Hypertension has traditionally been diagnosed based on a series of office blood pressure measurements, repeated over a period of weeks or even months. In 2011, the UK’s National Institute of Health and Care Excellence (NICE) initiated a radical change of practice when it began advising that hypertension should rather be diagnosed based on mean daytime blood pressure as assessed by the routine use of ambulatory blood pressure monitoring (ABPM). “Using ABPM can condense the diagnostic process to as little as a day or at most a week,” says Professor Bryan Williams, Director: UCL Biomedical Research Centre, University College London and Chairman: NICE Hypertension Guideline Development Group. “ABPM is also a better predictor of target organ damage and cardiovascular risk.”

Based on a substantial and systematic review of published data, the NICE concluded that ABPM improves sensitivity and specificity and, critically, avoids the treatment of those who are not hypertensive. “As many as 25% of those currently on treatment for hypertension, based on traditional assessment, may not be hypertensive after all,” says Professor Williams. (A study undertaken in Spain actually found the incidence of white coat hypertension to be 29%!). “And is ABPM cost-effective? We were astonished by what we found. The greatly reduced incidence of misdiagnosis more than counterbalances the additional cost of ABPM, leading us to recommend its routine use in most patients.” For those who do not tolerate ABPM, he recommends home blood pressure monitoring as an alternative, as that too is superior to office blood pressure measurement.

The recommendation that ABPM therefore be used to assess/diagnose virtually all patients, except those with severe dysrhythmia, has drawn a lot of attention. But the NICE feels, based on a systematic review of the evidence, that white coat hypertension confers no or marginal excess risk and that there is no proven benefit to its treatment, in addition to the ‘disease labelling’ factor having negative implications.

The appropriate diagnostic thresholds for daytime blood pressure based on ABPM are as follows:
- Optimal: 120/80mmHg
- Pre-hypertensive: <130/80mmHg
- Hypertensive: 135/85mmHg
A diagnosis should be based on at least two readings per hour during normal waking hours (8h00 to 22h00) for a total of at least 14 readings.

Professor Williams summarises the advantages as follows. “ABPM has a stronger evidence base, produces objective data and provides high-volume data from a single period of time while the patient is engaged in normal activity in the environment where they live, as opposed to sitting still in the artificial context of an office. It also allows for night-time readings.

In addition to its utility in refining the diagnosis of hypertension, he feels ABPM should be used more routinely to assess control. “Clinic monitoring is inadequate to optimise BP control,” he says. “ABPM’s potential for identifying masked uncontrolled hypertension should drive even wider use of the modality.”

Summarising where things currently stand, Professor Williams reiterated that NICE’s 2011 recommendation that ABPM be used routinely to diagnose hypertension has prompted the biggest change in practice in 100 years. “It improves sensitivity and specificity and has proven cost-effective. New technologies are being developed that will continue to improve the data ABPM provides. All patients should therefore be offered ABPM – or at least home monitoring – except those with severe pulse irregularity, or if there is severe hypertension with evident target organ damage requiring immediate treatment. Its wider use in clinical trials will provide us with clearer and more objective data in future, allowing us to better define targets and thresholds while honing down populations so that we can treat more efficiently. Our strategy should be to target treatment only at those who have unequivocally elevated BP, while avoiding treatment of those who don’t,” he concludes.

Ambulatory blood pressure monitoring in practice

This section of the CPD-accredited report summarises the key points and slides from Professor Williams’ talk at the local stroke and hypertension congress. It also provides insight that will assist the clinician to complete the CPD questionnaire.

