Study monitors effects of IV fluid on dog circulation during surgery (w/ Video)

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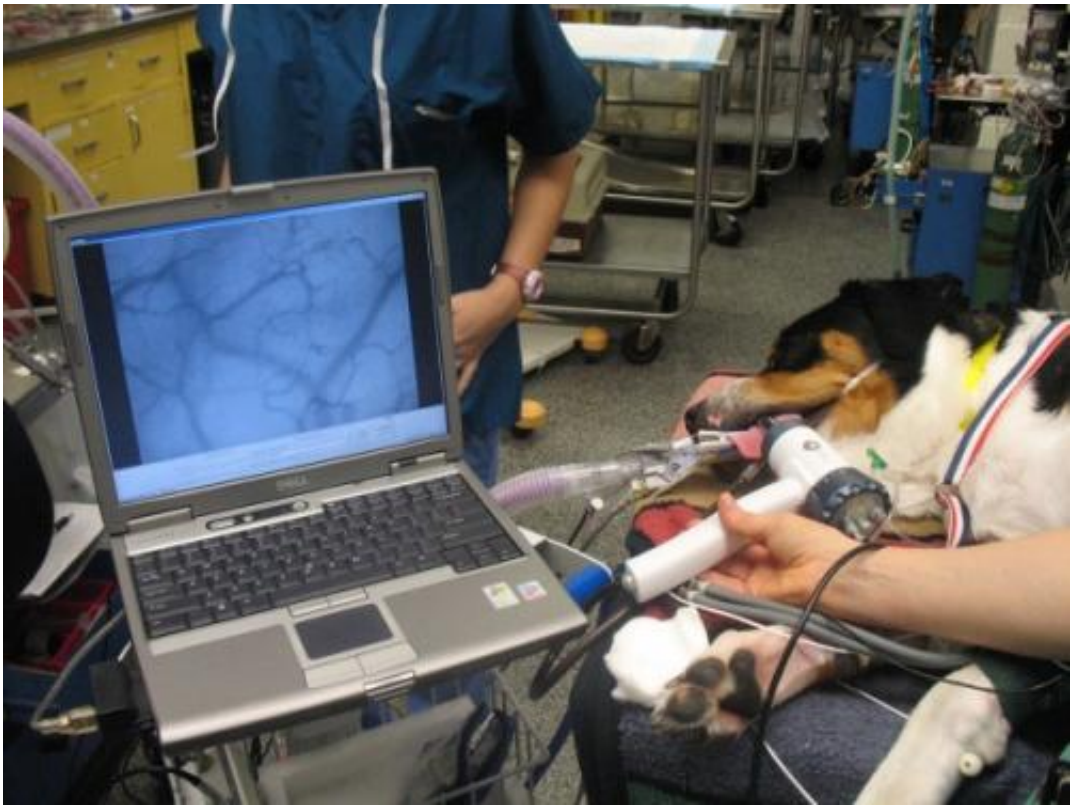


A video microscope reveals the fine-scale circulation in an anesthetized dog.

Almost anyone who has spent time in a hospital is familiar with the routine checks of blood pressure and oxygen levels that serve as signposts of a patient's overall health.

But these measures only reflect the pulsing of blood through the large

vessels, arteries and veins, not the smaller arterioles, venules and capillaries, which directly feed tissues and cells.

That network of small vessels, collectively known as the microcirculation, was the focus of a recent study led by a University of Pennsylvania veterinarian. Using a video microscope to record the blood flow of dogs undergoing spay surgeries, the investigation found that increasing the amount of fluid delivered to the animal enhanced the total number of vessels receiving blood flow. The study points to the importance of giving IV fluids during even minor, elective surgical procedures, a standard of care that is recommended but not often practiced in many veterinary hospitals.

The primary investigator on the paper, published in the American Journal of Veterinary Research, was Deborah Silverstein, an associate professor in the School of Veterinary Medicine's Department of Clinical Studies-Philadelphia. Amber Hopkins, who completed her residency at Penn Vet, was a coauthor. The Penn researchers collaborated with Elizabeth M. Cozzi of Abbott Laboratories and Thomas J. Keefe, a biostatistician from Colorado State University.

