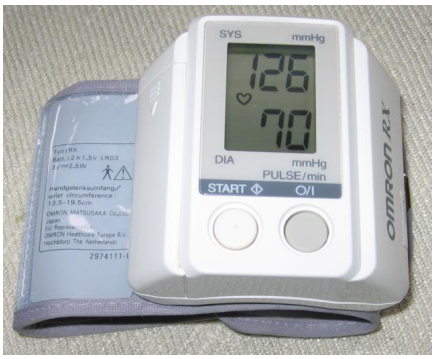
Sphygmomanometer

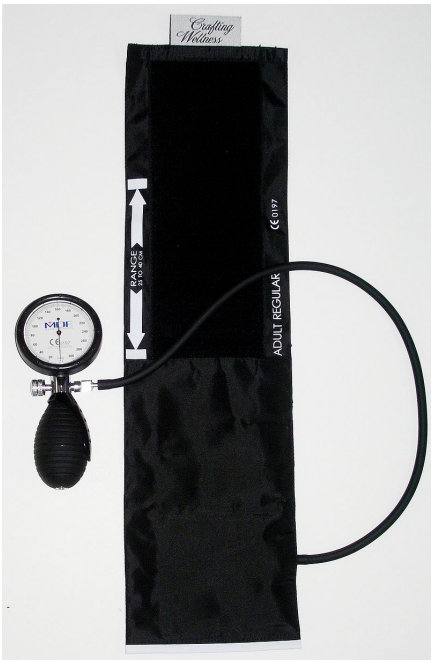
A **sphygmomanometer** (pronounced /ˌsfɪgmoʊməˈnɒmɨtər/ *SFIG-moh-mə-NOM-i-tər*) or **blood pressure meter** is a device used to measure blood pressure, comprising an inflatable cuff to restrict blood flow, and a mercury or mechanical manometer to measure the pressure. It is always used in conjunction with a means to determine at what pressure blood flow is just starting, and at what pressure it is unimpeded. Manual sphygmomanometers are used in conjunction with a stethoscope.



BP 126/70 mmHg as result on electronic sphygmomanometer

The word comes from the Greek *sphygmós* (pulse), plus the scientific term manometer (pressure meter). The device was invented by Samuel Siegfried Karl Ritter von Basch in 1881.[1] Scipione Riva-Rocci introduced a more easily used version in 1896. Harvey Cushing discovered this device in 1901 and popularized it.

A sphygmomanometer consists of an inflatable cuff, a measuring unit (the mercury manometer, or aneroid gauge), and inflation bulb and valve, for manual instruments.



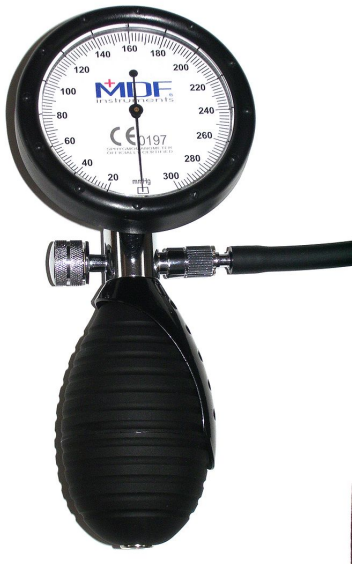
Aneroid sphygmomanometer with an adult cuff

Operation

In humans, the cuff is normally placed smoothly and snugly around an upper arm, at roughly the same vertical height as the heart while the subject is seated with the arm supported. Other sites of placement depend on species, and may include the tongue, flipper, tail or teat. It is essential that the correct size of cuff is selected for the patient. Too small a cuff results in too high a pressure, whilst too large a cuff results in too low a pressure. The cuff is inflated until the artery is completely occluded. Listening with a stethoscope to the brachial artery at the elbow, the examiner slowly releases the pressure in the cuff. As the pressure in the cuffs falls, a "whooshing" or pounding sound is heard (see Korotkoff sounds) when blood flow first starts again in the artery. The pressure at which this sound began is noted and recorded as the systolic blood pressure. The cuff pressure is further released until the sound can no longer be heard. This is recorded as the diastolic blood pressure. In noisy environments where auscultation is impossible (such as the scenes often encountered in emergency medicine), systolic blood pressure alone may be read by releasing the pressure until a radial pulse is palpated (felt). In veterinary medicine, auscultation is rarely of use, and palpation or visualization of pulse distal to the sphygmomanometer is used to detect systolic pressure.

