Chitwood, M. Colter, et al. "Meningeal worm (Parelaphostrongylus tenuis) as a cause of mortality in the restored elk (Cervus canadensis) population in Missouri, USA." *Journal of wildlife diseases* 54.1 (2018): 95-100.

Abstract: Meningeal worm (Parelaphostrongylus tenuis) is an important cause of mortality of elk (Cervus canadensis) in populations in the eastern US and has been implicated in the failure of several restoration attempts**. From 2011 to 2013, the Missouri Department of Conservation translocated 108 adult and yearling elk from Kentucky (US) to southern Missouri (US) to establish a free-ranging population. From release in spring 2011 through August 2015, we monitored 167 elk (adult, yearling, and calf) to determine causes of mortality. Of 78 mortalities, 26 (33%) were linked to meningeal worm** based on necropsy results and/or observed behavior; this group included 19 elk with confirmed or suspected cases of meningeal worm infection that died of other proximate causes. **Other important mortality sources included euthanasia (n=11, 14%), emaciation (n=7, 9%), and predation (n=5, 6%). Eleven of the 26 (42%) meningeal worm-related mortalities were adults, and 22 (85%) were female.** **Meningeal worm was an important cause of mortality during the restoration of Missouri elk, potentially contributing to the loss of 16% of the monitored individuals.** Greater mortality in adult female elk could reduce initial population growth by limiting reproductive output in the restored herd, especially given that females were disproportionately affected in Missouri. **Because translocated Missouri elk undoubtedly were exposed to meningeal worm in Kentucky, our results could be explained by exposure to a different genetic strain of meningeal worm once in Missouri, loss of immune response due to translocation, increased dose of larval worms, or some unquantified factor.**

* Meningeal worm: Parelaphostrongylus tenuis.
  + Most common disease in restored elk in Eastern US.
  + Nematode, inhabits CNS of WTD (primary host). WTD rarely have clinical signs.
* Missouri Department of Conservation (MDC) restoration effort for free-ranging elk herd in MO.
* Over 3 year period, translocated adult and yearling elk from KY free-ranging herd to SE MO.
* Radiotags used to monitored survival, resource selection, movement, dispersal of released elk.
  + Monitored 167 elk, documented 78 mortalities.
  + 9% of elk deaths directly attributed to meningeal worm on necropsy.
    - 33% had evidence of meningeal worm infection regardless of proximate cause of death.
    - Meningeal worm infections affected young female elk most commonly.
    - High levels in adult females could play a major role in limiting population growth rates of elk herds.
  + Other causes of death – “various systemic maladies” i.e. septicemia (15%), euthanasia (14%), emaciation (9%), some vehicular trauma or predation.
* Meningeal worm infections are likely to be underreported. Behavioral changes in infected elk make them more likely to succumb to secondary infections i.e. pneumonia, and more vulnerable to predation, HBC, targeted removal.

Takeaways: Meningeal worm was an important cause of mortality during restoration of Missouri elk. Subclinical infections and subsequent behavioral changes may make mortality due to other causes more likely Infection of female elk overrepresented in this study and could limit population growth.

Rivas, Anne E., et al. "EVALUATION OF PASSIVE TRANSFER IN NINE SPECIES OF CERVIDAE." *Journal of Zoo and Wildlife Medicine* 52.2 (2021): 838-842.

Abstract: The reliability of **packed cell volumes (PCV), total solids (TS), blood glucose (BG), γ-glutamyl transferase (GGT), and glutaraldehyde test in determining passive transfer of colostral immunoglobulins was investigated in nine species of cervids**: axis deer (*Axis axis*), hog deer (*Axis porcinus*), sika deer (*Cervus nippon*), tufted deer (*Elaphodus cephalophus*), Père David's deer (*Elaphurus davidianus*), pudu (*Pudu puda*), sambar deer (*Rusa unicolor*), barasinga deer (*Rucervus duvaucelli*), and Eld's deer (*Rucervus eldii*). **Individually the parameters evaluated were significant though imperfect predictors of passive transfer status in cervids. Interpreted collectively as a panel along with neonate condition, these tests were clinically helpful in diagnosing failure of passive transfer (FPT).** Collectively interpreting test results as a panel along with clinical assessment of the animal is recommended. Some species-specific variations in TS, GGT, and glutaraldehyde test results were identified.

