Pathology of the Domestic Ferret

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Mustela putorius furo (domestic ferret)

• Males average 2.5 pounds
• Females average 1.25 pounds
• Usually purchased neutered and desented
• Males - hobs or gibs
• Females - jills or sprites
• Lifespan - 7-8 years
Canine Distemper

- 100% fatal in ferrets; 12-45 day progression
- Most commonly seen in pet store kits or as a facility outbreak
- Diagnosis should be made on clinical signs, followed by euthanasia of all affected animals
- Antemortem FA testing available but not recommended.
Canine Distemper

- Oculonasal Discharge
- Hyperkeratosis of Nasal Planum and Footpads
- Skin rash
- Diarrhea
- Weight loss
- Lethargy
- Pneumonia
Canine Distemper

Hyperkeratosis of Nasal Planum and Footpads
Rabies

- Uncommon disease
- Less than 50 diagnosed cases
- Ferret susceptible to skunk, bat, and raccoon strains
- Dumb and furious presentations
- Should be a ruleout for all neuro cases.

Negri bodies in mink brain

Rabies

- No treatment
- Quarantine period in most states
- Annual IM vaccination for all ferrets beginning at 15 weeks
  - Imrab-3 vaccine

Neural Tube Defects

- Color diluted ferrets
- Varying degrees of:
  - Genes of cerebrum
  - Spinal dysraphism
- Often associated with:
  - Other birth defects
  - Intra-uterine growth retardation

Growth retardation and NTD's in ferret kits
Neural Tube Defects

Iniencephaly

- Anencephaly
- Anencephaly
- Craniorachischisis
- Cervical vertebral fusion
- Other birth defects

Iniencephaly in a color-diluted ferret kit

Gastrointestinal System
Megaesophagus

• Uncommon disease
• Primary middle-aged males
• No apparent cause
• Treat as other domestic species
Helicobacter mustelae

- Diagnosis
  - Most readily made from pyloric biopsies
  - Characteristic L-P gastritis
  - Argyrophilic extracellular spiral bacteria associated with mucus superlayer or within crypts
- Diff-Kwik on endoscopic or surgical biopsy impression

Lymphofollicular gastritis in ferret with *H. mustelae* (HE, 20X)

Gastric Ulcers

- Common in ferrets and other mustelids under stress or with concurrent disease
- May be associated with *Helicobacter mustelae*
- Hemorrhage associated with non-lethal ulceration
Ferret Coronavirus
• "Epizootic catarrhal enteritis (ECE)"
• High morbidity, low mortality
• Asymptomatic carriers – often pet store kits.
• Older animals more severely affected
• Prolonged shedding of virus

**Pathogenesis**
- Viral infection of villar tips
- Necrosis of cells
- Loss of surface area and brush border enzymes
- Passive secretory diarrhea
- Malabsorption
- Mucus hypersecretion
Ferret Coronavirus
Chronic Lesions
• Last up to one year post infection
• Villar atrophy
• Villar atrophy, fusion, and blunting
• Lymphocytic enteritis

Ferret Coronavirus
Acute Lesions
• Vacuolar degeneration and necrosis of villar tip enterocytes
• Villar blunting

Jejunum of ferret with ECE with villar atrophy, fusion and blunting and lymphocytic enteritis
Proliferative colitis

Clinical signs

• Frequent, painful defecation
• Frank blood or mucous in stool
• “Cobblestone” appearance to colon in ferret with PC stool
• Anorexia
• Weight loss
• Abdomen painful on palpation
• Clinical signs exacerbated by stress
• May progress to anemia, death.

Proliferative colitis

Treatment

• 50 mg/kg Chloramphenicol palmitate orally BID
GI Parasites

• Coccidia

• Giardia lamblia in a domestic ferret

• Nematodes – rare

• Yeasts - commensal

Coccidiosis

• Eimeria furonis, E. ictaluri

• Generally asymptomatic

• Villar blunting and loss due to coccidiosis

• Generally asymptomatic, but may be life-threatening in young kits or severely affected animals

• Fecal floatation
Gastrointestinal foreign bodies

• Very common in ferrets
• High index of suspicions in ferrets less than 1 year of age

NO house is completely ferret-proofed!

• May be seen in bored, caged ferrets.
• Latex, rubber, cloth most popular
Gastrointestinal foreign bodies

- Hairballs - Less common than Ferret trichobezoars!
- Traditional foreign bodies
- Foreign bodies rarely show up on radiographs

Electrical cord injury

Mycobacterium avium-intracellulare
- Chronic wasting disease in ferrets
- Minimal zoonotic potential
Clostridium perfringens

Squamous cell carcinoma

- Most commonly seen in skin, but may arise from oral epithelium
- Predilection to invade jaw bones
- Radical surgical excision is only documented cure
- Low metastatic potential, but massive tissue destruction.

Extensive mandibular involvement by SCC
Hepatic lipidosis

Fatty livers

- Common physiologic finding
- Due to inanition and mobilization of peripheral fat stores

Fatty Liver in a Ferret
Hepatic tumors
• High percentage of malignancy in this organ
• Lymphoma most common
• Primary neoplasms exhibit slow growth

Hepatic carcinoma in a ferret (Photo courtesy of Dr. Renato Miracca)

Hepatic Tumors
Hepatic Neoplasms

Large biliary cystadenoma in ferret liver affecting multiple lobes (Photo courtesy Charles Weiss)
Islet cell tumor

- Most common ferret tumor
- May be function or non-functional
- Inappropriate secretion of insulin resulting in “trances”, hindlimb paresis, salivation, seizures and coma.
- Benign progression
Islet cell tumor

Diagnosis

• History and clinical signs
• Blood glucose test
  60-80 g/dl - questionable
  <60 positive
• Insulin testing generally not necessary

Normal pancreas in a ferret (note gastric and jejunal arms)

Islet cell tumor

Histology does not correlate with behavior

Watch out for pancreatic nodular hyperplasia!