<table>
<thead>
<tr>
<th>Slides</th>
<th>Commentary</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Philosophy of treating hypertension</td>
<td>Getting the right diagnosis is very important. Currently, we measure BP in a completely artificial setting in the doctor’s rooms or clinic.</td>
</tr>
<tr>
<td>• Treat those who need treatment and don’t treat those who do not</td>
<td></td>
</tr>
<tr>
<td>• Who needs treatment? Patients with an unequivocally elevated BP</td>
<td></td>
</tr>
<tr>
<td>• When you decide to treat, you convert a person into a patient…</td>
<td></td>
</tr>
<tr>
<td>2. Clinic blood pressure – Current daily practice</td>
<td>Also, remember that the systolic BP measured traditionally is at the time of a single heartbeat. We make the diagnosis of hypertension on a single heartbeat once or twice a year. Furthermore, patients without clinic-measured high BP have heart attacks or strokes.</td>
</tr>
<tr>
<td>• We measure BP in an artificial setting</td>
<td></td>
</tr>
<tr>
<td>• We measure BP based on a single heartbeat in this setting, once or twice a year and define the quality of BP control</td>
<td></td>
</tr>
<tr>
<td>• Patients with normal clinic BP still have strokes and heart attacks</td>
<td></td>
</tr>
<tr>
<td>• We have a poor appreciation of our patients’ usual BP in their normal daily life</td>
<td></td>
</tr>
<tr>
<td>3. Current practice for the diagnosis of hypertension</td>
<td>When the NICE guidelines were revised in 2011, the current practice (globally) was based on the screening diagram (slide 3) to make a diagnosis of hypertension.</td>
</tr>
<tr>
<td>Screening BP – high?</td>
<td></td>
</tr>
<tr>
<td>Repeat BP measurement in doctor’s office</td>
<td></td>
</tr>
<tr>
<td>Repeat BP measurement in doctor’s office</td>
<td></td>
</tr>
<tr>
<td>Repeat BP measurement in doctor’s office</td>
<td></td>
</tr>
<tr>
<td>± Diagnose hypertension</td>
<td></td>
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</table>
AMBULATORY BLOOD PRESSURE MONITORING

4. Radical change in practice
- NICE Hypertension Guideline 2011 recommended how hypertension should be diagnosed.

In the face of GPs’ concern as to whether this was effective in reaching patients-at-risk, NICE advocated a radical change in practice: when you screen and find a high BP, you need to offer ABPM to confirm the diagnosis as you will be treating the patient for the rest of his/her life. This was done on daytime pressure average. This was first met with concern re cost and capability, but NICE held to the view that if you wish to diagnose hypertension accurately, you need to use ABPM (daytime average).

5. Why ABPM?
- We should treat patients on the basis of their risk
- ABPM is a better predictor of target organ damage than clinic BP
- ABPM is a better predictor of adverse cardiovascular outcomes than clinic BP
- ABPM records BP in the patient’s natural setting where they experience cardiovascular events… not in the doctor’s office

Undoubtedly, ABPM is better at predicting left ventricular hypertrophy, retinal changes or proteinuria. ABPM is also a better predictor of risk of future heart attacks or strokes. Why? It takes more readings in the patient’s natural setting. This is backed by research1 which shows ABPM improves the sensitivity and specificity of the diagnosis of hypertension.

6. ABPM for the diagnosis of hypertension
- ABPM is a better predictor of clinical outcomes than clinic BP
- ABPM is the reference standard used when there is uncertainty about the diagnosis
- ABPM improves the specificity and sensitivity of diagnosis versus clinic and home BP measurement;
- ABPM avoids treatment in people who are not hypertensive – as many as 25% with white coat hypertension.

The extent of white coat hypertension was questioned by the medical fraternity when the NICE Guidance was issued. At the same time, in Spain some 6,000 suspected clinic-assessed hypertensive patients were evaluated using ABPM and the results showed 29% had white coat hypertension.

7. Spanish ABPM Registry showed prevalence of white coat hypertension
Prevalence of White Coat Hypertension in 6,176 untreated hypertensive patients

This confirmed the NICE research data showing 25% of patients treated have white coat hypertension and on ABPM have a normal BP (135/85mmHg).

8. Is white coat hypertension benign?
- Controversy from observational studies – NICE systematic review suggests marginal/no excess risk versus ABPM confirmed hypertension
- No data on benefit versus harm from intervention trials in this patient group
- Most have stage 1 clinic hypertension – there is controversy regarding the merits of treating stage 1 hypertension diagnosed on the basis of clinic readings
- Implications:
  (i) Disease labelling
  (ii) No clear evidence of excess risk
  (iii) No proven benefit of treatment

No one has tried in an intervention trial to treat ‘white coat hypertension’ and show benefit/no benefit. We do not believe that there is benefit in treating people with white coat hypertension. White coat hypertension is nowhere near ‘sustained high BP’ in terms of risk of CV events.
## Do we know the appropriate diagnostic BP threshold for ABPM?

