SKILLS CHECK

Noninvasive Blood Pressure Monitoring in the Canine and Feline Patient

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Abstract

Noninvasive blood pressure (NIBP) measurement is a valuable tool for monitoring hemodynamic stability in dogs and cats as blood pressure can be used to guide treatment and determine prognostic factors. NIBP is obtained by placing a properly measured cuff on the patient’s extremity, inflating the cuff to occlude arterial blood flow, and recording the pressure at which arterial blood flow returns. The 2 noninvasive methods for obtaining blood pressure are Doppler ultrasonography and oscillometric. Regardless of method used, accuracy can be affected by the type of equipment used to obtain the reading, blood pressure cuff size and placement, and psychosocial and physiological factors of the patient.
Noninvasive blood pressure (NIBP) monitoring provides valuable information about hemodynamic stability of canine and feline patients. It is less stressful for the patient than catheterization of peripheral arteries. Results can be used to guide the veterinary team’s determination of treatment and prognostic factors. Accuracy of the results can be altered by the type of equipment used to obtain the reading, blood pressure cuff size and placement, and psychosocial and physiological factors of the patient. Reference ranges for blood pressure are shown in TABLE 1.

MAXIMIZING THE SETTING

Before beginning the measurement process, consider the location of the patient, if the patient can be transported, who should be present, and what type of NIBP will be performed. A recent study that used oscillometric units showed a notable difference in NIBP results obtained at home versus in the hospital, confirming “white-coat hypertension” in canine and feline patients.² For hospitalized patients, their location within the hospital can determine the level of noise and traffic, which can affect their psychosocial stress. Being in the hospital, whether for an examination or illness, increases stress for any patient, and increased stress can lead to inaccurately elevated readings. If the patient is stable, plan NIBP monitoring during quiet times.

For patients visiting for an appointment, NIBP monitoring can be performed in a quiet examination room or treatment area, with or without the client present (depending on hospital protocol). Often the client’s presence reduces the stress associated with inaccurately elevated readings. NIBP measurement of cats is more accurate if performed while the cat is still in the carrier, as opposed to on the examination table.³

TABLE 1 Blood Pressure Reference Ranges for Dogs and Cats

<table>
<thead>
<tr>
<th></th>
<th>SYSTOLIC (mm Hg)</th>
<th>DIASTOLIC (mm Hg)</th>
<th>MEAN (mm Hg)</th>
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</thead>
<tbody>
<tr>
<td>Dog</td>
<td>90–140</td>
<td>50–80</td>
<td>60–100</td>
</tr>
<tr>
<td>Cat</td>
<td>80–140</td>
<td>55–75</td>
<td>60–100</td>
</tr>
</tbody>
</table>
METHODS

Doppler Method
Doppler ultrasonography devices (FIGURE 1) generate ultrasound waves that audibly indicate velocity of arterial blood flow. A cuff is placed over the artery and inflated until it impedes blood flow, at which time the sound is no longer audible. As the cuff is deflated and arterial flow resumes, the first returning audible sound corresponds to the systolic arterial pressure. The sound is amplified by a probe containing 2 piezoelectric crystals, whichReplace use of a stethoscope. One of the crystals transmits energy and the other receives the echo from the artery; as sound waves travel through the ultrasonography gel, the echo of the pulsing artery is transmitted. Use of headphones will reduce external noise, which will help calm the patient for an accurate reading. To ensure optimal contact between the probe and the skin (as sound waves passing through air become distorted), the probe and skin should be clean and the hair over the artery may be shaved. Locating small arteries can be challenging; making small, slow, lateral movements with light pressure of the probe can be helpful. Too much pressure can occlude the artery, making it challenging to locate. After the artery is located, the patient’s heart rate can be assessed, if indicated. Doppler ultrasonography has historically been proven to be unreliable for measuring diastolic blood pressure as accurately recording the flow sounds.
is audibly challenging; however, the quality of newer Doppler ultrasonography units is increasing, enabling accurate diastolic pressure measurement.

**Oscillometric Method**

Oscillometric units (FIGURE 2) measure air pressure fluctuations inside the cuff, generated by pulsations of the underlying artery. Oscillometric units work automatically and can be set to record blood pressure in increments from immediately to hourly. The digital display shows systolic pressure, diastolic pressure, and mean arterial pressure. Oscillometric blood pressure measurement of small patients (<7 kg [15.4 lb]) or excessively moving patients can be inaccurate. For patients of any size, the reading may be inaccurate if the patient is squirming/struggling, shaking, or panting. To determine if the reading is inaccurate, compare the oscillometric pulse rate to the patient’s pulse rate; if they do not match, the reading can be considered inaccurate.

