Ambulatory blood pressure monitoring

Its place in general practice

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With the listing of 24-hour ambulatory blood pressure monitoring as Medicare item number 11607 for the diagnosis of hypertension, it is timely to reassess its place in general practice.

What is 24-hour ambulatory blood pressure monitoring?

Ambulatory blood pressure monitoring (ABPM) involves fitting a patient with a portable oscillometric blood pressure (BP) monitor (positioned on the left or right hip using a belt) connected to an upper arm cuff via a connecting tube. The device is usually programmed to inflate the cuff and measure BP every 15 to 30 minutes during the day and every 30 to 60 minutes during the night over a 24- to 26-hour period. The mean BP is determined at the peak of the pressure oscillations in the cuff but the systolic and diastolic values are calculated using an algorithm.

It is vital to use a validated and calibrated device (see https://www.validatebp.org or https://stridebp.org/) and to choose the correct cuff size and the arm with the highest readings as determined during fitting to get the most accurate result. If the systolic BP difference is less than 10mmHg, the nondominant arm should be used. ABPM is suitable and accurate in most patient groups, including young, elderly, obese and pregnant patients. Some very obese patients may need a conical shaped cuff. In such patients, using a standard or even a large cuff would lead to abnormally high readings.

What does it measure?

ABPM devices are programmed by specialised software that also collects the data from the device and generates a final report giving the average 24-hour, daytime (awake) and night time (asleep) systolic, diastolic and mean BP as well as heart rate. The first few readings during fitting at the clinic may include a white-coat component, so it is often best to ignore readings during the first hour. Other measures

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© GEOFFREY A. HEAD. MODEL USED FOR ILLUSTRATIVE PURPOSES ONLY AND TO SHOW A PERSON BEING ACTIVE WHILE WEARING THE DEVICE. NORMALLY THE CUFF IS WORN UNDER CLOTHING. SEE TEXT REFERENCES FOR CORRECT FITTING INSTRUCTIONS.

Key points

- **Ambulatory blood pressure monitoring (ABPM) is the gold standard method to measure blood pressure (BP). It is highly accurate and able to determine the entire 24-hour BP profile of a patient during a typical day and night.**
- **Nocturnal BP measurements are the best predictors of future cardiovascular events.**
- **ABPM is the best method to diagnose hypertension and can be used for long-term monitoring of a patient's BP profile.**
- **ABPM is the most accurate predictor of future cardiovascular events or end organ damage compared with clinic or home BP assessments.**
- **ABPM limits considerably hypertension misdiagnosis (white-coat or masked hypertension), which can occur with casual clinic BP measurements.**
- **The hypertension threshold for daytime ABPM is 135/85mmHg and night time, 120/70mmHg.**
- **ABPM is now available as Medicare rebate item number 11607 for the diagnosis of hypertension in previously untreated patients with grade 1 or grade 2 hypertension as recorded during clinic measurements.**
- **Setting up an ABPM service in general practice needs initial investment in equipment and training of staff or a practitioner to perform the recording and interpret result correctly.**
- **Only ABPM devices listed on the Australian Register of Therapeutic Goods should be used. They should also be validated and calibrated at regular intervals.**
- **ABPM should be used in conjunction with clinic and home BP measurements.**

include the 'BP load', which is the percentage of time BP readings are above the threshold for hypertension during the day and night.[1] For a typical recording from a normotensive person, the BP load should be less than 20%. ABPM can also measure BP and heart rate variability as well as the surge in BP in the morning, which is a period of greatest cardiovascular risk.

What constitutes a valid 24-hour recording?

A typical ABPM recording will have about 40 to 50 readings over 24 hours. To be valid, the recording should have at least 70% of the expected measurements, with at least 20 during the day and seven at night.[2] Clearly physiologically impossible values should be removed, but in general editing should be kept to an absolute minimum.[3]

Nocturnal dipping

A very important calculation from ABPM is whether the reduction in BP at night (called dipping) was sufficient. A normal dipping pattern is a reduction in systolic BP of between 10% and 20%. Greater than 20% is called 'extreme dipper', whereas from 0 to 10% is considered 'nondipping'. A rise in systolic BP at night indicates a 'riser' pattern, which is a high-risk category and may indicate sleep issues such as sleep apnoea.

When should you use ABPM in the general practice setting?

