What are the primary histopathologic lesions associated with betanodaviruses in marine teleosts?

1. Vacuolating necrosis of brain and retina
2. Necrosis of liver and pancreas
3. Lymphoplasmacytic gastroenteritis
4. Myocardial necrosis and fibrosis
5. Hyperplasia of the gill tissue

Which of the following chemotherapeutics is the least likely to be cleared from an aquatic system by activated carbon filtration?

1. Trichlorfon
2. Formalin
3. Praziquantel
4. Chloroquine
5. Copper Sulfate

**Practice Question:**

Which of the following species are native to the Great Lakes and would likely have the greatest morbidity and mortality during an outbreak of spring viraemia of carp virus?

1. Walleye (*Sander vitreus)*
2. Muskellunge (*Esox masquinongy)*
3. Fathead Minnow (*Pimephales promelas)*
4. Spotfin Shiner (*Cyprinella spiloptera)*
5. Common Carp (*Cyprinus carpio*)

Answer: C

A Banggai cardinalfish (*Pterapogon kauderni*) presents with white plaques over its operculum and near its lateral line. A skin scrape under direct microscopy shows extremely large, round cells with thickened outer membranes. What is your top differential?

1. Cyprinid herpesvirus 1
2. *Cryptocaryon irritans*
3. Lymphocystis disease virus
4. Granulomatous inflammation
5. Lateral line depigmentation

Answer: C

**Extralabel Drug Use in Wildlife and Game Animals**

Clapham MO, Martin KL, Davis JL, Baynes RE, Lin Z, Vickroy TW, Riviere JE, Tell LA.

JAVMA 2019;255(5):555-568

Which of the following is permissible extralabel drug use under AMDUCA?

A. Ivermectin-medicated bait to control ectoparasites in free-ranging white tailed deer

B. Commercially compounded itraconazole to treat Aspergillosis in a raptor in rehabilitation

C. Vaccination of raccoon kits with recombinant canine distemper vaccine in rehabilitation

D. Telazol immobilization of an untagged female free-ranging white tailed deer

E. Enrofloxacin treatment of sepsis in a cotton-tailed rabbit in rehabilitation

Answer: B

Compounded medications to treat wildlife are permissible when AMDUCA rules are followed (though compounded itraconazole is not recommended due to reports of poor absorption, low plasma concentrations, and treatment failures).

A. Medicated feeds are not permitted in wildlife species

C. Vaccines are considered a biologic and thus do not fall under AMDUCA

D. Telazol is not approved for use in deer and is therefore considered ELDU. ELDU in wildlife is only permissible when it can be kept in captivity or otherwise identified as not safe for human consumption during the withdrawal interval. This would be acceptable if the animal was tagged with a warning or number to call prior to consumption.

E. Enrofloxacin is prohibited from extralabel use in food animals and is therefore illegal to use in any animal that may enter the human food chain.

**Clinical Fish Medicine Ch A12 Medical Treatment**

Which of the following would be illegal to use in a salmonid that may enter the human food chain?

1. Florfenicol
2. Formalin
3. Malachite Green
4. Hydrogen peroxide
5. Oxytetracycline

Answer: C

Malachite green is prohibited in food animal species in the US due to carcinogenic and genotoxic effects.

\*Formalin is banned from use in fish in the EU due to carcinogenic effects

List 4 antibiotics approved by the US FDA for use in fish under specific indications.

A: florfenicol, sulfadimethoxine-ormetoprim, sulfamerazine, oxytetracycline

Sulfamerazine: approved by the FDA in the 1960s for use in food fish but no longer available in the US

Trimethoprim-Sulfadiazine: approved for use in salmonids in Europe and Canada but not the US

Oxolinic Acid: approved for use in aquaculture fish in Europe but not the US

Which of the following is an FDA approved drug for use in aquaculture?

1. Enrofloxacin
2. Vancomycin
3. Malachite green
4. Oxytetracycline
5. Chloramphenicol

Answer: D

Compare and contrast Cyprinid herpesvirus 1, 2, and 3, including species primarily affected, age group affected, severity, and primary lesions/organs affected

Cyprinid herpesvirus 1 (CyHV1; carp pox)

Carp and koi

Usually self-limiting, primarily a cosmetic problem.

Adult fish

Soft, friable, translucent pink, papillomatous or plaque like areas of epidermal hyperplasia.

Cyprinid herpesvirus 2 (CyHV2; goldfish herpesvirus, herpesviral hematopoietic necrosis virus)

Juvenile goldfish

Can cause high mortality.

Target is hematopoietic tissue of head kidney, necrosis can lead to profound anemia, infarcts in gills.

Cyprinid herpesvirus 3 (CyHV3; koi herpesvirus)

Koi and carp industries

Gills are primary target.

Severe, segmental, necrotizing and proliferative bronchitis, high mortality for all ages

Soto, E., Tamez-Trevino, E., Yazdi, Z., Stevens, B. N., Yun, S., Martínez-López, B., & Burges, J. (2020). Non-lethal diagnostic methods for koi herpesvirus in koi Cyprinus carpio. *Diseases of aquatic organisms*, *138*, 195-205.

**Abstract**Cyprinid herpesvirus 3, also known as koi herpesvirus (KHV), is a viral pathogen responsible for mass mortalities of carp worldwide. In this study, we **compared the sensitivity and specificity of ELISA and quantitative PCR (qPCR) methods for the diagnosis of KHV in experimentally infected koi Cyprinus carpio over an 11 mo period.** Koi were exposed to KHV at 18 ± 1°C (permissive temperatures for KHV disease) in laboratory-controlled conditions. At 21 d post challenge, the temperature in the system was decreased to <15°C (non-permissive temperature for KHV disease), and fish were monitored for the following 11 mo. At different time points throughout the study, samples of blood and gills were collected from exposed and control koi and subjected to qPCR and ELISA. Survival proportions of 53.3 and 98.8% in exposed and control treatments, respectively, were recorded at the end of the challenge. Traditional receiver-operating characteristic analysis was used to compare the sensitivity of the ELISA and blood and gill qPCR during permissive and non-permissive temperatures. **ELISA was superior to qPCR of gills and whole-blood samples in detecting previous exposure to KHV. Similar results were obtained in a second experiment exposing koi to KHV and inducing persistent infection at >30°C (non- permissive temperature for KHV disease).** Finally, **KHV ELISA specificity was confirmed** using cyprinid herpesvirus 1-exposed koi through a period of 3 mo. This study demonstrates that the combination of **ELISA and gill qPCR should be recommended in the diagnosis of KHV exposure of suspected carrierstate fish.**

Question:

Which of the following is true regarding diagnostic testing for cyprinid herpesvirus 3?

1. qPCR of blood is more sensitive than qPCR of gill tissue.
2. qPCR of blood is superior to ELISA in detecting previous exposure to KHV.
3. CyHV-1 can cross react with KHV on KHV ELISA tests, reducing sensitivity.
4. qPCR of gill tissue allows for earlier detection compared to qPCR of blood.
5. Epithelial hyperplasia is the most common histologic finding.

Answer: D

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Question:

Name two cyprinid herpesviruses that are reportable to the OIE.

Answer:

Cyprinid herpesvirus 3 (koi herpes virus)

Spring Viremia of Carp Virus