



ASSESSMENT OF BLOOD PRESSURE USING AMBULATORY BLOOD PRESSURE MONITOR

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ABSTRACT

The prevalence of high blood pressure (BP) is increasing these days. It is a very important risk factor for many diseases involving the cardiovascular system, renal system and neurological system. Usually the blood pressure of a person is measured routinely using the mercury sphygmomanometer and it is taken only once or twice. This reading of blood pressure is known as office or clinic blood pressure. But this casual blood pressure reading can not represent the whole day BP levels. Many of the patients can be misdiagnosed as hypertensives and many can be underdiagnosed. With recent advances, the use of ambulatory BP monitor (ABPM), which can measure the whole day and night BP levels, is becoming very important. The mean of the values recorded by ambulatory blood pressure monitor has a greater prognostic and therapeutic value as compared to the single clinic blood pressure value.

INTRODUCTION

The prevalence of hypertension is increasing day by day. There is need for accurate and timely diagnosis. There are various techniques of BP measurement and ABPM is one of them. Ambulatory BP monitors are small devices which are automatic and can be worn on the waist by the help of belt and a pouch inside which the monitor is placed. It is battery operated. The device is connected to the blood pressure cuff through a tube. This blood pressure cuff is wrapped around the upper arm in the same manner as the normal sphygmomanometer cuff. These devices can be worn for as many days as required but are usually worn for twenty four hours including day and night time. The device can be preset to timely obtain the readings every 15 minutes, 30 minutes or any time interval as required.^[1]

Working principle of ambulatory BP monitors

It is based on the principle of cuff oscillometry. The blood pressure cuff continues to inflate until the pressure inside the cuff is sufficient to occlude the flow of blood in the brachial artery. Now as there is release of pressure, there is flow of blood inside the artery which creates oscillations in the wall of the artery. These oscillations are detected by the device. The intensity of oscillations increases at first, then decreases and finally ceases as the normal blood flow is established. The pressure at which there was maximum oscillations is expressed as mean arterial blood pressure (MABP) by the device. Then, with the help of software, systolic BP (SBP) and diastolic BP (DBP) are calculated using an algorithm.^[2,3]

Indications for ABPM^[4,5]

1. In the diagnosis of white coat hypertension. It is a condition in which there is normal BP at home or ambulatory monitoring and elevated BP at clinic or office measurement.
2. In the diagnosis of masked hypertension. It is a condition in which there is normal office BP but elevated ambulatory or home BP.
3. In the diagnosis of nocturnal hypertension. It is a condition in which BP is normal or controlled during day time, but elevated during night time
4. During pregnancy, in the diagnosis of preeclampsia. Also, to rule out falsely elevated BP to prevent the use of antihypertensives in pregnant women.
5. In monitoring therapy with antihypertensives, it can be seen whether the BP levels are being controlled or not by the use of ABPM.
6. In the diagnosis of non dippers. Normally, the BP falls by 10 to 20% during the sleep time as compared to day time. In case of non dippers Bp falls by less than 10% or can be even more than day time BP. Non dippers are prone to adverse cardiovascular outcomes.

Contraindications of ABPM^[6]

1. Patients having disorders of clotting
2. Patients having any cardiac rhythm abnormality like fibrillation of atria.
3. Presence of any arteriovenous fistula. For example, in patients undergoing dialysis.
4. Allergy to latex

Procedure

At first, patients have to be informed and explained about the device and the procedure.

Instructions to the patient

1. Patients are to be informed that it is a safe procedure and relatively painless.
2. They have to wear this monitor on their waist in a pouch and a cuff around the arm during the whole duration of recording.
3. In the test, their blood pressure will be measured at regular intervals of time which is preset.
4. Some minor discomfort can happen initially when the cuff is inflating and then it will finally deflate in the same manner as they undergo their routine clinic BP measurement.
5. Subjects are asked to be still and to hold their arm at chest height whenever a reading is being taken and then to record their activity, posture, location, and mood in a diary.
6. They can do their normal daily works and sleep as well.
7. They are instructed not to drive but if they are driving they should try to stop driving when the reading is being recorded.
8. They should minimize their exercise and travelling during the day of recording.
9. They should enter the time of going to sleep and the time of awakening in their diary.
10. Awake and sleep times are evaluated from the diary entries.

Precautions

1. Patients are told not to take bath as the device should not get wet.
2. The tube of the monitor should be prevented from kinking or compression, especially during sleep.
3. Patient should not press any button on the monitor.
4. If any emergency is there, then they can stop the monitor by pressing the stop button which is red in colour.
5. If there is any swelling or pain in the arm, then they can remove the device after pressing the auto on and off key for few seconds.

Complications of ABPM

Usually, there are no major complications of ABPM. Some patients may get skin rashes, bruising and abrasions. Some may experience inconvenience with work and some may experience interference during sleep time.

Method of fitting the ABPM to the patient

1. The monitor is to be programmed first for recording at fixed intervals of time.
2. Then the proper cuff size is to be selected. For this, the circumference of the mid biceps is to be measured and then the corresponding size of the cuff is to be determined from the given range of values.

3. Then the patient is asked to sit and extend his nondominant hand on the table in a relaxed position.
4. Then the cuff is wrapped around the arm which should be bare and it is wrapped two finger width above the crease of the elbow.
5. Now the monitor is connected to the tube of the cuff and the monitor is placed inside the carrying pouch.
6. Then the monitor is secured properly on the waist with the help of a waist strap which can be adjusted according to the patient's comfort.
7. Then the monitor is activated to start the recording session.

Data transfer and report generation

When the twenty four hour recording has been done, then the device is removed and then connected to the computer for transferring the data. Sleep time and awake time has to be entered in the software manually. The software of the device then prepares a report of the data analysed and gives the average values like the 24 hour, sleep time and awake time SBP, DBP, MABP and heart rate (HR). The nocturnal dipping in the SBP is calculated by the ratio of awake minus sleep BP divided by awake BP. The dipping should be more than 10% normally.

Interpretation of the report

In the diagnosis of hypertension using ABPM, two guidelines are there. One is the 2013 European Society of Hypertension (ESH) guidelines.^[7] and the other is the 2017 American Heart Association (AHA) guidelines.^[8] According to the 2013 ESH guidelines, hypertension is diagnosed if the mean 24 hour ambulatory BP is $\geq 130/80$ mm of Hg, mean day time ambulatory BP is $\geq 135/85$ mm of Hg and mean sleep time ambulatory BP is $\geq 120/70$ mm of Hg. According to the 2017 AHA guidelines, hypertension is diagnosed if the mean 24 hour ambulatory BP is $\geq 125/75$ mm of Hg, mean day time ambulatory BP is $\geq 130/80$ mm of Hg and mean sleep time ambulatory BP is $\geq 115/65$ mm of Hg.

Limitations of ABPM

1. During physical activity, measurements are inaccurate or are not recordable.^[9]
2. Artefacts can not be detected by the device.^[10]
3. The availability of ABPM is limited.
4. The cost of ABPM is high.

CONCLUSIONS

In the assessment of cardiovascular risk factors, many studies have shown that the use of ambulatory blood pressure monitor is superior and has greater prognostic values as compared to the usual office or clinic blood pressure measurement.^[11-16] The goal of this review is to provide guidance in terms of practical use of ABPM. This will be helpful in better diagnosis and care of the patients of hypertension and other comorbidities.

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