* Introduction:
  + Ruminants have an epitheliochorial placenta – Does not allow passage of IgG from dam to fetus during gestation, absorption from colostrum required.
  + FPT = Neonates that don’t consume colostrum, high morbidity and mortality.
  + This study summarized clinical utility of diagnostic tests for FPT in 9 cervid spp.
* M+M:
  + Routine neonatal health assessment blood sampling; animals 24-72h age.
  + PCV, TS, BG, GGB, glutaraldehyde test.
  + FPT diagnosed if neonate had at least two blood values suggestive of FPT or at least one blood value and requirement of medical intervention with hand-rearing.
  + Positive passive transfer PPT defined as fawns with clear evidence of maternal care and no need for medical intervention during first 6 mos of life.
* Results:
  + Only PCV found to not be significantly associated with passive transfer status.
  + TS, BG, GGT all significantly associated with passive transfer status.
  + FPT most often associated with a negative glutaraldehyde test reaction.
  + False negative glutaraldehyde tests most common in tufted deer, Pere David’s deer, and sambar deer.
* Discussion:
  + Species specific variability in TS (i.e. 7 g/dL vs 4.8 g/dL in sika deer vs sambar deer).
  + BG significantly associated with passive transfer status. If low BG encountered in otherwise normal neonate, authors recommend monitoring clinical condition, may be spurious.
  + GGT is excreted in high concentrations in colostrum, PPT animals have higher animals vs adults.
    - GGT < 240 U/L suggested FPT in these cervids.
    - Species differences – Pere David’s deer and sika deer lower median GGT in PPT fawns vs other spp.
    - All nine spp had lower GGT transfer in colostrum compared to previous reports in gazelles.
  + Glutaraldehyde test relies on uncharged amino groups on gamma globulin proteins forming cross-linkages with aldehyde groups and resulting in a visible clot.
    - Prone to falsely classifying PPT neonates as immunoglobulin deficient, 29 false negatives in 222 cases of PPT in this study.
    - Majority of false negatives in tufted deer, Pere David’s deer, and sambar deer.
      * May have inherently lower gamma globulins.

Takeaway: PCV/TS, BG, GGT, glutaraldehyde tests can be used as a panel to assess FPT in neonate cervids. Species specific differences in interpretation of results, glutaraldehyde test prone to false negatives for PPT.

*Dictyocaulus cervi*-like lungworm infection in a rocky mountain elk (*Cervus canadensis nelsoni*) from Wyoming, USA.

Bangoura, B., Brinegar, B. and Creekmore, T.E.

Journal of Wildlife Diseases 2021;57(1):71-81.

Dictyocaulus spp. infections are common in North American cervids, with Dictyocaulus viviparus described as most common. A Rocky Mountain elk (Cervus canadensis nelsoni) was found dead in Wyoming, US with significant bronchitis and pneumonia. In the bronchi and trachea, numerous large nematodes were found and grossly identified as Dictyocaulus spp. lungworms. Macroscopic alterations, such as distended interlobular septa and edema with foam and mucus observed on cut surface and in trachea and bronchi, were consistent with those commonly described in D. viviparus infections. Female lungworms were identified to Dictyocaulus spp. level via morphologic examination and molecular analyses based on mitochondrial cyclooxygenase 1 and 18S ribosomal RNA genes. A phylogenetic analysis was conducted employing the maximum likelihood method. Based on both morphologic and genetic assays, the isolated lungworms were most likely a strain of Dictyocaulus cervi. Within the female adult worms, free first stage larvae were observed besides worm eggs, which had not been described for Dictyocaulus spp. Phylogenetic analysis revealed that our parasites clustered closely with D. cervi, forming a subclade with that species within a larger clade that includes Dictyocaulus eckerti. While the elk tested positive for chronic wasting disease, it is assumed that significant pathology in the present case was caused directly by infection with the D. cervi-like lungworm, not previously described in North America.

