57th AAVLD Diagnostic Pathology Slide Seminar

American Association of Veterinary Laboratory Diagnosticians
Kansas City, Missouri
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3:30-6:00PM

Malignant Mesenchymoma in a dog

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Clinical History: A 4 year old cross breed dog was presented to the referring veterinarian with a history of a rapidly growing mass on its dorsum. Fine needle aspiration was performed which indicated a sarcoma with differential diagnoses of soft tissue sarcoma and amelanotic melanoma. Surgical excision was performed and the tissues were submitted for histologic examination.

Microscopic Description: Within sections of haired skin, the dermis and subcutis are infiltrated by a highly cellular neoplasm. The neoplasm is composed of streams and patternless solid aggregates of plump spindle to polygonal cells that contain moderate amounts of pale eosinophilic cytoplasm and single ovoid to irregularly cleaved vesicular nuclei with large prominent nucleoli. Scattered bi-nucleate cells are noted. Rare cells contain intracytoplasmic tan-brown pigment (melanin vs hemosiderin). Cellular pleomorphism and variation in nuclear size are marked. Mitotic activity is counted at 24 in 10 random HPF. There is a narrow Grenz zone and a focal area of ulceration. There is no evidence of junctional activity.

Ancillary Diagnostics: Immunohistochemistry for smooth muscle actin (SMA), CD18, Melan A, S100 and von Willebrand factor (vWF) were performed. Small clusters of neoplastic cells exhibited strong cytoplasmic staining for Melan A. S100 staining revealed equivocal to moderate staining within the Melan A staining clusters and in scattered cells throughout the mass. Approximately 40% of the neoplastic cells exhibited moderate to strong membranous staining for CD18. SMA staining is confined for the most part to those cells surrounding small vessels; however, there is a nodular focus within the mass that does exhibit strong cytoplasmic staining. Neoplastic cells were negative for vWF. Positive controls were all within normal limits.

Comments: Cytologic and histologic examination of this mass revealed a malignant spindle cell tumor of uncertain origin. Immunohistochemistry revealed differentiation into multiple distinct cell lineages (S100 and Melan A- melanoma; CD18 + fibrohistiocytic morphology- histiocytic sarcoma; SMA – leiomyosarcoma). This differentiation into multiple mesenchymal cell lineages within a single mass is indicative of a malignant mesenchymoma. These tumors are rare in veterinary medicine with scattered individual cases reported primarily in dogs[1-4]; although reports also appear in ferrets[4], a guinea pig[3], a bull[3] and an African fur seal[2].

References:

1. Gomez-Laguna et al. 2012. Malignant mesenchymoma of the heart base in a dog with infiltration of the pericardium and metastasis to the lung. J Comp Pathol. 147 (2-3):195-198

2. Laricchiuta et al. 2013. Diagnosis and treatment considerations in a case of malignant mesenchymoma in an African fur seal (*Arctocephalus pusillus*). J Zoo Wildl Med. 44(2):466-9

3. Puff et al. 2011. Malignant mesenchymoma in the nasal cavity of a bull. J Comp Pathol.145(2-3):148-51

4. Petterino et al. 2010. An intra-abdominal malignant mesenchymoma associated with nonabsorbable sutures in a ferret (*Mustela putorius furo*). J Vet Diagn Invest. 22(2):327-31

Fibrocartilaginous embolic myelopathy in a dog

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Clinical History and Gross Examination: A 3 year-old, spayed, female, Yorkshire terrier was presented to the referring DVM with a history of progressive pelvic limb paresis, difficulty urinating and defecating, and hematuria of unknown duration. The dog was euthanized and submitted to the OADDL for necropsy examination. In the spinal column at the level of L2-4 and L6-7, there was slight protrusion of intervertebral disc material into the vertebral canal on both sides of the intact dorsal longitudinal ligament.

Microscopic Description:

Spinal cord: Within sections of caudal thoracic and lumbar spinal cord, the dorsal and lateral funiculi contain relatively discrete, asymmetrical, 1 by 2 mm areas of necrosis characterized by loss of parenchymal cells, vacuolation of neuropil, abundant gitter cells, eosinophilic debris, and hemorrhage admixed with fibrin and edema. Lumens of multiple small caliber vessels within the gray and white matter are occluded by pale, acellular, homogeneous amphophilic material compatible with fibrocartilaginous emboli. Adjacent to necrotic regions, myelin sheaths are often markedly dilated, and axons are swollen, eosinophilic, and homogeneous (spheroids) or lost and replaced by gitter cells (Wallerian degeneration). Neurons near necrotic areas are swollen with pale eosinophilic cytoplasm with loss of Nissl substance (central chromatolysis) and nuclei are often peripheralized.

Diagnosis: Spinal cord, caudal thoracic and lumbar, dorsal and lateral funiculi: Severe, acute, multifocal necrosis with intravascular fibrocartilaginous emboli

Comments: Fibrocartilaginous embolic myelopathy is most commonly identified in large breed dogs, but may occur in small breeds as well. Affected animals typically present with peracute, non-progressive and non-painful asymmetric paresis or paralysis. Frequently, there is a history of recent exercise or trauma preceding the onset of clinical signs. The pathogenesis of this condition is not well defined. Emboli are believed to originate from the nucleus pulposus of an intervertebral disk. Several theories have been proposed to explain how the emboli gain access to the vasculature. They include 1) herniation of nucleus pulposus directly into the vertebral vasculature, 2) presence of arteriovenous anastomoses, 3) neovascularization of degenerating intervertebral discs, and 4) herniation of nucleus pulposus into the marrow cavity of an adjacent vertebral body.

