

Bone tumors

❑ Fibrosarcoma

It is a malignant tumor originating from the stromal elements of the bone marrow cavity.

❑ Hemangiosarcoma

Bone vessels are derived from endothelial cells. In dogs, it is mostly found in long bones, also in pelvis - sternum and maxillary bones.

❑ Giant cell tumor of the bone

In cats and dogs, it is a rare tumor originating from the mesenchymal cells of the bone marrow. Giant cells are formed by the combination of large, oval, or spindle shaped cells. The tumor is rich in vasculature and rarely has trabeculae in the collagen structure. Sometimes it is called osteoclastoma, which can metastasize to the lungs.

Blood and lymph vessels tumors

- Hemangioma
- Hemangiosarcoma (Malignant hemangioendothelioma)
- Hemangiopericytoma
- Lymphangioma - Lymphangiosarcoma
- Glomangioma (Glomus Tumor)

Hemangioma

- It is a benign tumor of endothelial cells of blood vessel and classified as **cavernous hemangioma** and **capillary hemangioma** according to the size of the vessel lumen.

Hemangioma

- It is most common **in dogs**,
- Less in cats, horses, cattle, sheep and pigs.
- There is no breed or sex disposition.
- It is usually subcutaneous, 0.5 to 3 cm in diameter, oval/medium and well-demarcated.
- It is red-black in color, with blood leaking from the cross-section and spongy in appearance.
- It may develop in the dermis, but it is smaller.

Hemangioma

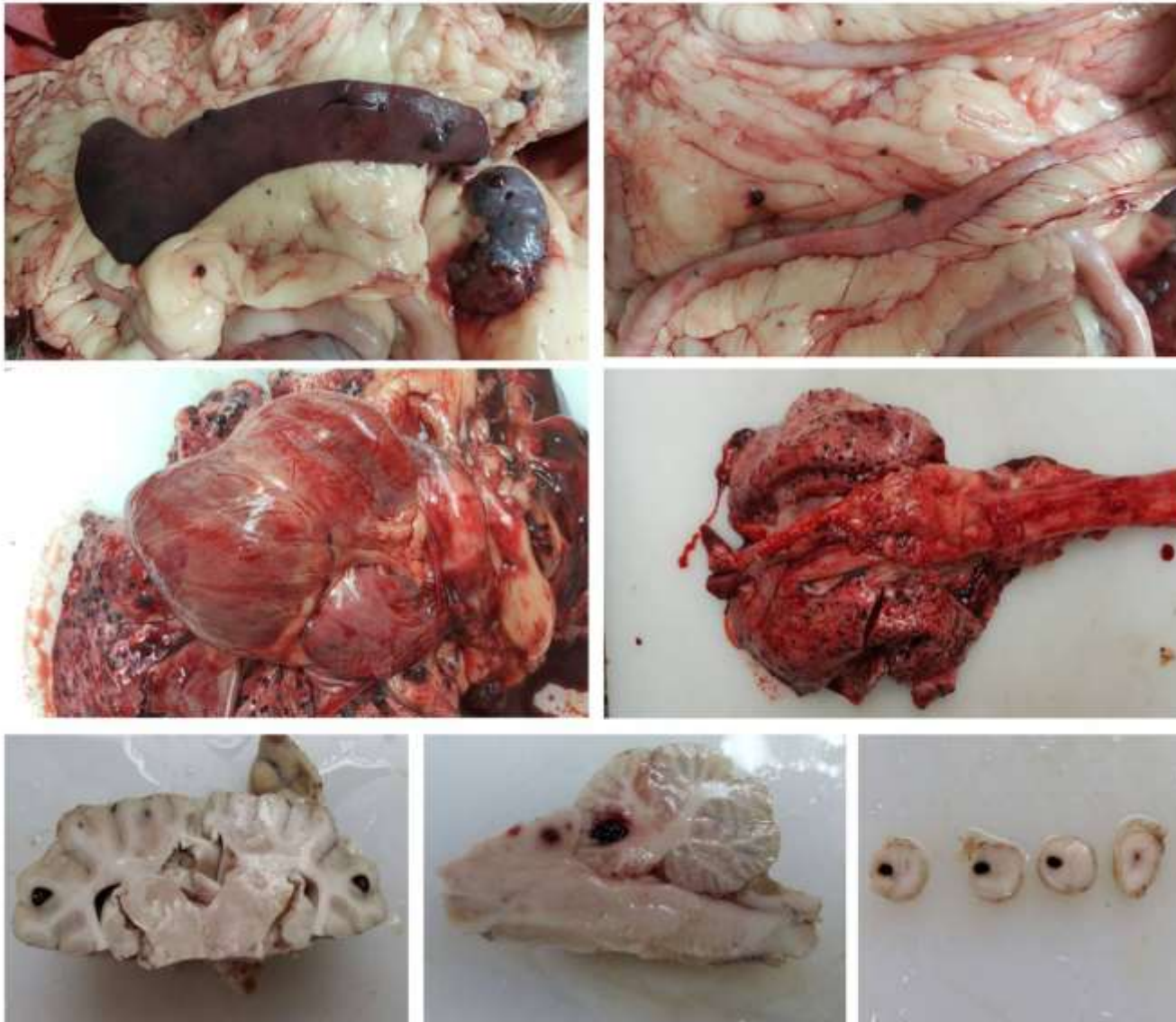
- Microscopic appearance;
- **The cavernous type** has single row epithelium and **wide lumen** vessels. **Thrombotic vessels** can also be observed.
- **In capillary hemangioma**, there are many veins of **capillaries** that are **not open to the circulation**.
- Tumor can be removed by surgery. Generally, no recurrence occurs.