**Background**

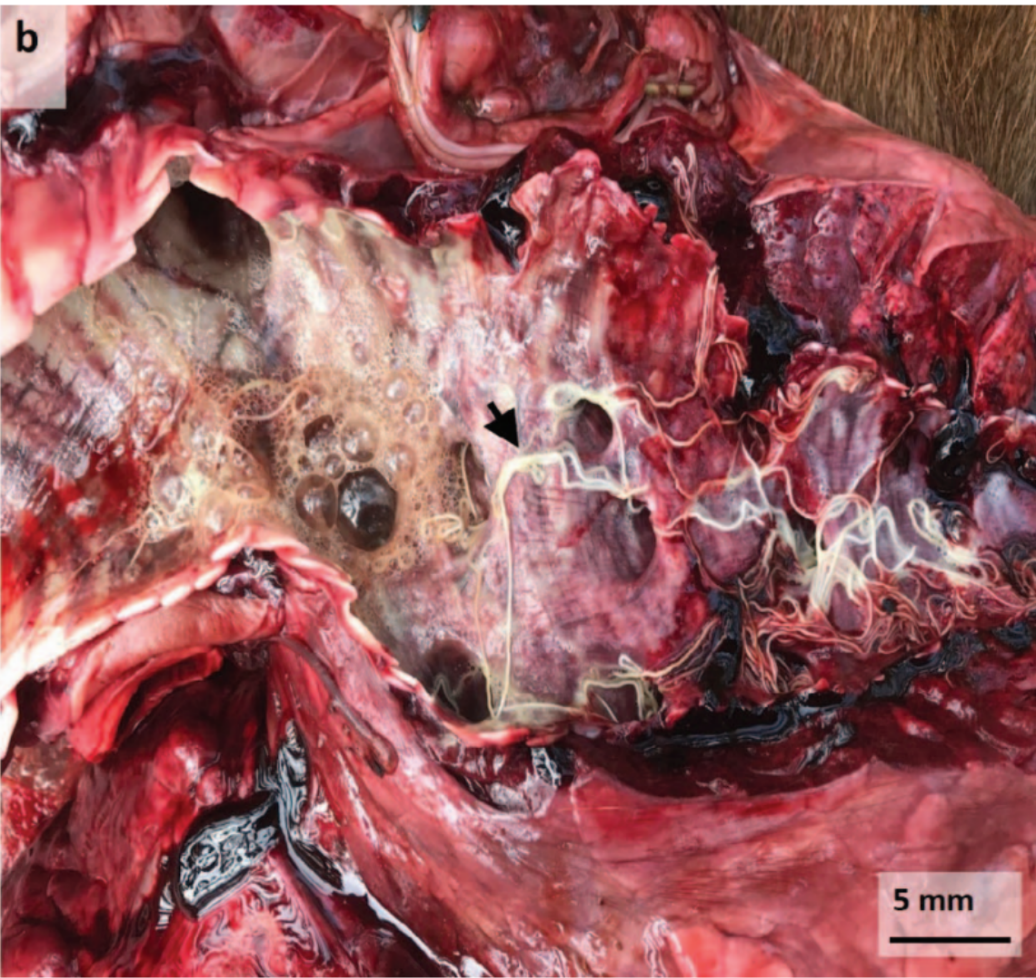
* Lungworms in ruminants: small protostrongylids, large *Dictyocaulus* spp.
  + Bovine: *D. viviparus*
  + Cervid: *D. viviparus* (considered the only species in wild ruminants in the US), *D. eckerti* (EU)*, cervi, capreolus, noerneri*
    - Prevalence in WY and MT elk: 0-19%

**Key Points**

* 2 yo male free-ranging Rocky Mountain elk found dead in Wyoming, positive for CWD, lungworms found in trachea and bronchi on necropsy
  + Morphologically resembled *D. cervi* most closely
  + Genetic analysis (*cox1, 18S rRNA* genes): closest relationship to *D. cervi* and in a clade with *D. cervi* and *eckerti*
  + Had large numbers of free L1 in all female worms (previous *Dictyocaulus* life cycle established as ovoviviparous)

**Conclusions**

* *D. cervi* elk lungworm identified, indicating a novel species in free-ranging elk in Wyoming



Macroscopic lung findings upon necropsy of the Rocky Mountain elk (*Cervus canadensis nelsoni*) found deceased in Wyoming, USA. Cut lung surface with foam and mucus, numerous nematodes present in the trachea, tracheal bifurcation, and major bronchi (arrowhead).

