

Report Start Date
14/Dec/2022

Necropsy Case Report

Report End Date
14/Mar/2023

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4004903 | Puma / *Puma concolor* | TCW22-34902 Individual
Sex: Male Birth Date: 01/Jan/2010 +/- 1 year Age at Submission Date: 12Y,11M,16D +/- 1

Case Info		
Case Number		
0069554		

Necropsy Submission						
Death Date	Date Submitted	Date Discovered		Manner of Death	Carcass Weight	Death Location
17/Dec/2022	17/Dec/2022	-		Euthanasia	-	NC99100 Harter Enclosure Group

Recent History/Observations
Mountain Lion from the LA area, P-22. Age estimated around 12 years old. Free-ranging but was losing body condition, changing behavior. Immobilized in the field by CDFW and brought to LA Zoo for diagnostics. Then brought to Safari Park for further evaluation. CT and various other diagnostic testing revealed diaphragmatic hernia with herniated liver parenchyma and omentum. Renal insufficiency also suspected, along with possible myocardial disease. Diffuse ectoparasitism with *Demodex gatoi* also identified. Euthanasia was pursued at the decision of CDFW, and was performed with IV pentobarbital.
After euthanasia, testicles were removed for gamete recovery.

Death Numbers		
Death Number	Effective Date	
0069554	17/Dec/2022	

Gross Necropsy			
Necropsy Date	Carcass Condition	Necropsy Location	
17/Dec/2022	Fresh	SANDIEGOZ NECROPSY LAB	
Report Date			
17/Dec/2022			

Sex: Male

Birth Date: 01/Jan/2010 +/- 1 year

Age at Submission Date: 12Y,11M,16D +/- 1

Received is a 44 kg, adult male mountain lion (puma) in fresh postmortem and good to fair body condition with mild generalized muscle atrophy and small to moderate fat stores. There is patchy alopecia and poor hair coat along the ventral neck, face, ears, distal tail (distal 25 cm), and distal limbs and feet. Two black, hairless, soft, pedunculated skin nodules are present on the dorsal neck which are 2 x 1.3 x 1.2 cm and 1 x 0.9 x 0.4 cm. A 3.6 x 1.7 cm area of alopecia caudal to the right eye also has 2 scabs. The right eye has patchy hemorrhage in the dorsal sclera and conjunctiva, and areas of redness overlying the lateral aspect of the iris within the eye. A small scab is present on the skin over the dorsal aspect of the left eye orbit. Along the right ventral mandible is a 2 x 0.6 cm crusted ulceration with edema and tan discoloration of the underlying subcutis. Areas of alopecia (~5 x 2 cm) are present over both hips, and there is a 1 x 0.8 cm abrasion along the lateral metatarsal region of the right hindfoot. Multiple claws are frayed. There is a 0.5 cm diameter skin incision along the left medial aspect of the stifle (antemortem skin biopsy). Within the right frontal sinus is a small amount of brown clotted blood. The zygomatic process of the right frontal bone surrounding the right ocular orbit has multiple chip fractures with mild associated hemorrhage.

There is mild hemorrhage in the subcutis and muscle along the lateral aspect of the right shoulder and proximal humerus. Some hemorrhage is also present around the left jugular venipuncture site in the neck. Fractures of the transverse process of the 7th cervical vertebra and acromion process of the right scapula noted on CT scan are not readily identified grossly. A thin (<1 mm diameter), approximately 2.5 cm long silver metallic wire foreign body is embedded along the internal aspect of the caudoventral abdominal midline. The reported metallic pellet in the region of the left hip on CT scan is not found.