The question is: have we correlated ABPM with our experience of measuring BP in the clinic and diagnosing hypertension at 140/90mmHg. This has been done in a number of ways:

- **a)** By using the level of ABPM readings that give exactly the same number of heart attacks and strokes as clinic readings (this was done in 6,000 participants, a prospective study in Europe and Japan to determine ABPM threshold). This equivalent risk at ABPM measurement has resulted in the ABPM levels shown in slide 10.

### 10. Normal versus abnormal ABPM

<table>
<thead>
<tr>
<th></th>
<th>24 h</th>
<th>Daytime</th>
<th>Night-time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertensive above</td>
<td>130/80</td>
<td>140/85</td>
<td>125/70</td>
</tr>
<tr>
<td>Normal below</td>
<td>125/75</td>
<td>130/85</td>
<td>110/70</td>
</tr>
<tr>
<td>Optimum below</td>
<td>115/75</td>
<td>120/80</td>
<td>100/65</td>
</tr>
</tbody>
</table>

Averages according to CVD risk equivalent clinic BP strata

### 11. ABPM diagnostic threshold equivalence to clinic BP strata

<table>
<thead>
<tr>
<th>Clinic BP threshold</th>
<th>ABP predicted from staff measured seated clinic BP (n = 5327)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>24-hour</td>
</tr>
<tr>
<td>Grade 3 (severe) hypertension</td>
<td>&gt;160/110</td>
</tr>
<tr>
<td>Grade 2 (moderate) hypertension</td>
<td>&gt;140/90</td>
</tr>
<tr>
<td>Grade 1 (mild) hypertension</td>
<td>&gt;120/80</td>
</tr>
<tr>
<td>Target BP plus 1 condition</td>
<td>&lt;130/80</td>
</tr>
<tr>
<td>Target BP with proteinuria</td>
<td>&lt;125/75</td>
</tr>
<tr>
<td>Normal BP</td>
<td>&lt;120/80</td>
</tr>
</tbody>
</table>

This has also been done in individual patients (n = 5327) measuring their clinic-based BP and then sending them home with a Holter to do a 24-hour ambulatory assessment. This has resulted in an ABPM diagnostic equivalent of stage 1 hypertension (Daytime ABPM averaged reading as rounded off by NICE) at 135/85mmHg and stage 2 at 150/95mmHg.


### 12. Summary of definitions of hypertension by office and out of office BP levels (2013 ESH/ESC Hypertension Guidelines)

<table>
<thead>
<tr>
<th>Category</th>
<th>Systolic BP (mmHg)</th>
<th>Diastolic BP (mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office BP</td>
<td>≥140 and/or ≥90</td>
<td></td>
</tr>
<tr>
<td>Ambulatory BP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daytime (or awake)</td>
<td>≥135 and/or ≥85</td>
<td></td>
</tr>
<tr>
<td>Night-time (or asleep)</td>
<td>≥120 and/or ≥70</td>
<td></td>
</tr>
<tr>
<td>24-h</td>
<td>≥130 and/or ≥80</td>
<td></td>
</tr>
<tr>
<td>Home BP</td>
<td>≥135 and/or ≥85</td>
<td></td>
</tr>
</tbody>
</table>

ESC has chosen the same approach.
13. NICE guidance on how often to do ABPM measurements

**NICE: ABPM for the diagnosis of hypertension**

- When using ABPM to confirm a diagnosis of hypertension, ensure that at least two measurements per hour are taken during normal waking hours (for example, daytime between 08:00 and 22:00);
- Use the average of at least 14 readings during these waking hours to confirm a diagnosis of hypertension;
- Some people will wear the monitor for 24 hours (i.e. start monitoring session in the afternoon) but this is not essential
- When using home BP monitoring (HBPM) to confirm a diagnosis of hypertension, ensure that:
  - For each BP measurement, two consecutive measurements are taken, at least 1 minute apart and with the person seated;
  - BP measurements are taken twice daily, ideally in the morning and evening;
  - BP measurement continues for at least 4 days, ideally for 7 days;
  - Discard the measurements taken on the first day and use the average value of all the remaining measurements

14. BP treatment targets: Monitoring of BP control after ABPM, and patient on treatment

**Blood pressure treatment targets**

- Use clinic BP to monitor BP control;
- Optimal clinic BP control is <140/90mmHg;
- In people with white coat effect, i.e. clinic BP is ≥20/10mmHg more than ABPM or home average, use Home BP average to monitor treatment – target home BP average of <135/85mmHg;
- Review BP control at least annually once BP treatment is stable.

