologic alterations of the heart. The left and right heart sides should be identified before the atria and ventricles are opened. The pointed apex is entirely formed by the left ventricle.

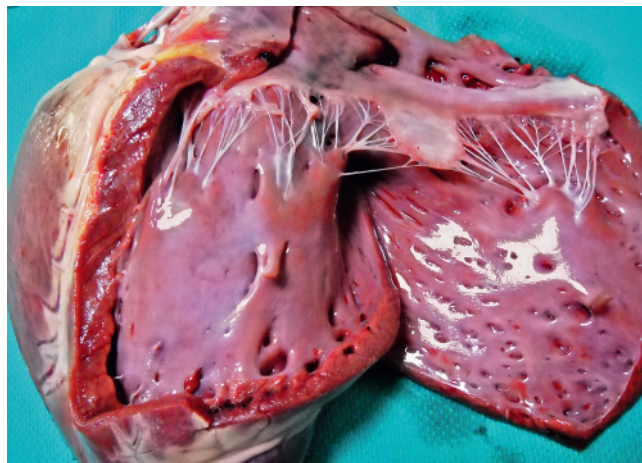
**Figure 1.3.** Horse. Opening of the Left Heart. The left ventricle is opened longitudinally by placing the cutting knife at the free lateral side. The cut is directed toward the left atrium, the tip of the instrument passing underneath the mitral valve leaflet toward the aortic ostium.



**Figure 1.4.** Horse. Opening of the Left Heart. The mitral valve leaflet is cut and the ascending aorta is opened. Rinsing with water facilitates the assessment of various internal structures of the left heart. The entire heart is weighed and measurements of valvular circumferences and ventricular and atrial muscular thickness can be taken.



**Figure 1.5.** Horse. Opening of the Right Heart. An incision is made by knife following the ventricular septum. The instrument is turned along the ventricular septum into the right atrium. Inspection of the internal structures is similar to the procedure listed for the left heart.



#### a. Cranial mesenteric artery

After dissection of the perivascular tissue, the vascular branch is opened with scissors. The mesenteric arterial root lumen is checked for patency and smoothness of its intima to rule out the presence of *Strongylus vulgaris* larvae.

### 3. Removal of the brain and spinal cord

Before removing the head, cerebrospinal fluid can be collected by syringe from the atlanto-occipital cistern for analysis to aid in the diagnosis of central nervous system disease. Decapitation is performed at the level of the atlanto-occipital joint. The guttural pouches near the occipital condyles are inspected. The cranial cervical ganglion is located next to the carotid artery in the dorsocaudal aspect of the medial compartment of the guttural pouches and can be felt as a bulge in the fold of tissue at that site.

The severed head is placed tightly into a vice or on a solid surface against a rigid object such as a wall or raised table corner.



**Figure 1.6.** Horse. Head. For a field necropsy, a simple method to access the brain is to perform a transverse craniotomy via handsaw through the middle of the head caudal to the last visible molar tooth toward the palatine bone and oral cavity, thus splitting the head into rostral and caudal parts.

**Figure 1.7.** Horse. With the cranium open, both rostral and caudal portions of the brain can be removed with a gentle push. This technique is easier to perform if the mandible is removed at the temporomandibular joints and across the pterygomandibular folds to reduce the bulkiness of the equine head.



**Figure 1.8.** Horse. Spinal Cord. Removal. Field Technique. (Reprinted from *Equine Medicine and Surgery*, Colahan et al., Figure 3-65, page 127, Copyright Elsevier, 1999.)



For the removal of the spinal cord, institutional facilities use an electric band saw. The spinal cord can also be safely harvested with a handsaw under field conditions. After fleshing, it is preferred to divide the vertebral column into three to four major segments (cervical, two thoracic, lumbar). Depending on the suspected location of the pathologic process, one or all of these segments are cut transversely through the arches and bodies of adjacent vertebrae, leaving the intervertebral articulations intact.



**Figure 1.9.** Horse. Spinal Cord. The vertebral canal is exposed and the spinal cord segment is removed with scissors. This can be repeated on as many vertebrae as necessary.



**Figure 1.10.** Horse. Spinal Cord. Normal. This piece measures the length of one vertebra and has the dura mater removed for better fixation.

#### **4. Examination of the locomotor system**

As part of a routine necropsy, one should open a regular set of joints. This examination should be extended when clinical history identifies their involvement in lameness. Similarly, muscles and tendons are examined when indicated. Knowledge of joint anatomy facilitates a direct, safe approach to any joint. The skin over the selected joint should be removed to guarantee better visibility and sterility should there be the need to collect joint fluid for culture. Under normal condition, a slight amount of viscous straw-colored fluid oozes from an opened joint. A healthy articular cartilage has a moist, smooth, light bluish-white surface. The synovial fossae vary in size depending on joint location and age of the animal. In cases of laminitis, the hooves are separated proximal to the coronary band and the pedal bone can be exposed by splitting the hooves into halves with a handsaw or electric bandsaw.

