Chapter 1

Forensic Investigation of Equine Intoxications

DEFINITION/OVERVIEW

- Determining underlying causes for sudden or unexplained equine deaths has significant medicolegal importance. Potentially all horses are at risk, but horses are less commonly intoxicated than other species due to more selective dietary habits, more controlled environments, and more observant owners.
- Clues that might point towards an intoxication include sudden death of one or more otherwise healthy horses, recent feed or environmental changes, easy access to chemical storage areas or trash piles, access to areas with potentially toxic plants, or threats of poisoning.
- Malicious poisoning does occur due to disputes or in situations in which animals are insured or involved in some form of competition.
- Determining the cause and manner of death is critical to substantiating claims and the ultimate liability of insurers.
- A systematic and thorough postmortem examination is essential to confirm death caused by toxicant exposure.
- Documentation (e.g., use of chain-of-custody procedures) of proper sample collection, storage, and laboratory submission is crucial, especially with accidental feed contamination or malicious poisoning suspicions.
- Toxicant testing can be targeted (i.e., testing for specific toxicants) or non-targeted (i.e., looking for unknowns). While non-targeted testing can identify many toxicants, there is no single comprehensive test for unknowns.
- It is important to keep an open mind when investigating the death of any animal and not to be misled by allegations of malicious intent.

SIGNALMENT/HISTORY

- Exclusive of plants for which ingestion is associated with sudden death, potential toxicants include strychnine, phosphides, cholinesterase-inhibiting insecticides (e.g., OPs, carbamates), nicotine, metaldehyde, cyanide, fluoroacetate, illicit drugs (e.g., amphetamines, cocaine, heroin, morphine), metals (e.g., mercury, arsenic, lead, selenium, iron), drugs (e.g., insulin, barbiturates, reserpine, succinylcholine), electrolytes (e.g., potassium, calcium) and vitamins A, D, and E.

Blackwell's Five-Minute Veterinary Consult Clinical Companion: Equine Toxicology,
First Edition. Edited by Lynn R. Hovda, Dionne Benson, and Robert H. Poppenga.

Companion website: www.wiley.com/go/hovda/equine

- Ingestion of toxic plants is a less common cause of malicious poisoning but still a possibility. Exposure to extremely toxic plants (e.g., *Taxus* spp. [yew], *Nerium oleander* [oleander], *Conium maculatum* [poison hemlock], *Cicuta* spp. [water hemlock]) should be considered, as should zootoxins (e.g., cantharidin).

CLINICAL FEATURES

- Signs vary considerably depending on the specific toxicant to which a horse is exposed.
- Most malicious intoxications are associated with administration of highly toxic drugs or chemicals intended to kill quickly.
- An ideal toxicant used maliciously would cause rapid death, not result in specific postmortem lesions, and be difficult to detect in postmortem tissue or fluid samples. Fortunately, the list of toxicants meeting all three criteria is rather limited.
- Most toxicants that result in sudden death impair the central or peripheral nervous systems, cardiovascular system, or respiratory system. Thus, if signs are noted before death, they generally relate to failure of one or more of these systems.
- Intoxications can result in more chronic disease and multiple exposures might be required before onset of clinical signs (e.g., ingestion of pyrrolizidine alkaloid-containing plants).
- Depending on the toxicant, there might be evidence of struggle before death, as might occur following central nervous system (CNS) stimulation or respiratory impairment. Alternatively, some toxicant-induced deaths are associated with no struggle before death, as might occur after administration of a barbiturate or other CNS depressant.

DIFFERENTIAL DIAGNOSIS

- There are many causes of sudden or unexplained death other than toxicants:
  - Physical causes – trauma, electrocution, lightning strike, suffocation, heat stroke, and gunshot.
  - Natural or genetic causes – hyperkalemic periodic paralysis, cardiac conductive disturbances, acute myocardial necrosis, cerebral thromboembolism, aortic aneurysm or other vessel rupture, and neoplasia.
  - Infectious or parasitic causes – acute clostridial diseases, salmonellosis, Tyzzer's disease, anthrax, equine monocytic ehrlichiosis, foal actinobacillosis, babesiosis, and verminous arteritis.
  - Metabolic and nutritional causes – hypoglycemia, hypocalcemia, hypomagnesemia, and selenium or vitamin E deficiencies.