References:

- Thompson K: Bones and joints. *In*: Jubb, Kennedy, and Palmer's Pathology of Domestic Animals, ed. Maxie MG, 5th ed., vol. 1, pp. 156-157. Elsevier Saunders, Philadelphia, PA, 2007
- Summers BA, Cummings JF, de Lahunta A: Degenerative diseases of the central nervous system. *In*: Veterinary Neuropathology, pp. 246-249. Mosby, St. Louis, MO, 1995
- De Risio L, Platt SR. Fibrocartilaginous Embolic Myelopathy in Small Animals. Vet Clin North Am Small Anim Pract. 2010 Sept; 40(5): 859-869.

Embolic mycosis caused by *Mortierella wolfii*

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Signalment and History: A reportedly 5-year-old Holstein cow is submitted for necropsy 5 days after surgical correction of a displaced abomasum was performed. The cow is also reported a being three weeks postpartum with retained placenta treatment.

Gross finding: An approximately 10 cm long, closed, linear surgical incision is present at the right paralumbar fossa associated with a large abscess in the subjacent muscle. There are numerous, firm, tan to brown, slightly raised nodules, ranging from 3 to 12 mm in diameter, scattered throughout the parenchyma of the lung, liver, spleen, and kidneys. The uterus contains opaque fetid fluid and the endometrial surface is diffusely dark green to brown. The brain has multifocal to coalescing malacia and hemorrhages around the ventral aspect of the lateral and third ventricle, midbrain, and rostral brainstem. A blood clot is present within the lateral ventricle.

Histopathologic Findings: Sections of brain, lung and liver have marked multifocal fibrinosuppurative and necrotizing inflammation associated with vasculitis, multifocal thrombosis, and variable numbers of intralesional fungal organisms. Inflammatory cells consist of large numbers of viable and degenerate neutrophils mixed with moderate numbers of macrophages and low numbers of lymphocytes and plasma cells. Affected blood vessels contain dense fibrin thrombi and have brightly eosinophilic fibrinoid mural necrosis with large numbers of mural viable and degenerate neutrophils and surrounding hemorrhage. In the brain, the adjacent neuropil is rarefied and aggregates of neutrophils frequently extend from inflamed vessels. Rare fungal organisms are found within deteriorated vessel walls and free in the neuropil. The pleural surface of the lung and capsular surface of the liver are markedly thickened by abundant fibrin, edema, necrotic debris, and inflammation with variable numbers of fungi. Fungal organisms in the brain, lung, and liver are comparable in morphology and characterized by prominent hyphal forms and fewer rounded yeast-like forms. The hyphae are poorly staining, nonseptate, and approximately 4-8 micrometers in width with irregularly parallel walls, and occasional variable branching.

Additional Testing: The fungal organisms in the lung, liver, and brain stain variably positive for PAS and GMS. Fungal culture was not successful in this case; however, a pan-fungal PCR assay was performed from the formalin-fixed paraffin-embedded liver tissue. The PCR product was submitted to the Research Technology Support Facility at MSU for nucleic acid sequencing, and the DNA sequence identified the intralesional fungus as Mortierella wolfii.

Comments: The Zygomycete, Mortierella wolfii, is the most common causes of bovine mycotic abortion and pneumonia in New Zealand[1]. This saprophytic fungus has a worldwide distribution and is widespread in the environment. Systemic infections of M. wolfii have also been reported in cows and a calf in North America and England[2]. The pathogenesis of abortion is not fully understood. It is most likely that fungi establish a primary focus of infection in the lungs and then spread through the blood to the uterus, resulting in endometritis and abortion. Approximately 20% of aborted cows developed disseminated infection, potentially due to other contributing factors, such as ketoacidosis, immunosuppression, or degree of damage to uterine blood vessels[3]. In our case, it is hypothesized that this cow developed a primary wound *M. wolfii* infection, and eventually resulted in disseminated mycosis, possibly triggered by ketoacidotic condition.

References

1: Davies JL, Ngeleka M, Wobeser GA. Systemic infection with *Mortierella wolfii* following abortion in a cow. Can Vet J. 2010 Dec;51(12):1391-3.

2: Gabor LJ. Mycotic pneumonia in a dairy cow caused by *Mortierella wolfii*. Aust Vet J. 2003 Jul;81(7):409-10.

3: Munday JS, Laven RA, Orbell GM, Pandey SK. Meningoencephalitis in an adult cow due to *Mortierella wolfii*. J Vet Diagn Invest. 2006 Nov;18(6):619-22.

Equine Sabulous Urolithiasis

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History: A 12-year-old, Thoroughbred mare presented with urine scald of unknown duration. A urine cytologic examination was performed and indicated the presence of bacteria, protein, and blood. Cystoscopy was utilized to rule-out uroliths and identified a proliferative, brownish-gray, irregular growth located diffusely along the ventral aspect of the urinary bladder. A urinary bladder biopsy was taken for histopathology.

Histologic findings: Histologically, the bladder lumen contained large amounts of birefringent crystalloid material, small aggregates of mineral and cell debris, and low to moderate numbers of neutrophils. Crystals were frequently spherical to lobulated and had radial striations. A large majority of the mucosal epithelium was absent and was replaced by a small amount of fibrous connective tissue that was occasionally covered by mats of fibrin and neutrophils. The submucosa was mildly fibrotic and diffusely infiltrated with low to moderate numbers of neutrophils and lesser numbers of macrophages. Submucosal blood vessels were frequently congested and lined by hypertrophied endothelial cells.

