

The importance of using automatic blood pressure measuring devices in hypertension patients

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ABSTRACT

Accurate blood pressure measurement is essential for screening, diagnosing, and managing hypertension. There is ongoing concern about the accuracy of blood pressure measurement in clinical settings, despite efforts to promote proper techniques. A digital blood pressure monitor is a device used to measure blood pressure and pulse. It can be fully or semi-automated and is typically simple to use, lightweight, and portable. Digital blood pressure monitors are reliable and provide quick and easy measurements of blood pressure.

Keywords: Hypertension, automatic blood pressure measuring devices, home blood pressure measurement.

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Introduction

Hypertension, also known as high blood pressure, is a serious and preventable disease that is prevalent globally. It can lead to various other conditions such as heart attack, stroke, heart failure, and kidney disease. Controlling hypertension is crucial in avoiding these related conditions, which is why it is important to measure blood pressure regularly and accurately. However, blood pressure measurements taken in outpatient clinics may not always be accurate due to various individual and environmental factors and may not truly reflect the patient's overall blood pressure status. Regular blood pressure readings provide doctors with valuable information about the

patient's overall blood pressure status and can aid in the patient's treatment.

Therefore, there is a requirement for a home blood pressure measurement method that is comfortable to apply, gives accurate results, and is non-invasive for the patient. There are several known methods for measuring blood pressure, and one of them is automatic blood pressure monitors. This study aimed to examine the strengths and limitations of automatic blood pressure measuring devices in both clinical use and home measurements.

What is Hypertension?

Hypertension, also known as high blood pressure, is typically defined as a systolic blood pressure (SBP) of 140 mmHg or higher and/or a diastolic blood pressure (DBP) of 90 mmHg or higher in adults [1].

Hypertension is a significant global public health problem that is prevalent around the world and in our country. Its incidence tends to increase with age, and it carries a high mortality

rate due to the complications it can cause. It is estimated that approximately 7.6 million people die from hypertension-related complications yearly, accounting for 31% of all deaths worldwide [2].

According to epidemiological studies, the prevalence of hypertension (HT) in adults ranges from 35-46%. It is projected that approximately one-third of the global population will be affected by HT by 2025. The high prevalence of HT has been linked to factors such as obesity, an aging population, and the consumption of excessive amounts of salt in the diet [3].

In Turkey, as is the case globally, 90-95% of hypertension (HT) cases are primary (essential) HT, for which the exact underlying mechanism is not known. The remaining 5-10% of HT cases are secondary, meaning that they are caused by underlying conditions such as kidney disease, Cushing's disease, thyroid disorders, parathyroid gland disorders, acromegaly, aortic coarctation, renal artery stenosis, adrenal gland disorders, pheochromocytoma, and sleep apnea [4]. Despite advances in the diagnosis and treatment of hypertension, the control of blood pressure levels around the world varies widely, ranging from 13% to 72% [5]. Inadequate blood pressure control can lead to increased complications, higher treatment and care costs, and increased morbidity and mortality [6]. Therefore, it is significant to closely monitor and effectively manage blood pressure to reduce the risks associated with hypertension.

Hypertension (HT) is a critical condition that is associated with high morbidity and mortality rates due to complications such as cardiovascular disease, hemorrhagic and thrombotic stroke, renal disease, peripheral arterial diseases, and death. However, HT is a preventable and treatable disease [7].

In developed countries, approximately 50 billion dollars are spent each year on the diagnosis, treatment, and management of HT-related complications, representing about 10% of healthcare expenses [8].

Accurate measurement of blood pressure is essential for the diagnosis of HT. Blood pressure is one of the "vital signs" and an important indicator of a person's health status. Although blood pressure measurement seems straightforward, it is one of the most erroneous measurements in practice. Inaccurate measurement of blood pressure can lead to misdiagnosis of the patient and initiation of inappropriate treatment. Therefore, accurate and thorough measurement of blood pressure is a crucial aspect of the diagnosis, treatment, and follow-up of HT [9].

Blood Pressure Measuring Devices

The gold standard for determining blood pressure is through the direct method using an intra-arterial catheter, although this method is not practical for everyday use and is only preferred for groups (such as in operating rooms, for intensive care patients, or research purposes). Three types of sphygmomanometers are currently considered to meet standard criteria: mercury, aneroid, and oscillometric manometers. Of these, measurement with a mercury manometer is the gold standard for indirect blood pressure measurement. However, the use of mercury manometers is no longer recommended due to the risk of environmental pollution. In clinical practice, aneroid and digital manometers are preferred due to their ease of use, accessibility, cost-effectiveness, and non-invasive nature [10, 11].

