• **Contributor:** Laboratory of Comparative Pathology, Hokkaido University, Sapporo, Japan

• **Signalment:** Juvenile, Whooper swan (*Cygnus cygnus*).

• **Gross Description:** The bird was in relatively good nutritional condition. In pancreas, multiple hemorrhagic foci up to 8 mm were scattered.

• **History:** This wild swan was found weak at the northern lake of Japan in Jan, 2011. A local veterinarian euthanized the bird and detected influenza virus using rapid test kit. The carcass was transported to Hokkaido university and dissected within the biosafety level 3 facility.

• **Histopathologic Description:** Heart: Multifocal to coalescing myocardial necrosis and scattered infiltration of inflammatory cells throughout the heart. The lesions consisted of coagulative necrosis of myocardial fibers admixed with lymphocytes, macrophages and mild hemorrhage. By immunohistochemistry, strong positive signals of influenza virus antigens were confirmed in myocardiocytes around the inflammatory lesions. A few parasitic nematodes enclosed in cuticles were visible in the myocardium. The nematodes contained microfilaria-like structures in their viscera. Inflammatory reaction to the parasites was indiscernible.
• **Contributors Morphologic Diagnosis:** Myocarditis, necrotic and nonsuppurative, multifocal to coalescing, severe, influenza virus infection and parasitic nematode infection.

• **Contributor Comment:** HPAI of H5N1 subtype is a threat to public health and fowl industry. First serious H5N1 was reported in Hong Kong in 1997 and emerged in east and southeast Asian countries in 2003 with Japan suffering small outbreaks in domestic fowl since then. HPAI surveillance in poultry farm and wild migrating birds is important to control and predict the epidemics of HPAI. This swan was one of the birds likely on migration from southern Asian countries to Siberia.

• Histologically, there was widespread necrosis and nonsuppurative inflammation in the heart, pancreas and brain that were consistent with HPAI infection lesion reported elsewhere in natural and experimental infections. IHC using anti-H5 subtype influenza virus polyclonal antibody also revealed the distribution of viral antigens in the lesions in the various organs, suggesting systemic infection of influenza virus.

• The lesions vary from mild to severe, although the affected birds usually die shortly after systemic infection. The histopathological lesions in the present case were relatively severe.

• Adult heartworms containing microfilariae in their uterus were found in the heart of the present case. Morphologically, the parasites were presumably identified as *Sarconema eurycerca*, a filarial nematode of the superfamily *Filariodea*. Although mortality cases in wild birds are reported, the pathological significance of this worm is still not well understood. Gross lesions described include an enlargement of the heart with dark red and white streaks due to the migration of adult worms in myocardium.

• The infection of heartworms may partly contribute to the development of severe myocardial lesions, but the cause of death in this swan might be concluded as systemic influenza virus infection.
JPC Diagnosis:
1. Heart: Myocarditis, heterophilic and granulomatous, chronic, multifocal, moderate, with myofiber necrosis, atrophy and loss, with adult filarid nematodes and microfilaria.
2. Heart: Vasculitis, heterophilic and necrotizing, multifocal, with thrombosis and myofiber degeneration and necrosis.

The contributor did not identify chronic granulomatous myocarditis and muscle atrophy as histological features.

Heterophilic myocarditis and vasculitis JPC diagnosed are not readily visible features this case

Conference Comment: The contributor provides an informative summary of both HPAI and Sarconema eurycerca infection in this very interesting case. Conference participants discussed the two disease processes occurring simultaneously and speculated on the two distinct patterns of necrosis in the heart: The chronic lesions are attributed to adult filarid migration tracts while the granulomatous inflammation observed in some sections is associated with microfilaria. Although the relationship between the chronic myocardial lesions and the more acute vasculitis, thrombosis and coagulative necrosis are unclear, participants attributed the latter to infection with HPAI.

HPAI is in the family Orthomyxoviridae, genus Influenzavirus A. Influenza A viruses commonly infect horses, swine, and domestic poultry, as well as humans. Wild birds, particularly ducks, shorebirds and gulls, are reservoir hosts for low-pathogenicity influenza A viruses; however, mink, seals, whales and dogs can also become infected. Influenza A viruses are currently classified into 16 hemagglutinin (H) and 9 neuraminidase (N) types. Gene reassortment results in numerous combinations of H and N subtypes; however, only a few combinations are important in naturally occurring infections in animals. Pathogenic combinations for other domestic animals and humans have been classified by other authors as well as factors that determine their pathogenicity.

Differential diagnosis of mononuclear myocarditis (Westnile Virus, Newcastle disease virus and protozoal myocarditis) were discussed. The presence of myocardial, pancreatic and/or hepatic necrosis in waterfowl should immediately raise the suspicion of HPAI infection.