Diagnosis: The combination of clinical history, provided gross description, and histopathology was consistent with equine sabulous urolithiasis.

Comments: Sabulous urolithiasis is an uncommon form of urolithiasis identified in horses. The disease is named for the large amount of sand-like, crystalloid sediment that accumulates in the bladder; sabulous is derived from the Latin word sabulum, which means sand and gravel. Sediment localizes to the ventral aspect of bladder and can grossly appear proliferative or mass-like. This condition typically occurs secondary to detrusor dysfunction, bladder paralysis, or other conditions that interfere with bladder emptying. Affected horses typically will present incontinent, with hind limb paresis, or ataxic. Prognosis is poor unless the underlying cause is identified and corrected.

Sabulous urolithiasis can be difficult to diagnose by surgical biopsy due to the rarity of the condition, the need for a thorough clinical history and gross description of the lesion, and the frequent submission of poor quality biopsies.

References:

- Keen JA, Pirie RS: 2006, Urinary incontinence associated with sabulous urolithiasis: a series of 4 cases. Equine Veterinary Education 18(1):11-19.
- Reed SM, Bayly WM, Sellon DC: 2004, Obstructive Disease of the Urinary Tract. *In*: Equine Internal Medicine, 2nd ed. Saunders, St. Louis.

Chronic interstitial pancreatitis leading to descending colonic obstruction and colic in a horse

Katharina Lohmann[1] and **Andy Allen**[2]

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Signalment: 13-year-old, Quarter Horse gelding

History: The gelding was presented to the Veterinary Medical Centre (VMC) of the Western College of Veterinary Medicine (WCVM) because it had been colicky for 3 days. While at the VMC, the gelding received IV fluids and various medications to alleviate his clinical signs. Multiple rectal examinations did not identify a cause for the colic and rectal examination became hampered by a distended large colon. The horse became refractory to treatment and was euthanized as the owners did not wish to pursue surgical exploration of the abdomen. The horse was submitted to Prairie Diagnostic Services, Inc., within the WCVM, for post-mortem examination

Gross Pathology: The large intestine, except the descending (or small) colon, was diffusely distended by gas and plant material. A segment of the descending colon was firmly adhered to a firm, 30 cm long by 20 cm wide by 5 cm thick mass located in the dorsal abdomen. The mass was later identified as the pancreas, which was nearly diffusely very firm, pale or cream colored, and composed of prominent 1 to 2 cm lobules.

Histopathology: The pancreas contained a moderately increased amount of interlobular fibrous tissue infiltrated with mild to moderate numbers of inflammatory cells, mostly neutrophils. Most exocrine pancreatic cells were irregular, attenuated and haphazardly arranged. Some exocrine cells appeared to be missing, leaving a space that was partially filled with fine strands of fibrous tissue. Islets were present in normal numbers, but also appeared to be missing a moderate proportion of cells.

Morphologic Diagnosis: Chronic, nearly diffuse, moderate, interstitial pancreatitis

Comments: There appears to be a very limited body of literature concerning pancreatitis in the horse and much of it describes acute, necrotizing pancreatitis or pancreatic necrosis. Descriptions of chronic interstitial pancreatitis in the horse appear in popular textbooks on veterinary pathology, but not in refereed journals. These descriptions suggest that chronic interstitial pancreatitis in the horse is typically not clinically important. In this horse, the changes in the pancreas were as associated with adhesion to the descending colon. The post-mortem findings suggest that this adhesion was the cause of a functional obstruction of the colon and the clinical signs of colic. The cause of chronic interstitial pancreatitis in the horse, and in other domestic animals, is believed to be ascension of intestinal bacteria through the pancreatic duct.

Mononuclear myelitis-neuritis of the cauda equina in a horse

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History: A 15-year-old, male castrated Thoroughbred horse was submitted for necropsy with a history of colic which improved with medical treatment. After 3 days in the hospital, the horse was unable to stand up and the veterinarian decided to euthanize.

Morphologic Findings: No significant gross findings were identified at the necropsy. The brain and spinal cord were completely removed and sectioned every three centimeters. Spinal cord tissues were routinely processed for histology.

Histologic Findings: In the caudal portions of the spinal cord, just proximal to the cauda equina, there is mild perineuronal mononuclear infiltrates and gliosis. Some of these neurons are degenerate, with hypereosinophilic cytoplasm, with focal evidence of neuronophagia. Adjacent to these infiltrates, a few axons are degenerated.

Ancillary Testing: Immunohistochemistry against Equine herpesvirus 1-4 (EHV1-4), West Nile Virus (WNV) and *Sarcocystis neurona* (SN) was performed. Using EHV1-4 antibody, inflammatory cells and endothelial cells resulted positive, and WNV and SN were negative. Additionally, PCR for EHV was performed with nasal swabs and sections of spleen, which resulted negative.

Comments: Based on the clinical and pathological findings, this case was finalized as myelitis-neuritis of cauda equina compatible with Equine Herpesvirus infection. This case presented significant difficulties for diagnosis due to the lack of respiratory signs, absence of thrombo occlusive vasculitis and absence of lesions in other sections of the central nervous system. The lesion was restricted to the cauda equina.

