You are presented with an African penguin (*Spheniscus demersus*) with increased respiratory effort and weight loss, and you suspect aspergillosis. Based on the current literature, what imaging modality has been shown to be the most sensitive for visualization of aspergillus lesions? Compare and contrast voriconazole and itraconazole for treatment of aspergillosis in penguins.

* Computed tomography
* Treatment:
  + Itraconazole – fewer reported toxicities, inconsistent oral absorption, increased resistance, compounded formulations may not reach MIC at peak plasma concentrations
  + Voriconazole – often nonlinear PK, toxicity reported in 6 species of penguin, high oral bioavailability in other species, less resistance

**Practice Questions:**

Which of the following measurements may be the most sensitive for detecting right-sided chamber enlargement in Humboldt penguins (*Spheniscus humboldti*) on routine radiographs?

1. Vertebral heart score (VHS)
2. Cardiocoelomic width ratio (CCWR)
3. Cardiac silhouette-to-keel ratio (CKR)
4. Proventriculus-to-keel ratio (PKR)
5. Cardiothoracic ratio (CTR)

Answer: B

Which of the following fractions determined via protein electrophoresis is unique to aspergillosis diseased African penguins (*Spheniscus demersus*)?

1. Prealbumin
2. Albumin
3. Alpha 1 globulins
4. Alpha 2 globulins
5. Gamma globulins

Answer: D

Trumpp, K., Sander, S., Sander, W., Zimmerman, D., & Bronson, E. (2021). RETROSPECTIVE STUDY OF MORBIDITY AND MORTALITY OF AFRICAN PENGUINS (SPHENISCUS DEMERSUS) UNDER MANAGED CARE IN NORTH AMERICA: 2007–2018. *Journal of Zoo and Wildlife Medicine*, *52*(4), 1135-1142.

Abstract: Currently, more than 20% (51/240) of zoos and aquariums accredited by the Association of Zoos and Aquariums house African penguins (*Spheniscus demersus*) in their collections. The African penguin Species Survival Plan (SSP) veterinary advisors regularly collect information from those facilities to characterize morbidity and mortality for this species and to collate preventative medicine and treatment regimens. These efforts resulted in more than 10 yr of collection of management data across the SSP, representing the care and management of more than a thousand birds. **The most common morbidities reported included those of dermatologic (27%, 125/452 institutions) and musculoskeletal or neurologic (18%, 82/452 institutions) disease, while the most common causes of mortality were respiratory diseases (20%, 65/323 deaths) and systemic or multifactorial conditions (19%, 62/323 deaths). Aspergillosis cases accounted for 69% (45/65 deaths) of respiratory-related mortality and avian malaria cases comprised 31% (19/62 deaths) of mortality related to systemic diseases. Mortality was most commonly reported in geriatric birds, or those older than 15 yr of age (34%, 111/323 deaths). Reproductive related mortality was only defined in female birds,** while other causes of death were more evenly distributed between sexes. Utilizing the SSP data to determine morbidity and mortality trends within this population provides important information to veterinary and animal care teams, allowing them to provide enhanced levels of care to the penguins housed at their institutions. By recognizing the most important diseases and causes of death in this species, management and healthcare resources can target conditions with the highest impact on the population.

Question: Which of the following is true regarding Aspergillosis infection and treatment in African penguins (*Spheniscus demersus*) under managed care in North America?

1. Female penguins with aspergillosis are more likely to die.
2. Aspergillosis most commonly affects geriatric penguins.
3. Voriconazole has been associated with fatal toxicity.
4. *Aspergillosis flavus* is the most common etiologic agent.
5. Aspergillosis infection only occurs in free-ranging populations.

Answer: C

Parsons, N. J., Vanstreels, R. E., & Schaefer, A. M. (2018). Prognostic indicators of rehabilitation outcomes for adult African penguins (Spheniscus demersus). *Journal of Wildlife Diseases*, *54*(1), 54-65.

**Abstract:** The Southern African Foundation for the Conservation of Coastal Birds facility near Cape Town, South Africa, receives ~900 African Penguins (*Spheniscus demersus*) for rehabilitation every year. Data were analyzed from 3,657 adult African Penguins over a 12-yr period (2002–13), and multivariate logistic regression analysis was used to evaluate whether individual history and clinical parameters upon admission could predict the outcome of rehabilitation. **Penguins admitted due to molt or debilitation were more likely to die during rehabilitation than those admitted due to oiling.** **Individuals admitted during summer and spring were more likely to die during rehabilitation than those admitted during winter.** **Penguins diagnosed with Plasmodium infection at some point during rehabilitation were more likely to die than those that were consistently negative, and no significant effect was found for other blood parasite infections**. **Penguins admitted with low body mass, low total plasma protein, or low hematocrit were more likely to die during rehabilitation than those with normal values.****With regard to euthanasia, penguins admitted due to molt, debilitation, injury, or other causes and those admitted during spring or with low plasma protein were more likely to be euthanized.**

Question: Which of the following is true regarding prognostic indicators of rehabilitation and release outcomes for adult African penguins (*Spheniscus demersus*)?

1. Penguins admitted during winter had lower changes of release.
2. The majority of deaths occur between 1-2 months of admission.
3. Oiled penguins had the lowest rehabilitation success and release rate.
4. Penguins admitted while undergoing molt are more likely to die.
5. High total protein on admission is a negative prognostic indicator.

Answer: D

Based on a survey of North American zoos, which of the following treatment options was most effective at treating abnormal molt in African penguin (spheniscus demersus)?

1. GnRH agonists
2. Medroxyprogesterone acetate
3. Levothyroxine
4. Melatonin
5. No treatments have been effective

Answer: d

When designing a penguin exhibit, which of the following factors is most likely to predispose to aspergillosis growth and infection?

1. Low temperatures
2. Inadequate air filtration
3. Abundance of nesting material
4. Low humidity
5. Access to indoor and outdoor spaces