Disorders of Cell Growth & Neoplasia

Lecture 2
Neoplasia: Definitions & terminology; Benign tumors

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Neoplasia/Neoplasm = new growth (a purposeless, heritable altered growth of tissue that tends to be atypical, autonomous and aggressive)

Tumor = historically referred to any swelling; now synonymous with neoplasm.

Oncology = the study of neoplasia.

Oncogenesis = the causation or production of neoplasia.

Cancer (“crab”) = common term for all malignant neoplasms (human medicine).
"cancers adhere to any part that they seize on in an obstinate manner, similar to a crab"
"infiltrative growths that extend crab-like feet into adjacent tissues"
"radiating dilated veins often do appear over and around a bulging tumor resembling the claws of a crab"

"A tumor is an abnormal mass of tissue, the growth of which exceeds and is uncoordinated with that of the normal tissue and persists in the same excessive manner after cessation of the stimuli which evoked the change." (Willis, 1952)
Terminology

• Inconsistencies persist in the classification of neoplasms.

• The term for a neoplasm must convey whether it is:
  - Benign or malignant
  - Mesenchymal versus epithelial origin.
  - The suffix -oma is almost always present.

**Mesenchymal** = embryonic mesoderm (connective tissue, bone, cartilage, muscle and hematopoietic / lymphatic systems)

**Epithelial** = cells that line surfaces or lumina of organs and form glands
Benign

Mesenchymal (structural / connective tissues, vessels):

lipoma (lipocyte),

fibroma (fibrocyte),

osteoma (osteocyte),

chondroma (chondrocyte),

leiomyoma (*leios*, smooth; *mys*, muscle),

rhabdomyoma (*rhabdos*, rod [striated]; *mys*, muscle),

hemangioma (endothelial cells),

etc.
Benign epithelial:

i) **non-glandular** epithelial proliferations

- papilloma (squamous epithelium)
- trichoepithelioma (hair follicles), pilomatrixoma (hair follicles), etc.

**Esophageal papilloma, bovine.** Note finger-like projections from the surface.
Skin papilloma, bovine. In this low power histologic section note the finger-like projections (fronds or papillae) from the surface of the mass.

Benign

ii) adenoma (adenos = gland):

- cells form recognizable glandular structures:
  (e.g., tubules / acini)
  mammary adenoma
  pulmonary adenoma
  intestinal adenoma
  renal tubular adenoma

- cells derived from glandular tissue:
  (but no tubular / acinar arrangement)
  pituitary adenoma
  hepatocellular adenoma
  adrenal cortical adenoma
Inflammatory polyps, urinary bladder, dog. Note the multiple dark-red protrusions.

- **polyp** = club-shaped hyperplastic growth or benign tumor protruding from a mucosal surface.

**Polyp, small intestine, mouse.** The neoplastic growth arises from the mucosa and extends into the lumen of the intestine. It is supported by a stalk (peduncle) of fibrovascular tissue (s). P = polyp

Malignant

1. mesenchymal:

- **sarcomas:**
  - lipo**sarcoma**,
  - fibro**sarcoma**,
  - osteo**sarcoma**,
  - chondro**sarcoma**,
  - leiomyo**sarcoma**,
  - rhabdomyo**sarcoma**,
  - hemangio**sarcoma**, etc.

2. epithelial / parenchymal:

- **carcinoma:**
  (no glandular patterns)
  - squamous cell carcinoma
  - pituitary carcinoma
  - hepatocellular carcinoma
  - adrenal cortical carcinoma

- **adenocarcinomas:**
  (glandular patterns)
  - bronchoalveolar adenocarcinoma
  - mammary adenocarcinoma
  - intestinal adenocarcinoma

*Karkinos* (crab) ➔ *karkinoma* ➔ epithelial cancer
Malignant

Inconsistencies:

lymphoma (or lymphosarcoma) = malignant tumor of lymphoid tissue.

leukemia = malignant neoplasm of blood-forming tissues.

melanoma (or malignant melanoma) = a malignant tumor of melanocytes.

melanocytoma = benign tumor of melanocytes.

