



INDIAN SOCIETY OF HYPERTENSION



CURRENT MEDICAL CONCEPTS

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# Case Report

## Confirming a Diagnosis of “Hypertension”

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### Abstract

Hypertension is the leading cause, worldwide, of premature death or surviving with disabilities due to damage to the heart, the brain, or the kidneys. Making a correct diagnosis of hypertension is an essential step in reducing the impact of elevated blood pressure (BP) on an individual’s health. In this article, we will use a typical case to illustrate the steps involved in confirming a diagnosis of hypertension, along with the rationale for the usage of the current out-of-office BP measurement tools, to correctly identify and confirm elevated BP. The reader will be guided through an explanation of how to use the office BPs with, or without, complementary information from BPs readings obtained using at home devices, or through the use of an ambulatory BP monitors. The utility of these different approaches to how, and settings within which, BP is measured are also examined.

**Keywords:** Hypertension, home blood pressure monitoring, self-monitoring of blood pressure, ambulatory blood pressure monitoring, blood pressure measurement

### Introduction

It’s a busy day in the clinic. Returning from lunch you have a 45-year man in a clinic room as your first patient who may have “hypertension.” You enter the room, introduce yourself, greet him reassuringly, and begin the visit.

### Case Report

He feels fine, and says he is here today because his family has told him he needs to have this blood pressure (BP) problem evaluated. He has had a few BPs recorded over the years leading up to today. They are usually “a little bit high” but he always assumed that they were in error, because he feels well. He has a family history of hypertension, on the mother’s side. He has three siblings, all younger, and none with a diagnosis of hypertension. He works in a nearby pharmaceutical plant as a laboratory technician. He does not smoke. He has no history of diabetes. His history is otherwise unremarkable.

His examination shows a man with a body mass index of 29.6 kg/m<sup>2</sup>. He has seated BPs in his dominant (right arm) of 156/92 mmHg and 154/92 mmHg with a regular heart rate of

76 beats/min. On standing, his BP is 152/98 mmHg with a heart rate of 78 beats/min. His fundi show mild arteriolar narrowing. The rest of his physical exam is unrevealing.

### Discussion

In the following paragraphs, I hope to conduct the reader through some of the common considerations faced by a practitioner making the diagnosis of hypertension in a patient. This will take the form of a narrative review and is based largely on the experiences of this author over the past 40 years of caring for patients with high BP.

#### Does he have “hypertension?”

How well does the BPs from a single office visit reflect a diagnosis of hypertension? This question was addressed by a UK study which sought to address the question of just “how many times do you need to check a BP in the office to feel reasonable confident that someone has hypertension?” Or at least confident that the clinic reflects the real BP. In the study mentioned,<sup>[1]</sup> 42 general practice providers in the

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United Kingdom were each asked to enroll the next three untreated patients who had an office diastolic BP of at least 90 mmHg to <110 mmHg. They recruited 110 new patients with suitably elevated diastolic BPs, and by a clever means of randomization, each patient was assigned a schedule of follow-ups over the next 8 weeks that would either occur at 4 and 8 weeks subsequently, or at 2, 4 6, and 8 weeks subsequently, or at 1, 2, 3, 4, and 8 weeks subsequently. It turns out, no matter what the follow-up assignment was, the same trend was evident in all three groups. Figure 1 shows pictorially what occurred during follow-up of these patients. Between the initial and subsequent visits, the systolic pressure declined by about 7 mmHg in all three groups and declined an additional 3 mmHg in all three groups at the third visit. After the third visit, there was little further change in systolic BP. The diastolic BP declined by about 5 mmHg between the initial and subsequent visit in all three groups, and although it declined an additional 2 mmHg between the second and third visit, there was little significant change in diastolic BP after the second visit. The fall in diastolic BP was not appreciably affected by the magnitude of the initial diastolic BP. However, those with higher systolic BPs tended to have a greater reduction in systolic BP in subsequent visits. Hence, it seems that two BP recordings taken and averaged for a single value, and repeated at occasions separated by 1–4 weeks between visits seemed like a valid way to use office BP readings to diagnose hypertension. Needless to say, in a patient presenting with greatly elevated BPs, for example, higher than 180/110 mmHg, therapy should begin right away, particularly if there is evidence of prior hypertension mediated organ damage (HMOD) such as left ventricular hypertrophy, heart attack, heart failure, prior stroke, or kidney function impairment. Comments in this article are basically meant to apply to uncomplicated, treatment naïve patients like our 45-year old patient.