Significance

By observing the mercury in the column while releasing the air pressure with a control valve, one can read the values of the blood pressure in mm Hg. The peak pressure in the arteries during the cardiac cycle is the systolic pressure, and the lowest pressure (at the resting phase of the cardiac cycle) is the diastolic pressure. A stethoscope is used in the auscultatory method. Systolic pressure (first phase) is identified with the first of the continuous Korotkoff sounds. Diastolic is identified at the moment the Korotkoff sounds disappear (fifth phase).

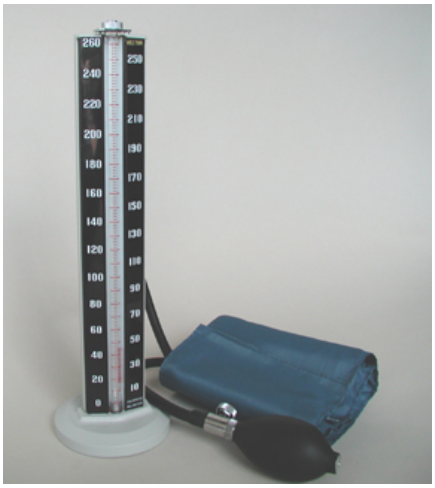


Aneroid sphygmomanometer dial, bulb, and air valve

Types

There are three types of sphygmomanometers:

- Digital with manual or automatic inflation. These are electronic, easy to operate, and practical in noisy environments. Many have not been validated for all patient groups, and they can give very inaccurate readings. They measure mean arterial pressure (MAP) and use oscillometric detection to calculate systolic and diastolic values. In this sense, they do not actually measure the blood pressure, but rather derive the readings. Digital oscillometric monitors are also confronted with "special conditions" for which they are not designed to be used: arteriosclerosis; arrhythmia; preeclampsia; *pulsus alternans*; and *pulsus paradoxus*. Some wrist cuff blood pressure monitors have been found to be quite accurate, but the monitor has to be at the level of the heart when the reading is taken.[2]


Clinical mercury Manometer

- Digital portable finger blood pressure monitors with automatic inflation. These are more portable and easy to operate, although less accurate. They are the smallest blood pressure monitors.
- Manual. Ideally operated by a trained person. Mercury manometers are considered to be the gold standard because their measurements are absolute and the units do not require re-calibration. For this reason they are often required in clinical trials of pharmaceuticals and for clinical evaluations of determining blood pressure for high risk patients including pregnant women. However, the risk of mercury leaks when they are damaged has led to their withdrawal from many clinical areas. Aneroid, (mechanical types with a dial) are in common use, but they should be calibrated against a mercury manometer. The unit of measurement of blood pressure is millimeters of mercury (mmHg) and are usually given as an even number. Manual sphygmomanometers require a stethoscope for auscultation. Although it is possible to obtain a basic reading through palpation, this only yields the systolic number.

External links

- US2560237 [3] (1951-07-10) R. H. Miller, *Sphygmomanometer*.
- US6752764 [4] (2004-06-22) Man S. Oh, *Pocket sphygmomanometer*.

References

[1] Booth, J (1977). "A short history of blood pressure measurement" (http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=1543468). *Proceedings of the Royal Society of Medicine* **70** (11): 793–9. PMID 341169. . Retrieved 2009-10-06.

[2] Watson, S.; Wenzel, R. R.; di Matteo, C.; Meier, B.; and Lüscher, T. F. (1998). "Accuracy of a new wrist cuff oscillometric blood pressure device". American Journal of Hypertension 11: 1469-1474 (1998). Retrieved from http://www.nature.com/ajh/journal/v11/n12/index.html.

[3] http://patft.uspto.gov/netacgi/nph-Parser?patentnumber=2560237

[4] http://patft.uspto.gov/netacgi/nph-Parser?patentnumber=6752764

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