Differences and Similarities

Both methods are readily available and easy to use (TABLE 2). Regardless of which method is used, when serial blood pressure measurements from a given patient are needed, the same method (unit, cuff size, cuff location, patient position, patient environment) should be used each time. A recent study of NIBP measurement in conscious cats showed that results from oscillometric and Doppler ultrasonography units differ, and thus they cannot be used interchangeably.

With either method, proper cuff size selection and placement is essential for obtaining an accurate result. Arteries accessible for NIBP are shown in FIGURE 3. Both methods are best used on arteries proximal to the carpus or hock or under the tail. With use of a Doppler ultrasonography device, the cuff should be located above the joint proximal to the probe; with use of an oscillometric unit, the cuff should be placed proximal to the carpus or hock joints or at the tail base (FIGURE 4). No matter which method is used to obtain the readings, 5 to 7 readings should be obtained to ensure accuracy, and all readings along with the type of unit, cuff size, cuff location, and patient position should be properly recorded in the patient’s record.

**TABLE 2 Advantages and Disadvantages of Noninvasive Blood Pressure Methods**

<table>
<thead>
<tr>
<th>METHOD</th>
<th>ADVANTAGES</th>
<th>DISADVANTAGES</th>
</tr>
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<tbody>
<tr>
<td>Doppler</td>
<td>• Inexpensive</td>
<td>• Less accurate for patients in motion and patients with peripheral vasoconstriction (difficult to obtain audible signal)</td>
</tr>
<tr>
<td></td>
<td>• Easy to use</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Useful for patients of any size</td>
<td></td>
</tr>
<tr>
<td>Oscillometric</td>
<td>• Easy to use</td>
<td>• Less accurate for small patients; patients with tachycardia/arrhythmia or hypotension; or patients who do not/cannot remain still</td>
</tr>
<tr>
<td></td>
<td>• Readings can be set at timed intervals (minimizes patient handling)</td>
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**FIGURE 4.** Noninvasive blood pressure cuff placement at the base of the tail.

**STEPS FOR NIBP MONITORING**

For both types of units, the initial steps are the same.  
1. Collect the supplies required, depending on the type of unit to be used.  
2. Choose a quiet, low-traffic area for the procedure.  
3. Gently restrain the patient into ventral or lateral recumbency; if necessary, ask for assistance with restraint.  
4. Determine the proper size cuff for circumference of the location on the patient (proportion = 30% for cats, 40% for dogs) (FIGURE 5).  
5. Place the cuff securely around the limb, proximal to the carpus or hock joint, or the base of the tail.
Doppler
Follow steps 1 through 5 as above.
6. Prepare the location for the Doppler ultrasonography probe placement as mentioned above.
7. Apply ultrasonography gel to the probe.
8. Attach the gauge to the cuff.
9. Place the probe distal to the cuff.
10. Inflate the cuff until arterial sound is no longer heard or until a standard is reached (200 mm Hg in humans) unless the sound is still present at 200.

11. Slowly release pressure on the cuff.
12. Record systolic blood pressure at which arterial sound returns.
13. Record each reading in the patient’s record.
14. Repeat 5 to 7 times. Between each reading, completely release air from the cuff and wait 3 to 5 seconds for the integrity of the vessel wall to return.

Oscillometric
Follow steps 1 through 5 as above.
6. Attach monitor tubing to cuff.
7. Start the blood pressure unit.
8. Record each reading in the patient’s record.
9. Repeat 5 to 7 times.

SUMMARY
Obtaining and recording accurate NIBP measurements is a skill that veterinary nurses can use to proactively care for their patients. Ensuring accurate results requires assessing all risk factors associated with inaccurate readings, avoiding as many psychosocial and physiological stressors for the patient as possible, precisely measuring cuff size, properly placing the cuff, and properly positioning the patient. 

References

FIGURE 5. Proper noninvasive blood pressure cuff size.

Paula Plummer
Paula has been at Texas A&M University since 2007, starting in the small animal intensive care unit before moving to the feline internal medicine service, where she is now the staff development coordinator. She graduated from Murray State College in Oklahoma in 2000 and received her VTS (ECC) in 2011 and her VTS (SAIM) in 2014. In 2020, Paula graduated from Tarleton State University with a bachelor’s degree in applied science. She is one of the organizing committee members for the Academy of Veterinary Technicians in Clinical Practice’s feline specialty and serves on several regional and national committees. Outside of work, Paula enjoys spending time with her husband and pets.