Smiths Medical PM, Inc.

Oscillometric, Linear Bleed Non-Invasive Blood Pressure Technology

Answers to frequently asked questions

What is oscillometric NIBP technology?

During oscillometric blood pressure measurements, the inflated cuff detects the pulsation of the artery wall as a pressure vibration. The interpretation of these small variable amplitude vibrations provides a blood pressure value. Each specific manufacturer has it's own technology of interpreting these oscillations.

How can a linear bleed monitor read higher than a step down deflating monitor?

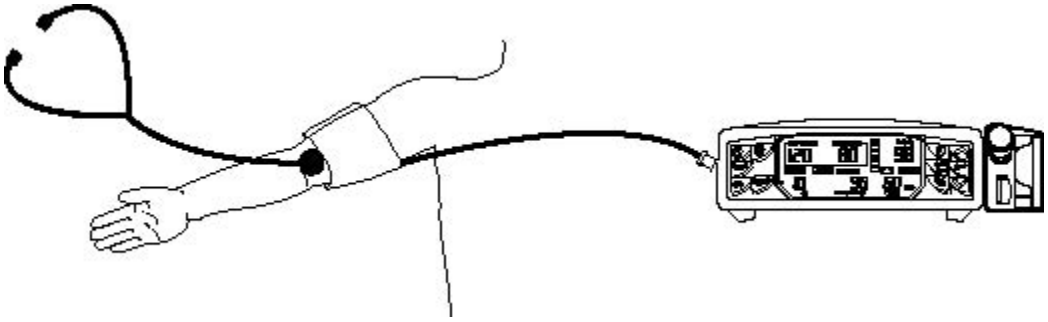
Since linear bleed deflates continuously, it will recognize the first vibration and interpret that as the SYSTOLIC value. This same concept applies to the DIASTOLIC value, in which it concisely interprets the last vibration. Given that the step down method deflates the cuff in steps of 5-10 mmHg, it will only measure the oscillometric strength at that step before it deflates to the next step. Since step deflation only allows the monitor to see the vibrations at each step and not between steps, it generally gives a lower less accurate reading than linear bleed.

How can an oscillometric linear bleed NIBP reading be higher than an ausculatory BP?

The auscultatory technique is based on sounds caused by the blood flow through the artery that is enclosed by the cuff on a patient's arm. These sounds are referred to as Korotkoff sounds. These Korotkoff sounds are detected by the clinician by using a stethoscope. Variability between auscultatory and oscillometric blood pressure readings may be due to clinician skill, hearing sensitivity of the clinician, and environmental noises to name a few. The main reason that an oscillometric reading is typically higher is that the human ear picks up only sound, not vibrations. Vibrations in the artery typically occur before any sounds have manifested, so by the time the clinician hears the Korotkoff sounds, systolic may have already occurred earlier.

How can an oscillometric NIBP reading be verified for accuracy?

The best way to verify an oscillometric reading is by listening with a stethoscope while the monitor is deflating. The clinician would use the monitor as the manometer. Thereby, simultaneously the reading shown on the monitor could be compared to what the clinician heard.



How can improper cuff size affect an NIBP reading?

This is one of the most common errors with blood pressure readings. The biggest concern is a too small cuff. In this situation it is well documented that readings are falsely elevated, sometimes to the extreme. A too large cuff will generally work well, but is strongly not recommended. The rule established by the American Heart Association (AHA) indicates the bladder width should be at least 40% of arm circumference at the greatest diameter of the arm, bladder length should be at least 80% of arm circumference at it's greatest point.

Assure that the cuff is wrapped snugly and neatly around limb. One finger should be able to slip snugly under cuff when it is on the limb.

What is the proper patient positioning for achieving an accurate blood pressure?

The following are some guidelines that should help in getting a more accurate blood pressure reading:

- Have the individual sit in a chair with his/her back supported and both feet resting comfortably on the floor. Lying in a supine position works well also.
- Position the individual's arm at heart level. Typically resting arm on a table or individual's side if lying down.
- Center the cuff over the brachial artery. The lower border of the cuff should be about 2.5 cm about the antecubital crease.

Can the external environment actually have an impact on a blood pressure reading?

A noisy, cold environment can increase an individual's blood pressure. So the individual's comfort is of essence. Other factors that may interfere with accuracy include patient nervousness and the placing of the blood pressure cuff over clothing. Also environmental noises can challenge the hearing capabilities of the clinician.

What kinds of patient internal environmental factors affect a blood pressure reading?

So many variables can affect a blood pressure reading. An astute clinician with savvy assessment skills can properly and accurately troubleshoot an automated blood pressure reading. As indicated before external environmental factors may affect a reading, but so do internal factors as well. The following are a few common causes; talking, seizures, certain medications, dehydration, straining, smoking and patient movement. The expertise of good assessment skills is necessary to troubleshoot quickly and accurately.

How does an irregular rhythm, such as atrial fibrillation, affect accuracy of blood pressure readings?

Medical Journals have clearly documented that an irregular rhythm can cause erroneous blood pressure values. This is because of the fluctuations in the amount of blood with each heartbeat. If a heart rate is regular, the blood volume between beats is typically consistent. The variation in blood volume per heartbeat with an irregular heart rate creates highly variable pressures between one beat to the next.

Why do NIBP readings vary from manufacturer to manufacturer?

Each individual manufacturer utilizes their proprietary algorithm for systolic and diastolic blood pressure. Given that algorithms vary, it is difficult to compare between different blood pressure monitors from different manufacturers. This concept is similar to the impossibility of trying to compare between different manufacturers in Pulse Oximetry.

How does an oscillometric NIBP monitor tolerate motion?

Automated blood pressure monitoring may not tolerate movement very well. Due to expected pressure variations in the cuff, that are needed to determine blood pressure, any patient movement or an accidental bumping of the cuff by the clinician can simulate pressure variations causing erroneous readings. Stressing proper technique to the practitioner should aid in obtaining more accurate blood pressure readings.

Safety and Effectiveness

Performance testing for the BCI® NIBP function was completed in accordance to FDA standards. Testing in accordance to ANSI/AAMI SP10-1992 standard (American National Standard for *Electronic or automated sphygmomanometer*) & ANSI/AAMI/ISO SP10A-1996 Amendment to ANSI/AAMI SP10-1992. The SP10 testing was conducted under an approved IRB at the VA Medical Center in Milwaukee and at Smiths Medical PM, Inc.

Why doesn't the monitor NIBP reading match the simulators NIBP reading?

A simulator does not know each manufacturer's proprietary technology, therefore the chance of the monitor and simulator reading exactly are minimal. However, the simulator can be used to verify the performance of the blood pressure monitor by documenting the repeatability of the readings obtained.

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