#### **5. Examination of the placental membranes and the fetus**

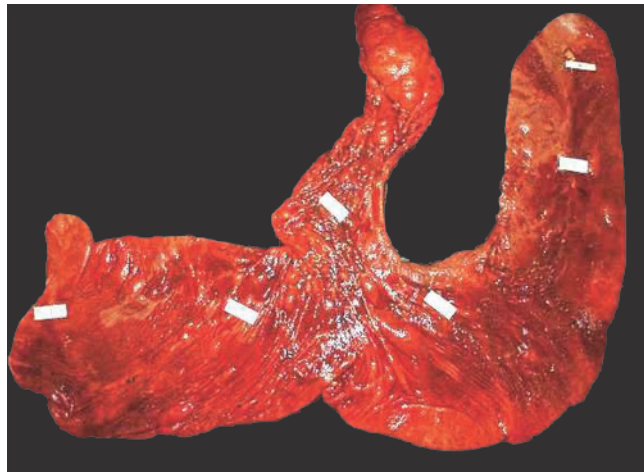
Placentation in the mare is classified at the gross level as diffuse. The placenta is composed of chorioallantois, allantoamnion, and the umbilical cord. The

examination of placental membranes is critical in determining events that led to abortion, stillbirth, premature birth, or prolonged gestation. Ideally, intact, noncontaminated, and completely preserved placental membranes are needed for meaningful diagnostic analysis. The total placenta should be weighed.

**Figure 1.11.** Horse. Placental Membranes. Both membranes are spread out; the chorionallantois as an “F” and the amnion as a flat membrane to which a small portion of umbilicus is attached. The visible chorionic surface on the bottom is velvety and reddened because it is rich in vasculature. The amnion on the top is normally thin and translucent and contains coiled muscular arteries. A yellow hippomane (allantoic calculus) is present between the placental membranes. Hippomanes contain lipids, cellular debris of desquamated fetal membranes, and mineral deposits. Their function is unclear.



**Figure 1.12.** Horse. Placental Membranes. Several sites of tissue collection for histologic evaluation should be chosen from both placental membranes. (Courtesy Dr. J. Roberts, National Zoo, Washington DC.) (See also Chapter 12, “Diseases of the Reproductive Tract.”)



The umbilicus severed from its attachment contains the urachus, two arteries, and, depending on the segment, covered by amnion or allantois, one or two veins, respectively. The length of the umbilicus should be measured. The umbilicus normally contains several twistings that should not be confused with pathologic twists.

The fetus should be weighed, its gender determined, and a crown-rump length established. A complete necropsy should be performed regardless of gestational age and tissue freshness. Autolysis rapidly occurs in kidneys and liver; lung and heart tissues stay relatively viable for some time.



### III. Tissue collection

Depending on how much the complete necropsy reveals at the gross level, ancillary tests are required to determine the cause of death or nature of disease. These tests include histopathology, virology, bacteriology, toxicology, parasitology, serology, molecular biology, or postmortem radiology. Each test requires special handling of the selected specimen. Regarding histopathology, the collection of tissue should take into account sample size, fixation type, fixation time, and volume of fixative. There should be 10 times as much fixative as tissue volume.

### IV. Recording of findings of routine cases

All observations should be recorded or written down at the end of the necropsy and ideally before the carcass and its remaining organs are disposed of. Gross abnormalities should be recorded in an objective and descriptive manner to allow the reader a mental image of what the prosector saw. The necropsy report should incorporate weights and measurements of organs as well as shape, color, texture, and aspect of the cut surface. The diagnoses should be listed in order of importance. At the end of the report, a comment should interpret the cause of death or nature of disease and explain possible inconsistencies between clinical history and pathologic findings. It should incorporate and interpret the results of all ancillary tests performed. Incidental findings, background pathology, or postmortem changes should be listed as such.

#### Equine necropsy – Fact sheet

##### Definition

Orderly dissection of a cadaver

##### Types

- Disease oriented
- Insurance
- Medicolegal

##### Objective

Performance of a complete necropsy to obtain a complete answer for the cause of death or nature of disease.

## **Equine necropsy – Fact sheet continued**

### **Special techniques for**

- Brain and spinal cord
- Heart
- Placental membranes

### **Tissue collection**

- Histopathology
- Ancillary tests

### **Recording**

Dated and signed necropsy report

## **Selected reference**

King R, Dodd N. 2009. *The Necropsy Book*. 5th ed. Guerne, IL: Charles Louis Davis DVM Foundation.