Adrenal-associated endocrinopathy

• Extremely common
• Due to hyperestrogenism, not Cushin g
  s!!!
• Proliferative lesions (hyperplasia, adenoma, carcinoma have identical clinical signs)

Classic bilateral truncal alopecia in ferret with AAE
On the adrenal cortical cells are LH receptors that are activated after neutering by high LH levels.
Splenomegaly

- Commonly seen, especially in older ferrets
- Stereotypical response to chronic smoldering inflammation
- Less than 5% are neoplastic

Marked splenomegaly in a ferret

Splenomegaly

- 95% are benign extramedullary hematopoiesis
- Splenectomy is treatment of choice.

Splenic extramedullary hematopoeisis in enlarged ferret spleen

Malignant lymphoma (Lymphosarcoma)

- Most common malignancy in ferrets
- 1-2 years - Juvenile (Lymphoblastic) - visceral (Lymphoblastic) distribution
- 2-7 years - Lymphocytic - lymph node distribution
- 2-7 years - Immunoblastic polymorphous

Juvenile lymphoma in a young ferret
Malignant lymphoma (Lymphosarcoma)  

Diagnosis  
- Clinical signs  
- Organ-specific changes in clinical pathology data  
- Biopsy of enlarged lymph node or organ  

Can not diagnose on CBC alone!!!

Malignant lymphoma (Lymphosarcoma)  

Aspirates  
- Good for preliminary, but not definitive diagnosis  
- Can be extremely difficult to interpret  
- Histo required for definitive diagnosis

Treatment  
- Poor prognosis except in primary cutaneous cases  
- Chemotherapy regimes available, but less than 10% respond.

Renal lymphosarcoma in an adult ferret
Aleutian Disease

- Resurgent disease in ferrets – new strain?
- New outbreaks have almost 100% morbidity and mortality.
- Insidious disease with long latency period
- Death in 2-3 years, as opposed to mink (strain variation?)

Characteristic appearance of glomerulonephritis in ADV-infected ferret
Aleutian Disease
Hematuria in ADV-infected ferret

Avecon POCT
Coronaviral-Associated Granulomatous Disease

Gross lesions resemble FIP. FeCoV antigen has been identified in lesions.

Coronaviral-Associated Granulomatous Disease

Mostly young male ferrets

Hypergammaglobulinemia (>6.0), leukocytosis, mild anemia
Hemangiosarcoma

• Low metastatic potential for skin tumors
• Moderate metastatic potential for visceral tumors

Solid hemangiosarcoma in a ferret spleen (Photos courtesy of Robert Monaco, DVM)

Hemangiosarcoma

• May arise in any organ
• Neoplasms of blood vessels
• Often result in hemorrhage
Cystic Prostatic Disease

- Sequelae to adrenal disease in male ferrets
- Dysuria, but easily expressed
- Estrogen effect on glandular epithelium
- Adrenalectomy is curative
• Very common in older ferrets
• Triangular areas of cortical scarring containing obsolescent glomeruli
• Not infarcts
Estrus-associated Anemia

Signs referrable to which line(s) affected in marrow.

Death by severe anemia is most popular.
Cardiovascular System
Cardiomyopathy
• Common in American bloodlines
• Genetic with incomplete penetrance

Dilatative cardiomyopathy in a ferret with biventricular enlargement and passive hepatic congestion
Cardiomyopathy
Marked pleural effusion in ferret with cardiomyopathy
Cardiomyopathy
In fulminant cases, may see active myocardial necrosis
Aspiration pneumonia
Endogenous lipid pneumonia
Common incidental finding which is misinterpreted

Influenza
• Can contract both Type A and Type B influenza from humans
• Symptoms similar to human, but slightly more severe and longer lasting
• Symptomatic treatment only if anorexic
• May use antihistamines to decrease watery nasal discharge
Chordoma

- Most common orthopedic tumor of ferret
- Only on spine
- Develops from primitive notochord
- Most commonly seen at tail tip

Formalin-fixed specimen of chordoma at tail tip.
Osteoma

- Benign tumors of flat bones
- Complete surgical excision curative
Osteoma
Osteosarcoma

• Uncommon malignancies that are most commonly seen on extremities.
• Low malignant potential.

Actinomycosis
Ectoparasites

Earmites (*Otodectes cyanotes*)

Ixodes hexagonus (hedgehog)
Ectoparasites
Demodex sp

Skin Neoplasia
Sebaceous epithelioma
• Often look much worse than they really are
• Don’t believe malignant diagnoses!
Mast cell tumors

- Scaly, flat tumors
- May be multiple
- May be pruritic
- Invariably benign
- Surgical excision is curative.

Skin Neoplasia

Apocrine cysts from ferret prepuce
Skin Neoplasia

Spindle cell tumors – usually arise from smooth muscle
Locally aggressive, slow to metastasize
Brain Tumors

• Uncommon
• Astrocytomas most common
• Tend to cause progressive dysfunction as tumor grows
• Seizure activity
• Coma

Diagnosis and therapy are difficult. Meningioma compressing brainstem in a ferret (Photo courtesy of Mike Garner, DVM)