**Neoplasms, part 2**

**Leiomyoma** **(*myoma levicellulare s. leiomyoma*)**

* benign tumour originating from smooth muscle tissue
* grows in the form of clearly demarcated tumours, but may not have a connective tissue capsule
* leiomyomas are often found in the genitourinary system (in females, their growth is often hormone-dependent), but they can also occur in the stomach wall, intestines; they are rarely found in the skin (in that case they originate from the muscle of arrector pili – piloleiomyoma)
* leiomyomas easily undergo regressive changes (necrosis, hyalinization, mucosal degeneration, calcification) and may occur in the form of mixed tumours, e.g. adenoleiomyoma
* the connective tissue stroma is usually scanty, occasionally containing collagen fibres, reticular fibres and elastic fibres
* neoplastic cells are numerous, elongated and usually have cigar-shaped nuclei, blunt-ended; neoplastic myocytes are arranged in fascicles and bundles of chaotic arrangement, forming characteristic tissue whorls – the cell arrangement similar to fibroma – in order to differentiate between leiomyoma and fibroma, van Gieson stain is used – muscle fibres stain yellow-green, while connective tissue cells stain red

**Angioma**

* is a benign neoplasm derived from the vascular endothelium of blood vessels **(*haemangioma*)**or lymphatic vessels **(*lymphangioma*)**
* is well-circumscribed (but often does not have a connective tissue capsule), does not damage nearby tissues when growing
* surgical excision usually leads to recovery
* angiomas are common in dogs, but rare in other animal species
  + they can occur in very young horses, usually on the distal limbs
  + in horses, cattle and pigs may be inborn
  + in Yorkshire and Berkshire pigs, they are found within the scrotum
* in dogs, they occur usually in animals above the age of 8-9 years; predisposed breeds: Boxer, Airedale Terrier, German Shepherd Dog, especially males
* may be caused by prolonged exposure to the sunlight (in short-haired dog breeds) – in these cases, they may be multifocal
* angiomas caused by prolonged exposure to the sunlight are located in the superficial layers of the skin and are less circumscribed

Depending on the diameter of vascular structures, the following types can be distinguished:

* **Capillary haemangioma *(haemangioma simplex s. capillare)***
* **Cavernous haemangioma *(haemangioma cavernosum)***

**Capillary haemangioma (*haemangioma simplex s. capillare*)**

* is made up of a very large number of capillaries, lined by endothelium, often tangled together, among a small amount of stroma
* solid, non-canalised endothelial ridges are present between capillaries, as well as clusters of endothelial cells, precursors of future capillary vessels
* is most often found in the skin, subcutaneous tissue, and rarely in internal organs (brain, lungs, spleen, liver) in the form of small red or blue tumours

**Cavernous haemangioma (*haemangioma cavernosum*)**

* is the most common type of angioma observed in animals
* is made up of wide endothelium-lined cavities,
* due to impaired circulation (slow flow), blood clotting and clots may occur in the lumen of its cavities
* can reach large sizes; it is very common in the skin, in subcutaneous tissue, but can also occur in internal organs such as the spleen, kidneys or liver

**Histological features of malignant tumours**

|  |  |
| --- | --- |
| Growth rate | * fast (within several weeks or months) * growth inhibition is rare |
| Encapsulation | usually absent |
| Growth type | * infiltrating (neoplastic cells penetrate into crevices of the surrounding tissues) * no clear boundaries of neoplastic growth * the neoplastic foci are spread in normal tissue |
| Post-operative recurrence | yes, usually within or around a post-operative scar – relapse, recurrence – ***recidiva*** |
| Penetration into vessels and metastases | * ability to penetrate the lumen of small blood vessels, lymphatic vessels and cerebrospinal fluid vessels – cells are spread or implanted into the serous membranes of body cavities * carcinomas tend to spread through lymphatic vessels * sarcomas usually spread through blood vessels * metastasis formation |
| Effects on the body | * local – damage to the surrounding tissues and metastases to important organs * general – systemic intoxication with neoplastic tissue decomposition products * reduction of the body’s immunity |
| Regressive and other changes | frequent – necrosis, ulceration, haemorrhages |

