

Automated Monitoring of Noninvasive Blood Pressure (NIBP)

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

How is the noninvasive pressure measured?

Most techniques use a cuff wrapped around an extremity (usually the arm) and inflated to occlude blood flow. The cuff pressure is then decreased allowing the arterial blood flow to return. Routine BP uses the auscultation technique in which a stethoscope is placed over the artery below the occlusion and you listen for the Korotkoff sounds produced by the turbulence of the blood flow as the cuff pressure is decreased. You determine the systolic and diastolic pressures from changes in these sounds. The NIBP monitor uses the oscillometric technique which has a sensor in the cuff detecting changes in oscillations, or amplitude of pressure pulses, in the arterial walls created by the blood flow when the occlusion is released. The systolic, diastolic and mean arterial pressure are calculated from the changes detected in these pressure pulses. So a key difference is that the routine auscultatory method uses sound waves while the NIBP monitor utilizes *oscillation* waves in measuring the pressure changes. As you have found, accuracy of the auscultatory method can be challenging in a noisy environment and readings may vary with the skill and hearing acuity of the clinician. The NIBP monitor is not affected by sound and attempts to filter out artifact that is similar to the pulse pressure signals it detects. Both techniques require correct application.

What affects blood pressure measurements?

The following factors affect readings in **both** techniques of blood pressure measurement:

- Any motion such as movement by the patient or bumping the patient may interfere with a reading. Common events include shivering, tremors, seizures or the patient flexing their arm in reaction to cuff pressure.
- Patients' physiological condition affects BP determinations. Very low pressures, such as those found in patients in shock, produce low pressure amplitudes which can be difficult to detect or hear.
- Cardiac arrhythmias such as atrial fibrillation or frequent premature beats may cause variations and difficulty in getting precise readings.
- Using the wrong size of cuff or altering equipment tubing can produce incorrect pressures.
- Muscle tension in the extremity used for BP can alter readings. The extremity should be relaxed, well supported and approximately at the same level as the patient's heart.
- Any air leak or kink in the cuff or tubing may cause errors.
- Releasing the cuff pressure too quickly produces incorrect pressure measurements.
- Rapidly repeated cuff inflations produce venous congestion making determination difficult.

Any additional considerations?

- Change in the patient's position usually produces a shift in blood pressure.
- It is normal to have up to 10mmHg difference in BP between the right and left arms.
- Pressure cuffs should not be placed on the same arm that is used for IVs or pulse oximetry.
- Patients, especially those in an emergency setting, need reassurance that 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.
- Patients with clotting abnormalities, on aspirin or anticoagulants may develop bruises under the cuff site.
- Blood pressure is dynamic and can change in seconds.
- All equipment requires periodic calibration to assure accuracy.

Are there specific considerations for NIBP in a multiparameter device?

- NIBP monitoring is not available during defibrillation.
- NIBP measurement typically takes 40 seconds to complete. If the measurement is not complete in 120 seconds, the cuff automatically deflates.
- When the device is turned on, the NIBP monitor conducts a self-test which takes approximately three seconds.
- Most protocols and procedures on NIBP require an auscultatory manual BP as a baseline reading.
- Initial cuff pressure should be set approximately 30mmHg higher than the patient's baseline systolic pressure.
- The air bladder in some BP cuffs is limited to 2/3 the length of the cuff and the bladder must be positioned over the artery. The bladder in the Medtronic Physio-Control NIBP Cuff (TUFF CUFF™) fills the whole length of the cuff which provides pressure around the complete circumference of the extremity.
- With the exception of a noisy environment, any factor that affects auscultatory BP can interfere with the NIBP measurement.

Summary

Blood pressure measurement 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 measurements as reliable and accurate as the common auscultatory method. This monitoring provides an automated pressure measurement reading that can free you to attend to the patient's other needs. However, NIBP can only detect pressure pulse changes and display the data, you have much more information about the patient and events. As with all patient data, interpretation of this information as it applies to each patient is up to the care provider.

Additional Information

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

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



Medtronic Physio-Control
11811 Willows Road NE
P.O. Box 97006
Redmond, WA 98073-9706 USA
Tel: 425.867.4000
Toll Free (USA Only): 800.442.1142
Fax: 425.867.4146
Internet: www.physiocontrol.com
Internet: www.medtronic.com

Europe
Basingstoke, Great Britain
Tel: 44.1256.782.727
Fax: 44.1256.782.728