



Diagnostic Exercise
From The Latin Comparative Pathology Group*

Oleander (*Nerium oleander*) intoxication in a bison

Contributors:

Nicolás Streitenberger¹, Javier Asin¹, Mauricio A. Navarro²,
Robert H. Poppenga³ and Francisco A. Uzal^{1*}

¹ California Animal Health and Food Safety Laboratory System, San Bernardino Branch, University of California-Davis, San Bernardino, USA

² Instituto de Patología Animal, Facultad de Ciencias Veterinarias, Universidad Austral de Chile, Valdivia, Chile

³ California Animal Health and Food Safety Laboratory System, Davis Branch, University of California-Davis, Davis, USA

****Corresponding author:** E-mail: fauzal@ucdavis.edu

Clinical History:

Two 18-month-old female bison and a heifer died suddenly in the same ranch. The three animals were submitted for postmortem examination and diagnostic workup. The changes of one of the bison are presented here.

Necropsy Findings:

The carcass was in fair nutritional condition, with small amount of fat reserves, but still well fleshed, and in mild state of post-mortem decomposition. There was a small amount of clotted dark-red blood in the nostrils and anus. The heart presented extensive sub-endocardial hemorrhages in all four chambers. These lesions were most pronounced in both ventricles where they extended deep into the underlying myocardium (Fig. 1 and Fig. 2). The mucosa of the abomasum was diffusely and mildly congested, and the mucosa of the small and large intestine was diffusely and severely congested (Fig. 3). There was a moderate amount of red fluid in the lumen of the small intestine, cecum, and colon. Both lungs had a few, small, well delineated, deep, firm, multifocal dark-red areas in all pulmonary lobes, but lung tissue samples floated when placed into formalin.

Follow-up questions:

- *Microscopic description*
- *Morphologic diagnosis*
- *Most likely etiology*

**The Diagnostic Exercises are an initiative of the Latin Comparative Pathology Group (LCPG), the Latin American subdivision of The Davis-Thompson Foundation and published in cooperation with the Brazilian Journal of Veterinary Pathology. These exercises are contributed by members and non-members from any country of residence.*

Consider submitting an exercise! A final document containing this material with answers and a brief discussion will be posted on the CL Davis website:

<https://davisthompsonfoundation.org/diagnostic-exercise/>

Editor-in-chief for this Diagnostic Exercise: Claudio Barros
Associate Editor for this Diagnostic Exercise: Francisco A. Uzal



Gross and Microscopic Images:

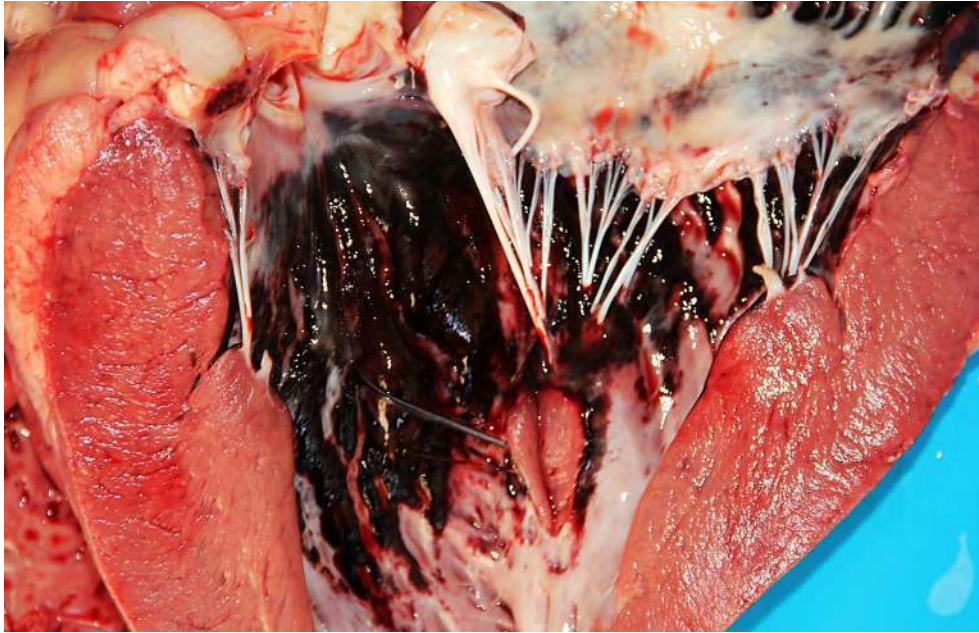


Figure 1. Left ventricle of the heart in a bison with *Nerium oleander* intoxication. There is severe, focally extensive to diffuse sub-endocardial hemorrhage.