Hemangiosarcoma

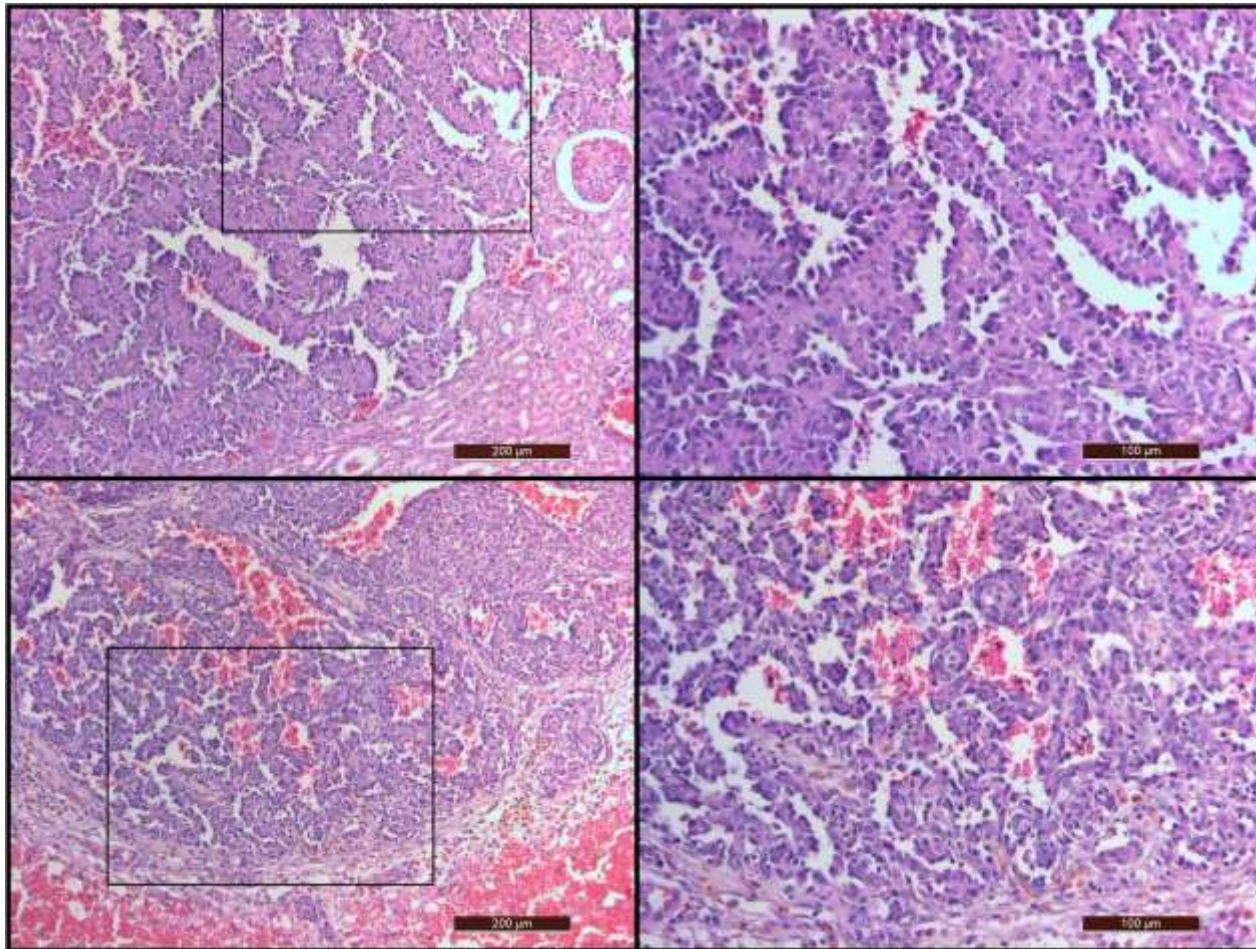
- It is a malignant tumor of endothelial cells of blood vessel.
- Hemangiosarcoma commonly presents as a **multicentric disease** involving the **spleen, liver, lungs, and right auricle of dogs.** (It can also be seen in the nervous system, liver, bone, muscle and gastrointestinal tract.)
- German shepherd, Golden retriever
- Male > female
- Less frequently in cats and rarely in large domestic animals.