**Cytological features of malignant neoplasms**

|  |  |
| --- | --- |
| Cell image | * usually poorly differentiated cells * cell diversity (pleomorphism – shape variation; anisocitosis – size variation) |
| Cell differentiation grade | * varied * highly differentiated neoplasm – the neoplastic tissue is similar to the mature tissue * poorly differentiated, anaplastic neoplasm – it is difficult to recognize the origin of neoplastic cells |
| Cellular nuclei | * varied shape, size – anisokaryosis * large cellular nuclei – macronucleosis * increased nuclear-cytoplasmic ratio (N:C lower than/equal to 1:2) * hyperchromasia * often multiple nuclei in a cell * uneven distribution of chromatin * often numerous nucleoli (of various sizes and shapes) * nuclear membrane corrugated, thick |
| Mitotic index | * high – numerous figures of mitotic division * mitotic figures often abnormal – **mitosis abortiva** (their increase indicates higher malignancy of the tumour) |

**Sarcoid**

* skin neoplasm, locally malignant
* horses, donkeys, mules
* predisposed breeds: Wielkopolski, Holsteiner, Malopolski, Arabian, Quarter, Appaloosa, Standardbred
* can occur at any age, but most cases are diagnosed in animals between 3 and 6 years old
* bovine papillomavirus (*bovine papillomavirus type 1, type 2*) plays an important role in aetiology
* 20% of all neoplasms and 36% of skin neoplasms in horses
* single/multiple tumours of the head, limbs, abdomen, genitals
  + in about 40% cases multiple tumours are observed
* the surface of the tumours often undergoes ulceration, necrosis, injuries with subsequent scar formation
* recurrences are frequent, especially in the case of incomplete surgical excision
  + in addition to surgical excision, the treatment also includes laser therapy, radiotherapy, local injection of immunostimulants (BCG: Bacillus-Calmette-Guerin), local chemotherapy (cisplatin)
  + no metastases occur (in the case of the "malignant" type, metastases to regional lymph nodes are sometimes observed)
* spontaneous regression is seldom observed

There are six types of sarcoids:

* **occult (flat) –** surface of the tumour is flat, covered with rough, very coarse, hairless epidermis (eyelids, ears, snout, neck) – changes are limited to the surface of the epidermis
* **verrucous (epithelial)** – warty hyperplasia of skin (starting in the dermis), usually not covered by hair, slow growth, most likely the next stage of the latent type (genitals, groins, ears, head)
* **fibroblastic** – the most common, it quickly becomes large in size and looks like “proud flesh" (proliferation of neoplastic fibroblasts), erosions and ulcers are often present on the surface of the tumour (chest, limbs, neck, lower abdomen)
* **mixed** – a combination of two or more types (genitals, head)
* **nodular (spherical)** – the excrescence starts in subcutaneous tissue, the lesion is located under the epidermis, in case of ulceration it may become a sarcoid of the fibroblastic type (genitals, eyelid corners)
* **malevolent/malignant** – the least frequent; it is highly infiltrating, infiltrates lymphatic vessels with the formation of ulcerative nodules on the surface of the skin, with the possibility of an invasion of local lymph nodes; this form most often develops from other types of sarcoid, exposed to frequent, repeated damage (less frequently develops spontaneously); it occurs most frequently in the area of the face, mandible, elbows and inner side of thighs

Microscopic image of sarcoids – epidermal proliferation and neoplastic growth of connective tissue cells (fibroblasts):

* the surface of the neoplasm shows epidermis affected by proliferation, with the formation of characteristic finger-like invaginations into the tumour **(*rete pegs*)**, orthopaedic hyperkeratosis is also present, ulceration with subsequent inflammatory cell infiltration is often found
* tumour parenchyma is made up of neoplastic fibroblasts (spindle cells of various sizes, with polymorphic, large, bright cellular nuclei and small nucleoli), they form characteristic whirls and intertwining cell bundles, and herringbone pattern
* the number of mitotic figures is varied
* collagen fibres in variable amounts and blood vessels (sometimes immature) are also present

