

Taking blood using 'push-pull' method gets accurate results with fewer pokes

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A new study by University of Pennsylvania veterinary researchers has found that blood samples collected from an intravenous catheter using a special "mixing" technique are as accurate as those collected via venipuncture, in which a needle is used to access the vein directly.

Unlike alternative techniques for drawing blood, the mixing [method](#), better known as the "push-pull" technique, requires no "presample" to be discarded, preventing unnecessary blood loss. It also has the potential to greatly reduce the number of needle pricks a patient receives during a hospital stay, lessening pain to the patient and trauma to the blood vessel.

The research was led by Ciara A. Barr, a lecturer in Penn's School of Veterinary Medicine, who was an anesthesiology resident at the time of the study. The senior author on the work is Deborah C. Silverstein, an associate professor in the Department of Clinical Studies at Penn Vet. Their coauthors included Giacomo Gianotti, Carly E. Graffeo and Kenneth J. Drobatz, all of Penn Vet. The study was published in the *Journal of the American Veterinary Medical Association*.

"This method had been shown to be accurate in human populations but we wanted to confirm that that would also be the case in our veterinary population," said Barr. "This technique is really optimal for using on an anesthetized patient; it makes taking a blood sample convenient and painless."

In human medicine as well as veterinary medicine, routine blood tests

are a key part of monitoring the health of patients under anesthesia or those who are critically ill. Getting an accurate reading of such measures as blood glucose, electrolytes, packed cell volume and blood gas levels can influence treatment decisions.

"The standard of care for taking a blood sample through a catheter was to either use the discard method, where we draw a presample from a catheter, discard it, then draw a real sample for submission, or the reinfusion method, in which you reinfuse the presample after taking the real sample," said Barr.

Both methods, however, are potentially problematic. The discard method can put patients at risk of anemia, as a significant amount must be discarded in order to ensure the "real" sample isn't contaminated or diluted with drugs or saline solution from the IV. Concerns with the reinfusion method include the possibility of introducing a blood clot into the patient, contaminating the drawn blood, mistaking the presample for the real sample or damaging [red blood cells](#) during the process.

In the current study, Barr, Silverstein and colleagues decided to try another option. In the push-pull technique, the presample blood volume, equivalent to three times the volume of the "dead space" in a catheter, is pulled into a syringe, and then reinfused into the patient. This process is repeated three times, all the while keeping the syringe connected to the catheter. Then a second syringe is used to take the blood for analysis. In this case no blood is discarded and the blood never leaves the closed system of the IV, minimizing the chance for contamination.

Though already validated in human medicine and particularly widely used in pediatric patients, whose blood volume is lower and who can be more fearful of needle pricks, no one had tested the technique in veterinary patients.

To do so, the Penn Vet team enrolled in their study 30 healthy pet dogs who were coming to Penn Vet's Ryan Hospital for an elective surgery. All the dogs weighed more than 10 kilograms so that a relatively large catheter could be used.

The researchers collected [blood samples](#), using both venipuncture and the push-pull method, both prior to and after the dogs were anesthetized. The dogs were randomly assigned to be given one of two anesthesia drugs, alfaxalone or propofol.

Comparing blood levels of pH, [blood](#) gases, electrolytes and other metrics, the researchers found no clinically relevant differences between samples collected using the two different methods. The type of anesthesia didn't make a difference either.

"We saw only very small differences between the methods," Silverstein said, "but nothing that would alter clinical assessments or decisions."

The researchers would like to follow up on this work with studies in smaller animals, including cats. They'd also like to see if the push-pull method could be used on catheters that have been in place over a longer period of time.

But for now, Penn Vet clinicians are already putting it to use.

"Now that it's been rigorously tested, we've started adopting this method for our anesthetized patients here at Ryan Hospital," Barr said. "It's convenient, it's safe for our [patients](#) and it's giving us accurate results."

More information: Ciara A. Barr et al, Effect of blood collection by the push-pull technique from an indwelling catheter versus direct venipuncture on venous blood gas values before and after administration of alfaxalone or propofol in dogs, *Journal of the American Veterinary*

Medical Association (2017). [DOI: 10.2460/javma.251.10.1166](https://doi.org/10.2460/javma.251.10.1166)

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