Blood pressure

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Introduction

As the term quite clearly states, blood pressure is the pressure exerted on the walls of arteries, capillaries, and veins (per unit area) by blood, as it circulates around the body. This phenomenon is expressed using two values known as the systolic pressure and the diastolic pressure (in mm Hg). For example, the normal resting blood pressure for adults is 120/80. The systolic pressure (i.e. the larger number at the top) is the measurement of pressure when the heart contracts (Diagrams Illustrating Systole and Diastole Phases (http://www.interactive-biology.com/75/show-me-a-diagram-of-the-human-heart-here-are-a-bunch/)). On the contrary, the diastolic pressure (i.e. the lower number at the bottom) is the measurement of pressure when the heart refills with blood between beats.

Evidently, an individual's blood pressure is influenced by heart output, force with which the blood is passed from the left ventricle, peripheral resistance, total quantity of blood, and viscosity. Other factors include: age, gender, activity, and overall health of a patient. It is also controlled by messages sent from both the nervous and endocrine systems, for example, secretion of the hormone adrenaline (from the endocrine system) raises the blood pressure. When blood pressure is consistently below the normal range, it is pathologically known as hypotension (Blood Pressure Chart for Adults (http://www.bloodpressureuk.org/BloodPressureandyou/Thebasics/Bloodpressurechart)). Alternatively, when the blood pressure is consistently higher than the normal range, it is termed as hypertension.

Importance in Clinical Medicine

Blood pressure, body temperature, pulse rate and respiration rate are the four vital sings which are routinely monitored by health care providers in primary care. If these vital signs appear abnormal, they provide insight to other underlying health problems. Since General Practitioners or Family Physicians are the first contact a patient has with the health-care system, the regulation of blood pressure is normally dealt with in this branch of medicine.

With a normal blood pressure, blood perfuses appropriately through all the different systems of the body without any problems. In a hypotensive patient, there is a likelihood that certain organs are not adequately supplied with the correct amount of blood, in the correct amount of pressure. Therefore, the ability for the organ to function adequately, will severely decline. For example, poor blood flow to the kidneys may cause renal failure. It has also been found that treatment of hypertension has shown to greatly reduce the onset of these diseases. For that reason, physicians in primary care must regularly examine patients' blood pressure to prevent the risk of these various diseases.

Development

In 1800, Carl Ludwig recorded the pressure in an artery through waveforms, however, this was done in an invasive method. Six years later, Riva-Rocci produced the mercury sphygmomanometer (Riva Rocci Sphygmomanometer (http://woodlibrarymuseum.org/museum/cat/2/safety-&-monitoring)). Korotkoff was an individual that established the techniques used to detect the sounds produced by diastolic pressure (i.e. Korotkoff sounds). The next century observed a trend of the development of methods which were more applicable to the clinic; these included measurement using an intra-arterial cannula which was thought to truly illustrate both systolic and diastolic pressures. Since this era, many different invasive and non-invasive methods, as well as automated and manual methods, have been evolved from the previous ones mentioned.

How Does it Work?

Auscultatory Method: Blood pressure is measured with a sphygmomanometer cuff that is placed around the arm, approximately at the same vertical height as the heart. Blood is restricted from flowing through the Brachial artery with inflation of the cuff. The nurse/physician then releases the pressure and listens for the Korotkoff sounds, with a stethoscope, as the blood begins to flow. The pressure at this point is the systolic pressure. The pressure continues to be released until no sounds can be heard. This pressure at this point is the diastolic pressure.

Oscillometric Method: Instead of recording the reading acoustically (i.e. Korotkoff sounds), this method uses oscillations of the arteries to measure the systolic and diastolic pressures. The advantage of this method is that it does not require much skill to measure the blood pressure in this way, therefore, the electronic device can also be used at home.

***Oscillations: regular variation in magnitude or position about a central point, especially of an electric current or voltage (Oxford Dictionary of English).

- Blood Pressure Difference (i.e. Amplitude) = Systolic Blood Pressure - Diastolic Blood Pressure

- Mean Blood Pressure = Mean of All Values of Blood Pressure (in a cardiac cycle)

***N.B. not the arithmetical mean of Systolic Blood Pressure and Diastolic Blood Pressure

Conclusion

The techniques used at present are evolving to work faster, more efficiently, and with more reliability in clinical measurements. The aim at the moment is to make the measurement of blood pressure easier and more accessible to people living in underserved areas. As well as this, individuals in the medical field are promoting the increased use of ambulatory blood pressure monitoring (ABPM) and self-blood pressure monitoring (SBPM).

Bibliography: http://www.heart.org/HEARTORG/Conditions/HighBloodPressure/AboutHighBloodPressure/Understanding-Blood-Pressure-Readings_UCM_301764_Article.jsp http://www.ncbi.nlm.nih.gov/books/NBK268/ http://ulb.upol.cz/lectures/vaa11/circulation http://ieeexplore.ieee.org/xpl/articleDetails.jsp?tp=&arnumber=6317436&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs_all.jsp%3Farnumber%3D6317436 http://books.google.cz/books?id=ooH1nH81_h4C&pg=PA238&dq=blood+pressure+measurement+development&hl=en&sa=X&ei=rcuCVNDHLInsUtPogOAP&redir_esc=y#v=onepage&q&f=false http://www.slideshare.net/medicinemcq5/dynamic-of-blood-flow?next_slideshow=1 http://tensoval.com/oscillometric-measurement-devices.php http://hyperphysics.phy-astr.gsu.edu/hbase/ppois2.html http://www.ncbi.nlm.nih.gov/books/NBK268/