**Sarcomas**

* a collective term, including malignant tumours of mesenchymal origin often made up of spindle or oval cells, with varied arrangement, which sometimes suggests the exact type of the neoplasm
* possible cell arrangement in sarcomas:
  + cellular bands intersecting at various angles (herringbone pattern)
  + whorled pattern
  + bundles around the vessels,
  + storiform pattern
* sometimes due to non-specific morphology, the identification of neoplastic cells is performed by immunohistochemical methods

The most often found sarcomas include:

* fibrosarcoma
* haemangiopericytoma
* haemangiosarcoma
* malignant schwannoma
* leiomyosarcoma

**Fibrosarcoma**

* malignant neoplasm derived from fibroblasts
* takes the form of fast-growing, infiltrating, unencapsulated, single or multiple, soft or hard tumours
* may occur in all species of animals
* in dogs, it occurs quite frequently in the skin and subcutaneous tissue, buccal mucosa and nasal cavity (it can also occur in other organs)
  + has a low metastatic potential; however, due to infiltration growth, recurrence is quite common (complete surgical excision plays a key role in the treatment of this neoplasm)
  + the degree of malignancy of skin and subcutaneous fibrosarcoma depends on the mitotic index, the extent of necrotic areas and the differentiation of neoplastic cells
  + the canine well-differentiated maxillary/mandibulary fibrosarcoma variant is sometimes found in the gum area, which is histologically very similar to fibroma (due to the low mitotic activity of neoplastic cells and their high degree of differentiation), but shows infiltration growth and requires radical surgical procedure
* in cats, fibrosarcoma is a very common neoplasm of the skin and subcutaneous tissue, but it can also occur in buccal mucosa and nasal mucosa (and in other organs)
  + may occur spontaneously, post-injectionally or as a result of FeSV infection (***feline sarcoma virus***)
  + spontaneous fibrosarcomas are neoplasms of low to moderate degree of malignancy, their recurrence is possible after surgical removal, but they rarely give distant metastases, usually in the late stages of the disease
  + viral fibrosarcomas in cats usually occur as multiple lesions and affect young cats (FeSV is a feline leukemia virus variant, and cats infected with FeSV are always simultaneously FeLV+)
  + in feline injection-site sarcomas in cats, the prognosis is generally more cautious due to more frequent recurrence and more frequent distant metastases
* neoplasm parenchyma **is made of sarcoma cells**, which resemble fibroblasts in shape and size, but show features of atypia:
  + variety of shape (may be elongated, sometimes star-shaped, oval or polygonal – in cases of high anaplasia)
  + large variation in cell and nuclei size (high anisocytosis and anisokaryosis)
  + cell nuclei are elongated, oval, hyperchromatic or with an irregular distribution of chromatin, nucleoli are numerous and clear
  + giant polynuclear cells sometimes occur
  + the figures of mitotic division are numerous and sometimes atypical
* cytoplasm is poorly stained by eosin, therefore the outline and shape of cells is often difficult to distinguish
* sarcoma cells are arranged in the form of fascicles running at different directions, forming characteristic whorls, can produce collagen and reticular fibres, which are present between sarcoma cells in varying amounts
* fibrosarcomas often undergo regressive changes (degeneration, necrosis), and quite abundant blood extravasations are also observed
* sarcomas usually metastasize through blood vessels to the lungs and bones (but their metastatic potential is relatively low)

**Haemangiosarcoma**

* malignant neoplasm derived from blood vessel endothelial cells
* often occurs in internal organs, mainly the spleen, but also in the liver or myocardium
* haemangiosarcoma derived from internal organs is a neoplasm with high metastatic potential and can spread within e.g. abdominal organs (liver, spleen, omentum)
  + splenic haemangiosarcomas are often perforated and spread in the abdominal cavity, predisposed breeds include German Shepherd Dog
* haemangiosarcomas also occur in the skin, where they can represent metastatic foci (and be part of a systemic neoplastic process), but they can also be of primary type
  + primary cutaneous haemangiosarcomas show lower aggressiveness, lower metastatic potential and longer survival time as compared to the organ form of the neoplasm

**Splenic** **haemangiosarcoma**

* neoplastic cells are highly polymorphic, from spindle to polygonal, oval
* vascular channels are usually visible in a fragment of the tumour, but there are also areas of solid structure (resembling fibrosarcoma tumours)
* frequent mitotic figures
* stroma may be focally cell-free, hyaline, slightly eosinophilic
* frequent vascularisation of blood / haematomas