Maple Syrup Urine Disease in a Central Indiana Hereford Herd

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This case report describes identification of Maple syrup urine disease (MSUD) in a Hereford calf. MSUD is a well characterized aminoacidopathy of polled Shorthorn, polled Hereford, and Hereford cattle. Disease has been described in cattle in Australia and Canada but no reports exist of the disease in the United States. Initial suspicion of this disease occurred in a 5-day-old Hereford calf with depression, laterally recumbency, and bilateral nystagmus to the Purdue University Veterinary Teaching Hospital. The calf was subsequently euthanized due to poor prognosis and financial concerns. No gross lesions were observed at necropsy. Histologic abnormalities were confined to the white matter of the cerebellum and consisted of severe spongy vacuolation of myelin (status spongiosus). Vacuoles were empty with the long axis parallel to axons. Virchow Robin's space in the white matter was also variably expanded by increased clear space (edema). Astrocytes in the white matter had an increased amount of eosinophilic cytoplasm (reactive). Microscopic lesions of status spongiosus of the white matter with reactive astrocytes is consistent with many conditions including MSUD. Other conditions considered included many toxic plants and chemicals which were deemed less likely due to lack of exposure, and renal/hepatic disease, which were ruled out as these organs were histologically normal. To confirm suspicion of MSUD, genetic testing was done at Illinois University and revealed that the calf was homozygous for the previously described mutation that causes MSUD. Multiple tissues were submitted to Penn State University and were shown to contain increased concentrations of branched –chain amino acids consistent with a diagnosis of MSUD. To the authors' knowledge, this represents the first confirmed documented case of MSUD in cattle in the United States confirmed with genetic testing.

Leukoencephalomalacia in a Quarterhorse

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Signalment: Nine year old Quarterhorse stallion

History: The horse was in Oklahoma for training and on February 20, 2014 there was a general complaint that the horse was just not right. Two days later he developed neurologic signs including lack of menace response, depression, and head pressing. He arrived in Kansas the following day. One day later he presented to the equine service at the Veterinary Health Center at Kansas State. Physical exam revealed cortical blindness, lack of menace, and continued head pressing. A complete blood count and skull radiographs revealed no significant findings. The menace response returned in the left eye 48 hours after presentation and the horse was able to eat and drink. Due to the poor prognosis the stallion was euthanized.

Gross Findings: Bilaterally, the white matter of the rostral cerebral hemispheres contained multifocal pinpoint 2-3mm areas of necrosis which were surrounded by hemorrhage and rimmed by a zone of yellow discoloration (malacia). Both temporal lobes contained large cavitations ranging in size from 1x1.5x.5cm to 2.5x1.5x1.5cm in approximate diameter.

Histopathology Findings: Within the subcortical white matter and rarely extending into the thalamus, there are regionally extensive, irregular areas of necrosis and cavitation of the neuropil often surrounding and following blood vessels with infiltration by moderate numbers of neutrophils, hemorrhage, and occasional plasma cells and gitter cells. Multifocally, adjacent vessel walls are thickened and surrounded by large numbers of eosinophils, macrophages, lymphocytes, and occasional plasma cells. Adjacent gray matter is edematous, vacuolated, and contains multifocal spheroids and necrotic neurons. The meninges are multifocally expanded by small numbers of eosinophils, macrophages, lymphocytes, and rare neutrophils.

Final Diagnosis: A diagnosis of leukoencephalomalacia was made based on the gross and histologic findings.

Comments: Mycotoxic leukoencephalomalacia is typically seen in horses fed moldy corn for one month or longer. Clinical signs have an acute onset and death usually occurs within 2-3 days, but horses have survived up to a month. The associated toxin is *fumonison B1* which may be found in *Fusarium moniliforme* and *F. proliferatum*. Mules and donkeys may be affected as well. Lesions result from microcirculatory damage and the ensuing ischemia. This horse was reportedly fed sweet feed containing corn while housed at the training facility. Follow-up testing of feed samples was not performed.

References: Maxie M G, Youssef S (2007). Nervous System. In Maxie M.G. (Ed.), *Jubb, Kennedy, and Palmer's Pathology of Domestic Animals* (358-9). Elsevier.

Theiler's disease in a horse

Anabell Montiel-Del Valle, Francisco A. Uzal
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Signalment: 10 year old female Quarter horse

Clinical history: Acute onset of colic and neurologic signs with head pressing. No previous biologic treatment. Histopathology of formalin-fixed liver samples was requested.

Microscopic description: Liver: Diffusely there is massive necrosis characterized by loss of hepatocytes, stromal collapse and replacement by eosinophilic cellular and karryohectic debris. The remaining hepatocytes are often degenerate with swollen, pale and vacuolated cytoplasm, necrotic, with shrunken hypereosinophilic cytoplasm and pyknotic nuclei, or occasionally contain medium to large, distinct, clear intracytoplasmic vacuoles (vacuolar change, lipid type). Hepatic cords are disrupted and separated by multifocal areas of hemorrhage, moderate numbers of Kupffer cells that sometimes contain phagocytized erythrocytes and minimal amounts of intracytoplasmic brown granular pigment (hemosiderin), and scattered lymphocytes and plasma cells. Portal areas are occasionally, mildly expanded by clear space (edema) and contain mildly increased amounts of fibrous connective tissue, few lymphocytes, plasma cells, macrophages, and rare neutrophils.

Morphologic diagnosis: Liver: Severe, diffuse, massive hepatocellular necrosis with stromal collapse, multifocal hemorrhage, lipid type vacuolar degeneration and portal lymphoplasmacytic infiltrates

Comments: Theiler's disease, also known as idiopathic acute hepatic disease, equine serum hepatitis, post-vaccinal hepatitis, acute liver atrophy, acute hepatic necrosis of horses and serum sickness, is the most common cause of acute hepatitis and hepatic failure in horses, and is mostly seen in adults, although occasional cases in horses of 1 year of age and younger have been reported.