### So, does our patient have hypertension?

*We are not sure yet*

The ability to measure BP outside of a physician office has taught us that there are several patterns to BP in ambulatory people. Some patients have normal BPs within the office setting, as well as at home, or while wearing an ambulatory BP monitor (ABPM) that is configured to automatically take and record their BPs over 24–48 h. These people are considered “truly normotensive.”

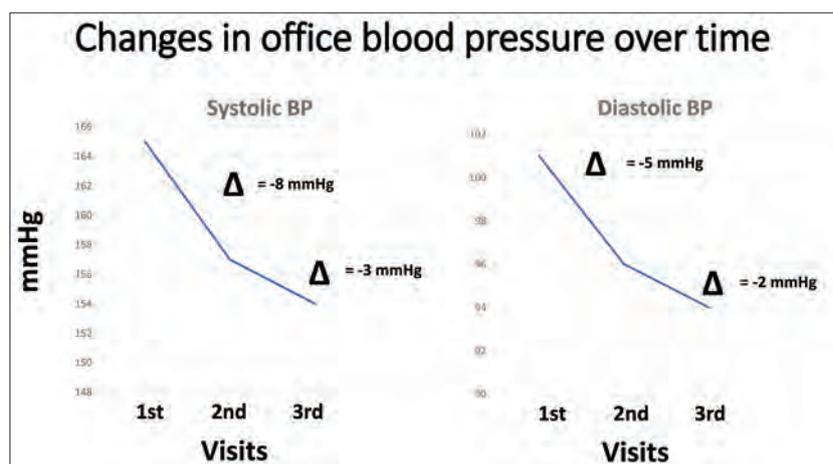
Some people have an office BP that is at, or above, the current threshold for a diagnosis of “hypertension” like our case, yet when monitored outside the office their BPs are lower than this threshold, and these people are considered to have “office hypertension” or, as it has several names, “white coat hypertension” or “white coat untreated hypertension” when they are not taking BP medication.<sup>[2]</sup>

Other people have the opposite finding from white coat. Their BPs are below the current hypertension threshold values, yet when outside the office, either during the day, or the night, or during both the day and the night, they are elevated. This pattern is generally known as “masked hypertension”<sup>[3]</sup> and is also called “masked uncontrolled hypertension” if they are on BP medication, or “masked untreated hypertension” when they are not taking BP medication.

Finally, there is the pattern where in-office and out-of-office BPs are high, and the patient is considered “truly hypertensive;” it is also known as “sustained hypertension” or “treated uncontrolled hypertension” when BPs levels remain elevated despite taking BP medicines. Figure 2 diagrams the four categories of BP using in-office and out-of-office findings.

### How common are these patterns in India?

This question was recently addressed in a large study of Indian patients evaluated with 24 h ABPM.<sup>[4]</sup> The short answer is that



**Figure 1:** Unadjusted changes in-office blood pressure (BP) overtime in 110 patients attending primary care practices with a new diagnosis of hypertension, defined as a diastolic BP > 90 mmHg (and <110 mmHg). Adapted from Hartley *et al.*, left panel shows changes in-office systolic pressures; right panel shows changes in-office diastolic BP

in 27, 472 adult Indian patients with ABPM data, 68% male, and about half taking BP medicines:

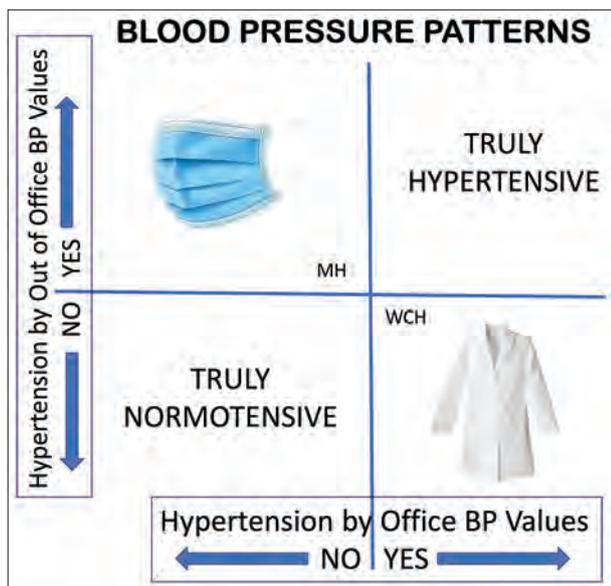
- 13% were normotensive (or controlled).
- 12% had white coat.
- 19% had masked.
- 56% were truly hypertensive (or uncontrolled).

These data indicate that it is possible for the office BPs to misrepresent what our patient’s out-of-office BPs are about 31% of the time. Said another way, relying on the office BP alone can misclassify about 3 people in 10.

**How will we further evaluate the BP in our patient?**

We have several avenues available. To confirm elevated BP using the office values only, we could ask him to return in 2 weeks for another BP check, and then once more after that. In addition to measuring BP, we would also be assessing him to address these questions in hypertension evaluation:

- Is this person truly hypertensive? (when the answer is “yes,” proceed to next point)
- Is their elevated BP primary, or is it a reflection of another issue in which elevated BP is a “symptom” (like aldosterone excess, or renal artery disease for example)?



**Figure 2:** Patterns of blood pressure (BP) comparing values measured in an office setting with values obtained outside the office. The lower left and upper right indicate concordance with office and out-of-office values. When patients have office values below current hypertension thresholds, for example, either <130/80 mmHg or <140/90 mmHg depending on the country, yet have out-of-office BP above the hypertension threshold, they have masked hypertension (upper left box, “MH”). When patients have office values above current hypertension thresholds, for example, either >130/80 mmHg or >140/90 mmHg depending on the country, yet have out-of-office BP below the hypertension threshold, they have white coat hypertension (lower right box, “WCH”). For this illustration, patients are assumed to be untreated with BP medications

- Is there evidence of HMOD?
- Are there other CV risk factors, besides high BP, at play in this person?

For now, we will continue to pursue the first bullet point. The reader is referred elsewhere to address the second through the fourth bullet points.<sup>[5]</sup>

In addition to, or in place of, further office visits we could ask him to have his BP measured at home, or (when available), using an ABPM. So which is the BEST way to confirm the diagnosis of hypertension?

The answer to this last question will seem unsatisfying. All three are the BEST at some aspect of diagnosis. They differ from one another so much that they provide what can only be called complementary information. Table 1 provides some commentary to support this.

The value in-office BP as the diagnostic tool is based mainly on the sheer length of experience with this technique. Literally, all that we know about the consequences of high BP (e.g. death and HMOD), and the benefits of treating high BP are directly derived from the office BP experience. Both home and ABPM represent improvements on this, but cannot supplant the foundational aspects that office BP has provided in the diagnosis and management of high BP. That said, there is a need to use good technique when performing office BP measurements. The errors in not doing so, and there are many possibilities for error, almost always result in BP readings that are higher than the true BP for that individual.<sup>[6]</sup> Many societies have published guidance documents on the measurement of BP in humans.<sup>[7]</sup>

The value in home BP monitoring (HBPM), or as it is also known, self-measured (or monitored) BP (SMBP) is incremental to the office experience. The office values cannot identify white coat or masked effects; these rely on out-of-office measures like HBPM or SMBP (or ABPM – see below). As with office BP, good technique is equally important with home BP measurement. A useful graphic that provides a good summary of the necessary positioning and proper measurement technique for home BP measurement is available at

|| [https://www.heart.org/-/media/files/health-topics/high-blood-pressure/how\\_to\\_measure\\_your\\_blood\\_pressure\\_letter\\_size.pdf?la=en](https://www.heart.org/-/media/files/health-topics/high-blood-pressure/how_to_measure_your_blood_pressure_letter_size.pdf?la=en) Accessed April 12,2021 ||.