**Cutaneous** **haemangiosarcomas:**

* elevated lesions
* poorly circumscribed
* red
* hairless
* pigment-free

**Haemangiopericytoma**

* malignant neoplasm, derived from pericites of blood vessels
* occurs in dogs
* predisposed areas: skin and subcutaneous tissue of the limbs, trunk, may also occur within the internal organs
* shows infiltrating growth, but has quite low metastatic potential
* its malignancy is graded (similarly to fibrosarcoma malignancy) depending on the number of mitotic division figures, the extent of necrotic areas and differentiation of neoplastic cells
* the metastatic potential of the neoplasm may increase with the recurrence of the process (relapse)
* neoplastic cells of a spindle, oval or round shape form characteristic perivascular whorls
* degree of differentiation, atypia and mitotic index of cells determine the degree of malignancy of the neoplasm
* polynuclear cells are sometimes present

**Melanocytic neoplasms**

* develop in tissues containing pigment-producing cells (melanoblasts, melanocytes), i.e. in the skin, mucous membranes (oral cavity – gums, lips, cheeks, soft palate), the eyeball (ciliary body)
* as metastatic tumours, they may occur in the lungs, liver, brain, heart, lymph nodes
* the lesions take the form of tumours of various sizes, with colours varying from brown to black, often also colourless (amelanotic)
* in animals, melanocytes may lead to:
  + non-neoplastic progressive changes (pigmented marks)
  + benign neoplasms: melanocytoma
  + malignant neoplasms: melanoma

**Melanocytoma**

* benign tumour; in some cases (especially in some animal species such as horses) it can progress towards a malignant tumour – melanoma
* is common in dogs, horses and certain breeds of pigs; less common in cats and cattle, and the least common in sheep and goats
* the macroscopic appearance varies depending on how long the tumour is present – it may occur as small pigmented spots or as tumours of different size (sometimes reaching 5 cm or more in diameter); the colour is variable and depends on the degree of pigmentation of the neoplastic cells (from grey, red, through brown to black); the lesion is well-circumscribed, usually unencapsulated

DOG:

* melanocytoma occurs most often in animals 7-12 years old, but it is sporadically observed in dogs under one year old
* the most predisposed breeds are: Vizsla, Miniature Schnauzer, Irish Setter, Standard Schnauzer, Australian Terrier
* most often occurs in head areas (particularly the eyelid area)

HORSE:

* In horses, melanocytoma can be congenital or acquired.
  + both congenital and acquired melanocytomas are relatively common in horses under 2 years old, of different breeds and coat colours
* in young horses, it is usually located on the limbs and trunk
* however, most cases are observed at around 10 years of age
* it is more frequent in mares than in male horses
* grey horses are predisposed to melanocytoma (a genetic mutation associated with grey coat colour), especially: Lipizzaner, Percherons, Arabian, Camargue, Thoroughbred – and, in this case, the number of melanocytomas increases with age, tumours are often located in the perineal region
* although the vast majority of equine melanocytic neoplasms are benign in early stages, even up to 2/3 of the tumours, if they are not treated properly, will progress to a malignant form (melanoma)

PIG:

* melanocytoma occurs as a congenital lesion in certain pig breeds: Sinclair, Hormel, Duroc, Libechov Minipigs
* it is unclear whether melanocytic neoplasms in these pigs should be classified as benign (melanocytoma) or malignant (melanoma) – because some of them undergo spontaneous regression, while others give regional lymph node metastases and distant metastases
* are used as a model for studying human melanocytic tumour biology

CAT:

* melanocytoma is rare; it is observed mainly at the age of 4-13 years, mainly in the European Shorthair breed

CATTLE:

* melanocytoma is rare, but it has been found to be a congenital lesion
* Angus breed shows a predilection

