Blood Pressure Measurements

Definition of Blood Pressure

Arterial blood pressure is the force exerted by the blood on the wall of a blood vessel as the heart pumps (contracts) and relaxes. Systolic blood pressure is the degree of force when the heart is pumping (contracting). The diastolic blood pressure is the degree of force when the hearts relaxed.

Location of measurement

The standard location for blood pressure measurement is the brachial artery. Monitors that measure pressure at the wrist and fingers have become popular, but it is important to realize that systolic and diastolic pressures vary substantially in different parts of the arterial tree with systolic pressure increasing in more distal arteries, and diastolic pressure decreasing.

Pulse is the rhythmic expansion and contraction of an artery caused by the impact of blood pumped by the heart. The pulse can be felt with the fingers at different pulse pressure points throughout the body and heard through a listening device called a Stethoscope.

The Auscultatory Method

In the measurement procedure a cuff is wrapped around a person's arm with an inflatable rubber bag inside the cuff centered over the brachial artery. Enough air pressure is pumped into the cuff to close the artery. Air pressure is then released by opening the thumb valve. When the pressure in the cuff is equal to the pressure on the artery, the artery opens and the blood begins to return to the part of the artery that was closed. As the blood returns to the artery, pulse sounds begin. These sounds can be heard through a Stethoscope (Body sounds can be heard at the skin's surface and transported via enclosed columns of air to the ear) placed over the brachial pulse point. The sounds continue for a time while the cuff is deflated slowly, eventually becoming too faint to hear.

The cuff is connected by tubing to a manometer (consists of a calibrated glass tube connected to a reservoir containing mercury), which shows the amount of pressure on the artery. When the first pulse sounds are heard, the reading on the manometer measures the systolic blood pressure. The last sound heard is the diastolic blood pressure

A technique can be used for measuring the ankle-brachial index, in which the systolic pressures in the brachial artery and the posterior tibial artery are compared, to obtain an index of peripheral arterial disease.

Blood pressure measurements are also influenced by the position of the arm a progressive increase in the pressure of about 5 to 6 mm Hg as the arm is moved down from the horizontal to vertical position. These changes are exactly what would be expected from the changes of hydrostatic pressure. If the patient is sitting bolt upright the diastolic pressure may be up to 6.5 mm Hg higher than if sitting back.

The white coat effect, Diurnal Variation & Short-term variability

There are also technical sources of error with the auscultatory method:

These error sources include the position of the column, which should be at approximately the level of the heart. The mercury should read zero when no pressure is applied, and it should fall freely when the pressure is reduced (this may not occur if the mercury is not clean or if the pin-hole connecting the mercury column to the atmosphere is blocked).