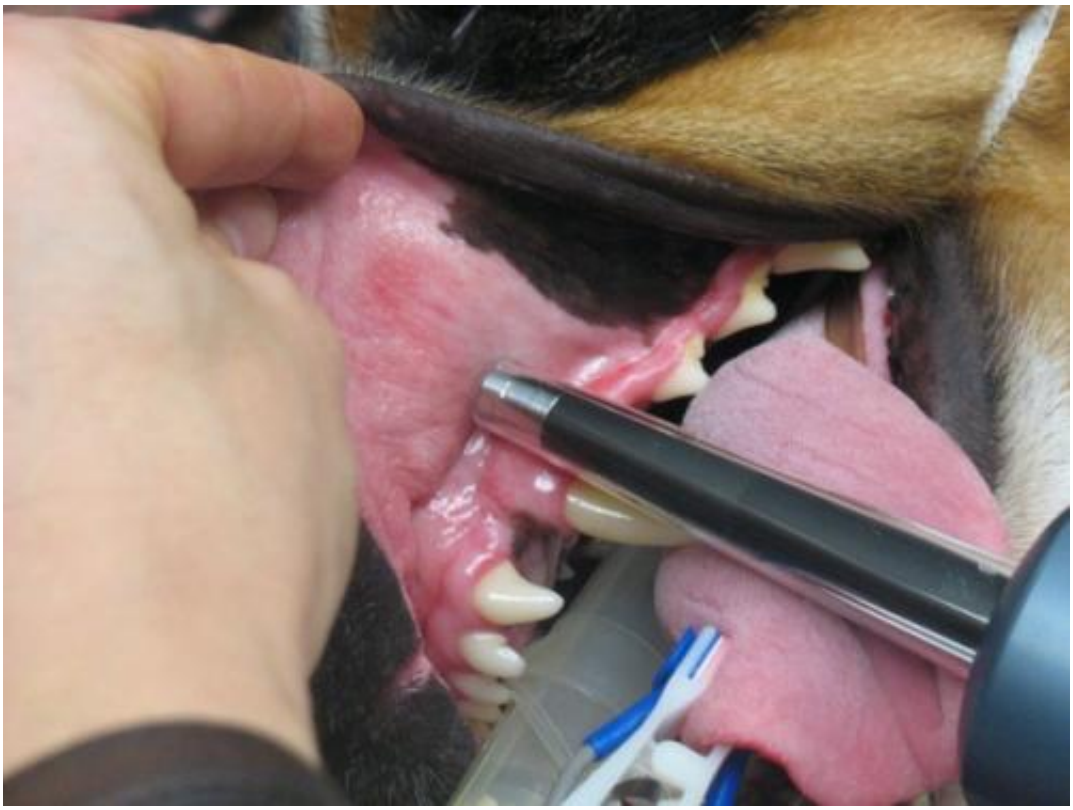
The circulatory system ferries oxygen and nutrients to the body's cells and tissues and carries away waste products and carbon dioxide. Arteries and veins serve as the highway system to and from the heart, lungs and other organs. These larger vessels branch into arterioles and venules, which constrict and relax to direct blood flow to and from the capillaries. These tiny capillaries form a network in which cells are enmeshed. Depending on hydration, metabolism, hormones and many other factors, the body can dynamically regulate when and how much blood flow travels to different parts of the circulation.

During brief surgeries like spays and neuters, animals can lose fluids through their abdominal cavity, their respiratory tract and through blood

loss. When combined with the effects of the anesthetic drugs, which can reduce the ability to regulate blood pressure, these losses can be significant enough to result in reductions in blood flow to and from cells.

"When we monitor a patient's blood pressure or oxygen levels, we're not always able to discern what is happening at the cellular level," Silverstein said. "Sometimes there are tissues and cells that are getting a surplus of oxygen while other cells or tissues are in need of more, but our measuring the big things, like blood pressure, doesn't tell us that. The only way we figure that out is when the patient develops organ dysfunction or new complications arise following anesthesia."

It's routine practice during even the most minor human surgeries to administer an IV drip to compensate for fluid loss, but the same standard, while recommended by the American Animal Hospital Association and American Association of Feline Practitioners, is not always adhered to by all vets, primarily because of the added costs. Giving an IV during spays and neuters is, however, standard procedure at Penn Vet's Ryan Hospital.



Blood circulation in the gum tissue is thought to be similar to that of the gut.

Silverstein and her colleagues were interested to find out whether giving IV fluid during one of these minor procedures in a healthy animal would impact its microcirculation and also to see what level of fluid delivery achieves optimal results.

To find out, the team conducted a study of 49 client-owned dogs in good health to see how varying levels of IV fluid administration affected their blood flow. They assigned the dogs to one of three groups: one that received no fluid and two others that received either 10 or 20 milliliters per kilogram weight per hour of an IV solution called lactated Ringer's solution, one of the most commonly used fluids in veterinary medicine.

The researchers placed the video microscope against the dogs' gums to

assess flow in blood vessels of various sizes before the procedure and 30 and 60 minutes after the animals were anesthetized. The video microscope magnifies blood vessels 326 times onto a computer screen image.

After the videos were analyzed, the researchers did not find any differences among the groups in the proportion of vessels with blood flow or the amount of flow in the vessels. They were also somewhat surprised not to find differences among the groups in the tiniest blood vessels, the capillaries that are less than 20 micrometers in diameter.

They did, however, see a difference in the blood vessels larger than 20 micrometers: dogs that received the greatest amount of fluids had greater densities of these blood vessels than dogs receiving no fluids, and they also had greater densities of these larger vessels with blood flow compared to the control group as well.

The results demonstrate that fluids are indeed having an affect on the circulation, but more research is needed to understand the implications of the study and the optimal rate of fluid delivery.

"The larger vessels are the ones that are constricting and dilating to feed the microcirculation," Silverstein said. "And it appears that the animals that got the highest rate of fluids in this study—which may not be the optimal rate—are the ones that seemed to have the greatest recruitment of arterioles and venules."

The authors also noted that almost a third of the animals in the study had a drop in blood pressure low enough to require an infusion of fluids.

"That just shows that monitoring blood pressure and having fluid support is important," Silverstein said.

She also pointed out that the study may have been affected by some of the dogs going into the surgery slightly dehydrated.

"Some dogs get nervous being in the hospital overnight before surgery and don't touch food or water, so that could have compromised their hydration status prior to surgery."

Silverstein would like to follow up with studies using different IV fluids, perhaps testing different amounts and types of fluids to see if there is an impact on the microcirculation. She will also continue studies of microcirculation in patients with diseases such as sepsis to see if monitoring blood flow to the smallest vessels can help detect or predict health impacts more effectively than can other measures.

"Part of what I love about this research is just focusing on something so small but yet so important," she said. "The microcirculatory system is one of the largest organs in the body but impossible for the naked eye to see."

Provided by University of Pennsylvania