

The aim of this diploma thesis is to compare and evaluate the results of two most widespread blood pressure measurement methods.

First method, which is used as reference in this work, is auscultatory method.

Nowadays, it is most often used method and it is based on auscultatory sounds. The sounds were described by the Russian physician Nikolaj Korotkov in 1905. The auscultatory method uses a tonometer with inflatable cuff and a stethoscope. The cuff is wrapped around an upper arm or wrist and inflated to about 30 mmHg above the systolic pressure - the pressure at which the radial pulse is obliterated. With the stethoscope placed over the brachial artery distal to the cuff, the cuff is then deflated at a rate 2 to 3 mmHg per second or heart beat, during which Korotkoff sounds can be heard. The cuff pressure at the onset of Korotkoff sounds, or tapping sounds, is generally taken to be systolic pressure. Diastolic pressure is generally taken to be the cuff pressure at the onset of silence.

Second method used is oscillometric method. This method is based on evaluation of oscillometric pulsations that are generated in cuff during increasing or decreasing of the cuff pressure. The big problem of this method is the no clear criterion for evaluation of systolic and diastolic pressure. BPs are usually determined by application of mathematical criteria that are characterised by certain reliability interval.

The reason for comparison of these methods is boom of the new commercial available oscillometric blood pressure monitors. Producers of the monitors are still developing more accurate algorithms even though their accuracy are not sufficient when compared with auscultatory method. The accuracy of many of those new oscillometric blood pressure monitors does not meet the criteria of European standard EN 1060-3 and some clinical protocols.

Usually in the prestiged companies this requirement is kept in laboratory conditions. However, the testings most of the time are performed on voluntaries, which usually are young and healthy people. Monitors are especially intended for home uses and generally for people, on which is necessary a regular control of their BP. These people often suffer from some disease which causes variances in their BP or hypertension attacks. Among those diseases belong especially cardiovascular diseases, diabetes mellitus etc. These diseases can considerably affect the accuracy of the measurement and in extremaly cases it could indicate values with fatal errors, which could have very negative consequences on the patient health.

The task was to collect sufficient quantity of data and to find out whether the oscillometric BP monitors meet the criteria of EN 1060-3 and whether those results are in accordance with international protocols for non-invasive BP methods. The attention was oriented on various states as age, sex, presence of some disease etc.

Data collection was carried out in two retirements' houses and 3<sup>rd</sup> internal clinic of General Faculty Hospital and Charles University in Prague. It was measured more than 200 people by both methods simultaneously and more than 900 records were acquired. Usually each person was mesured with oscillometric blood pressure monitor Omron M4-I and mercurial sphygmomanometer simultaneously firstly on his/her left arm and after it on right arm. Continual decreasing of cuff presuure was set up on 2 mmHg per second. Subsequently was carried out another two measurements on the left arm, always with three minuts interval. Both mentioned blood pressure monitors were verified in Accredited Metrological Laboratory K127. It was used only Omron cuff that was connected via T-piece with both monitors though ensuring simultaneous mesurement. Oscillometric pulsations were recorded by Oscilo 1 equipment and after that transmitted

to the PC. Educated staff completed another data to each measured person to the protocol (age, weight, height, diagnosis, medicines etc.).

In the following results comparison it was found that around 70% of measurements were in allowed tolerance of  $\pm 5$  mmHg. Around 15% of measurements were with difference higher than  $\pm 10$  mmHg or were with error of measurement. Higher differences were found in diastolic pressure but with repeated measurements the differences were smaller.

No statistical significant dependence on gender was found in the data but considerable differences in diastolic pressure of people older than 90 years were discovered.

A very important finding was the influence of some diseases on accuracy of the measurements. The lower quality of measurement was caused especially by ischemic heart disease, diabetes mellitus, hypertension, brain atherosclerosis and generalized and unspecified atherosclerosis. This was very evident during the measurements of diastolic pressure.

It was proven that some diseases have very high influence on measurements using oscillometry method. In case of substitution of auscultatory method by this method in routine operation it is necessary to considerably improve the evaluation algorithms.