**Table 1:** Comparison of techniques for diagnosing hypertension

|                             | Office  | ABPM   | Home BP   |
|-----------------------------|---|--|---|
| For diagnosing hypertension | >100 years of experience  | Largest # of out-of-office studies confirming hypertension       | Practical, convenient, inexpensive              |
| Value                       | Research showing benefit of treating BP is based on office readings | Better than office for predicting outcomes                       | Better than office for predicting outcomes      |
| BP readings                 | Can be standardized per AHA and other societies                     | Reflect “real-world” activities: Eating, walking, sleeping, etc. | Can be standardized per AHA and other societies |

With home BPs, the ideal period of monitoring is a week long, with two measurements in the morning (between 7 AM and 10 AM) and two in the evening (between 7 PM and 10 PM) daily. Once these are obtained, the 1<sup>st</sup> day readings are set aside, and the average of the ensuing 6 days is calculated. If one uses an office threshold of 140/90 mmHg to diagnose hypertension, then home values of >135/85 mmHg are considered “hypertensive.”<sup>[8]</sup> If one uses an office threshold of 130/80 mmHg, the home values defining hypertension are also 130/80 mmHg.<sup>[8]</sup> Some authorities are comfortable with shortening the period of home BP measurement to five<sup>[9]</sup> or even 3 days.<sup>[10]</sup> The reader is referred to the excellent, balanced review of the different schedules of home BP recordings by Stergiou.<sup>[11]</sup> Although as few as 3 days are endorsed by the European Society, it is not optimal to use so short a period, and at least 5 days are preferred for diagnosing hypertension.

The value in ABPM is also incremental to the office BP readings. ABPM acquires multiple BPs, determined by how the monitoring device is configured, and represents a “real-world” collection of readings that spans the daytime activities and usually includes the night time (sleeping) readings. Unlike office or home readings, ABPM readings are not predicated on a period of rest before they are taken, nor is it necessary to sit, avoid exercise, etc. The ideal number of readings to acquire over a 24 h period is not universally agreed on, but many programs obtain clinical readings every 20 min while awake, and every hour while asleep, and generally require a minimum of 14 daytime and 6 nighttime readings to make diagnostic inferences. If one uses an office threshold of 140/90 mmHg to diagnose hypertension, then an average of the 24 h of ABPM values of >130/80 mmHg is considered “hypertensive.”<sup>[8]</sup> If one uses an office threshold of 130/80 mmHg to diagnose hypertension, then an average of the 24 h of ABPM values of > 125/75 mmHg is considered “hypertensive.”<sup>[8]</sup>

#### **How do I choose which method (office, home, or ambulatory) to confirm the diagnosis of hypertension?**

The answer to this question is a mix of pragmatism and availability. Sometimes, the patient’s situation precludes buying or using a home BP monitor for economic or personal reasons. ABPM can be difficult to obtain due to the limited number of locations that offer this service. On the other hand, a home BP monitor can be of value for years to come when medications are started, titrated, or discontinued. Or when a patient loses weight, exercises, etc., to improve lifestyle factors associated with better BPs.

And, also on the other hand, the bulk of published evidence confirms the value of ABPM as an out-of-office confirmation of elevated BP.<sup>[12]</sup> Moreover, the nighttime values obtained during ABPM are, in health, about 10% or more lower than the daytime values.<sup>[13]</sup> When this fall in nocturnal BP is not present, this can be a clue to a patient at enhanced risk of HMOD.<sup>[14]</sup> A recent review comparing home and ABPM readings is recommended for further reading on the relative values of each modality,<sup>[15]</sup> as well as the recent report cited previously from a large sample of Indian patients undergoing 24 h ABPM.<sup>[4]</sup>