In numerous studies, no clinical differences have been observed in measurements taken with manual blood

pressure devices and digital blood pressure devices [10, 12].

Principles of Accurate Blood Pressure Measurement

The following principles should be followed to ensure accurate blood pressure measurement in an outpatient or clinic setting:

1. The measurement should be taken in a room with a normal temperature, free from noise and distractions.
2. The patient should be allowed to rest for at least five minutes in a sitting or lying position before the measurement is taken.
3. The patient should be questioned about any factors that may affect blood pressure, such as eating, exertion, exercise, the urgency to urinate or defecate, the presence of pain, mood, smoking, consumption of drinks containing caffeine, dehydration, and drug use. These conditions should be considered before measuring blood pressure.
4. The arm circumference of the patient should be measured before the measurement, and a cuff appropriate for the arm circumference should be used in conjunction with a blood pressure measuring device that has been previously calibrated and checked.
5. If the patient's blood pressure is to be measured in a sitting position, his back should be supported, and his feet should be in contact with the ground.
6. The arm to be measured should be supported so that it is parallel to the ground and at heart level, and there should be no clothing that can squeeze the arm to be measured, if any, clothing should be removed.
7. To prevent contraction of the arm muscles, the arm should be supported from below and the hand should be free.
8. If a digital blood pressure monitor is being used in a clinic or at home, the pulse should be

checked first. The patient's cardiac rhythm should be assessed to ensure that it is normal. If the patient has arrhythmia, using a digital device to measure blood pressure may produce incorrect results. Therefore, the pulse should be evaluated by palpation before measuring blood pressure, and if there is any irregularity, measurement should be made with aneroid devices using a stethoscope.

9. To begin the measurement, the pressure level at which the brachial artery pulse can no longer be felt should be determined manually. The cuff should then be inflated to approximately 20-30 mmHg above this level. If the cuff is over-inflated without knowing the systolic blood pressure value, it may result in an incorrect measurement of high systolic blood pressure.

10. At least two measurements should be taken at a time, with at least two minutes between each measurement, and the average should be recorded. Patients whose blood pressure is found to be 140/90 mmHg or higher in the first evaluation should be re-evaluated during the second examination to confirm the diagnosis.

11. Care should be taken to measure blood pressure from both arms, particularly during the first examination. If the blood pressure difference between the two arms is greater than 20 mmHg systolic or more than 10 mmHg diastolic, further investigation should be conducted to determine the presence of any secondary causes.

12. The patient should be given verbal and, if necessary, written information about HT and accurate blood pressure measurements. Thus, it will enable the person to realize the importance of the disease and to create awareness that blood pressure measurement with the right technique is an important factor affecting the diagnosis. During the period until the second examination, home or ambulatory blood pressure measurements of the patients should

be made. Thus, this method will help patients reach a more accurate diagnosis.

Importance of Home Blood Pressure Monitoring

Home blood pressure measurement involves the use of a mechanical or electronic device with a cuff suitable for the arm to measure the patient's blood pressure from their own arm. It is recommended to follow the general rules for blood pressure measurement and to inform the patient in advance. Home measurements should be taken for at least five days, but it is preferable to do it for seven days. Measurements should be taken in the morning and evening, after resting for at least five minutes in a sitting position and before eating. If masked hypertension or white coat effect is suspected, it is especially important to perform home measurements [13]. Sphygmomanometers to be used in home measurements are usually aneroid or electronic sphygmomanometers. Aneroid monitors should be preferred first.

Electronic devices may be recommended for elderly individuals who cannot use these devices or have hearing difficulties. The accuracy of these devices should be checked at regular intervals by comparing them simultaneously with the measurement results with a mercury blood pressure monitor. The technique for clinical measurements should be used for home measurements, but patients and their relatives should be trained by a physician on how to properly measure blood pressure [14-19]. Hypertensives tend to have higher blood pressure when measured in the practice or clinic than in other locations. Measuring blood pressure outside the office can provide valuable information for the initial evaluation of patients with hypertension and for monitoring their response to treatment. In recent years, the method of monitoring the patient's blood

pressure at home (self-monitoring) has been widely used. The advantages of measuring blood pressure by the patient himself are as follows [20, 21]:

1. Distinguishing true hypertension from “white coat” hypertension.
2. It is easy, cheap, and practical.
3. Numerous measurement possibilities during the day
4. Opportunity to follow up for days-weeks-months
5. Increase the rate of hypertension control
- 6- Determination of daily blood pressure values in new-onset blood pressure elevations and borderline hypertension.
7. Evaluation of therapeutic response to antihypertensive drugs.
- 8-The patient's compliance with the treatment plan and active participation in the treatment process increase treatment compliance and treatment success.
9. Reduces the cost of patient monitoring. It also makes an important contribution to reducing unnecessary diagnosis and treatment, the number of visits and the number of medications.