Journal of Wildlife Diseases, 2020;56(3):568–575

**EFFECT OF ORAL COPPER SUPPLEMENTATION ON SUSCEPTIBILITY IN WHITE-TAILED DEER (*ODOCOILEUS VIRGINIANUS*) TO CHRONIC WASTING DISEASE**

Lisa L. Wolfe, Mary M. Conner, and Michael W. Miller

**Abstract**: Chronic wasting disease (CWD) is an infectious disease, but reported associations suggest several metals—especially copper (Cu) and manganese—potentially play a role in this and other prion diseases. To assess the utility of dietary Cu supplementation in protecting white-tailed deer (Odocoileus virginianus) from CWD, **we compared incidence and disease course among individuals naturally exposed to CWD while being maintained on sustained-release Cu boluses or unsupplemented (control).** Oral Cu supplementation increased liver tissue Cu concentrations compared to controls but did not affect susceptibility to CWD or survival after natural exposure in the captive white-tailed deer we studied. Over the 27 mo study, 89% (8/9) of the Cu-supplemented deer and 86% (6/7) of control deer became CWD-infected. Survival to 27 mo postexposure did not differ between Cu-supplemented and control deer: model-averaged survival probabilities to 27 mo were 0.45–0.47 for all combinations of Cu treatment and PRNP gene haplotype presence. The PRNP gene haplotype influenced the probability of deer remaining biopsy negative for at least 17 mo but did not affect overall susceptibility.

**Background**

* Copper: absorbed by GI, stored in liver, released bound to an enzyme or protein
* Deficiency (hypocuprosis): low dietary Cu or interfered absorption (high zinc, calcium, iron, molybdenum (Mo), sulfates)
  + Diarrhea, unthrifty, hypopigmentation of hair coat, swollen painful joints, hind limb weakness, infertility, anemia, decreased resistance to disease
* Cu supplementation in hamsters delayed onset of clinical signs

**Key Points:**

* Cu oxide needles in slow-release capsules, exposure to CWD, tonsil biopsies
* All but 2 deer became infected, survival did not differ in Cu supplemented
* Mean liver tissue Cu concentrations were higher but not brain tissue
  + Uptake occurred within the first few weeks of supplementation
* Presence of S rather than G at PRNP codon 96 likely affected PrPSc deposition

**Take home:** Oral Cu supplementation increased liver Cu concentrations compared to controls but did not affect susceptibility to CWD or survival after natural exposure. The PRNP gene haplotype influenced the probability of deer remaining biopsy negative for at least 17 mo but did not affect overall susceptibility.

Cervids 8/11/21 Summaries

Journal of Wildlife Diseases, 56(4), 2020, pp. 781–790

**HUNTING PRESSURE MODULATES PRION INFECTION RISK IN MULE DEER HERDS**

Michael W. Miller,1,2,3 Jonathan P. Runge,1,2 A. Andrew Holland,1 and Matthew D. Eckert1

**ABSTRACT:** The emergence of chronic wasting disease, an infectious prion disease of multiple deer species, has motivated international calls for sustainable, socially accepted control measures. Here, we describe long-term, spatially replicated relationships in Colorado, US, mule deer (*Odocoileus hemionus*) herds that show hunting pressure can modulate apparent epidemic dynamics as reflected by prevalence trends. Across 12 areas in Colorado studied between 2002-18, those with the largest declines in annual hunting license numbers (pressure) showed the largest increases in the proportion of infected adult (2–yr-old) male deer killed by hunters (prevalence); prevalence trends were comparatively flat in most areas where license numbers had been maintained or increased. The mean number of licenses issued in the 2 yr prior best explained observed patterns: increasing licenses lowered subsequent risk of harvesting an infected deer, and decreasing licenses increased that risk. Our findings suggest that harvesting mule deer with sufficient hunting pressure might control chronic wasting disease—especially when prevalence is low—but that harvest prescriptions promoting an abundance of mature male deer contribute to the exponential growth of epidemics

**Study Design:** Retrospective epidemiological modeling (logistic regression)

**Goal:** Describe long-term, spatially replicated relationships between hunting pressure and CWD dynamics in Colorado mule deer herds that show hunting can modulate disease emergence