Theiler's disease has been associated with the administration of biological products of equine origin. Clinical signs are usually observed between 4 and 12 weeks after the administration of biologics, which suggests an infectious blood-borne cause, although an agent has never been identified.

In the past 2 years, 2 genetically different virus from the Pegivirus genus, Equine Pegivirus (EPgV) and Theiler's disease associated virus (TDAV)BB, and 8 from the Hepacivirus genus, named Non-primate Hepaciviruses (NPHVs 1 to 8) - all members of the Flaviviridae family - have been discovered to infect horses. Of these 3, EPgV and the 8 NPHVs are not associated with disease, while TDAV has been the only one reported to cause hepatic disease and was proved to be transmitted by inoculation of a contaminated bioproduct of equine origin. Nonetheless, the association of TDAV and Theiler's disease, although strong, remains inferential.

Reported clinical signs of Theiler's disease are unspecific, including lethargy, anorexia, severe icterus, decrease borborygmi, pica, yawning, photoactive dermatitis, colic and central nervous system signs, including head pressing, ataxia, blindness, bruxism and circling. Currently, a diagnosis of Theiler's disease is based on the clinical history, clinical signs, biochemical findings and hepatic biopsy, or necropsy and histopathology.

References:

1. BURBELO, PD, et al. 2012. Serology-enabled discovery of genetically diverse hepaciviruses in a new host.J Virol. 2012 Jun;86(11):6171-8. doi: 10.1128/JVI.00250-12.

2. CHANDRIANI, S. et al. 2013. Identification of a previously undescribed divergent virus from the Flaviviridae family in an outbreak of equine serum hepatitis. Proc Natl Acad Sci U S A. doi: 10.1073/pnas.1219217110.

3. JUBB, K., KENNEDY, P.C. and N. PALMER. 1993. The liver and biliary system. Volume 2. Academic Press, INC. San Diego, California, pp.368-370.

4. KAPOOR, A. et al. 2013. Identification of a pegivirus (GBV-like virus) that infects horses. J Virol. Doi:10.1128/JVI.00324-13

Severe Keratoconjunctivitis in Freedom Ranger Chickens

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Signalment and History: This mixed age flock of Freedom Ranger chickens had a recent history of increased mortality associated with ocular and respiratory disease. Affected animals were lethargic and poorly responsive. The eyes were often swollen, and there were variable epiphora and periocular and conjunctival sac exudates. In total, seven live and six dead birds ranging in age from few weeks to several months of age were submitted for necropsy.

Gross Findings: The eyelids of all but two of the examined birds were closed, and were surrounded and covered by a small to large amount of yellow, dry, crusted material. The conjunctival sacs of all birds were mildly to markedly distended by yellow, firm material (fibrinopurulent exudate), that in some animals caused marked bulging of the eyelids.

Histopathologic Findings: The submitted slide represents an eye and associated eyelids from one of the severely affected chickens that were submitted live. The conjunctival epithelium is largely intact, is segmentally hyperplastic or has squamous metaplasia, and contains mild to moderate intraepithelial infiltrates of heterophils. There are marked infiltrates of lymphocytes and plasma cells within the subepithelial stroma. Fibrin, proteinaceous fluid, heterophils, histiocytes, occasional sloughed necrotic epithelial cells, and numerous mixed colonies of bacteria expand the conjunctival sac. The corneal epithelium is diffusely necrotic and extensively lost, and there is regionally extensive necrosis of the underlying corneal stroma. Dense bands of heterophils infiltrate the margins of regions of corneal necrosis, and the corneal endothelium is replaced by similar dense cellular infiltrates. There is marked accumulation of fibrin, heterophils, and histocytes within the remainder of the anterior chamber. The iridal stroma is infiltrated by heterophils, lymphocytes, plasma cells and histiocytes, and there are similar inflammatory cells throughout the ciliary cleft and trabecular meshwork. In less affected birds, ocular lesions were largely confined to the marked lymphoplasmacytic conjunctivitis. In one severely affected bird, there was extensive corneal perforation associated with necrotizing keratitis.

Diagnosis: Severe lymphoplasmacytic and heterophilic conjunctivitis, necrotizing keratitis, and endophthalmitis

Additional Findings: Cultures from conjunctival swabs yielded mixed bacterial growth including *Mycoplasma gallisepticum*. PCR was consistently negative for avian influenza virus, infectious laryngotracheitis virus, and Newcastle disease virus.

Comment: The lesions in this case are consistent with keratoconjunctivitis associated with *M.gallisepticum* and secondary mixed bacterial infection. *M.gallisepticum* is a well reported as a cause of infectious conjunctivitis in birds. Most notably, this bacterium is recognized as a cause of epizootic conjunctivitis in house finch populations.[1] In chickens, *M.gallisetpicum* can be associated with keratoconjunctivitis, is often implicated as playing a role in polymicrobial chronic respiratory disease, and is one of the reasons boiosecurity to prevent exposure of poultry flocks to wild birds is important.[1,2]

References:

1. Luttrell MP, Stallknecht DE, Kleven SH, Kavanaugh DM, Corn JL, Fischer JR. Mycoplasma gallisepticum in house finches (Carpodacus mexicanus) and other wild birds associated with poultry production facilities. Avian Dis. 2001 Apr-Jun;45(2):321-9.
2. Nunoya T, Yagihashi T, Tajima M, Nagasawa Y. Occurrence of keratoconjunctivitis apparently caused by Mycoplasma gallisepticum in layer chickens. Vet Pathol. 1995 Jan;32(1):11-8.