**Malignant melanoma *(melanoma malignum; melanosarcoma)***

* is usually found in older animals, rare in young animals
* the lesions take the form of tumours of various sizes, well-circumscribed, from brown to black, often also colourless (amelanotic)
* melanomas are common only in dogs, they are rare in other animal species
* age predisposition: dogs aged 6-15 years (usually 10-13 years)
* predisposed breeds: Standard Schnauzer, Miniature Schnauzer, Giant Schnauzer, Chow-Chow, Shar-Pei, Scottish Terrier
* melanoma is rare in cats, usually in older animals
* neoplastic parenchyma of melanosarcomas is formed by poorly differentiated cells derived from melanoblasts and melanocytes, which can take the following shape:
  + oval, polygonal (epithelial type)
  + spindle-type (spindle-cell type)
  + mixed (spindle-epithelial type)
  + signet-ring cells
  + balloon, clear cells
* sarcoma cells produce melanin, which accumulates in their cytoplasm or extracellularly in the form of abundant deposits and/or small grains. There are also forms of melanoma with low melanin content **(*m. hypomelanoticum*)** or pigment-free **(*m. amelanoticum*)**– usually less varied and more malignant
* melanoma cells may form fascicles, divided by streaks of connective tissue, or form smaller or larger nesting arrangements (as in fibrosarcoma)
* the connective tissue stroma is usually scarce, with an abundant network of thin-walled capillaries (hence the numerous extravasations) and lymphatic vessels. It often undergoes regressive changes, mainly necrosis
* the first metastases are to the surrounding lymph nodes, then through blood vessels to the lungs and other organs

Cutaneous and oral melanomas in dogs are divided into melanomas of low and high degrees of malignancy, depending on the number of mitotic division figures in 10 contiguous fields of view (400x, HPF).

**Cutaneous melanoma:**

* of low degree of malignancy – up to 2 figures of mitotic division in 10 HPF
  + 90% of dogs with the same type of melanoma live for at least 2 years (mean survival time – 104 weeks)
* of high degree of malignancy – above 2 figures of mitotic division in 10 HPF
  + two-year survival time is 25%, mean survival time is 30 weeks; 50% of dogs live shorter than 7 months

**Oral mucosal melanoma**:

* of low degree of malignancy – up to 3 figures of mitotic division in 10 HPF
  + one year survival probability is 90%
* of high degree of malignancy – above 3 figures of mitotic division in 10 HPF
  + 80% dogs live shorter than 1 year, average survival time is less than 4 months

**Round cell neoplasms**

* a collective term for neoplasms built of round cells
* these cells are of mesenchymal origin, hence the former term ‘sarcoma globocellulare’ – round-cell sarcoma
* they can be benign or malignant
* accurate determination of the origin of neoplastic cells often requires additional histochemical and immunohistochemical examination
* round cell neoplasms include
  + histocitary neoplasms
  + neoplasms derived from mast cells
  + neoplasms of myeloid and lymphatic origin

**Histiocytic tumours**

Histiocyte – a collective term for cells of marrow origin, which include macrophages, dendritic cells presenting the antigen

Macrophages physiologically occur in:

* the liver – Kupffer–Browicz cells
* in bones – osteoclasts
* in many organs – macrophages of lymphatic organs, pulmonary macrophages, serous cavity macrophages and synovial macrophages, macrophages of the CNS

Dendritic cells physiologically occur in:

* epidermis – Langerhans cells
* connective tissue of various organs (including the dermis) – interstitial dendritic cells
* blood – blood dendritic cells
* lymphs – veiled cells
* thymic core – thymic dendritic cells
* lymph nodes, spleen – interdigitating dendritic cells
* lymphatic follicle nodules – follicular dendritic cell

**Histiocytic tumours in dogs**

1. Non-neoplastic tumours:

* cutaneous histiocytosis
* systemic histiocytosis

1. Neoplastic tumours

* histiocytoma
* histiocytic sarcoma
  + localized
  + diffuse (malignant histiocytosis)

**Cutaneous and systemic histiocytosis**

* multiple, non-neoplastic lesions
* breeds predisposed: Bernese Mountain Dog, Retriever, Rottweiler (systemic histiocytosis)
* reactive proliferation of interstitial dermal dendritic cells accompanied by other inflammatory cells (lymphocytes, plasmocytes, less numerous neutrophils, eosinophils)
* may involve the skin (**cutaneous form**) or the skin and many internal organs (**systemic form**) – the starting point is always the skin
* histiocytic infiltrations demonstrate angiotropism, are located around blood vessels, do not demonstrate epitheliotropism
* skin nodules are painless, non-itchy (head, neck, genital area, limbs)
* nodules wax and wane
* treatment: anti-inflammatory (strictly contraindicated for **histiocytoma tumours!**)
* histiocytic cells are monomorphic, with no cellular or nuclear atypia

