

Common skin tumors of dogs and cats
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Learning objectives

- Be able to determine if a skin lesion is inflammatory or neoplastic
- Be familiar with common skin tumors in dogs and cats
- Be able to link keywords from the pathologist report to the patterns of growth of common skin tumors in dogs and cats

Outline of presentation

- Simple approach to the diagnostic evaluation of skin cytology
- Common epithelial skin tumors
- Common mesenchymal tumors
- Common round cell tumors

As we go along the lecture, we will try to apply these principles in the different examples that I provided.

Differentiating between inflammatory and neoplastic conditions

- Determine if inflammation is present
 - Presence of neutrophils
 - Presence of lymphocytes, plasma cells or macrophages
- Determine if the inflammatory process is dominant
 - If yes then describe (suppurative, pyogranulomatous, granulomatous, eosinophilic, etc.)
 - If not then...
 - Determine if the majority of cells are epithelial
 - Epithelial cells are in clusters
 - Epithelial cells have cohesive cell to cell borders
 - Determine if the majority of cells are mesenchymal
 - Mesenchymal cells are in aggregates
 - Often spindled
 - Determine if neoplastic cells are round

Epithelial skin tumors

Bowenoid In-Situ Carcinoma (BISC)

Biology

Common in cats older than ten years. One case report in a dog. There is an association between papillomaviruses and BISC in cats (approximately 45% positive

immunohistochemically). About 22% of cases are immunohistochemically positive for FIV/FeLV. About 17% develop into squamous cell carcinoma.

Gross appearance

Multifocal heavily crusted plaques and verrucous lesions that can occur anywhere in the body. In areas of pigmented skin, it is usually heavily mineralized.

Cytologic features

Cytologic features of epithelial dysplasia and neoplasia such as large nucleus relative to the cytoplasm, prominent nucleoli, cytoplasmic vacuoles, dyskeratosis

Histology

Full thickness dysplasia across all layers with a notable loss of nuclear polarity, variable cell size, variable cell and nuclear shape. There is no evidence of invasion through the basement membrane. Low-moderate mitotic index. Additional features: hyperplasia with broad rete ridges, hyperkeratosis, serocellular crusts

Squamous cell carcinoma

Biology

Squamous cell carcinoma is the most common malignant neoplasm of the skin in cats and the second most common in dogs, following mast cell tumor. Often solar-induced, and there is a potential involvement of papillomaviruses in cats. Occurs most frequently in sun-damaged skin and may be preceded by actinic keratosis.

Gross appearance

Have different morphologies: plaques, ulcerated craters, papillary, or like ringworm. Can be several millimeters to several centimeters in diameter. Alopecia, erythema, ulceration, and crusting are often present.

Distribution in cats: nasal planum, pinnae, and eyelids.

Distribution in dogs: ventral abdomen, ventral flanks, and medial stifles.

White cats have 13 times increased risk; similarly, Dalmatians, Pit Bull Terriers, harlequin Great Danes, and Beagles have a higher risk.

Cytologic features

Cohesive clusters of polygonal cells. Large N/C ratio. Pale blue cytoplasm, bizarre nuclei, nuclear molding, large nucleoli

Histology

Tumor cells breach the basement membrane. Tumor cells form islands, cords, and trabeculae, have prominent intercellular bridges and are usually contiguous with the overlying epidermis. Keratin pearls (concentric lamellae of keratin) are characteristic of SCC. Poorly differentiated tumors may only show keratinization of individual cells.

Tumor cells have abundant and eosinophilic cytoplasm and vesicular nuclei with one or multiple prominent nucleoli.

Tumor cell invasion is usually associated with marked fibrosis of the dermis. There are often many mitoses, and it is associated with the degree of anaplasia.

Most carcinomas are positive for cytokeratin.

Sebaceous gland adenoma

Biology

Very common in dogs, less common to uncommon in the cat. Breeds at increased risk are English Cocker Spaniel, Cocker Spaniel, Samoyed, Siberian Husky, Cock-a-poo, Alaskan Malamute, West Highland White Terrier, Cairn Terrier, Dachshund, Miniature Poodle, Toy Poodle, and Shih Tzu. There is no sex predilection. Persian cats are predisposed too. In the dog the tumors tend to be on the head, in the cat, they tend to be on the head, back, and tail, and can be multicentric.

Gross appearance

The tumors are often nodular, exophytic, multilobular, and greasy, and may extend to the dermis and subcutis. There is often alopecia and ulceration with secondary infection. Some of these tumors are hyperpigmented, but most often they are pale yellow to white.

Cytologic features

Clusters of cohesive sebocytes that have ample amount of vacuolated, pale basophilic cytoplasm. The vacuoles are discrete. Nuclei are round, central and have bland chromatin with an occasional central round basophilic nucleolus.

