

Clinical Information

Making NIBP Work for You

Blood pressure is checked in all cardiac emergencies; it is part of the initial evaluation of adults and children and is frequently repeated when monitoring a patient's status. Automated noninvasive blood pressure (NIBP) can be a valuable tool in collecting and documenting this critical information. Although the NIBP device measures the same parameter you do when you check a blood pressure, there are some similarities and a few key differences to keep in mind.

Most methods for obtaining noninvasive blood pressure use a cuff wrapped around an extremity (usually the arm) which is inflated to occlude blood flow. Cuff pressure is then slowly decreased to allow arterial blood flow to return. Routine BP uses the auscultation technique: a stethoscope is placed over the artery below the occlusion, and the user listens for Korotkoff sounds produced by turbulence of the blood flow as cuff pressure is decreased. Systolic and diastolic pressures are determined from changes in — or the appearance and disappearance of — these sounds.

The NIBP monitor uses the oscillometric technique: a sensor in the cuff detects changes in oscillations, or amplitude of pressure pulses, in the arterial walls. The oscillations are created by the blood flow when the occlusion is released. Systolic, diastolic and mean arterial pressures are all calculated from changes detected in these pressure pulses.

Using oscillation waves instead of sound waves is a key difference between the auscultatory and oscillometric methods and that difference can be a big help. As you have found, getting an accurate auscultatory reading can be challenging when noise levels are high, and readings may vary with the skill and hearing acuity of the clinician. The NIBP monitor is not affected by sound, but must attempt to filter out artifact similar to the pulse pressure signals it detects. Both techniques require correct application.

Factors Affecting Blood Pressure Measurements

Both techniques of blood pressure measurements are affected by multiple factors such as motion, the patient's physiological condition, cardiac arrhythmia, cuff size, muscle tension, cuff or tubing problems, and frequency of cuff inflation.

Any motion may interfere with a blood pressure reading. Common events include patient movement such as shivering, tremors, seizures or flexing the arm in reaction to cuff pressure. External

motion such as bumping the patient or motion of the connecting tubing — particularly if it hits other surfaces — can also produce problems. Similarly, muscle tension in the extremity used for the blood pressure measurements can alter readings. The NIBP monitor uses artifact rejection techniques to provide accurate results. These can prolong the measurement process time if motion produces a lot of artifact.

Very low pressures, such as those found in patients in shock, produce low pressure amplitudes which can be difficult to detect or hear. Atrial fibrillation or frequent premature beats may cause variations and difficulty in getting precise readings since very early beats produce variable cardiac output.

Arrhythmias can affect pulse rate accuracy or the time needed to complete a measurement may be longer.

Some problems are related to operator technique. It's important to use a correctly sized cuff. Using a cuff that is too small produces inaccurately high readings; a too-large cuff underestimates pressure. The patient should be instructed to relax the extremity, which should be well supported and approximately at the same level as the patient's heart. Due to the effects of hydrostatic pressure, if the arm is held above the heart level, reading can be inaccurately low, if below the heart, reading may appear high.

Probably the most common cause of incorrect auscultatory pressure readings is the too rapid release of cuff pressure. Another problem making BP determination difficult results when the operator retries a missed pressure or a NIBP device is set at too frequent intervals. The culprit is venous congestion.

Other problems relate to the equipment used. Any air leak or kink in the cuff or tubing may cause errors. Altering the equipment tubing can also produce incorrect pressures.

Additional Considerations

Blood pressure is dynamic and can change in seconds. Even a change in the patient's position usually produces a shift in blood pressure. And blood pressure is different in different extremities — it's normal to have up to 10mmHg difference in BP between the right and left arms.

Pressure cuffs interfere with some other procedures or monitoring techniques and occasionally produce undesirable side-effects;

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avoid placing a BP cuff on an arm being used for IV's or pulse oximetry. Patients with clotting abnormalities, on aspirin or anticoagulants may develop bruises under the cuff site.

Patients, especially those in an emergency setting, need reassurance the BP measurements are routine and reminded that they "will feel a big squeeze" around the arm and perhaps some tingling in their fingers with each cuff inflation.

Finally, all equipment requires periodic calibration to assure accuracy. Make sure the equipment you use has been recently checked.

Specific Considerations for NIBP in a Multiparameter Device

Most protocols and procedures on NIBP require an auscultatory manual BP as a baseline reading.

NIBP measurements take a little time: when the device is turned on, the monitor conducts a self-test which takes approximately three seconds. A typical reading takes 40 seconds. In most NIBP devices, if the measurement is not complete in 120 seconds, the cuff automatically deflates.

Initial cuff pressure should be set approximately 30mmHg higher than the patient's baseline systolic pressure.

Placement of the air bladder used in the Physio-Control NIBP Cuff is not critical since the bladder fills the whole length of the cuff. The air bladder in some BP cuffs is limited to 2/3 the length of the cuff. In those cases, the bladder must be positioned over the artery.

There is no need to disconnect the device from the patient during defibrillation.

Summary

Blood pressure measurements and monitoring is very common in cardiac and emergency care. Although it is easy to check blood pressure, there are several factors to consider to assure accuracy and reliability in any method of BP measurement. NIBP with the oscillometric technique and artifact rejection has been shown to provide measurement as reliable and accurate as the common auscultatory method.

NIBP devices provide an automated pressure measurement reading that can free care providers to attend to the patient's other needs. As with any device, NIBP products can only detect signals and display the data; as a provider, you have much more information about the patient and events. Interpretation of the information as it applies to each patient is up to you.

Additional information

Geddes LA. *Handbook of Blood Measurement*, Clinton, NJ: The human Press Inc.; 1991.

Perloff D, Grim C, Flack J, et al. AHA Medical/Scientific Statement: Human Blood Pressures by Sphygmomanometry. *Circulation*, 1993;2460-2470



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