**Key Points:**

* CWD an infectious prion disease/transmissible spongiform encephalopathy occurs on three continents in at least seven species in the family Cervidae
* Hunting can be an effective and socially acceptable tool for managing deer but its effectiveness in controlling this disease has been debated
* Prion-infected mule deer show greater vulnerability to predation and vehicle collisions, and also seem more vulnerable to hunter harvest than uninfected individuals
* Removal mechanisms that preferentially target infected animals should be most effective in suppressing epidemic growth
* Hunting pressure applied over a series of successive seasons likely helps expose vulnerable infected deer to harvest in later seasons as learned wariness develops in unaffected individuals
* Sustained hunting pressure might afford a level of suppression comparable to that expected from natural predation, but light harvest likely will not stem epidemic growth even when applied over multiple seasons
* Prevalence of CWD was measured in Colorado mule deer herds as the proportion of sampled adult (>=2–year-old) male deer testing positive for abnormal prion protein accumulation
* CWD prevalence and incidence show positive correlation across a wide range of values in field studies where both parameters were measured in the same mule deer herd, with prevalence equaling or somewhat overestimating incidence in both genders
* Across 12 areas in Colorado studied between 2002-18, those with the largest declines in annual hunting license numbers showed the largest increases in the proportion of infected adult (2–yr-old) male deer killed by hunters (prevalence)
  + Prevalence trends were comparatively flat in most areas where license numbers had been maintained or increased.
* The mean number of licenses issued in the 2 yr prior best explained observed patterns: increasing licenses lowered subsequent risk of harvesting an infected deer, and decreasing licenses increased that risk

**TLDR:**

* Harvesting mule deer with sufficient hunting pressure might affect CWD control especially when prevalence is low
* Across 12 areas in Colorado studied between 2002-18, those with the largest declines in annual hunting license numbers showed the largest increases in the proportion of CWD infected adult male mule deer killed by hunters (prevalence)
  + CWD prevalence trends were comparatively flat in most areas where license numbers had been maintained or increased

Journal of Wildlife Diseases, 57(1), 2021, pp. 40–50

**NEONATE HEALTH AND CALF MORTALITY IN A DECLINING POPULATION OF NORTH AMERICAN MOOSE (*ALCES ALCES AMERICANUS*)**

Tiffany M. Wolf,1,2 Yvette M. Chenaux-Ibrahim,3 Edmund J. Isaac,3 Arno Wu ̈nschmann,1 and Seth A. Moore3

**ABSTRACT:** Moose (*Alces alces americanus*) populations in many areas along the southern extent of the North American moose range, including Minnesota, have experienced decline. Ascertaining neonate health and cause-specific mortality is critical where calf survival is low and understanding underlying causes of population dynamics is important. To investigate moose neonate health and causes of mortality, we studied 43 calves shortly after parturition during 2013–15 and 2018. The observed natural calf mortality rate was 84% by the following January of each calving season. Most natural calf mortalities were caused by black bear (*Ursus americanus*) or wolf (*Canis lupus*) predation or associated injuries (71%) but also included stillbirth (16%), orphaning (7%), generalized bacterial infection (3%), and hunter harvest (3%). Neonate health was evaluated in 27 calves by hematology, serum biochemistry profile, and maternally derived immunoglobulin. General health parameters were mostly within an expected range for normal health and adequate maternal immunoglobulin transfer. Importantly, these data contribute to a growing body of literature on moose neonate health and is the first report, to our knowledge, of maternally derived immunity in moose neonates.

**Study Design:** Prospective longitudinal cohort study

**Goal:** To evaluate neonatal health and describe cause-specific calf mortality of moose on the Grand Portage Indian Reservation (GPIR) in northeastern Minnesota