Histology

The mass arises from the dermis, often exophytic, non-encapsulated, well circumscribed, multilobulated, expansile, densely cellular. Thick collagenous stroma supports the neoplasm. Neoplastic cells have mild to moderate amounts of vacuolated cytoplasm, a single central, round nucleus, with stippled chromatin and a single round basophilic nucleolus. There often moderate numbers of mitoses. There is almost always chronic inflammation surrounding the neoplasm.

Follicular skin tumors

Biology

Follicular tumors are common in dogs and cats. This category includes trichoblastoma, infundibular keratinizing acanthoma (IKA), trichoepithelioma, tricholemmoma, and pilomatricoma, depending on location in the hair follicle from which the tumor arises. There are also rare malignant forms of trichoepitheliomas and pilomatricomas.

IKA arises from the infundibulum. Trichoepithelioma arises from the external root sheath. Pilomatricoma arises from the hair matrix cells. Trichoblastoma arises from germ cells

Most of these are benign, and excision is curative. IKA is a cystic lesion that commonly occurs in dogs. The Norwegian Elkhound, German Shepherd, and Terrier breeds are predisposed. Trichoepitheliomas are common in dogs and less common in cats. Breed predisposition includes Setter dogs and Persian cats. Tricholemmoma is uncommon in dogs and rare in cats. Pilomatricoma is also uncommon and breeds that have higher incidence include Poodles, Kerry Blue Terriers, Bedlington Terriers and Schnauzers.

Gross appearance

IKA- Solitary, firm, cystic and alopecic nodule that has a central pore. Often on the back and trunk, and less commonly in the neck or tail.

Trichoepithelioma- firm, white, multilobulated on the back, neck, thorax, and tail.

Tricholemmoma- Most commonly on the head; nodular, encapsulated and alopecic.
Pilomatricoma- like trichoepithelioma. Heavily mineralized. Solitary, solid, cystic, alopecic, occasionally ulcerated.

Cytologic features

Keratin debris and fragments of hair are characteristics. Inflammation is often common as the hair fragments induce pyogranulomatous inflammation.

Histology

IKA- central cavity lined by squamous epithelium with progressive keratinization, no ghost cells, central keratin debris. There is often granulomatous or pyogranulomatous reaction in the surrounding dermis.

Trichoepithelioma- islands of basaloid cells with gradual and abrupt keratinization and ghost cells. There is often granulomatous or pyogranulomatous reaction in the surrounding dermis.

Tricholemmoma- lobules surrounded by distinct basement membrane with some central tricholemmal keratinization. There are no ghost cells.

Pilomatricoma- multiple layers of basaloid cells with abrupt keratinization and large amounts of luminal ghost cells

Apocrine gland tumors

Biology

Relatively common adnexal skin tumor in cats, whereas it is the least common adnexal skin tumor of dogs.

A solitary nodule that can be hyperplastic, adenomatous or malignant.

Great Pyrenees, Chow Chows, Malamutes, Old English Sheepdogs, and Persian cats are predisposed for simple adenomas.

Persian and Himalayan are predisposed to have multiple cystadenomas on the eyelid or ear canals.

Adenomas are frequently located on the head, neck, and dorsal trunks in dogs and head in cats.

Apocrine gland adenocarcinomas are uncommon and occur on the legs of dogs and the head, abdomen, and leg of cats.

Gross appearance

Cystic and/or papillary.

Cytologic features

Round nuclei that are often bland and have ill-defined cytoplasmic borders and are 'sweeming' in a 'sea' of pale basophilic cytoplasm.

Histology

Well circumscribed, nonencapsulated, dermal masses forming cysts, acini, tubules, lined by a single layer of cuboidal epithelial cells with moderate eosinophilic cytoplasm and apical blebbing. Sparse collagenous stroma support the tumor and there is occasionally secondary pyogranulomatous inflammation surrounding the neoplasm.

Mesenchymal skin tumors

Lipoma / liposarcoma

Biology

Common benign tumor of dogs. Higher incidence in cocker spaniels, dachshunds, Weimaraner, Doberman Pinschers, Miniature Schnauzers, Labrador Retrievers and small terriers. There is also increased incidence in obese female and middle-aged to older dogs and cats.

Infiltrative lipoma is uncommon and has a higher incidence in Doberman Pinschers, Labrador Retrievers, and Standard Schnauzers. Locally invasive, and often recur following incomplete excision.

Liposarcoma is rare, locally invasive but not very metastatic. Dachshunds, Shetland Sheepdogs, and Brittany Spaniels are predisposed.

Gross appearance

Lipomas are well-circumscribed, soft, movable, subcutaneous masses.

Infiltrative lipomas / liposarcomas are poorly circumscribed, soft, deep masses that are attached to surrounding tissue.

Cytologic features

Lipomas consists of 'normal' adipocytes. Don't stain well. Infiltrative lipomas infiltrate adjacent structures (muscles).

Liposarcomas –round to spindle cells, central nucleus, and vacuolated cytoplasm. Can be multinucleated.

