 **2023 Northeastern Veterinary Pathology Conference** 

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IDENTIFICATION NUMBER: 4178357-00/G220782/I210838

SIGNALMENT: Adult (unknown age) female basket star (*Gorgonocephalus eucnemis*)

HISTORY/PHYSICAL EXAM: This central disc was melting, and the animal was euthanized.

GROSS FINDINGS: Five tissues, up to 21 cm, were received in formalin and processed in six blocks, with appropriate decalcification of blocks #2-6.

HISTOPATHOLOGIC FINDINGS:
Pyloric stomach, gastrodermis: Affecting approximately 75-80% of the section, there is multifocal individual cell degeneration, loss of cellular architecture and replacement by cellular and karyorrhectic debris (necrosis), or sloughing of the pseudostratified columnar epithelium, secretory cells, and supporting cells of the pyloric gastrodermis. Within the gastrodermal lumina, there is abundant dark brown granulated material. The pseudostratified epithelial cells of the gastrodermis frequently have 20-30-µm-diameter, oval, deeply basophilic, glassy, intranuclear inclusions that peripheralize the chromatin. Body wall (not shown): The epidermis is multifocally necrotic with cavitating lesions into the mutable collagenous tissue and minimal coelomocytic infiltration.

TRANSMISSION ELECTRON MICROSCOPY:
Pyloric stomach, gastrodermis: 1,000x image: There are approximately four to eight gastric polygonal cells with distinct cell borders, a moderate cytoplasm, a round to oval nucleus with a moderate amount of euchromatin, sparse heterochromatin, and a prominent central round nucleolus. The cytoplasm contains few organelles, most of which are phagosomes. 1,000x image: In adjacent polygonal cells, there is cytoplasmic vacuolation, mucin droplets, and degeneration and breakdown of the nucleolemma. 1,200x, 4,000x images: Expanding the nucleus of a gastric polygonal cell is an electron dense intranuclear viral inclusion with abundant 72-nm-diameter round to icosahedral, electron dense virions, attempting to form paracrystalline arrays.

MORPHOLOGIC/ETIOLOGIC DIAGNOSIS:
Pyloric stomach, gastrodermis: Epithelial degeneration and necrosis, diffuse, severe, acute with abundant intranuclear viral inclusions.

DISCUSSION: This is the first recorded case of a viral infection that was confirmed histologically and ultrastructurally in an echinoderm. All previously reported “viral

infections" in echinoderms have identified viruses only through molecular methods and failed to localize viruses in echinoderms tissues. In this case, TEM revealed abundant intranuclear 72 nm virions, occasionally arranged in arrays. This morphology is most suggestive of either an adenovirus or adomavirus. PCR is pending in attempt to identify this virus. The viral inclusions were associated with abundant gastrodermal karyorrhexis, a lesion that is rarely seen in echinoderms (LaDouceur, personal communication), suggesting a possible causative effect from this viral infection.

Sea Star Wasting Disease (SSWD) is a non-specific term for a clinical syndrome in echinoderms that may result in: focal to multifocal flat to nodular white dermal lesions that may progress to perforation of the body wall and internal organ exposure[3], loss of turgor (deflation) of the body[1], twisting of arms and limbs, or stomach eversion[3]. These clinical signs may result in death of the echinoderm within days to weeks; some clinicians anecdotally report recovery from SSWD if the animal is treated with antibiotics for weeks to months (LaDouceur, personal communication). There are numerous causes for SSWD, most of which are related to changes in the aquatic environment, such as temperature fluctuation, organic matter load changes, water quality, issues, etc. Infectious causes, such as bacteria and scuticociliates, are uncommonly identified. Recently it is postulated that SSWD may result in alterations or shifts in the host microbiome composition, which ultimately results in sea star demise, wasting, and death[3]. Ultimately, no infectious agents have been consistently isolated or identified by light microscopy or electron microscopy within diseased sea stars or their lesions[1]. In 2012-2015, SSWD resulted in deaths of billions of sea stars along the Pacific coast of North America[1,3.] A 2014 study reported DNA sequencing of these diseased sea stars resulted in the isolation of a novel sea star associated densovirus (SSaDV), and this virus was initially thought to be the infectious cause of SSWD[3]. However, it was soon discovered SSaDV is also commonly isolated from clinically healthy sea stars and is present free in the water column. As such, the group that originally reported SSaDV determined that this virus was very unlikely to have caused the 2012-2015 outbreak. Additionally, it was found that the 2012-2015 SSWD outbreak was highly correlated with fluctuations is water temperature.[1]

ACKNOWLEDGEMENTS:

Thank you to the SSWD Pathology Working Group for review of this case, especially Dr. Alvin Camus (College of Veterinary Medicine, University of Georgia). The authors also wish to thank the TEM laboratory and administrative staff at JPC, specifically Adina Cummings Tasker, Blondell Smith, Kayla Coffin, Stacey Tamer, Warren McNeal, Kenenya Gathers, and Ann Brown. Special thanks to the WRNMMC laboratory for providing outstanding histology technical support.

DISCLAIMER:

The views expressed in this abstract are those of the authors and do not necessarily reflect the official policy of the Department of Defense or U.S. Government.

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