Hemangiosarcoma

- Macroscopically
- They are red/brown to black, soft to firm, and exude blood when cut.
- The veins that form in the tumor are very fragile and easily rupture, leading to bleeding.
- Hemorrhage and necrosis are the main findings of tumor.



(Yucel Tenekeci et al, 2017)



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Hemangiopericytoma

- Hemangiopericytomas are very common in middle-aged or older dogs (9-14 years old).
- Tumors are usually solitary, arise in the subcutis around joints of limbs.
- Rarely they are seen in head and tail.
- It is usually 2-10 cm (sometimes reaching 25 cm) in size and is firm and nodular. The cross-section surface is gray-pink and lopped. The covering skin may ulcerate.

Hemangiopericytoma

- Hemangiopericytomas have a characteristic "fingerprint pattern" appearance that is composed of multiple layers of spindle cells arranged in whorls that surrounds a central blood vessel.



Lymphangioma - Lymphangiosarcoma

- Tumors **originating from lymph vessels** and are rarely seen in animals.
- Microscopically, tumor cells grow directly on bundles of collagen, dissecting them and forming numerous clefts and channels.
- Lymphangiosarcoma is very rare.

Glomangioma (Glomus tumor)

- It is a benign tumor originating from small **arteriovenous anastomoses** called "**glomus body**" that control blood flow in the hands and toes.
- A small pinkish nodule-like tumor encapsulates but causes pain.
- Microscopically, tumor is composed of glomus cells and angiomatous spaces.
- Glomus cells are light-colored, round-oval nuclei and do not show pleomorphism and mitosis.

Tumors originating from serous membranes

Mesothelioma

- It is a tumor originating from mesothelial cells covering the surfaces such as peritoneum, pleura and pericardium, originates from mesoderm.
- It usually develops in calves (congenital)
- Rarely, in adults of ox, horse, dog, cat and pig
- The great majority of cases that occur **in humans** are related to **asbestosis** and develop in the **lungs**.

Mesothelioma

- Macroscopically;
 - Tumor masses are multiple,
 - Nodules can be small and demarcated or wide and cauliflower in appearance.
 - The sizes of masses can be between 2 mm and 4 cm
 - White-gray, yellowish or pink
 - On cut surface, white area is seen at the centre.
 - Firm

Mesothelioma

Microscopically

- Mesothelial cells are generally single-row, cubic, columnar-shaped, with large vesicular nuclei and prominent nucleoli.
- Sometimes, vacuoles are found in the cytoplasm. The mitotic figures are few and multi-nucleated giant cells can be seen.
- Stroma is composed of loose connective tissue and large amount of vessels.

Mesothelioma

- Rarely, it can metastasize through the blood and lymph vessels.
- It can be spread quickly by implantation metastasis .
- There is no effective treatment method.
- However, it is reported that chemotherapy is useful in limited cases.