**Key Points:**

* Declining moose populations have been documented in several regions along the southern cusp of their North American range
  + These include New Hampshire and Maine, with 50% decline since the 1990s, Minnesota with .50% decline since the 1990s, and Ontario, Canada, with 50–60% decline in the past decade
* Drivers of the northwest Minnesota decline were considered high adult mortality and low pregnancy rates, whereas more-recent declines in the northeast have been attributed to high adult mortality and low calf recruitment
  + Causes of low calf recruitment include low pregnancy rates, high pregnancy loss, and high calf mortality
  + Further, low body condition and heavy winter tick (*Dermacentor albipictus*) burden of captured cows were consistently observed in the winter of the years before the start of this study
* This study provides a comprehensive assessment of neonatal health, including CHEM, CBC, and maternal antibody transfer data as well as causes of mortality in free-ranging moose calves
* This study found a high rate of natural mortality of study calves (84%; 36/43), and predation by wolves and black bears was determined to be the primary cause of mortality
* This study did NOT identify any clear trends in neonate health or maternal Ig levels that would suggest comprised health as a predisposition to mortality, as has been observed elsewhere
  + Most of the moose neonates tested (83%; 20/24) had IgG levels >1,000 mg/dL by RID, considered the gold standard for assessing maternal Ig transfer in calves
  + In contrast, we found semiquantitative total Ig levels trended lower than the more accurate IgG concentrations
* Despite the low GGT levels observed in this study, maternally derived immunity appeared to be sufficient
  + Thus, GGT may not be a reliable indicator of colostral intake and maternal antibody uptake in moose calves
* Non-predation mortality was high (29%; 9/ 31) as compared with other studies of moose calf mortality, which was largely driven by the number of stillbirths we observed
* This study aligned with previous research that demonstrated hepatic copper concentrations of moose fetuses that increased markedly up to birth and rapidly declined within 6 mo of life
  + The high copper concentration in the fetal liver helps to support rapid fetal growth in late pregnancy and early postnatal life in the face of a relatively low milk copper concentration
* Hematologic and serum biochemical parameters were comparable to the few reports of free-ranging neonate moose and white- tailed deer

**TLDR:**

* This study found a high rate of natural mortality of study calves (84%; 36/43), and predation by wolves and black bears was determined to be the primary cause of mortality
* General health parameters were mostly within an expected range for normal health and adequate maternal immunoglobulin transfer

Journal of Wildlife Diseases, 54(4), 2018, pp. 671–679

**A HEADACHE FROM OUR PAST? INTRACRANIAL ABSCESS DISEASE, VIRULENCE FACTORS OF TRUEPERELLA PYOGENES, AND A LEGACY OF TRANSLOCATING WHITE-TAILED DEER (ODOCOILEUS VIRGINIANUS)**

Bradley S. Cohen, Emily H. Belser, Shamus P. Keeler, Michael J. Yabsley, and Karl V. Miller

**Abstract:** **Trueperella pyogenes, a bacterial opportunistic pathogen residing along the skin layer of apparently healthy animals, is the etiologic agent of intracranial abscessation-suppurative meningoencephalitis, a cause of mortality for male white-tailed deer (Odocoileus virginianus).** Occurrence of this disease has been speculated to be influenced by virulence of T. pyogenes residing on white-tailed deer in geographically distinct metapopulations. To determine if differences in virulence potential of T. pyogenes could affect occurrence of disease across populations, we examined if frequency of seven virulence genes of T. pyogenes from forehead swabs of 186 apparently healthy white-tailed deer differed between sites in the state of Georgia, US, where ≥ 1 male tested positive for a cranial abscess and sites where no individuals tested positive for a cranial abscess. **We detected six of seven virulence genes more frequently at sites where we detected ≥ 1 male with a cranial abscess compared to sites where we did not detect any individuals with a cranial abscess** (nanH, P<0.001; nanP, P=0.007; fimA, P<0.001; fimC, P=0.037; fimE, P<0.009; fimG, P<0.001; and cbpA, P=0.872). Our findings suggest differences in the pathogenic potential of T. pyogenes at individual sites may help to explain spatial variability of this disease. Anecdotally, the incidence of cranial abscess disease in Georgia seems to be associated with areas that were restocked with white-tailed deer from a high-fenced property in Wisconsin, US. Given the spatial distribution of this disease, we speculate that these genetic differences in T. pyogenes may have arisen from white-tailed deer restocking efforts, and our observations may be a legacy of an introduced disease manifesting itself generations later.

**Summary**:

Introduction

* intracranial abscessation-suppurative meningoencephalitis disease complex
  + one of many causes of mortality in white-tailed deer populations
  + can account for 35% of annual mortality of mature males
  + risk factors - sex and age and prevalence of Trueperella pyogenes
* Trueperella pyogenes
  + bacterial opportunistic pathogen commonly residing on skin layer and mucosal membranes of apparently healthy deer
  + induces suppurative infections - abscesses, empyemas, and pyogranulomas
  + isolated from 111 of 165 published cases of intracranial abscess disease
  + virulence factors - fimbriae (fimA, fimC, fimE, and fimG), neuraminidases (nanH and nanP), and collagen-binding proteins (cbpA)
* used PCR to determine frequency of genes coding for virulence factors of T. pyogenes found on foreheads of apparently healthy deer harvested across populations