Negative pressure is absent in the thorax on opening the abdominal cavity. The lungs are diffusely collapsed and pink. The heart is 218.9 g (0.498% of body weight), and the mitral valve leaflets are mildly thickened and smoothly nodular. There is a 3 x 2.5 cm hole in the right ventral aspect of the diaphragm through which a portion of omentum (approximately half) is herniated into the right thoracic cavity. The margin of this diaphragmatic tear is smooth and rounded with no evidence of hemorrhage. An approximately 1 cm diameter dark red nodule also bulges into this tear which is adjacent to a second approximately 5 cm diameter tear centrally in the diaphragm. This tear also has smooth edges, and through it bulges into the thoracic cavity a roughly 9 cm diameter x 4 cm thick section of liver which is discolored and mottled shades of tan, orange and red. There are tight adhesions between the left crus of the diaphragm and the left lateral lobe of the liver. Pleura and connective tissue is tightly adhered to and encapsulates the intrathoracic herniated portion of liver, which appears to be a portion of the left medial lobe or papillary process of the caudate lobe. The cystic duct of the gallbladder is sigmoid in shape. The liver is 1.4 kg (3.2% of body weight), subjectively enlarged with rounded lobe margins, and is diffusely dark tan with a moderately enhanced reticular pattern.

A perihepatic lymph node is mildly enlarged at 7 x 1.5 x 0.7 cm, and the mesenteric lymph nodes are similarly prominent. The spleen is diffusely enlarged, dark red, and congested (presumed euthanasia artifact). The medullae of both kidneys have mild pale tan streaking to the renal crests. Numerous long cestodes are present throughout the small intestine. In the dorsal peripheral aspect of the left thyroid gland is a soft, brown, 0.9 x 0.8 x 0.7 cystic nodule filled with brown cloudy fluid.

crown-rump: 110 cm

subcutaneous fat amount: small
pericardial fat amount: small
abdominal fat amount: moderate

digestive system content:

stomach: full of soft digesta containing abundant fur and some fragments of bone and pieces of hay
small intestine: thick pale yellow fluid and small boluses of fur and hay with numerous long (>20 cm) cestodes
cecum: pasty brown feces containing abundant fur
large intestine: formed feces containing abundant fur

lymph nodes examined: mandibular, axillary, tracheobronchial, mesenteric, perihepatic/peripancreatic

joints examined: atlanto-occipital, right shoulder, left hip, left and right stifles

Preliminary dx:

1. Euthanasia
2. Right eye: mild intra- and peri-ocular hemorrhage
3. Bone, zygomatic process of right frontal bone: multiple chip fractures
4. Right frontal sinus: mild hemorrhage
5. Subcutis and muscle, right shoulder: mild hemorrhage
6. Liver, diaphragm and thoracic cavity: chronic diaphragmatic tears (2) with intrathoracic liver and omentum herniation and entrapment
7. Liver: enhanced reticular pattern
8. Skin, multiple sites (head, neck, distal limbs, distal tail): patchy alopecia and poor hair coat with multiple abrasions, crusts and ulcerations (left and right orbits, right ventral mandible, right foot)
9. Skin, dorsal neck: pigmented skin tags (2)
10. Kidneys: mild medullary streaking
11. Small intestine: cestodiasis, moderate
12. Left thyroid gland: focal cyst
13. Abdominal body wall: foreign body (metallic wire)
14. Good to fair body condition

Sex: Male

Birth Date: 01/Jan/2010 +/- 1 year

Age at Submission Date: 12Y,11M,16D +/- 1

Gross/Preliminary Diagnosis

Diagnosis	Standardized Diagnosis
subcutis, shoulder, hemorrhage	Subcutis, SHOULDER, Hemorrhage
abdominal wall, foreign body	Abdominal wall, Foreign body
euthanasia	euthanasia
diaphragm, thoracic cavity, liver, omentum, herniation, diaphragmatic hernia	Diaphragm, Diaphragmatic hernia, liver, Omentum, Herniation, Thoracic cavity
eye, right eye, sinus, frontal sinus, hemorrhage, trauma	SINUS, Frontal sinus, Hemorrhage, Trauma, Eye, Right eye
skin, alopecia, poor hair coat	Skin, Alopecia, Poor hair coat
small intestine, cestodiasis	Small intestine, Cestodiasis, Parasitism (internal)

Histopathology**Histopathology Report Date**

11/Jan/2023

Tissue Trim Date	Trimmed By	Submission Date	Completion Date	Laboratory	Reference Number

Histopathology Report

Histologic dx:

- Bone, right orbit (zygomatic process of frontal bone): subacute to chronic comminuted fracture with hemorrhage, necrosis, and fibrosis
- Skin, whole body: 1) mild to moderate epidermal hyperplasia and hyperkeratosis with mild multifocal lymphocytic mural folliculitis and perifollicular dermatitis, follicular atrophy and loss, and myriad intrafollicular mites (*demodicosis*, *Demodex* sp.) and dermatophyte hyphae and spores (dermatophytosis); 2) minimal multifocal granulomatous dermatitis with intralesional fungal elements (pseudomycetoma)
- Skin and subcutis, right mandible: focally extensive, chronic, ulceration and draining tract with granulation tissue, pyogranulomatous dermatitis and panniculitis, furunculosis, and intralesional hair shafts
- Skin, dorsal neck: polyp with multiple cystic follicles
- Stomach, pylorus: moderate, subacute, regional, neutrophilic and lymphohistiocytic gastritis with glandular microabscesses and intraglandular spiral bacteria (consistent with *Helicobacter* sp.)
- Liver, herniated region: chronic passive congestion with centrilobular atrophy, perivenous and portal fibrosis, focally extensive lipidosis, and capsular mesothelial hypertrophy
- Liver: acute diffuse centrilobular congestion, lipogranulomas, and mild Ito cell hyperplasia
- Pulmonary vein, lung: subacute luminal thrombus
- Heart, left atrioventricular valve: mild myxomatous degeneration (endocardiosis)
- Arteries and arterioles, heart and kidney: mild multifocal arteriosclerosis and arteriolosclerosis with medial hypertrophy, subintimal fibrosis and amphophilic hyaline material deposition
- Kidney: mild multifocal proliferative glomerulonephritis with glomerulosclerosis, periglomerular fibrosis, hypertrophy of Bowman's capsule epithelium, and minimal multifocal lymphoplasmacytic interstitial nephritis
- Lung: mild multifocal alveolar histiocytosis
- Peripheral blood, whole body: circulating neutrophilia
- Bone marrow: mild myeloid hyperplasia
- Tonsil and lymph node (left axillary): minimal multifocal granulomatous tonsillitis and lymphadenitis with intralesional fungal elements
- Lymph node, mesenteric: minimal to mild multifocal pyogranulomatous lymphadenitis
- Small intestine: luminal cestodes, numerous

ADDENDUM DATED 2023/01/19:

Ancillary test and results:

CAHFS Accession #D2217781 Toxicology results: FINAL

Dx:

Exposure to multiple anticoagulant rodenticides

Exposure to bromethalin

Anticoagulants Screen - Quantitated, Liver

Analyte Result (ppb) Rep. Limit (ppb)

Brodifacoum, 96, 50

Bromadiolone, 530, 50

Chlorophacinone, 87, 50

Coumachlor, Not Detected, 20

Difethialone, 220, 50

Diphacinone, 960, 50

Warfarin, Not Detected, 20

Difenacoum, Not Detected, 20

Bromethalin, Adipose Tissue

Analyte Result (ppb) Rep. Limit (ppb)

Desmethylbromethalin, Trace, 1.0

Sex: Male

Birth Date: 01/Jan/2010 +/- 1 year

Age at Submission Date: 12Y,11M,16D +/- 1

Histopathology Diagnosis

Diagnosis	Standardized Diagnosis
bone, orbit, fracture, trauma	Bone, ORBIT, Fracture, Trauma
heart, endocardiosis, valvular endocardiosis	Heart, Endocardiosis, Valvular endocardiosis
liver, herniation, chronic passive congestion, atrophy	liver, Herniation, Atrophy, Passive congestion
kidney, glomerulonephritis, glomerulosclerosis	Kidney, Glomerulonephritis, Glomerulosclerosis
artery, arteriosclerosis	Artery, arteriosclerosis
skin, acanthosis, hyperkeratosis, folliculitis, demodicosis, dermatophytosis, acariasis, fungal infection	Skin, Folliculitis, Acanthosis, Hyperkeratosis, Fungal infection, Dermatophytosis, Demodicosis, Acariasis
stomach, gastritis, helicobacter	STOMACH, Gastritis, Helicobacter sp.
vein, pulmonary vein, thrombosis	Vein, Pulmonary, Thrombosis