A good correlation was observed between home measurements and ambulatory blood pressure measurements. Home measurements were lower than office measurements in both normotensive and hypertensive individuals. In the PAMELA study, it was observed that the blood pressure of 140/90 mmHg measured in the office corresponded to systolic 121-132 mm Hg and diastolic 75-81 mm Hg in home measurements [22-25]. For this reason, the upper limit of blood pressure values in home measurements should not be 140/90 mmHg, but a maximum of 135/85 mmHg. If the mean blood pressure measurement values at home is 135/85 mmHg and above, the diagnosis of HT should be considered [26-30].

Benefits of automatic blood pressure measurement devices

Automatic blood pressure measurement devices are very practical and useful tools for home measurements. They are popular and their use is becoming more and more common. They measure the oscillation/vibration (oscillation) that blood pressure creates on the vessel wall. Digital manometers are preferred more because of their ease of application, accessibility, economic and non-invasiveness [11].

In many studies, when manual blood pressure devices and digital blood pressure devices were compared, it was seen that there was no clinical difference in the measurements [10].

Benefits of automatic blood pressure monitors:

- It is easier to use than other cuffed sphygmomanometers.
- The training that should be given to the patient for its use is much simpler.
- Their prices are more reasonable.
- They are small and more convenient size for carrying.
- Provides ease of record keeping thanks to its memory capacities.
- Measurement can be made not only from the arm but also from the wrist.
- It can provide ease of use with its voice command feature.
- Blood pressure measurement value and time can be saved.
- The probability of erroneous measurements can be reduced by making consecutive measurements.
- Preventing the pump from rising to very high levels provides less discomfort in the arm.
- Having a large screen provides an advantage for those with vision problems.
- Easy fitting of the cuff provides ease of use.
- Low battery alert reduces the possibility of incorrect measurement.

- It provides ease of communication thanks to the feature of being able to reach telemedicine service providers via Bluetooth.

- Connecting to a computer provides ease of registration and communication.

-Measuring the pulse rate also provides additional benefits in follow-up and treatment.

Limitations of automatic blood pressure measuring devices

The most considerable disadvantage of automatic blood pressure measuring devices is the risk of erroneous measurements. Checks and calibrations should be made at certain periods.

-Since they measure the oscillation/vibration (oscillation) created by blood pressure on the vessel wall, increased stiffness (stiffness) in the vessel wall may affect the correct measurement of automatic instruments. This may affect the measurements, especially in elderly patients with advanced atherosclerosis.

- Weakening of the battery power and not being noticed by the user may cause erroneous measurements and evaluations.

In patients with arrhythmias, the risk of automatic blood pressure measurement devices giving false results increases.

Conclusions

Hypertension is an important universal public health problem, which is very common in the world and whose incidence is increasing rapidly due to the complications it causes.

Hypertensives tend to have higher blood pressure when measured in the practice or clinic than in other locations. Measuring blood pressure outside the office can provide valuable information for the initial evaluation of patients with hypertension and for monitoring their response to treatment. In recent years, the method of monitoring the patient's blood

pressure at home (self-monitoring) has been widely used. Measuring blood pressure at home by the patient himself has many advantages.

Prospective studies are needed to understand whether measurements at home are more valuable in determining morbidity and mortality than conventional measurements. Home monitoring can be misleading in people who are severely obese or have irregular heart rhythms. Therefore, blood pressure values measured at home should be considered supportive information for diagnosis and treatment by the physician and should not replace examination measurements.

In clinical practice, aneroid and digital manometers are preferred more because of their ease of application, accessibility, economics, and non-invasiveness. In many studies, when manual blood pressure devices and digital blood pressure devices were compared in studies, it was seen that there was no clinical difference in the measurements.

Blood pressure monitoring at home with automatic blood pressure devices; is recommended to be preferred for patients since it is very easy to use, economical, accessible, and accurate results are the same as manual devices. There are also some limitations depending on the patient and the device. Providing full coordination by joint evaluation of digital home measurements and manual measurements in the clinic; will contribute to the increase of patient-physician cooperation, patient compliance, and the success of diagnosis and treatment.

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