Noninvasive Blood Pressure Monitoring

Kathleen R Dobbin, RN, MS

For more 20 years, noninvasive blood pressure (NIBP) monitors have been widely used in operating rooms and critical care units to closely monitor blood pressure in patients of all ages. Despite the widespread use of automated blood pressure monitors, clinicians continue to deliberate over the accuracy and reliability of automated NIBP devices compared to other methods of blood pressure determination. The following answers to commonly asked questions about the use of NIBP monitoring are based on clinical research.

Q: How do blood pressure measurements obtained with automatic noninvasive blood pressure (NIBP) devices compare to direct arterial measurement of blood pressure?

Clinical research studies have demonstrated that when blood pressures (systolic, diastolic, and mean arterial) determined by NIBP monitors from various manufacturers are compared to direct arterial pressures, the two values are, on average, within 5 mm Hg of each other. Factors such as the anatomical location of measurement contribute to the differences that exist between direct and indirect methods. For example, in comparing brachial arterial pressure obtained by the NIBP monitor to radial arterial pressure obtained by direct arterial cannulation, radial arterial pressure is normally higher because the radial artery is a smaller vessel and creates greater resistance to flow, which in turn leads to a higher blood pressure reading than that determined via the brachial artery.

These studies also indicate that occasionally, an individual NIBP blood pressure determination value will vary by as much as 37 mm Hg from the direct arterial value. This large discrepancy indicates that treatment should never be made based on a single NIBP determination without comparison to an auscultatory blood pressure determination or several consecutive measurements performed by an NIBP monitor.

Q: Is it important to use the correct cuff size when using automatic NIBP devices?

Yes. Using a cuff that is too small will lead to falsely high readings, and using a cuff that is too...
large will lead to falsely low readings. The cuff width selected should equal 40% of the arm circumference (see Figure). The American Heart Association recommendations for appropriate cuff sizes based on upper-arm circumference should also be followed when using NIBP monitors (see Table).

Q: Are there any patient-related complications associated with using NIBP devices?

Skin and tissue compression from NIBP monitors, which can lead to skin irritation and bruising, are probably the most commonly occurring complications. Prolonged use and frequent blood pressure determinations can lead to venous pooling and congestion. Excessive venous pressures can lead to tissue ischemia and nerve damage.11,12

Several circumstances can prevent accurate determination of blood pressure with NIBP devices. Highly irregular or rapid cardiac rhythms make it difficult to accurately determine blood pressure using NIBP devices because of the great beat to beat variability. Most NIBP devices employ oscillometric technology that is dependent on fairly regular cardiac rhythms to determine blood pressure. Excessive patient movement such as shivering, restlessness, or external movement such as that from a helicopter, ambulance transport, or a rapid-cycling ventilator can interfere with detection of cardiac oscillations by the NIBP monitor. This can lead to erroneous blood pressure measurements.1,13

Q: What factors can interfere with obtaining accurate NIBP measurements?

References

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**Note**
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### Table

American Heart Association recommended sizes for blood pressure cuffs based on arm circumference

<table>
<thead>
<tr>
<th>Extremity circumference (cm)</th>
<th>Cuff name</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 - 7.5</td>
<td>Newborn</td>
</tr>
<tr>
<td>7.5 - 13</td>
<td>Infant</td>
</tr>
<tr>
<td>13 - 20</td>
<td>Child</td>
</tr>
<tr>
<td>17 - 25</td>
<td>Small adult</td>
</tr>
<tr>
<td>24 - 32</td>
<td>Adult</td>
</tr>
<tr>
<td>32 - 42</td>
<td>Wide/large adult</td>
</tr>
<tr>
<td>42 - 50</td>
<td>Thigh</td>
</tr>
</tbody>
</table>

* Determined as middle of upper arm or middle of upper thigh
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