Canine Schistosomiasis in New Mexico

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Signalment: 2-years-old, castrated male, Boxer mixed breed dog

Clinical History: The dog had a two week history of bloody stools. The dog developed a rectal prolapse, which appeared grossly normal. The colon appeared corrugated on radiographs. A portion of the prolapsed rectum was submitted for histopathology.

Microscopic Description: The mucosal epithelium and the submucosa of the submitted segment of rectum contain large amounts of hemorrhage and edema with occasional erosion and ulceration of the mucosal epithelium. The lamina propria of the mucosal epithelium and the submucosa contains numerous trematode ova consistent with *Heterobilharzia americana.* The ova are often surrounded by pyogranulomas consisting of neutrophils, epithelioid macrophages, and multinucleated giant cells.

Diagnosis: Multifocal pyogranulomatous proctitis with hemorrhage, edema, and numerous intralesional trematode ova; etiology consistent with *Heterobilharzia americana*

Comment: Canine schistosomiasis is caused by the trematode *Heterobilharzia americana*, which is in the family Schistosomatidae. Traditionally in the United States, the fluke has only been seen in south-Atlantic and Gulf Coast States. In New Mexico, we have seen canine schistosomiasis in at least 4 dogs that have lived exclusively in New Mexico their entire lives. The definitive host of *H. americana* is the raccoon, but infections have been seen in multiple other species including horses. The mammalian host is infected by cercariae discharged from snails that penetrate the skin while the mammal is in fresh water. The immature schistosomes migrate to the lungs and then to the liver where they mature into adults. The adult flukes migrate to the mesenteric veins where the adult female and male flukes mate. The ova migrate to the intestine where they penetrate venules to exit into the intestinal wall and be shed into the lumen. The ova that come in contact with fresh water hatch releasing miracidia that penetrate an appropriate species of snail. The miracidia then develop into cercariae within the hepatopancreas of infected snails. Ova in the intestinal wall and that are hematogenously spread to other organs of the mammalian host often elicit severe granulomatous inflammation.

References:

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- Johnson EM. Canine schistosomiasis in North America: an underdiagnosed disease with an expanding distribution. *Compend Contin Educ Vet*. 2010 Mar: E1-E4

Cerebellar hypoplasia in three sibling dogs associated with intrauterine or early postnatal parvovirus infection

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Signalment: Three 6- to 8-week old littermate puppies were submitted for necropsy.

History: The puppies had intention tremors and were non-ambulatory. The bitch was a stray dog with unknown vaccination and medical history. Due to a poor prognosis, the puppies were euthanized and submitted for necropsy.

Gross Necropsy findings: The cerebellum was markedly reduced in size (hypoplasia) with reduced foliar development. There were no significant gross lesions in other organs.

Histopathology Findings: Brain, cerebellum: All three puppies had similar microscopic changes. In most of the cerebellum there was a lack of formation of folia and the outer contours were rounded and smooth. Normal cerebellar cortical architecture was lost with abnormal arrangements of molecular and, granular, Purkinje cell layers, and the white matter. The granular cells were arranged in islands, interconnecting cords, and perivascular accumulations in the molecular layer. The white matter was multifocally indistinct or absent. The Purkinje cells were haphazardly scattered between the granular cells and within the molecular layer. There were segmental foci of normally formed cerebellar layers mostly in the lateral cerebellar areas.

Morphological Diagnosis: Brain, cerebellum: Hypoplasia/dysplasia.

Laboratory Findings: PCR analyses on feces, lymph nodes, kidneys, small intestine, brain, and heart from all the puppies were positive for canine parvovirus type 2c (CPV-2c) infection. PCR on brain was negative for canine distemper virus.

Comments: The gross and microscopic lesions in the cerebellum were diagnostic of cerebellar hypoplasia that caused clinical signs of tremors in these puppies. In cats, a classical cause of cerebellar hypoplasia is *in utero* or perinatal infection with feline panleukopenia virus (parvovirus). However, in dogs, cerebellar hypoplasia associated with parvovirus infection has rarely been reported. PCR testing was positive for CPV-2c, which the most recently recognized strain of CPV-2. Neurologic deficiencies due to cerebellar hypoplasia caused by *in utero* or perinatal canine parvovirus infection should be taken into consideration as differential diagnoses for ataxia in neonatal and juvenile dogs.

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An Unusual Presentation of an Equine Extramedullary Plasma Cell Tumor

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SIGNALMENT: 21-year-old, female intact Standardbred horse.

History: The horse was presented for weight loss and chronic dry cough during the past month. Her respiratory clinical signs had worsened, she was tachypneic (28 rpm), moderately tachycardic (52 bpm), and afebrile (99.7 °F).

Gross Necropsy Findings: The thoracic cavity contained approximately 10 L of yellow to red-tinged fluid admixed with deposits of mats of fibrin on the pleural and pericardial surface. There were multifocally extensive areas of hemorrhages in the skeletal muscles of the shoulder and elbow region with subcutaneous edema in the lateral right thoracic wall and right shoulder region which extended down to the level of carpus.

Histopathology Findings: Multifocally, expanding and infiltrating the facial planes of the skeletal muscles and the perimysium of right lateral shoulder, elbow region and diaphragm was a poorly delineated, moderately cellular neoplasm composed of round cells arranged in sheets with distinct cell borders. These cells had moderate to abundant amounts of eosinophilic to amphophilic cytoplasm with occasional perinuclear clearing (halo). The nuclei were round to oval with coarsely stippled chromatin and an indistinct nucleolus. There were frequent binucleated cells with occasional large anaplastic cells with convoluted nuclei. There were 8 mitotic figures in 10 high-power fields. There was marked anisocytosis and anisokaryosis. Similar neoplastic cells were present within lymphatic vessels. The pleura and pericardium were thickened and contained similar neoplastic cells as described in the skeletal muscles.

