Under Pressure

Hyperbaric therapy holds promise—but is it safe and scientifically valid?

by Joel Warner

To the uninitiated, hyperbaric oxygen therapy can seem like something out of science fiction: a futuristic cylindrical chamber that, simply through the use of pressurized oxygen, can noninvasively treat ailments ranging from infections and wounds to bone fractures and head trauma.

Advocates for hyperbaric oxygen therapy say it is akin to a miracle drug, one that's reinvigorated their practices. Others, however, worry the therapy might be too good to be true—animal-based research on the matter is minimal, and veterinary hyperbaric chambers have been associated with catastrophic accidents that have killed both animals and humans.

One thing is clear: Hyperbaric oxygen therapy is a hot topic in veterinary circles these days. Here's what you need to know to separate the science from the science fiction.

From deep-sea divers to animals

The medical use of hyperbaric, or pressurized, chambers isn't new, says Dennis Geiser, DVM, DAVBP, associate professor in the Large Animal Clinical Sciences department at the University of Tennessee's College of Veterinary Medicine and

Jerry Jensen, CVT, (left) assists a patient into the hyperbaric chamber in the ICU at AAHA-accredited referral Veterinary Specialty Center in Buffalo Grove, Ill. Photo courtesy of Hyperbaric Veterinary Medicine (hvm). www.hvmed.com

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—RONALD LYMAN, DVM

founder of the Veterinary Hyperbaric Medical Society.

As far back as 1662, physicians were experimenting with pneumatically pressurized chambers as a treatment for lung ailments and other illnesses. Later, in the early 20th century, the military began using pressurized oxygen to treat decompression sickness, or "the bends," among deep-sea divers.

"Then it was adopted by the medical industry to treat various diseases," says Geiser. Currently, the Undersea and Hyperbaric Medical Society has approved hyperbaric oxygen therapy as a reimbursable treatment for 14 human conditions including carbon monoxide poisoning, anemia, and skin grafts.

For years, the only time animals would be placed in hyperbaric chambers was during lab research, says Geiser. Lately, however, that's changed. Over the past 10 years, veterinary practices around the country have been installing both small-animal hyperbaric chambers for patients like dogs and cats and, to a lesser extent, large-animal hyperbaric chambers designed for horses.

"More and more practices are getting small-animal chambers," says Geiser. "It's really growing."

The power of oxygen

Undergoing a hyperbaric oxygen treatment feels a bit like scuba diving, says Geiser. Once the patient is sealed inside the chamber, the pressure increases as oxygen is pumped into the space. The patient will likely feel pressure building in their ears, similar to what people feel during an airplane landing. That and maybe some claustrophobia are likely the only downsides a typical patient might experience, says Geiser.

Small animals like cats and dogs are usually exposed to 2 to 2 ½ atmospheres of pressure for a maximum of 45 minutes per treatment, says Geiser, while in large-animal chambers, horses are often exposed to 2 to 3 atmospheres of pressure for 45 minutes to an hour.

The idea, says Geiser, is to force more oxygen into the body. "If you administer 100 percent oxygen under increased pressure to a patient, you are acutely increasing the concentration of oxygen they receive," he says, noting that this can lead to 15 times the normal concentration of oxygen in the bloodstream. This results in more oxygen reaching diseased tissues, which use the molecules as part of their recovery. "Oxygen is one of those compounds that is really necessary in tissues to not just maintain the life of the cells but also help those that are injured," Geiser explains. "In order to kill bacteria, white blood cells oxidize the bacteria, and they require tremendous amounts of oxygen in order to do so." At the same time, says Geiser, the increased oxygen also causes the body to produce helpful antioxidants.

That makes hyperbaric oxygen therapy beneficial, either on its own or as an adjunctive therapy, for treating a variety of wounds and infections, says Geiser, who adds that the therapy can also help to reduce swelling and increase circulation to injured tissues. There's also growing evidence that hyperbaric oxygen therapy helps trigger the release of stem cells from bone marrow.

The hyperbaric oxygen therapy seems so versatile, in fact, that some veterinarians consider their hyperbaric chambers among the most important parts in their practice.

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"We have given over 27,000 individual hyperbaric oxygen therapy treatments over the past 11 years, which makes this the most-used piece of equipment at our hospital," says Ronald Lyman, DVM, DACVIM, founder and president of the Animal Emergency and Referral Center in Fort Pierce, Fla. "The results in many types of diseases are absolutely life-changing for patients." Lyman says he's found hyperbaric oxygen therapy helpful for traumatic injuries, chronic osteoarthritis, orthopedic surgery recovery, severe anemia, and even global brain ischemia.

"I would not want to practice veterinary medicine anywhere without a hyperbaric chamber," concludes Lyman. "I would feel I was not doing the best for my patients."

Where's the science?

Brennen McKenzie, MA, VMD, a small-animal veterinarian at Adobe Animal

Q&A with Veterinary Hyperbaric Oxygen

Trends spoke with Veterinary Hyperbaric Oxygen (VHBO2), the company that manufactured the large-animal chamber that exploded in 2012. VHBO2 spokesman Gerard First responded:

***Trends*: Can you tell me a bit about the company?**
VHBO2: We decided to start building our own chambers in 2003 after experiencing insurmountable problems with several chambers we purchased from another company. Our chambers were designed by an American engineer on the board of the ASME PVHO committee (American Society of Mechanical Engineers, Pressure Vessel for Human Occupancy—the code entity guiding the design of this type of pressure vessel) with over 30 years' experience building human hyperbaric chambers and submersibles for the U.S. Navy. The first chambers were produced and sold in mid-2004.

