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## Pearls for the Practitioner

### Topic: Dialysis for Intoxications

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#### **BENJAMIN!!!**

Benjamin is a 6 year old male castrated Golden Retriever who decided one day to eat his sister's entire phenobarbital prescription. All in all, Benjamin ingested over 100 mg/kg of phenobarbital! By the time his owner came home and discovered the scene of the crime, he had become very lethargic and weak. He was hospitalized at his local veterinary hospital where emesis was induced and activated charcoal administered. Unfortunately the majority of the phenobarbital had already been absorbed into his blood stream, and Benjamin was in a drug-induced coma. He could barely breathe on his own by the next day.

He was transferred to the Animal Medical Center for hemodialysis, along with charcoal perfusion, because phenobarbital can be removed from the body by dialysis. Within 30 minutes of starting dialysis, Benjamin was breathing better. By one hour, he was awake and raising his head. After 3 hours of dialysis, he had become a typical Golden Retriever: trying to get into the garbage! His phenobarbital level prior to dialysis was 160 ug/ml (therapeutic range: 15-45 ug/ml), and after 5 hours of dialysis the level was down to 25 ug/ml. After 24 hours of hospitalization, Benjamin was able to return home!

#### **DISCUSSION**

Dogs and cats can be exposed to a number of toxins, and the method of addressing a specific toxicity depends on a variety of factors. General principles include gastric decontamination (including inducing vomiting and oral administration of activated charcoal), increasing elimination (IV fluids, altering metabolism), and specific antidotes when available. Other available options include direct removal of the toxin when possible.

Hemodialysis is an extracorporeal therapy traditionally used to treat acute renal failure and chronic kidney disease patients. The main principle behind dialysis is that blood is removed continuously from the patient during the treatment, passes through a filter (the dialyzer)

which removes unwanted substances (uremic toxins), and certain substances can be added to the blood (via the dialysate, such as bicarbonate) before returning the blood to the patient. The continual replenishment of fresh dialysate (i.e. toxin-free) ensures a constant diffusion gradient for the passage of unwanted substances from the blood to the dialysate via the dialyzer (high gradient to low gradient). Many substances can be removed by dialysis, including medications such as phenobarbital, and household substances such as ethanol (alcohol) or caffeine. Ethylene glycol (antifreeze) can be readily removed from a patient and renal failure averted if dialysis therapy is begun early enough after ingestion (within 6 hours). Small molecules, especially those less than 500 daltons, but up to 1500 daltons or more, are small enough to fit through the pores of the dialyzer membrane.

Charcoal hemoperfusion is a method of passing the blood over a substance (activated charcoal) that binds toxins and removes them from the blood. Charcoal hemoperfusion can be used to remove substances that are less effectively removed by dialysis, such as certain antibiotics, non-steroidal anti-inflammatory drugs, some chemotherapeutic drugs, amatoxins (poisonous mushrooms), and others. Charcoal perfusion therapy is sometimes combined to standard hemodialysis to remove a greater fraction of a toxin.

Not all toxicities can be treated with these techniques, but they add to our abilities to address toxicities for which there is no antidote. These therapies are reserved for cases that are severe in which traditional management has failed. While hemodialysis can be performed on dogs and cats, charcoal hemoperfusion is generally limited to medium to large dogs because of the amount of blood that is required to be outside the body at a time.

In conclusion, hemodialysis and charcoal hemoperfusion can be used to rapidly remove many toxins from the blood.[1-4] In Benjamin's case, it saved him from a much longer hospitalization (and higher cost!), as well as potential complications from being in a drug-induced coma such as aspiration pneumonia and even death.

The Dialysis Team of the Nephrology Service at The Animal Medical Center is available 7 days a week, 24 hours a day for emergencies. Veterinarians can reach us anytime at 212-838-8100. Non-urgent inquiries or questions can also be addressed via email: [hemodialysis@amcny.org](mailto:hemodialysis@amcny.org).

#### The Dialysis Team at The Animal Medical Center

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To reach a Referral Coordinator, please call 212.329.8758/8890.

## SUGGESTED READING

1. **Langston, C.E.**, *Acute Uremia*, in *Textbook of Veterinary Internal Medicine*, S.J. Ettinger and E.C. Feldman, Editors. 2010, Saunders Elsevier: Philadelphia. p. 1969-1984.
2. **Langston, C.E.**, *Hemodialysis in Dogs and Cats*. *Compend Contin Educ Pract Vet*, 2002. 24(7): p. 540-549.
3. Scott, N.E., T. Francey, and K. Jandrye, *Baclofen intoxication in a dog successfully treated with hemodialysis and hemoperfusion coupled with intensive supportive care*. *J Vet Emerg Crit Care*, 2007. 17(2): p. 191-196.
4. Torre, D.M., et al., *Treatment of a dog with severe baclofen intoxication using hemodialysis and mechanical ventilation*. *J Vet Emerg Crit Care*, 2008. 18(3): p. 312-318.