Histology

Lipomas have a thin fibrous capsule and are well circumscribed, nodular, expansile masses.

Infiltrative lipomas are similar to lipomas but infiltrate adjacent tissues.

Liposarcomas are poorly circumscribed, nonencapsulated, nodular, densely cellular, invasive masses.

Round cell skin tumors

Mast cell tumor

Biology

Common in dogs and cats. Mutations in the protooncogene c-kit, which encodes a receptor for stem cell factor, may have something to do with development and progression of the tumor. KIT expression is inversely associated with the degree of differentiation of canine mast cell tumors.

There is no sex predisposition in dogs, and the tumors appear in dogs 8-year of age and older. Certain breeds such as Boxers, Boston terriers, English bulldogs, fox terriers, bull terriers, Labrador retrievers, dachshunds, beagles, pugs, golden retrievers, Weimaraners and Shar-Pei dogs have an increased risk for developing mast cell tumors, with the Shar Pei developing it at a younger age and multicentrically. In the dog, the distribution is usually trunk and limbs and less frequently head and neck.

In cats, Mast cell tumors are usually benign and involve the head and neck region. Pleomorphism and infiltrative growth do not correlate with malignancy as in the dog.

25% of dogs have a metastatic mast cell tumor and will have metastases in the lymph nodes (i.e., more than 3% of all cells in cytology).

Gross appearance

Tumors can be solitary or multicentric. They are nodular, firm and occasionally ulcerated. They can be dermal or subcutaneous.

Cytologic features

Large round cells with high N/C ratio and well-defined cytoplasmic borders. The granules of the neoplastic cells do not stain well with Diff-Quick. Finely stippled chromatin with prominent round nucleoli.

Histology

Unencapsulated poorly circumscribed, densely cellular, nodular, expansile and infiltrative to invasive, which maintains a Grenz zone. The neoplastic cells are arranged in solid sheets and supported by edematous collagenous stroma. Eosinophils often infiltrate the neoplasm.

Grading systems

Patnaik grading scale

Grade 1 (well differentiated): Small, well-circumscribed, superficial dermal, well-differentiated mast cells with no mitotic figures; and moderate to high numbers of eosinophils

Low chance of recurrence and 3.5-year survival rate of approximately 90%.

Grade 2 (intermediately differentiated): Larger, dermal to subcutis, not well-circumscribed, large to slightly pleomorphic neoplastic cells, with 0-2 mitoses per HPF, and fewer eosinophils

Low to moderate metastatic rate and 3.5-year survival rate of approximately 55%.

Grade 3 (poorly differentiated): Large, ulcerated, poorly-circumscribed, often extend into the subcutis, with sparsely granulated, highly pleomorphic cells with 3-6 mitoses per HPF and very few infiltrating eosinophils.

High metastatic rate and a 3.5-year survival rate of approximately 15%

2-Tier histologic grading system for cutaneous Mast cell tumors

High-grade MCT: 7 or more mitotic figures in 10 hpf; at least three multinucleated (3 or more nuclei) cells in 10 hpf; at least three bizarre nuclei (indented, segmented) in 10 hpf; karyomegaly of at least 10% of neoplastic cells vary by at least two-fold

High-grade MCTs were significantly associated with shorter time to metastasis or the development of new tumor/s, and with MST of less than 4 months (more than two years for low-grade MCTs)

Subcutaneous Mast cell tumors

Infiltrative growth pattern, multinucleated cells and >4 mitoses per 10 HPF are associated with decreased survival.

Prognostic markers

Increased expressions of AgNOR, PCNA, and Ki-67 have been associated with a poorer prognosis

Cutaneous histiocytoma

Biology

Benign tumor of young dogs. Can be seen in older dogs. Tend to regress spontaneously and rarely metastasizes.

Breed predisposition: Boxer, Dachshund, Scottish Terrier, Bull Terrier, Boston Terrier, English Cocker Spaniel, Flat-Coated Retriever, Doberman Pinscher, Shetland Sheepdog, Rottweiler, and great Dane

No sex predilection

Distribution: head, pinnae, muzzle, forelegs.

Gross appearance

Solitary, firm, button-like or dome-shaped nodular mass that is erythematous and ulcerated. Most often < 2 cm in diameter.

Cytologic features

Large round cells with pale cytoplasm and circumferential cytoplasmic clearing. Nuclei are pale eosinophilic and stippled.

Histology

Nonencapsulated, poorly circumscribed, wedge-shaped, densely cellular, infiltrative mass that occasionally infiltrates the papillary dermis and composed of sheets of round neoplastic cells with mild amounts of pale eosinophilic cytoplasm, single round to reniform nucleus with stippled chromatin and a single nucleolus. There are often many mitotic figures. There is a variable degree of infiltration by lymphocytes and plasma cells. The epidermis is often hyperplastic, with prominent rete ridges.