***Trends*: How and why has the industry grown over the past few years?**
VHBO2: While the number of chambers in clinical use has grown relatively slowly over the past few years, the knowledge of hyperbaric oxygen therapy (HBOT) as a treatment modality option has grown significantly. This has been due to the presence of veterinary hyperbaric technicians and veterinarians at human hyperbaric meetings and the presentations of veterinary-specific HBOT research and case studies. Many vets without chambers use referrals to send patients to clinics with chambers. The increased interest in veterinary HBOT has led to the development of a veterinary-specific certification through the National Board of Diving and Hyperbaric Medical Technology—available since December 2012.

***Trends*: About how many other chamber vendors are there in the United States? Is it growing?**
VHBO2: The number of small animal hyperbaric chambers in use has doubled in the past 3–4 years. There are currently two other manufacturers offering small-animal hyperbaric chambers in the U.S., while some veterinarians obtain used human chambers for veterinary use.

***Trends*: How much should practices plan on spending to make this part of their program? Are prices going down? And how long does it usually take for the chamber to pay for itself?**
VHBO2: Chamber prices have remained relatively stable aside from slight increases due to steel prices and production costs. Depending on the type of clinic (emergency, referral only, rehab), some clinics have seen profits within 18 months.

Visit the company online at *vhbo2.com*.

Hospital in Los Altos, Calif., and president-elect of the Evidence-Based Veterinary Medical Association, says that preclinical evidence and human-based studies suggest hyperbaric oxygen chambers might be a promising new veterinary therapy.

He's concerned, however, that there has been a lack of animal studies on the matter. Since these procedures can be expensive (Geiser says for horses, prices can range from $120 to $500 per treatment), McKenzie believes veterinarians need to be upfront about what they do and do not know about hyperbaric oxygen therapy for animals.

"We should be honest with people that this is a bit experimental; it might not have all the benefits we hope it has," he says. "I think you need to give some thought into how you present this to clients: 'There is reason to be hopeful that this will help, but there isn't a lot of research yet.'"

Gesier says the results of human-based studies on hyperbaric chambers can be extrapolated to animals, since they use oxygen in healing in the same way that people do. However, he concedes that he would like to see more studies focused specifically on hyperbaric oxygen treatments for animals.

One problem, he points out, is that currently only two veterinary colleges have hyperbaric chambers: the University of Tennessee, where he works, and the University of Florida. "And I can tell you that here at the University of Tennessee, where there are two of us who run the chamber, we just don't have the time [to do much research]." He hopes,

however, that as more veterinary practices invest in hyperbaric chambers, additional research on the matter will follow suit.

Dangerous?

Whether or not hyperbaric oxygen therapy is a scientifically valid treatment for animals, some people question the inherent safety of the therapy, especially after a large-animal hyperbaric oxygen chamber exploded at the Kentucky Equine Sports Medicine and Rehabilitation Center (KESMARC) in Ocala, Fla., in February 2012, killing the horse inside it and a veterinary technician.

The accident shook up the industry. Following the incident, Veterinary Hyperbaric Oxygen, the Lexington, Ky.–based manufacturer of the chamber in question, issued a letter to its customers asking them to stop using their large-animal chambers until investigators determined the cause of the accident. A recent call to Veterinary Hyperbaric Oxygen confirmed that the company is now no longer manufacturing large-animal hyperbaric chambers; Geiser says he isn't sure any U.S. companies are currently producing large-animal chambers.

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Geiser points out that hyperbaric chamber accidents are exceedingly rare, and the most egregious examples have all been caused by human error. That includes the 2012 explosion in Florida. A review of the accident concluded the horse's metal shoes had not been removed or covered before it was placed in the chamber, as is standard practice.

When the horse became agitated and kicked the wall of the chamber, it caused a spark that ignited the pressurized oxygen. (Along with making sure to remove or cover anything that contains metal, such as collars or splints, Lyman cautions hyperbaric chamber operators to avoid using the therapy on patients with collapsed lungs, since the changing oxygen pressure can cause more air

A patient receives hyperbaric therapy at Gulf Coast Veterinary Specialists in Houston, Texas. Photo courtesy of Hyperbaric Veterinary Medicine (hvm). www.hvmed.com

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to leak out of the lungs and lead to pulmonary arrest.)

For Geiser, the Florida accident drives home the need for proper training in how to use hyperbaric oxygen chambers. "There are some practices that have had absolutely no training," he says. "That is not good." To help remedy that, the National Board of Diving and Hyperbaric Medical Technology recently announced a new Certified Hyperbaric Technologist Veterinary training and certification program.

Find your champion

After treating more than 2,000 patients in his practice's small-animal chamber over the past 5 years, Andrew Turkell, DVM, owner of the Calusa Veterinary Center in Boca Raton, Fla., heartily recommends the therapy to his fellow veterinarians. "There isn't a day that goes by when the thought doesn't go through my head, 'Would the hyperbaric chamber help this patient?'" he says.

Yes, chambers can be expensive; Geiser estimates small-animal chambers can range from $45,000 to hundreds of thousands of dollars. But Turkell says that Hyperbaric Veterinary Medicine, one of the major manufacturers of small-animal chambers, offers a program in which they provide chambers to practices at no cost in exchange for a pay-per-use commission.

Still, cautions Turkell, the investment might not be worth it unless you have committed buy-in from your practice. "I believe that a practice needs to have a champion," he says. "Somebody needs to be interested in hyperbarics and needs to promote it within his or her practice."

Once you have that buy-in, Lyman says a hyperbaric chamber can end up transforming your practice. Just look at what it's done to his operation. Thanks to their small-animal chamber, Lyman says his operation has become known as a wound treatment center and now receives referrals from all over the country and beyond. "I derive more satisfaction from treating patients with hyperbaric oxygen therapy than anything else," he says. "It has absolutely reinvigorated my practice." ※

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