M+M:

* inspected animals for presence of cranial abscesses
* swabbed foreheads to detect T. pyogenes
* tested for virulence factors

Results/discussion:

* Subcutaneous abscesses are typically the predecessor of intracranial abscesses
  + SC abscesses acquired from fights
* occurrence of genes coding virulence factors creates differences in population-level pathogenicity of T. pyogenes and helps explain site-to-site variation in presence of cranial SQ abscesses and likely intracranial abscess disease
* Virulence genes equal for males and females, higher in areas with more abscesses
  + virulence factors allow for epithelial attachment & cellular adhesion
  + sex-skewed bias likely behaviorally mediated
* nanP seems important for inducing latent infections, enhancing epithelial attachment, and subsequent colonization
* nanP and fimA present in 100% of isolates from cranial abscesses
* adherence factors (fimC, fimE, and fimG) important for recognition of host-specific tissue
  + fimE - occurred most frequently, present in 98% of isolates from cranial abscesses where virulence gene occurrence was examined

**Take Home**: Trueperella is found on skin, fight wounds allow it to enter, virulence factors allow for epithelial attachment and sc and then intracranial abscessation in male WTD

Journal of wildlife diseases 54(3), 2018, pp. 511-519

**Evaluation of a test and cull strategy for reducing prevalence of chronic wasting disease in mule deer (Odocoileus hemionus)**

Lisa L. Wolfe, Mary Kay Watry, Michael A. Sirochman, Tracey M. Sirochman, and Michael W. Miller

**Abstract**: We evaluated a test and cull strategy for lowering chronic wasting disease (CWD) prevalence in a naturally-infected, free-ranging mule deer (Odocoileus hemionus) herd wintering in the town of Estes Park, Colorado, US and in nearby Rocky Mountain National Park. We tested 48-68% of the estimated number of adult (>1 yr old) deer annually for 5 yr via tonsil biopsy immunohistochemistry (IHC), collecting 1,251 samples from .700 individuals and removing IHC-positive deer. Among males, CWD prevalence during the last 3 yr of selective culling was lower (one-sided Fisher’s exact test P = 0.014) than in the period prior. In contrast, CWD prevalence among females before culling and after culling were equivalent (P = 0.777). Relatively higher annual testing of males (mean 77%) compared to females (mean 51%) might have contributed to differences seen in responses to management. A more intensive and sustained effort or modified spatial approach might have reduced prevalence more consistently in both sexes. Limitations of this technique in wider management application include cost and labor as well as property access and animal tolerance to repeated capture. However, elements of this approach could potentially be used to augment harvest-based disease management

**Summary**:

Introduction:

* Chronic wasting disease (CWD)
  + infectious transmissible spongiform encephalopathy of cervid species
  + culling infected animals or groups are mainstays of recommended strategies for controlling CWD

M+M:

* test and cull in an area in CO
* tonsil biopsy and blood collected for testing after darting deer - IHC
* tagged and culled if positive

Results/discussion:

* Males: last 3 of 5 years had significantly lower prevalence
  + Higher annual testing rates compared to females
  + Females: no difference
* females captured in spring unexpectedly tended towards a higher prevalence than did females captured in autumn
* Estimated prevalence from hunter killed deer in the surrounding area stable/unchanged
* Results potentially support role of predation of sufficiently high intensity and duration in helping suppress CWD outbreaks
* **selective culling did not uniformly reduce CWD prevalence**

Yang, Anni, et al. "Effects of brucellosis serologic status on physiology and behavior of Rocky Mountain elk (Cervus canadensis Nelsoni) in southwestern Montana, USA." *Journal of wildlife diseases* 55.2 (2019): 304-315.