ABPM is only one way to measure a patient's BP, and clinic BP measurements as well as home BP measurements still have an important role. Although measurements taken in the clinic by the physician or practice nurse are routinely used, they should be considered as a screening tool rather than for diagnosis of hypertension as they can be inaccurate even if made by automated devices.[3] Home BP measurements can complement the diagnosis of hypertension and may be slightly more preferable to patients, but ABPM is considered more reliable.[4] Patients are more likely to take medication based on ABPM

Common indications for ABPM

- To confirm or not the diagnosis of hypertension
- To confirm or not the presence of white-coat hypertension, defined as BP exceeding thresholds measured in the clinic (≥140/90 mmHg) but otherwise normal at home or at work
- If there is suspected masked hypertension, which is normotensive BP levels in the clinic but hypertensive at home or work
- If there is suspected lack of nocturnal dipping or nocturnal hypertension
- To correctly determine if the patient remains hypertensive despite antihypertensive treatment
- For patients with a high risk of future cardiovascular events
- For patients with suspected episodic hypertension

Abbreviation: ABPM = ambulatory blood pressure monitoring.

compared with home or clinic BP measurements.[4] Patients are renowned for selecting some readings and ignoring others and may not follow the recommendations of how to measure BP at home correctly.[5-7] Nevertheless, home measurements have an important place in long-term assessment of the effectiveness of antihypertensive treatment.[8] They should be seen as an adjunct to ABPM rather than a replacement.[3]

The Box lists the most common indications for ABPM.

Why should you use ABPM?

Accuracy and prognostic value

ABPM is the gold standard for assessing the BP profile of patients during daily life and is more accurate than occasional clinic BP measurements due to sheer number of recordings. Many prospective outcome studies indicate that ABPM is a better predictor of cardiovascular events, end organ damage and clinical outcomes than conventional clinic measures.[9,10] A well-conducted study comparing clinic BP, home BP and ABPM and measuring a composite outcome (cardiovascular mortality, myocardial infarction, stroke, heart failure hospitalisation and coronary intervention) found ABPM to be superior in predicting cardiovascular risk.[11] Much of the prognostic advantage of ABPM over home and clinic BP measurements lies in its ability to assess the nocturnal BP level, which is the highest predictor of future cardiovascular events. ABPM can be used to monitor antihypertensive therapy, particularly if the patient has nocturnal hypertension. Few studies have validated ABPM in the management hypertension, but a 1997 comparison concluded that ABPM guidance led to a reduction in antihypertensive prescriptions and a similar level of hypertension control compared with clinic BP measurements.[12]

Preventing misdiagnosis by detecting white-coat and masked hypertension

Although occasional clinic BP measurement has been the mainstay of hypertension diagnosis, it has been increasingly recognised that the small number of readings as well as a not uncommon white-coat effect can lead to misdiagnosis. The white-coat effect is defined as a raised BP in the presence of a physician when the patient is otherwise normotensive. Further, the in-office measurements may very much depend on who is present, with the values obtained by physicians being considerably higher than those taken by trained staff or practice nurses.[13] It should be noted that white-coat hypertension is not benign, with affected patients having double the risk of cardiovascular events than normotensive patients and also being likely to develop sustained hypertension within one to two years.[14] A second cause of misdiagnosis occurs when the reading in the clinic is normal but the patient is hypertensive at home or work. This is called masked hypertension. The prevalence of untreated masked hypertension in the Australian population is similar in men and women and may be as high as 20% according to a recent population study.[15] These patients have a level of cardiac hypertrophy and end organ damage that is similar to that observed with sustained hypertension.[16] Combined, the misdiagnosis of patients using clinic BP measurements can be as high as 25 to 30%.[15,17]

Although home BP measurement can be used to detect masked or white-coat hypertension, this technique is not as reliable as ABPM, which has a much higher sensitivity.[18] A direct comparison found that over half of patients with white-coat hypertension were not accurately detected with home BP measurement compared with ABPM.[18] Note that if the cuff size is too small, both ABPM and home BP underestimate the prevalence of white-coat hypertension and overestimate masked hypertension.[19] With an oversized cuff, the converse is true.

Limitations of ABPM

Some patients, particularly those with hypertension, find the repeated inflations during ABPM uncomfortable and in rare cases some bruising can occur. There are some limitations with oscillometric devices in patients with arrhythmias, which can interfere with the correct determination of the BP.[20] However, there are ambulatory devices that can detect arrhythmias and avoid this issue.[21] Measurements during the night may interrupt sleep and lead to an invalid recording, so it is important to check the patient diary (see later). ABPM is not needed to determine if patients with grade 3 hypertension (clinic systolic BP ≥180 mmHg and/or diastolic BP ≥110 mmHg) need treatment, as current guidelines suggest such patients start therapy immediately.

Claiming the Medicare rebate for ABPM (item 11607)

From November 2021, a new item number was introduced to Medicare for the following: 'Continuous ambulatory blood pressure recording for 24 hours or more for a patient suspected of hypertension, who has not commenced anti-hypertensive therapy, including the development of a report and treatment plan.'[22]

Several criteria must be met to qualify for the rebate, including the following.