DIAGNOSTICS

CBC/Serum Chemistry/Urinalysis

- When possible, collect whole blood, serum, plasma, and urine before death for routine clinicopathologic tests; this helps to delineate pathophysiologic processes, which aids in refining an initial differential list.

Other Laboratory Tests

- In addition to samples collected for clinicopathologic testing, other samples for toxicologic analysis include stomach contents, urine, liver, kidney, brain, eyeball, and heart blood. Given the delay in the possible incorporation of a chemical into hair, hair samples are not generally useful for testing.
- With any suspicion of an injection site, obtain tissue from around that site.
- Collect representative feed and water samples.
- Submit plants for identification if necessary (submit fresh whole plants, wrap plant [at least the base of the plant] in moistened paper towels, place in a plastic bag and keep chilled; representative samples of hay can also be collected for identification of contamination).
- Because of medicolegal considerations, handle all samples under chain-of-custody procedures. These records specifically identify each specimen, document their condition and container in which they are packaged, time and date of both transfer and receipt of samples, and all individuals involved in their handling, transfer, or receipt.
- Testing can be targeted or non-targeted depending on whether there are known exposures or unknown exposures. Mass spectrometry is a powerful technique for broad-based targeted testing. However, there is no one or two analytical procedures that can rule out all possible chemical exposures.

Pathological Findings

- Conduct a complete and thorough postmortem examination.
- Consider transporting the animal to a veterinary diagnostic facility as soon as possible. If this is not an option, conduct a thorough field postmortem examination, and record any actual or suspected abnormalities.
- If an animal cannot be taken to a veterinary diagnostic facility, consultation with a veterinary pathologist or toxicologist might be warranted to ensure collection and appropriate preservation of useful samples in sufficient quantities.
- Carefully examine stomach and GI tract contents for evidence of toxic plant fragments or unexpected grain or forage ingestion.
- Collect formalin-fixed samples from all major organ systems and any gross lesions, and submit these samples to a veterinary pathologist for histopathologic examination.

THERAPEUTICS

- In many situations, treatment is not possible; however, if the animal is alive, direct treatment toward stabilization of vital organ systems – establish and maintain an open airway, control seizures, correct life-threatening cardiac dysrhythmias, and begin fluid administration.
- Once the animal is stabilized, initiate oral and dermal decontamination.

Detoxification

- AC (1–4 g/kg PO in water slurry [1 g of AC in 5 mL of water]).
- One dose of cathartic PO with AC if no diarrhea or ileus – 70% sorbitol (3 mL/kg) or sodium or magnesium sulfate (250–500 mg/kg).
- Administration of other drugs depending on the individual situation.

Appropriate Health Care

Appropriate monitoring and follow-up depend on the specific toxicant under suspicion or analytically confirmed.

Antidotes

- Antidotes are not available for most toxicants, but fortunately, many animals survive with timely decontamination and appropriate symptomatic and supportive care.
- If an antidote is available, consider giving it first before further treatment.

COMMENTS

Prevention/Avoidance

- Routinely inspect the immediate environment of an animal and note any unusual human activity.
- Routinely inspect feed and water for any foreign material.
- Encourage clients to know sources of feeds and forages.
- To minimize malicious poisoning opportunities, camera surveillance can be considered, particularly for valuable animals.

Possible Complications

- Potential complications depend on the specific toxicant involved.

Expected Course and Prognosis

- Variable depending on the chemical.

See Also

Necropsy Analysis
Other specific toxicant topics

Abbreviations

See Appendix 1 for a complete list.

Suggested Reading

Haliburton JC, Edwards WC. Medicolegal investigation of the sudden or unexpected equine death: toxicologic implications. In: Robinson, NE, ed. Current Therapy in Equine Medicine 4. Philadelphia: WB Saunders, 1997; pp. 657–659.

Johnson BJ. Handling forensic necropsy cases. Vet Clin N Am: Equine Practice 2001; 17(3):411–418.

Poppenga RH. Toxicology. In: Southwood LL, Wilkins PA, eds. Equine Emergency and Critical Care. Boca Raton: CRC Press, 2015.

Author: Robert H. Poppenga DVM, PhD, DABVT
Consulting Editor: Robert H. Poppenga DVM, PhD, DABVT