ABSTRACT: Brucellosis, caused by bacteria in the genus Brucella, is an infectious zoonosis affecting animals and humans worldwide. Free-ranging Rocky Mountain elk (Cervus canadensis nelsoni) and bison (Bison bison) in the Greater Yellowstone Ecosystem (areas of southwestern Montana, eastern Idaho, and northwestern Wyoming, US) are the self-sustaining reservoirs of bovine brucellosis (Brucella abortus) and elk are considered the primary source of livestock infections. It has been hypothesized that Brucella-exposed elk might have different physiologic status (pregnancy rates and body condition) and migration behaviors than would healthy elk. **Here we tested the effects of brucellosis serologic status on pregnancy rates and winter ingesta free body fat of 100 female elk in southwestern Montana.** We also evaluated the effects of serologic status on two characteristics of spring migration behavior, migration types (migrant, mixed migrant, resident, disperser, nomad, and undetermined type) and timing (start and end dates and duration). The migration behaviors were quantified using a model-driven approach based on the relative net squared displacement. **We detected a significant difference (P=0.003) in pregnancy rates between seropositive and seronegative elk, with about a 30% drop in seropositive individuals. However, we did not detect differences in body fat between seropositive and seronegative elk or differences in either migration type or timing of spring migration.** **These results confirmed that the major effect of brucellosis in free-ranging elk is associated with reproduction.**

Key points:

·   Evaluated the effects of Brucella serology status on pregnancy rates, body fat, and migration type and pattern. N = 100 adult females

·   Overall 14% seroprevalence of Brucella

·   30% decrease in pregnancy rates in seropositive elk (P=0.0003)

o   Note that this evaluated pregnancy based on serology, impact on carrying the fetus to term/possible abortions was not evaluated

o   May not have a significant impact on population growth rate if the brucellosis-exposed elk only abort their first calf and continue to be fertile after that

·   No significant difference in body fat

·   No difference in migration type

·   No difference in spring migration timing

·   Migration was highly variable overall, likely due to environmental (climate change) related factors

·   Concluded that Brucella impacts reproductive success, but not other markers of health measured in this study

Becker, Michael E., et al. "Postmortem detection of bluetongue and epizootic hemorrhagic disease viruses in the bone marrow of white-tailed deer (odocoileus virginianus)." *Journal of wildlife diseases* 56.1 (2020): 58-65.

Michael E. Becker,Sean Healy,Will Forbes,Jonathan Roberts,James LaCour,and Lane D. Foil. **Postmortem detection of Bluetongue and Epizootic hemorrhagic disease virus in the bone marrow of white-tailed deer (*Odocoileus virginianus*)**. JWD 2020 56(1) 58-65

ABSTRACT: We determined the temporal aspects of detecting bluetongue virus (BTV) and epizootic hemorrhagic disease virus (EHDV) in postmortem bone marrow samples of white-tailed deer (Odocoileus virginianus) using molecular and in vitro cell culture techniques. Bone marrow samples from carcasses were collected and assayed on the day of death and at intervals up to 16 wk after death. We **recovered BTV and EHDV from fresh bone marrow collected at day 0** **by isolation** in Vero and BHK-21 cell cultures. However, attempts to replicate the viruses from aged bone marrow in Vero and BHK-21 cell cultures failed. The real-time quantitative reverse transcriptase PCR **(qRT-PCR)** results confirmed that **EHDV and BTV can be detected in aged bone marrow for up to 12 and 16 wk**, respectively, after death. The RNA of BTV and EHDV could be detected by qRT-PCR in white-tailed deer bone marrow for extended periods of time postmortem. This technique will provide a useful tool for retrospective determination of BTV or EHDV infection of white-tailed deer at the time of death.

Key points

* Hemorrhagic disease associated with bluetongue virus (BTV) and epizootic hemorrhagic disease virus (EHDV) is most important infectious viral disease of wild deer in US
  + Orbivruses transmitted by biting midges (*Culicoides* sp.)
  + Associated with high morbidity and mortality rates
* Common late summer to early fall, causes high fever and dehydration 🡪 deer seek water
  + ↑deer mortality in August-Sept and near water is suggestive of EHDV or BTV
* Blood rich organs (eg spleen) usually used to detect but these tissues often scavenged or degrade prior to carcass discovery
* N=5, WTD with clinical signs HD, bone marrow was collected at 0, 2, 4, 6, 8, and 12 wk postmortem for PCR and virus isolation in cell culture
* **BTV/EHDV was detected by PCR in bone marrow up to 16 weeks and 12 weeks** respectively
  + All bone marrow and spleen samples were BTV-PCR positive on day 0
* **BTV/EHDV virus isolation only from bone marrow up to 24 hours** (no viable cultures >24hr)

**Take** **home**: BTV and EHDV can be detected from bone marrow samples