Case Summary

Finalization Date	Relevant Death Info	Primary Body System Affected
15/Feb/2023		

Final Summary

The many lesions identified in this wild mountain lion on postmortem examination are consistent with the extensive clinical work up, history of recent and previous trauma, and reported deteriorating condition. Supporting the diagnosis of recent trauma (hit by car 6 days prior to euthanasia) was the histologic appearance of the right orbital fracture and gross evidence of hemorrhage in the adjacent frontal sinus and right eye. The suspected intraocular hemorrhage was not present in the examined histologic section of this eye, however, which appeared within normal limits. An inflamed tract/wound along the right mandible could also have been related to this traumatic event, though it could also have been more chronic. The diaphragmatic tears, through which omentum and a portion of liver were herniated into the thoracic cavity, appeared to be of much longer duration with smooth margins, mature fibrous adhesions, and chronic changes in the affected liver lobe. These were presumably the result of previous trauma, the exact timing of which cannot be determined from the gross or histologic appearance. Although there was evidence of a degree of chronic vascular compromise to the herniated lobe, the remaining majority of the liver was unaffected and relatively normal histologically.

A presumed major contributor to the deteriorating condition was skin disease. Heavy colonization of hair follicles with dermatophytes and *Demodex* sp. mites was seen in all examined sections of skin (face, neck, hip, foot). These combined infections account for the poor condition of the hair coat and probably some of the systemic inflammatory response evident in the bloodwork and histologically as myeloid hyperplasia and circulating neutrophilia. The intrafollicular location of the *Demodex* mites is more consistent with *D. cati* or the third feline *Demodex* sp. as opposed to *D. gatoi*, which colonizes the stratum corneum. Generalized *D. cati* infections suggest underlying immunosuppression or other disease. A *Microsporum canis* species was identified from antemortem hair samples and is consistent with the fungal/dermatophyte lesions seen, which included both extensive hair colonization and rare microscopic pseudomycetomas in skin, tonsil, and axillary lymph node. The latter finding is interesting evidence of lymphatic spread of the *M. canis* infection beyond the skin, although the lesions were few and small.

Consistent with the advancing age of this animal, there were a variety of relatively mild, non-specific, age-related changes, including valvular endocardiosis, arteriosclerosis, and renal disease. The renal changes seen primarily involved glomeruli and could be related to chronic inflammation (such as from the skin disease) or cardiovascular disease, such as hypertension. Glomerular injury accounts for the reported proteinuria. Findings of undetermined cause and significance included regional gastritis and a small pulmonary venous thrombus. The gastric inflammation involved the pylorus (or possibly the cardia) and was neutrophilic and damaging to the glands, some of which contained *Helicobacter*-type spiral bacteria. No other parasites were seen in the stomach. A specific cause was therefore not identified, but recent stress and *Helicobacter* could have been involved. In the small intestine, moderate numbers of cestodes were probably incidental.

Toxicologic analysis of a liver sample for rodenticides (performed by CAHFS) found 5 anticoagulant rodenticides at varying concentrations as well as a trace amount of bromethalin. Despite exposure to multiple compounds, two at relatively high levels (diphacinone and bromadiolone), there was no evidence of abnormal hemorrhage that would suggest a coagulopathy due to toxicosis. Bromethalin does not typically result in histologic lesions, but no clinical (neurologic) signs of bromethalin toxicosis were reported antemortem.

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Case Info for Husbandry Staff (Husbandry Note)

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Significant Contributors to Death

Diagnosis	Standardized Diagnosis
euthanasia	euthanasia
eye, right eye, sinus, frontal sinus, hemorrhage, trauma	SINUS, Frontal sinus, Hemorrhage, Trauma, Eye, Right eye
skin, alopecia, poor hair coat	Skin, Alopecia, Poor hair coat
bone, orbit, fracture, trauma	Bone, ORBIT, Fracture, Trauma
skin, acanthosis, hyperkeratosis, folliculitis, demodicosis, dermatophytosis, acariasis, fungal infection	Skin, Folliculitis, Acanthosis, Hyperkeratosis, Fungal infection, Dermatophytosis, Demodicosis, Acariasis