#### **Why does all this matter? Why bother treating an asymptomatic disorder like elevated BP?**

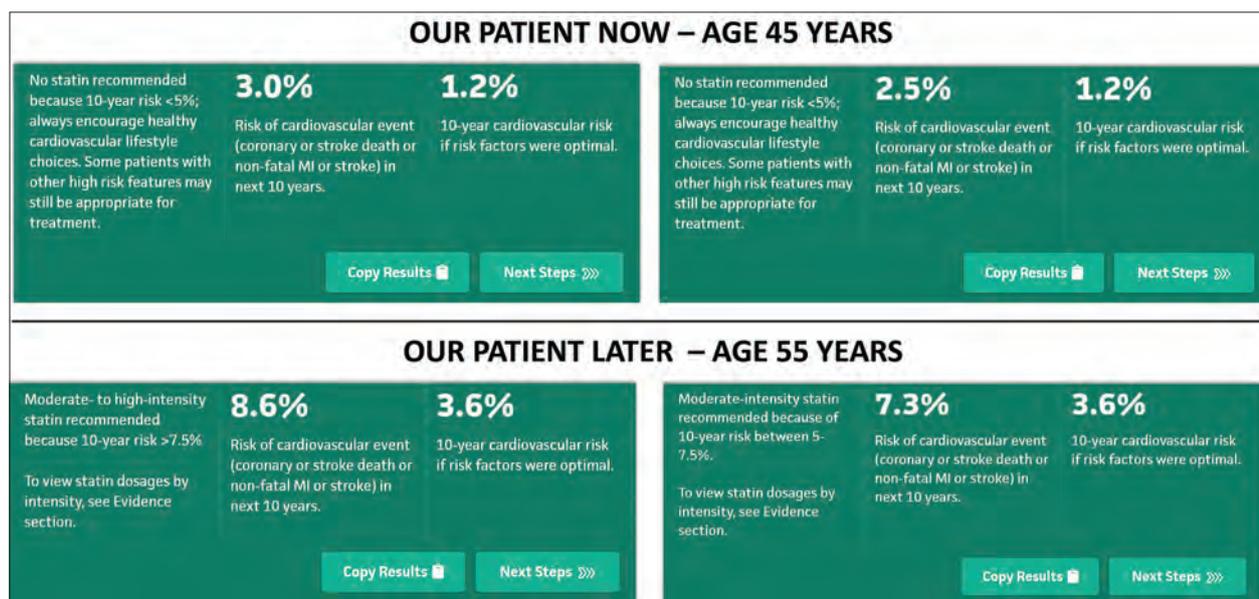
The goal in treating hypertension is to preserve the target organs – typically the heart, brain, and kidneys. When a person feels fine and has no evidence of HMOD, this represents “primary prevention.” When a person already has sustained HMOD, for example, a prior stroke, then the practitioner engages in “secondary prevention.” Whether the goal is primary, or secondary prevention, the patient is more likely to live longer with his or her organs functioning at the current level when BP is treated.<sup>[16,17]</sup> Moreover, the higher the BP level when beginning therapy, the greater the reduction in cardiovascular risk for the patient.<sup>[18]</sup> This, however, is not a license to “wait and see” arguing that if you delay treatment for a few years and allow the BP to rise further before treating it, the treatment “benefit” will be even greater. While the patient is being thus “monitored,” but not treated, their vessels are thickening (vascular remodeling), and their heart is working harder (ventricular hypertrophy). This sets the stage for something epidemiologists call the “residual risk” associated with hypertension. A simple exercise will demonstrate this point [Figure 3 for the details].

Open an online ASCVD calculator such as the one at <https://www.mdcalc.com/ascvd-atherosclerotic-cardiovascular-disease-2013-risk-calculator-aha-acc> || and enter data from our patient, who is a 45-year-old male, Indian (i.e. other), a non-smoker, not diabetic, and using a total cholesterol value of 4.0 mmol/L and an HDL cholesterol value of 1.0 mmol/L you will find that for the systolic BP value of 156 mmHg the 10-year CV risk is 2.5%. If he had all the same values entered, but you entered a YES for the query about “Treatment for hypertension?” the value rises from 2.5% to 3.0%. The exercise is repeated for the same patient 10 years later in the figure, all things being otherwise the same (except age), and the differences in 10-year CV risk when his systolic pressure is 156 mmHg on medication versus off medication 10 years from now is even more evident.

One of the most memorable analogies I ever read about making the diagnosis of hypertension, and then acting on that diagnosis came from the pen of Dr. Tom Giles, a Cardiologist from Louisiana in the USA. He wrote: “We now perform routine colonoscopy instead of flexible sigmoidoscopy and mammography to supplement breast self-examination. Chronic increases in BP should be taken seriously. We have lived through the concept of ‘essential hypertension’ (the classic oxymoron) and that systolic BP should be (mm Hg) = 100 + age (years). After all, should our patients not benefit from the dedicated efforts of those contributing to hypertension research? We have observed the natural history of hypertension for too long.”<sup>[19]</sup> The take home point here is that if you found a polyp on sigmoidoscopy, or if you were informed about a mass on mammography, would you just “monitor” it over the ensuing years?