Laboratory findings: Bone marrow core biopsy of sternum, ribs and both femurs showed no evidence of neoplasia. Urinalysis was negative for proteinuria. Protein electrophoresis showed no evidence of monoclonal gammopathy in the serum. Immunohistochemistry analysis revealed positive nuclear staining for MUM-1 and negative staining for CD3 and CD20 markers.

Final diagnosis: Extramedullary plasma cell tumor.

Comments: The diagnosis of plasma cell tumor was made based on the morphology of neoplastic cells (histopathology and cytology) and their positive immunoreactivity for the nuclear stain MUM-1. This case is a unique presentation of extramedullary plasma cell tumor with no evidence of primary neoplasm or serum monoclonal gammopathy but with marked local infiltration into the local skeletal muscles, pleura, pericardial sac and lymphatic vessels.

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Encephalitic astrovirus of mink in Wisconsin, USA

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History: Three juvenile, female, ranch-bred mink (one sapphire, one pastel and one black) were received for work-up of neurologic disease characterized by progressively worsening tremor of 7 days' duration. Kits started with mild tremor and progressed over 2-3 days to whole body shaking, although they did not shake in their sleep. Kits continued to eat and drink at first, but that became more difficult as signs worsened. They became hyper-reactive and aggressive toward each other; approximately 50% of kits had bite wounds. There were 10-30 new cases per day (75,000 mink on premises), and usually just one mink per litter of 5-8 kits; cases were distributed throughout the premises, with both sexes and all colors affected. Approximately 50 animals had died. Rare cases similar to these had been reported on other farms, but in smaller numbers; this ranch had no previous history of this disease. Kits were vaccinated 7 days prior to euthanasia for canine distemper and with a 7-way vaccine 28 days prior; they were fed a total mixed ration.

Gross Findings: At necropsy, diffuse pulmonary congestion was noted, often associated with CO2 euthanasia; the stomachs contained no feed, and there was scant ingesta/feces in the intestines; a small amount of black fluid, suggestive of gastric ulcers, was found over the gastric mucosa of #2 (pastel); the urinary bladders were empty.

Histologic Findings: Histopathology revealed widespread, lymphoplasmacytic perivascular cuffs in medulla, brain stem, and spinal cord, with foci of gliosis. Multifocal encephalitis was also seen rarely in the cerebral cortex and cerebellum. Patchy, non-suppurative meningitis was noted in the cerebellum and spinal cord. Lymphocytic inflammation was noted in spinal ganglia. Multifocal, mild necrosis with acute suppurative inflammation was noted in adrenal glands.

Diagnosis: The diagnosis was meningoencephalomyelitis. Tests were negative on brain tissue by fluorescent antibody (FA) for rabies, and by polymerase chain reaction (PCR) for the agents of canine distemper, toxoplasmosis, neosporosis and Eastern equine encephalitis; also, PCR was negative for West Nile virus. Other rule-outs still under investigation at the time of this write-up are Equine Protozoal Myelitis, (EPM, *Sarcocystis neurona*); *Listeria monocytogenes*; and pseudorabies; A canine PCR panel on liver and lung was negative for canine distemper, canine parvovirus 2, canine adenovirus 2, canine herpesvirus, parainfluenza and influenza, and *Bordetella.*

PCR was performed for mink astrovirus, a small, non-enveloped, positive-stranded RNA virus. Most astroviruses cause diarrhea, including in mink, but a divergent form that causes encephalitis has been described in mink, humans and cattle. Our case proved to be positive for a virus that aligned most closely with mink encephalitic astrovirus and poorly with other astroviruses including human astroviruses. To the best of our knowledge, this is the first identification of mink astrovirus in America, although clinical and pathologic observations imply that it may have occurred in the US at a prior date.

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Colitis of undetermined etiology in a pot bellied pig

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Clinical history: 2.5 year old neutered male Vietnamese Pot-bellied pig, with a 2 day history of high temperature culminating in death.

Gross findings: The carcass was moderately dehydrated but in good nutritional condition. The spiral colon was distended by a large amount of semi-liquid, green content. The colonic mucosa presented many linear, multifocal to coalescing ulcers of variable sizes (between a few mm to several cm). The serosa of the colon was diffusely congested and presented multifocal petechiae and echymoses. The mesenteric lymph nodes were moderately enlarged and edematous. No other significant gross abnormalities were observed in the rest of the carcass.

Histopathology: Within the superficial mucosa, there were multifocal to coalescing areas of necrosis characterized by loss of normal tissue architecture and replacement by cellular and karyorrhectic debris, moderate numbers of degenerate neutrophils, fibrin, and numerous 4-6 um long x 1 um wide rods that frequently extended deeper into the crypts. The superficial mucosal vessels adjacent to the necrotic areas often contained fibrin thrombi. Multifocally there was abundant mucus expanding the crypts and diffusely, the mucosal crypts were hyperplastic. The sub mucosa was edematous and presented diffuse infiltration of mononuclear cells and fewer neutrophils. Multifocally, there was moderate transmural congestion.