**Canine cutaneous histiocytoma**

* a single (rarely multiple) skin nodule, small, rapidly growing
* predisposed areas: auricle, other areas of the head, neck and limbs
* predisposed age group: young dogs, up to 3 years old
* often undergoes ulceration, secondary infections
* in most cases, it undergoes spontaneous regression from 3 weeks to 3 months after the change becomes visible
* recurrence is rarely observed
* neoplastic benign proliferation of Langerhans cells (dendritic epidermal cells)
* neoplastic infiltration is unencapsulated, poorly circumscribed, located in the dermis
* neoplastic cells demonstrate epitheliotropism (neoplastic cells can be observed in the epidermis)
* neoplastic cells are round or polygonal, have a fairly abundant cytoplasm, some testicles have characteristic incisions (resembling coffee beans)
* numerous mitotic figures

**Histiocytoma regression**

* immunologically controlled process
* with the maturation of neoplastic cells, T lymphocytes are activated, which cytotoxically destroy neoplastic cells
* regressive histiocytoma tumours have a large number of lymphocytes, initially on the perimeter of the tumour
* in advanced stages of regression, T lymphocytes predominate over neoplastic cells
* the presence of necrotic foci and suppurative inflammation of the neoplastic parenchyma in histiocytoma tumours are not indicators of malignancy (as in other tumours), but evidence of progressing neoplastic regression

**Histiocytic sarcoma**

* a rare malignant tumour derived from histiocytes
* predisposed breeds: Bernese Mountain Dog, Retriever, Rottweiler
* occurs as:
  + localized histiocytic sarcoma (LHS)
  + disseminated histiocytic sarcoma (DHS, malignant histiocytosis)

**Localized histiocytic sarcoma**

* a single tumour located in subcutaneous tissue, less frequently in internal organs
* grows rapidly, quite often metastasizes to regional lymph nodes
* predisposed areas: limbs (especially around the joints)
* neoplastic proliferation of dermal dendritic cells
* high nuclear and cellular atypia, high mitotic activity
* three cell populations: round, polynuclear and spindle-shaped

**Disseminated histiocytic sarcoma**

* occurs primarily in the spleen (neoplastic proliferation of splenic macrophages – hemophagocytic histiocytic sarcoma or dendritic cell sarcoma of the spleen), lungs, bone marrow, and less frequently – in the skin and subcutaneous tissue
* microscopically, localized and disseminated histiocytic sarcoma look similar
* hemophagocytic histiocytic sarcoma of the spleen demonstrates features of erythro- and hemophagocytosis

**Histiocytic tumours in cats**

* are rare
* the following types can be distinguished:
  + progressive histiocytosis
  + histiocytic sarcoma

**Progressive histiocytosis:**

* multiple, sometimes single skin nodules
* lesions wax and wane
* skin lesions may undergo ulceration
* the disease is slowly progressing, it is limited to the skin for a long period and, over time, changes also appear in internal organs
* cells with morphology typical of histiocytic cells (abundant cytoplasm, cell nucleus with characteristic incisions, cytoplasmic vacuoles)

**Histiocytic sarcoma:**

* Histiocytic sarcoma derived from dendritic cells occurs in the form of single skin lesions or in internal organs, shows high metastatic potential; it resembles an advanced stage of progressive histiocytosis
* histiocytic sarcoma derived from splenic macrophages

**Mast cell neoplasms (mastocytoma)**

Mast cells – cells of marrow origin, as precursors of mast cells migrate to target tissues, where they mature. Location: connective tissue of the dermis and connective tissue of mucous membranes. Mast cells in cytoplasm contain granules, storing histamine, serotonin, chemotactic factors and other inflammatory mediators, and are involved in immunological reactions (early and late hypersensitivity), blood pressure regulation, wound healing and others.