- The patient must have a clinic BP measurement using a sphygmomanometer or a validated oscillometric device that

shows a systolic BP ≥140 mmHg but ≤180 mmHg and/or a diastolic BP ≥90 mmHg but ≤110 mmHg.
- The rebate is applicable only once per year, and the recording is interpreted by a medical practitioner and a report is prepared by the same medical practitioner who will, if necessary, develop a treatment plan.
- Both the in-clinic BP monitor and the ABPM equipment (cuff and monitor) used for services under item 11607 must be listed on the Australian Register of Therapeutic Goods, with monitoring devices recalibrated at time intervals in accordance with the manufacturer's recommendations.
- The rebate is not available as part of hospital treatment.

Further details can be found at: http://www9.health.gov.au/mbs/fullDisplay.cfm?type=item&q=11607&qt=item&criteria=ambulatory.[23]

The use of this item number so far has been below expectations, with an average of only 3700 claims per month from November 2021 to January 2022 (data available via http://medicarestatistics.humanservices.gov.au/statistics/mbs_item.jsp). Questions have been raised as to why the criteria for claiming the rebate is limited and does not include other circumstance in which ABPM would be useful, such as in patients with masked hypertension or those who are being treated for hypertension. The explanation for this is that the major hurdle the applicants had to overcome was justifying the cost–benefit equation, which in the current case was benchmarked against three clinic visits needed to confirm a diagnosis of hypertension. By keeping the focus narrow, the applicants were successful in their submission to the Medical Services Advisory Committee during a process spanning four years. There is now the possible opportunity to make further applications for other indications provided that ABPM is cost effective.

Setting up an ABPM service in general practice

The initial outlay for the purchase of one or more ABPM devices can be expensive but they can be used for many years. The device chosen needs to be listed on the Australian Register of Therapeutic Goods. Effectively, as devices and cuffs need to be cleaned after each use, a normal rate of recordings would be limited to twice per week per unit. Perhaps the biggest hurdle is training staff or the physician in the correct use of the device, navigating the software and ensuring that patients are fully aware of what is required of them. Some manufacturers provide training videos. The High Blood Pressure Research Council of Australia runs workshops on the practical use of ABPM and the recordings from October 2021 are soon to be available on its website (https://www.hbprca.com.au/). Other written guides and information are available from Australian publications and the European Society of Hypertension.[20,24,25]

What do you need to tell the patient?

Importantly, patients need to be briefed on what to expect, given written information and asked to be still during readings and to fill out a diary to record their activities, sleep periods, taking of medicine, posture and any symptoms that may be related to BP (headaches, dizziness). Activities should continue as in a normal day but it is best to avoid things that may interfere with the recordings (e.g. vigorous exercise). Normally a weekday is chosen to better reflect the patient's BP profile.

What is normal for ABPM and what are the hypertension thresholds?

Optimal values for systolic BP and diastolic BP as measured by ABPM (equivalent to clinic BP <120/80 mmHg) are as follows:
- 24-hour average <115/75 mmHg
- daytime (awake) <120/80 mmHg
- night time (asleep) <105/65 mmHg.[13]

ABPM thresholds for the diagnosis of hypertension (equivalent to clinic BP ≥140/90 mmHg) are as follows:
- 24-hour average ≥130/80 mmHg
- daytime (awake) ≥135/85 mmHg
- night time (asleep) ≥120/70 mmHg.[13]

A visual inspection of the 24-hour pattern with reference to the patient's diary events and timing of therapy (if relevant) is strongly recommended. Values between optimal and hypertension thresholds are considered 'normal' or 'high normal'. The hypertension threshold may be reached during the day or night and with either systolic or diastolic BP, such as with isolated systolic hypertension, which is more common in the elderly. The decision to start treatment should consider the absolute cardiovascular risk in accordance with the National Heart Foundation guidelines (https://www.heartfoundation.org.au/conditions/hypertension). Nocturnal reduction in systolic BP should be less than 20% but greater than 10%.[3]

Conclusion

There are now few if any reasons not to use ABPM routinely in general practice for the diagnosis of hypertension. The advantages of ABPM are substantial, including avoiding unnecessary treatment for patients with white-coat hypertension and being able to assess to nocturnal BP levels and dipping pattern, which are high-level indicators of cardiovascular risk. There is well described documentation on how to use ABPM and companies eager to sell ABPM devices may well offer help in setting up a service. Ideally in larger general practices, a staff member can be trained to fit the device and inform patients about the test. ABPM is ideally partnered with home BP measurements, which are more suited to long-term management and assessing effectiveness of treatment. Although ABPM now has a Medicare item number, there are rather strict conditions and, unfortunately, the item cannot be used for patients on therapy or for those with suspected masked hypertension. CT

References

A list of references is included in the online version of this article (www.cardiologytoday.com.au).

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