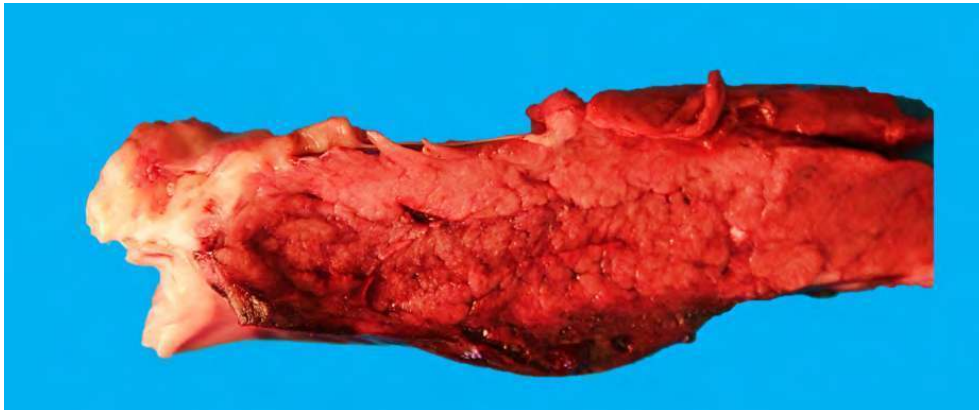


Figure 2. Left ventricle papillary muscle of the heart in a bison with *Nerium oleander* intoxication. There is severe, focally extensive sub-endocardial hemorrhage extending deep into the myocardium.



Figure 3. Small intestine of a bison with *Nerium oleander* intoxication. There is severe, diffuse congestion.

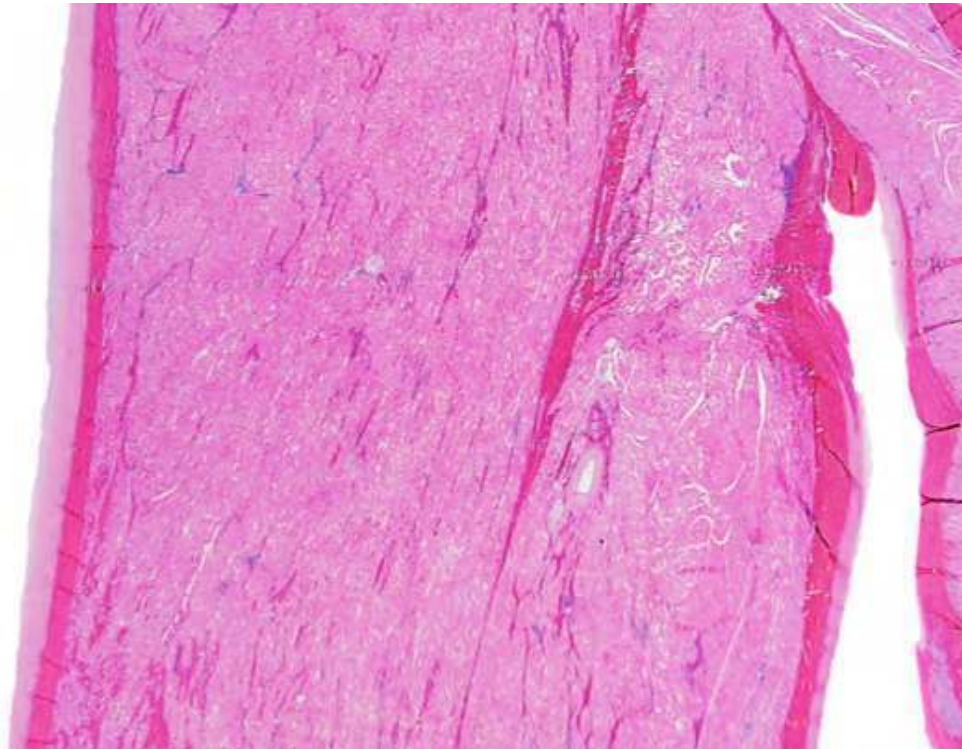


Figure 4. Myocardium of a bison with *Nerium oleander* intoxication. Extensive areas of hemorrhage can be observed at this magnification. H&E.

