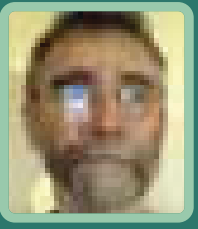
Monitoring blood pressure



PETER DOBROMYLSKYJ discusses the usefulness of blood pressure when giving a general anaesthetic

OPHTHALMOLOGISTS are very convincing people. All you have to do is to show a slide of a cat which has gone blind due to hypertensive retinopathy and a queue will form at the stand in the foyer to purchase some form of blood pressure measuring device.

Once purchased, and the initial enthusiasm has worn off, the machine will begin to gather dust in a cupboard, its exact location lost with the slow but inexorable turnover of staff, to be eventually forgotten about completely.

This is a pity. Setting aside any health and safety issues raised by disturbing the dust layer, blood pressure is a useful piece of information to anyone giving a general anaesthetic.

Most of us give more general anaesthetics than we see hypertensive cats, not that we shouldn't be screening for retinopathy routinely using a quick scan with the ophthalmoscope during every flea consultation.

Because anaesthetists deal in information I have a preference for manual doppler ultrasound estimation of systolic blood pressure over automated devices.

An automated oscillotonometer is very quick and easy to set up and they give accurate readings when they work. The problem is that it just gives you two numbers: systolic and diastolic pressure. There is no information about flow. Flow matters, as this is what actually delivers oxygen to the tissues.

Adrenaline is excellent at increasing blood pressure but the intense vasoconstriction from high dose rates can severely limit oxygen delivery. We all know that local anaesthetic with adrenaline can give white hair where it has been injected under the skin: this is a vasoconstriction-induced effect.

A doppler ultrasound system gives two separate pieces of related information: a modest underestimate of systolic blood pressure and an impression of flow. The flow cannot be quantified but is extremely useful.

If you are in the middle of a problematic bitch spay and suspect that something is bleeding deep in the abdomen, you can certainly track blood pressure as a marker of how badly your patient might be bleeding. But unless you have been using the maximum data sheet dose rate of acepromazine, your patient should have an intact sympathetic nervous system.

As blood volume falls, sympathetic nervous system activity increases to maintain an adequate pressure. The body guards this pressure at the cost of reduced oxygen delivery due to vasoconstriction.

Excellent numbers

An automated blood pressure device will give excellent numbers, even showing some increase in systolic and diastolic pressures, as the patient steadily bleeds out. It's only when there is inadequate blood volume left to perfuse the myocardium that there is a quite sudden and catastrophic fall in blood pressure, and usually heart rate too. Resuscitation is still possible at this stage but it's not easy.

The first warning from an automated device might be an unanticipated failure to get a reading.

A doppler system would also follow that same trend upward in blood pressure but the arterial flow would become progressively harder to hear as blood loss continued. Struggling to get audible flow through a doppler ultrasound machine should always alert you to the possibility that something is markedly wrong on a circulation basis, especially if flow in that same artery was easy to find 30 minutes ago.

It's arguable that a doppler might actually provide more information than an arterial line. Although a decent sized catheter in a large artery will undoubtedly be the gold standard for pressure monitoring, an arterial line still says nothing about the flow, the detection of which is intrinsic to using a doppler system. I like doppler ultrasound machines.

A doppler ultrasound probe over a peripheral artery acts as flow monitor and provides an estimate of systolic pressure.

The cuff

So how do you get the most out of your doppler? Choosing the correct sized cuff helps a lot.

The length of the cuff doesn't matter so long as the inflatable section is longer than the circumference of the artery. Even this is arguable, but it's a good rule of thumb.

The width of the cuff does matter. A very wide cuff underestimates pressure, a narrow cuff overestimates it. A width of about half the circumference of the leg is ideal, anywhere between 40% and 60% is acceptable. They are frequently pre marked.

Positioning the cuff at heart level helps. If the dog is big, on its back with its legs in the air, the cuff might be well above the heart and might under read, 20cm above the heart reduces the reading by 14mmHg.

Hanging the leg off the edge of the operating table does the opposite. This is probably relevant at the extremes of what you might consider acceptable values.

Having the cuff too loose puts a curve into the surface which comes into contact with the patient, so makes it behave as if it was too narrow, increasing the reading.

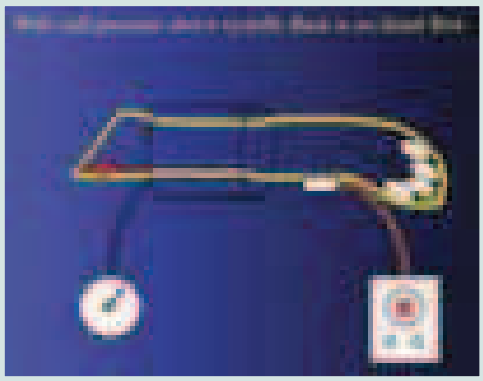
Having force-extended tendons under the cuff will protect the artery from applied cuff pressure and markedly, and artificially, increase your reading.

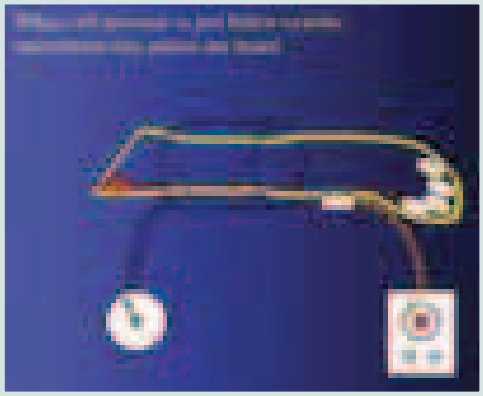
Some cuffs, especially the small latex ones for kittens, have an abrupt end. If you happen to position the end of the cuff just over the artery you are using you will again get a very elevated false estimate. The artery is in the step where the cuff overlaps itself so does not compress correctly.

All of these quirks apply equally to computerised oscillotonometer systems as they do to the doppler system, so they're worth considering if you get strange blood pressure readings with either.

If you have a convincing reading within physiologically acceptable limits you know that your patient, however much isoflurane you are having to give, is not about to die of overdose. This is, on occasions, very comforting information.

The other beauty of blood pressure monitoring, in addition to guiding anaesthesia decisions, is that there is often no financial outlay involved, it's just a matter of dusting off equipment which is not currently earning its keep.





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