**Mast cell neoplasms in dogs (mastocytoma)**

* very common canine cutaneous neoplasm (10-15% of skin tumours)
* **mastocytoma in dogs should always be considered potentially malignant**
* a single tumour or multiple tumours (multiple in about 10-15% of cases)
* reddened, hairless tumour, with sizes ranging from very small to several centimetres (very malignant forms can infiltrate and cover a large area of the skin)
* predisposed breeds: Boxers, Boston Terriers, Bull Terriers, Bull Mastiffs, Amstaffs, and many others
* Darrier’s sign – palpation results in the change of the tumour size (swelling, reddening), as mast cells release histamine
* occurs mainly on the trunk or limbs
* average age: 8 years
* mastocytoma can also occur primarily in the gastrointestinal mucosa (oral cavity, stomach, intestines) or in the spleen

Microscopic image of mastocytomas

* unencapsulated infiltration covering the skin or subcutaneous tissue
* poorly circumscribed (difficult to completely remove by surgery)
* the morphology of neoplastic infiltration may be very different, therefore there are three degrees of mast cell tumours differentiation according to **the PATNAIK system**:
  + well-differentiated (I grade)
  + intermediate (II grade)
  + poorly differentiated (III grade)
* neoplastic cells can demonstrate a loose or solid arrangement, sometimes forming characteristic cell chains
* neoplastic cells may resemble or significantly differ from normal mast cells (depending on the degree of differentiation of neoplastic cells and the degree of malignancy of the neoplasm)
* a variable number of metachromatic granules are present in the cytoplasm, which stain purple with toluidine blue or May-Grunwald-Giemsa stain; in poorly differentiated mastocytomas, granules may be absent (in such a case, immunohistochemical methods are necessary for the histopathological diagnosis)
* the nuclei are round with variable chromatin distribution
* the number of mitotic figures is variable depending on the degree of malignancy of the neoplasm
* polynuclear cells are sometimes observed in highly malignant tumours
* a typical, characteristic feature of mastocytomas are numerous eosinophils which accompany neoplastic cells (sometimes foci of collagenolysis)

Cutaneous mastocytoma – Kiupel’s classification

* the classification more frequently used nowadays is Kiupel’s grading, according to which a cutaneous mastocytoma is classified as a tumour of a low or high degree of malignancy
* in order to classify a mastocytoma as a highly malignant tumour, at least one of the following characteristics must be observed in the microscopic preparation
  + at least 7 mitotic division figures in 10 contiguous fields of vision (400x)
  + at least 3 bizarre nuclei in 10 contiguous fields of view (400x)
  + at least 10% of cells differ in nucleus size at least twice from others (karyomegaly criterion)
  + at least 3 polynuclear cells (at least 3 nuclei) in 10 contiguous fields of view (400x)

**Subcutaneous mastocytoma**

* Kiupel’s classification applies only to cutaneous mastocytomas
* subcutaneous mastocytoma is, in most cases, a tumour of low malignancy, in about 10% of cases an aggressive course of the disease is observed
* an aggressive course of the neoplastic disease should be suspected in case of:
  + increased mitotic index (more than 4 mitotic figures in 10 fields of view)
  + presence of bi- or polynuclear cells
  + old age of the animal
  + absence of metachromatic granules in the neoplastic cell cytoplasm
  + highly infiltrating tumour
* Boxers are a breed predisposed to the emergence of new neoplastic foci

**Mast cell neoplasms (mastocytoma) in cats**

* occurs in three histological forms:
  + benign, well-differentiated mastocytoma
  + atypical mastocystoma with a low granular content
  + pleomorphic mastocytoma
* although most cutaneous mastocystomas in cats are benign tumours, a small percentage of the tumours may demonstrate a more aggressive course; the negative prognostic factors are:
  + mitotic index of at least 5 mitotic figures in 10 fields of view
  + presence of numerous skin tumours (at least 5)
  + metastases to regional lymph nodes
  + low-to-moderate number of cytoplasmic granules.
* rarely, cutaneous mastocytoma can result from the spread of mastocytoma originally found in the internal organs
* mastocytoma is a quite common primary splenic neoplasm in cats, it can also occur within the gastrointestinal tract