Melanoma, skin, horse.
Mixed Tumors

- the majority of neoplasms are composed of cells representative of a single germ layer, and a single cell type.
- mixed tumors contain more than one cell type, but all derived from one germ layer.

° Mixed Mammary Tumor
  - relatively common in dogs.
  - contains both epithelial and mesenchymal elements.

Diagram of a secretory acinus.

Benign mixed tumor of mammary gland, canine.
Benign mixed tumor, canine. Gross: cut surface showing areas of bone and/or cartilage (arrows) that may be firm or hard. Microscopically, it contains glandular structures (G), myxoid tissue (M), cartilage (C) and bone (B).
Teratomas

- a variety of tumor cell types representative of more than one germ layer.
- possibly arise from pluripotential embryonic cells; in the **gonads**.
- these cells differentiate into various types of tissues.

**Ovarian teratoma**, canine. Grossly the tumor consists mostly of fibrous-like tissue with several cyst like structures evident. Note the aggregates of hair some cavitated areas of the mass.

**Ovarian teratoma**. Cystic (cavitated) mass containing hair usually admixed with sebaceous material and keratin. Dental structures may be present sometimes (not in this case).
Microscopic appearance of teratomas. These tumors may be composed by a variety of tissues such as: cartilage (C) keratin (K) from stratified squamous epithelium (S), mucous epithelium (M), nervous tissue (N), melanocytes (arrow), etc.
Benign vs Malignant Neoplasms

**Benign**

“after they have been removed, the patients can forget about them”

- well differentiated cells & architecture (closely resemble the tissue of origin)
- cohesive & expansile masses that remain localized
- grow slowly; may cause compressive atrophy of adjacent parenchyma.
- may have a fibrous capsule (from the surrounding compressed stroma)

**Thyroid (follicular cell) adenoma**, equine. Note: well demarcated (arrows) and compression atrophy of adjacent thyroid tissue (A) is evident on histology (right). T = tumor
Leiomyoma of the uterus. This benign, well-differentiated tumor contains interlacing bundles of neoplastic smooth muscle cells that are virtually identical in appearance to normal smooth muscle cells in the myometrium.

Benign tumor (adenoma) of the thyroid. Note the normal-looking (well-differentiated), colloid-filled thyroid follicles.

Subcutaneous lipoma, dog. Exophytic skin mass (top, left). *Histo:* The tumor is composed of normal looking lipocytes (top, right)

Liposarcoma, dog. The tumor is composed of poorly differentiated lipocytes. Fat vacuoles are very scant (bottom, right)

- exceptions – extramedullary plasmacytoma is anaplastic, yet benign behavior
Benign tumors may regress; e.g., cutaneous papillomas, cutaneous histiocytoma.

- Other benign tumors may slowly progress to malignancy, e.g., colonic adenomas.

**Colonic polyp.** This benign glandular tumor (adenoma) is projecting into the lumen.

**Colonic adenomatous polyps** are relatively common in humans and dogs. If not removed, these can progress to colonic adenocarcinoma.

Benign

- some benign neoplasms may have serious, consequences:
  1. tumors of the brain (space-occupying lesions)

**Intracranial meningioma**, cat. Note meningioma attached to the dura matter with compression of the cerebellum (arrow).

**Meningioma**, dog. Even small size tumors can have serious consequences because of its critical location. Note well circumscribed meningioma (M) compressing a cerebral hemisphere.
Some hormone-producing tumors, e.g., insulinoma, adrenal cortical adenoma.

**Adrenal cortical adenoma.** It may cause hyperadrenocorticism (Cushing’s syndrome) due to an excessive production of glucocorticoids.


**Insulin-producing islet cell tumor (insulinoma),** pancreas. These neoplasms may be benign but life-threatening by causing severe hypoglycemia and seizures.

Pedunculated lipoma equine. Although these lipomas (L) are benign, because they are attached by a long narrow stalk (peduncle, arrow), they can often wrap around and strangulate segments of bowel (as in above photo).