Comments: Possible etiologies considered for this problem were *Brachyspira spp., Salmonella spp., Clostridium difficile, Clostridium perfringens* type C, PRRS virus, PCV-2 virus, TGE virus, PDE virus, BVD virus and *Isospora suis*. The following laboratory tests were performed with negative or non-diagnostic results: aerobic culture of liver, lung and colon; ELISA for *Clostridium perfringens* toxins alpha, beta and epsilon (small intestinal and colonic content); ELISA for *Clostridium difficile* toxins A and B (colonic content); *Salmonella* spp. PCR (liver and colon) and culture (colon); Classical Swine Fever PCR (tonsil); fecal float (feces); *Brachyspira spp.* culture of (colon); *C. difficile* culture (colon); *Mycoplasma spp.* culture (lung); BVD PCR (spleen); PRRS PCR (spleen); Bovine coronavirus immunohistochemistry (colon); TGE immunohistochemistry (colon); PCV-2 immunohistochemistry (colon); PRRS immunohistochemistry (colon); direct TEM (colon contents) and PED virus PCR (colon). Despite extensive laboratory testing, the etiology of the problem remains undetermined.

Oak Poisoning in Yearling Cattle

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Signalment and History: A herd of approximately 200 yearling cattle were driven from high mountain pasture in the early autumn. The animals were allowed to overnight in an area containing a mixture of Juniper trees, Sagebrush and Oak brush. A small pond was also present to provide a water source for the night. The following morning six yearling heifers were found dead along with numerous sick animals, many of which had moderate to severe dyspnea, blood in the feces and straining. The animals were then moved further down the mountain onto winter pasture. Several more animals died during the next few days, then the deaths resided.

Microscopic description: The significant renal lesion was characterized by renal tubular necrosis of the convoluted tubules with the formation of granular and hyaline casts. In some tubules, necrosis of the epithelium was severe, leaving only a few tubular cells and bare basement membranes. In less severely affected tubules fewer numbers of tubular cells were necrotic or missing. Intratubular hemorrhage was also observed along with necrotic epithelial cells within some of the tubules. Some tubular were less severely affected and contained only degenerative changes with no necrosis. The completeness of necrosis in groups of tubules with intratubular hemorrhage distinguishes the nephrosis of acute Oak poisoning from that of most other causes.

Diagnosis: Toxic Nephrosis Due to Oak Poisoning

Comments: The clinical history of exposure to Oak (Quercus sp.) and the presence of acute renal nephrosis is diagnostic for Oak poisoning. Oak poisoning in ruminants, and occasionally horses can be caused by the ingestion of oak leaves, stems and acorns. The toxic substances are *gallotannins* which are hydrolyzed to tannic acid, gallic acid and pyrogallol which appeared to be the active toxic metabolites. In Western Colorado cattle graze areas abundant with Oak brush each year without incident. However, if the feed is limited and they graze heavily on the Oak leaves or acorns Oak toxicity can occur. Interestingly, the black bear (*Ursus americana*) graze heavily on Oak brush in the late fall consuming large numbers of acorn with little or no effect

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Mange in an African Pygmy Hedgehog

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History: This 5 year old male African pygmy hedgehog (*Atelerix albiventris*) was first examined because of perineal swelling. Over the next 2 weeks intermittent anorexia was noted, and eventually a laparotomy was performed. The animal went into respiratory arrest and died shortly after the surgery was completed.

Gross findings: Animal submitted whole in formalin. Good fat stores but decreased muscle mass. Lungs appeared congested. The tissue resected from caudal abdomen consisted of symmetrical paired glandular structures. No other gross abnormal findings.

Histopathology: The sections of haired skin have parakeratotic crusting which includes profiles of arthropods as well as intracorneal pustules of necrotic polymorphonuclear cells. Coccoid bacteria are often visible in the crusts. There is epidermal hyperplasia and eosinophilic intraepidermal pustules. Mast cells are prominent in the superficial dermis yet there are surprisingly few other leukocytes. Note the broad base to the quills (modified hair) and very large piloerector muscles. Other follicular adnexal structures are present but less prominent in quilled skin than in most domestic animal species (or haired skin of this section). Also note the thick skeletal muscle band, thought to help control quill orientation ..

Further changes in this section include a mild myopathy (coagulation of sarcoplasm, internal nuclei) and scattered angular atrophic myocytes. A few myocytes in this animal also had peripherally located PAS positive, diastase resistant sarcoplasmic inclusions.

Changes in spinal cord, nerve roots, and to a lesser extent, brain of this animal had considerable similarity to Wobbly Hedgehog Syndrome (WHS). This animal also had a severe chronic interstitial pneumonia which included macrophages filling alveoli. The tissues resected at laparotomy were dilated bulbourethral glands.

Diagnosis (slide): Severe chronic hyperplastic and pustular dermatitis with intralesional mites
Mild multifocal subacute degenerative myopathy

Comments: Clinical dermatologic disease was not recognized in this hedgehog. However, acariasis and pediculosis are two of the most common reasons for presentation of hedgehogs to veterinary clinics. These pets can develop infections with multiple species of mites (*Sarcoptes scabiei*, *Caparinia tripilis or C. erinacei* (psoroptic mites), *Notoedres muris* and *Demodex spp.*). Self-mutilation lesions or lichenified skin may develop in some individuals.
The cause of WHS remains unknown, although a familial tendency to develop the disease has been proposed. More recently a link between infection with a murine pneumovirus and WHS is being pursued. A 1922 text (Physiology of Reproduction by Marshall, Cramer and Lochead) which I could on partially access, noted a seasonal hyperplasia of bulbourethral glands in hedgehogs. The gland location at the base of the penis could give the impression of a mass in the caudal abdomen.

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