#### **Are there consequences to making a diagnosis of “hypertension?”**

In addition to the kidney, heart, and brain consequences of hypertension, there are several psychological ones as well, and



**Figure 3:** The results of using an online calculator of cardiovascular (CV) risk (<https://www.mdcalc.com/ascvd-atherosclerotic-CV-disease-2013-risk-calculator-aha-acc> Accessed March 30, 2021). The top two boxes show results for a 45-year-old man without diabetes, non-smoker, with reasonable cholesterol levels (4.0 mmol/L for total, 1.0 mmol/L for HDL). On the right of the top line is the 10-year risk of a CV event in a patient like the one presented in this review, whose systolic pressure is 156 mmHg. On the left of the top row is the same patient in all respects, except that the systolic pressure of 156 mmHg is in the presence of antihypertensive medication. The small but appreciable difference in risk of 0.5% over 10 years is called the “residual risk.” On the lower row is the same patient, 10 years later, with the same smoking/diabetes/cholesterol status, and again the right hand panel is the 10-year CV risk with an untreated systolic pressure of 156 mmHg, and the left hand panel is the 10-year CV risk with a treated systolic pressure of 156 mmHg. Now, the residual risk of 1.3% is more than doubled compared with the difference in CV risk values at age 45 years

these may have an onset in the patient’s life years before damage to the target organs is evident. In the rush to make a diagnosis and get a patient safely situated into a regimen of treatment meant to prolong life with functioning organs, we sometimes forget about the effect that applying a label like “hypertension” can have on a patient, a phenomenon sensibly known as the “labeling effect.”<sup>[20]</sup> There is a considerable literature, spanning decades of the psychological consequences of receiving the label “hypertensive.” Summarizing and hopefully doing justice to the field, when we label a patient as hypertensive they:

- Are more likely to be absent from work
  - Score lower on indices of well being
  - Show greater levels of psychological stress
  - Are more likely to experience marital difficulties
- along with other problems as outlined in the review by Wenger.<sup>[21]</sup> Hence, from a public health standpoint, as well as a private health standpoint, confirming the diagnosis is a vitally important issue.

**Conclusion**

As clinicians, it is challenging to find something we do that is more important from a global health perspective than finding and treating elevated BP. Making the correct diagnosis of hypertension, and instituting therapy, as early as possible

reduces the time the vasculature is exposed to higher BP levels, reducing the burden of HMOD. The in-office BP is usually the first opportunity to candidly discuss both the importance of elevated BP and the benefits of treatment. Using good technique is essential to obtaining accurate BP measurement in, and outside of, the office setting. Keeping in mind that the labeling of a patient as hypertensive has psychological consequences for the patient, it is important to balance these concerns by the reasonable tolerability of most antihypertensive treatments, and pointing out the benefits of reducing the likelihood of heart attack, heart failure, stroke, and kidney disease progression which accompanies successful reduction of elevated BP.

**Clinical Significance**

The WHO has identified elevated BP as the world’s most significant non-communicable disease.<sup>[22]</sup> Elevated BP is the most important contributor to premature death and premature damage to the brain, heart, and kidneys.<sup>[23]</sup> Clinical experience has shown the importance of proper technique to measure BP and reduce the likelihood of misdiagnosis. Decades of clinical trials have established the benefits of BP reduction, however, adherence to medication remains a significant challenge in high BP therapy.<sup>[24]</sup> In dealing with this last issue, adherence, it is particularly to confirm a diagnosis of hypertension early

to minimize future target organ damage, and to use the office visit as a means to support the patient as they are initiated on antihypertensive therapy. This is because some patients will experience medication side effects, some patients will be skeptical about benefits, and some patients will experience stressful psychological issues. Medical treatment is always an individualized risk-versus-benefit endeavor. The abundance of medication available, the clear message of benefit, and a caring attitude on the part of the clinician can make a huge difference in managing this globally important risk factor.

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