Histiocytoma

- It is a benign tumor, occurs especially in young dogs (under 2 years old), usually forms in skin.
- There is no gender predisposition.
- However it occurs in some pure breeds dogs (Boxer etc).
- It can be solitary or multiple.
- Seen in head, earbud, extremities
- Ulcerations can be seen.

Histiocytoma

- Microscopically; **Uniform** cells **infiltrate** into the **dermis** and **subcutis** and are packaged in the lower parts of the dermis.
- In areas near the epidermis, cells become sparse and form a row. Cells are ovoid-round, have large-nucleus and pale-large cytoplasm.
- The most characteristic feature is that many mitotic figures are seen.
- The appearance varies depending on the age of lesion and the degree of necrosis and secondary inflammation.

Mast cell tumor - Mastocytoma

- Since mast cells contain **heparin**, **histamine** and **serotonin**, **toluidine blue staining** is applied to mature cells and **PAS** method is applied to immature ones for the granules to be visible.
- The mast cells multiply both in the neoplastic response and reactive events (accompanied by an inflammatory reaction after an allergic event, "Reactive Mastocytosis").
- It is important in dogs, cats and horses.

Mast cell tumor

- Occurs commonly in Terrier breed
- There is no sex predisposition.
- 80% of the dogs with tumors have **gastric duodenal ulcers**, 70% have **focal glomerulitis**, *decrease* in **antibody production** and *prolongation* of **blood clotting**.
- It develops generally in multiple, well-demarcated, encapsulated, 1-10 cm sized nodules, anywhere in the skin (especially in the inguinal region, femur and scrotum). The cut surface is gray-white and sometimes yellow-red.

Mast cell tumor

Microscopically;

- It is divided into **mature type** and **anaplastic type** according to the differentiation degree.
- **In the mature type**, the cells are round-oval and in the same size. Cytoplasm boundaries are prominent and there are **large granules** inside. They show metachromasia with **toluidine blue**. Mitosis is rare. Cells are sparse.
- **In the anaplastic type**, cell **pleomorphism** is seen and nucleus is large-vesicular and irregular. Mitotic figures are common. In the tumor, a lot of cells are in contact and their borders are not clear.
- The presence of a large number of **eosinophil leucocytes** in the tumor is characteristic.
- Collagen degeneration and histiocyte infiltration, as well as fibrinoid degeneration in arterioles can be seen.

Mast cell tumor

- **Malignant mast cell tumor**
 - It may metastasize to regional lymph nodes, spleen, kidneys, liver, lungs and heart.
 - If the tumor mass is limited on the skin, it should be taken with a minimum of 3 cm of solid tissue around it.
 - Amputations are made in regions that are not suitable for a large excision (such as extremities).
 - Radiotherapy can also be applied.

MELANOCYTIC TUMORS

- Melanocytoma
- Malignant melanoma

- ☐ Junctional
- ☐ Dermal

MELANOCYTIC TUMORS

- Mature pigment producing cells are referred to as **melanocytes**.
- Common in dogs, horses, and pigs
- Rarely in goats and cattle, less in sheep and cattle.
 - ❖ It usually develops in male dogs between 7 and 14 years of age.
 - ❖ It is formed in horses over 8 years old and usually in Arabian horses. There is no gender predisposition.
 - ❖ In cattle, it can be seen in youngs and even can be congenital. It is usually found in dark-colored cattle. There is no gender predisposition.

MELANOCYTIC TUMORS

- Can occur in skin, mucous membranes and eyes.
- Although 90% of the tumors in the mouth are malignant, most of them are benign.
- In horses, it is located in the perineum and tail region
- In goats, it is located in the perineal region
- In cattles, it is located in subcutaneous region

MELANOCYTIC TUMORS

- Tumors that contain much melanin pigment (**Melanotic Melanoma**) are **dark brown-gray, black** in color.
- Tumor pigmentless (**Amelanotic Melanoma**) are **light-colored**.

MELANOCYTIC TUMORS

- According to one opinion: 1 cm or less is benign, 2.5 cm or more is malignant.
- Malignant melanomas can be in large, ulcerated, dark brown-black to light gray varying colors.