Once the BP is controlled, records should be updated annually by the primary healthcare provider. The exception perhaps is the patient at a high risk (diabetes, elderly) with borderline controlled hypertension. ABPM may be required more frequently in these very high-risk groups. Policy on this is evolving.

15. Is ABPM cost-effective for the diagnosis of hypertension?

NICE has done a careful evaluation incorporating the consequences of poor BP control. This study was published in the *Lancet* and the interpretation is summarised in slide 16.

16. Cost-effectiveness

**Cost-effectiveness of options for the diagnosis of high BP in primary care: a modelling study**

*Interpretation:* ABPM as a diagnostic strategy for hypertension, after an initial raised reading in the clinic, would reduce misdiagnosis and save costs. Additional costs from ambulatory monitoring are counterbalanced by cost savings from better targeted treatment. Ambulatory monitoring is recommended for most patients before the start of antihypertensive drugs.

*Lancet* 2011

ABPM was re-evaluated in 2013 for NICE and the policy of ABPM used to confirm a diagnosis of hypertension was reinforced because ABPM saves money and provides better care.

Conclusions

- NICE guidelines 2011 recommended the routine use of ABPM to confirm the diagnosis of hypertension, prompting the biggest change for the diagnosis of hypertension for more than 100 years;
- ABPM improves the specificity and sensitivity of diagnosis;
- This approach is highly cost-effective;
- New technologies are being developed that will improve the acceptability of ABPM;
- Cost of devices is likely to fall.

References

ABPM – A South African perspective

KEY MESSAGES

• The SAHS supports the NICE 2011 guidelines’ view that ambulatory blood pressure monitoring (ABPM) is the most accurate way to diagnose hypertension

• The SAHS feels that while its universal use is not necessary there are two instances particularly where it should be considered: patients with possible stage 1 hypertension without target organ damage and hypertensive patients who remain uncontrolled, despite being on optimal treatment

• The SAHS has endorsed an innovative ABPM programme launched by Cipla that is making ABPM more widely available locally

According to Professor Brian Rayner, the South African Hypertension Society (SAHS) agrees with the UK’s National Institute for Health and Care Excellence (NICE) that ambulatory blood pressure monitoring (ABPM) is indeed the most accurate way to diagnose hypertension and assess patients’ response to treatment.

There are practical and economic limitations to its uptake in South Africa, however, particularly in the public sector. This means that it is not being used as widely here as in the UK and as recommended by the NICE 2011 guidelines. “We would like to see it being taken up as an adjunct strategy, but not used in instances where ‘white coat’ hypertension is unlikely,” continues Professor Rayner. “It’s almost certainly not necessary where there is already overt target organ damage, chronic kidney disease and left ventricular hypertrophy. When these are present, we can be pretty sure that true hypertension is present.”

He and the Society recommend the use of ABPM in the following instances.

“Where there is possible stage 1 hypertension with no target organ damage, there is a very definite place for ABPM or, failing that, home monitoring, if ABPM is not available. The second important situation in which we would advise it would be in hypertensive patients who remain uncontrolled, despite being on optimal treatment.”

Pharmaceutical company, Cipla, has launched an ABPM monitoring programme which has been endorsed by the SAHS and which will hopefully lead the way in ABPM’s becoming more widely used in South Africa “It has been adopted in a few places, but these are still few and far between. And while there are no local data yet when it comes to costs, the UK experience has clearly shown that it certainly has long-term cost-saving benefits in that it helps to identify the up to 25% of patients with pseudo or white coat hypertension who should not be on treatment. ABPM therefore makes sense,” he concludes.