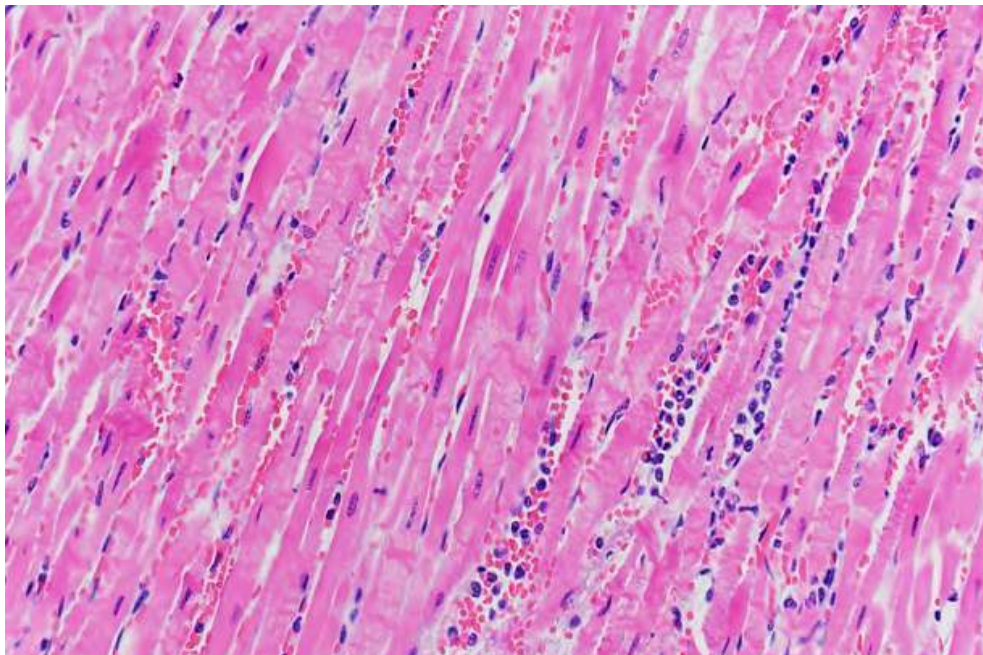


Figure 5. Myocardium of a bison with *Nerium oleander* intoxication. The myofibers show fragmentation, hypercontraction bands, hyper eosinophilia, lack of cross striations, vacuolation, and pyknosis. There is also infiltration of neutrophils, lymphocytes, plasma cells and fewer macrophages. H&E.

- **Microscopic description:** Heart. Extensive areas of hemorrhage admixed with fibrin, edema, and moderate number of neutrophils, lymphocytes, plasma cells and fewer macrophages are multifocally present in the myocardium; these changes are most marked in subendocardial and subepicardial myocardium. The myofibers in these areas have one or more of the following changes: fragmentation, hypercontraction bands, hypereosinophilia, lack of cross striations, vacuolation, and pyknosis (cardiomyocyte degeneration and necrosis) (Fig. 4 and Fig. 5). Thrombi are occasionally seen within the areas of hemorrhage.
- **Morphologic diagnosis:** Myocardial degeneration and coagulative necrosis, severe, multifocal, monophasic, subacute, with multiple foci of hemorrhages and pleocellular leukocyte infiltration.
- **Most likely etiology:** *Nerium oleander* (oleander) intoxication

Discussion:

Oleandrin, the toxic principle of *Nerium oleander* - *oleander* - (1,3) was detected in liver, and in rumen and colon contents via liquid chromatography with tandem mass spectrometry (LCMS), which, coupled with the gross and microscopic lesions, confirms the diagnosis of oleander poisoning (4). The source of oleander was the waste of plant clippings present on the ranch to which the animals had accidental access. There are no available descriptions of oleander intoxication in American bison in the scientific literature. In this case, the other two animals submitted for necropsy together with this animal from the same ranch, were also confirmed to have died of oleander poisoning. The clinico-pathologic presentation in the two bison was much more hemorrhagic than in the heifer, with abundant blood oozing from body orifices due to severe gastrointestinal hemorrhage, which initially had prompted a suspicion of anthrax. Other causes of myocardial necrosis such as ionophore and gossypol poisoning, vitamin E/selenium deficiency and several viruses (bluetongue, bovine coronavirus, border disease, epizootic hemorrhagic disease, infectious rhinotracheitis and malignant catarrhal fever) (2) were considered during the diagnostic process but were ruled out based on history and specific testing for most of those agents. Additional ancillary testing included aerobic culture (negative), *Salmonella* spp. culture (negative) and heavy metal screen, which was unremarkable, except for low copper levels, a change that was considered incidental.

References

1. Galey FD, Holstege DM, Plumlee KH, Tor E, Johnson B, Anderson ML, Blanchard PC, Brown F. Diagnosis of oleander poisoning in livestock. *J Vet Diagn Invest.* 1996 Jul; 8(3):358-64. doi: 10.1177/104063879600800314. PMID: 8844581.
2. Robinson WF, Robinson NA. Cardiovascular system. In: Maxie MG, ed. *Jubb, Kennedy and Palmer's Pathology of Domestic Animals.* Vol 3. 6th ed. Philadelphia, PA: Elsevier Saunders; 2016: 34-39.
3. Rubini S, Rossi SS, Mestria S, Odoardi S, Chendi S, Poli A, Merialdi G, Andreoli G, Frisoni P, Gaudio RM, Baldisserotto A, Buso P, Manfredini S, Govoni G, Barbieri S, Centelleghes C, Corazzola G, Mazzariol S, Locatelli CA. A Probable Fatal Case of Oleander (*Nerium oleander*) Poisoning on a Cattle Farm: A New Method of Detection and Quantification of the Oleandrin Toxin in Rumen. *Toxins (Basel).* 2019 Jul 25;11(8):442. doi: 10.3390/toxins11080442. PMID: 31349685; PMCID: PMC6723884.
4. Varga A, Puschner B. Retrospective study of cattle poisonings in California: recognition, diagnosis, and treatment. *Vet Med (Auckl).* 2012 Nov 14; 3:111-127. doi: 10.2147/VMRR.S28770. PMID: 30155434; PMCID: PMC6065581.