MELANOCYTIC TUMORS

Microscopically;

Melanocytoma

- Cells located in the upper parts of the dermis are oval, round and cuboidal and resemble epithelial cells.
- The cells in the deep parts of the dermis are usually fusiform and their nuclei are similar to the fibroblast's.
- The pigment loaded cells decrease in deeper parts of the dermis.

MELANOCYTIC TUMORS

Microscopically;

MALIGNANT MELANOMA

- **Epithelioid type;** It is similar to epithelial cells and sometimes shows trabecular pattern. Tumor cells contain less intracytoplasmic melanin.
- **Spindle cell type;** Consists of varying size of bipolar spindle-shaped cells and mitosis is more common than the other types.
- **Epithelioid and spindle cell type;** It is the most observed type in skin and mouth. The epithelioid and spindle shaped cells are dominant together.
- **Dendritic cell type;** Tumor cells display interwoven or whorled pattern. Dendritic cells contain pigment (melanin). Necrosis areas are common.

MELANOCYTIC TUMORS

- Metastatic pathways in malignant melanoma are lymphogenous and hematogenous.
- It can usually metastasize to regional lymph nodes, to the lungs, and sometimes to the muscles, brain, heart, kidneys, spleen, liver and other internal organs.

MELANOCYTIC TUMORS

- Surgical treatment is the most effective method.
- Since recurrence can often be seen, the tumor mass should be taken with at least 3 cm of solid tissue around it.
- Chemotherapy and radiotherapy can also be applied.

A case of malignant melanoma in a bay horse

- The tumor developed nodular masses from around the anus towards the base of the tail.
- The spleen reached to 9,5 kg, the liver reached to 22 kg in weight.
- Tumor, other than spleen and liver, metastasized to stomach, small intestine, rectum, right kidney, adren, pancreas, lung, pericardium, heart, aorta, intercostal muscles, skeletal muscles, lymph nodes, thyroid, parotid gland and pituitary



A case of malignant melanoma in a bay horse

- Microscopically;
- The tumor cells were epithelioid and spindle. Melanin pigment was observed in some tumor cells but not in some. Rarely are mitotic figures and a large number of giant cells were seen.



Tumors of the Nervous System

- Neuroglial tumors
- Neuronal tumors
- Choroid plexus tumors
- Mesodermal tumors
- Schwann cell tumors

NEUROGLIAL TUMORS

- Astrocytoma

- Oligodendroglioma

- Ependymoma

Astrocytoma

- It originates from [astrocytes](#).
- Tumor is commonly found in the hemispheres of the brain, but may also be found in the thalamus, brain stem, cerebellum and spinal cord.
- Differentiated/Indifferentiated

Oligodendroglioma

- The tumor originating from oligodendroglia develops in the white matter of the hemispheres, in the frontal lobe. Sometimes it can also reach to ependymal or meningeal surfaces.

Ependymoma

- The tumor originating from the ependymal cells grows into the ventricles and metastasizes with the cerebrospinal fluid.

NEURONAL TUMORS

- Neuroblastoma

- Cerebral Neuroblastoma (Medullablastoma)

- Ganglioneuroma

(These tumors, which are very rare in pets, originate from primitive neuroepithelial cells.)

KOROID PLEXUS TUMORS

- ❑ Choroid plexus papilloma

- ❑ Choroid plexus carcinoma

(It can be seen everywhere where the choroid plexus is present, but it develops mostly in the fourth ventricle.) Papillomas are common, and carcinomas are rare.

MEZODERMAL TUMORS

- Meningioma

Meningioma

- The tumor originating from the leptomeninges is more common in the basal part of the brain. Sometimes it can be formed on the spinal cord or the optic nerve.
- Meningioma can be seen in dogs (7 years and over) and cats (9 years and older), is rarely encountered in sheep, horse and cattle.

SCHWANN CELL TUMORS

- Schwannoma (Neuroma)

- Neurofibroma

- Neurofibrosarcoma

SCHWANN CELL TUMORS

- Tumors originating from Schwann cells in the peripheral nerve sheath are often found in older dogs (approximately 8 years old) and in older cattle (and sometimes in younger ones).
- The majority of tumors are seen in the skin. However, it can be found anywhere in the peripheral nervous system.

SCHWANN CELL TUMORS

- The tumors originating from Schwann cells are Schwannoma (Neuroma) - Neurofibroma - Neurofibrosarcoma and the microscopic structures of these tumors are very similar.