

Thirty-Minute Office Blood Pressure Monitoring in Primary Care

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ABSTRACT

PURPOSE Automated office blood pressure monitoring during 30 minutes (OBP30) may reduce overtreatment of patients with white-coat hypertension in primary health care. OBP30 results approximate those of ambulatory blood pressure monitoring, but OBP30 is much more convenient. In this study, we compared OBP30 with routine office blood pressure (OBP) readings for different indications in primary care and evaluated how OBP30 influenced the medication prescribing of family physicians.

METHODS All consecutive patients who underwent OBP30 for medical reasons over a 6-month period in a single primary health care center in the Netherlands were enrolled. We compared patients' OBP30 results with their last preceding routine OBP reading, and we asked their physicians why they ordered OBP30, how they treated their patients, and how they would have treated their patients without it.

RESULTS We enrolled 201 patients (mean age 68.6 years, 56.7% women). The mean systolic OBP30 was 22.8 mm Hg lower than the mean systolic OBP (95% CI, 19.8-26.1 mm Hg). The mean diastolic OBP30 was 11.6 mm Hg lower than the mean diastolic OBP (95% CI, 10.2-13.1 mm Hg). Considerable differences between OBP and OBP30 existed in patients with and without suspected white-coat hypertension, and differences were larger in individuals aged 70 years or older. Based on OBP alone, physicians said they would have started or intensified medication therapy in 79.1% of the studied cases (95% CI, 73.6%-84.6%). In fact, with the results of OBP30 available, physicians started or intensified medication therapy in 24.9% of cases (95% CI, 18.9%-30.9%).

CONCLUSIONS OBP30 yields considerably lower blood pressure readings than OBP in all studied patient groups. OBP30 is a promising technique to reduce overtreatment of white-coat hypertension in primary health care.

Ann Fam Med 2017;15:120-123. <https://doi.org/10.1370/afm.2041>.

INTRODUCTION

Patients with white-coat hypertension (isolated office hypertension) have a lower risk of cardiovascular disease than patients with sustained hypertension,¹ so it is commonly believed that blood pressure treatment should be focused on patients with sustained hypertension rather than those with white-coat hypertension.^{2,3} The situation is complicated by the absence of reliable criteria for office-based identification of patients with white-coat hypertension⁴ and the fact that the established techniques to measure sustained hypertension (ambulatory blood pressure monitoring and home blood pressure readings) are relatively expensive and not patient-friendly.

Recently, automated office blood pressure monitoring during 30 minutes (OBP30) has been proposed as an alternative method to assess hypertension, since it yields almost the same results as daytime ambulatory blood pressure monitoring and is much more convenient.⁵ OBP30 is performed with the patient sitting alone and undisturbed during 30 minutes while the blood pressure is measured automatically every 5 minutes, pro-

Conflicts of interest: authors report none.

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ducing 7 readings. The resulting OBP30 is the mean of the last 6 blood pressure readings.

It is unclear how the introduction of OBP30 influences blood pressure treatment in primary healthcare. Therefore, this study was designed to compare OBP30 with routine office blood pressure (OBP) readings for different indications in primary health care and to evaluate how OBP30 influenced the medication prescribed by family physicians.

METHODS

Design and Setting

The study had a cross-sectional design with prospectively collected data. It was performed in a single primary health care center in Rotterdam, the Netherlands. The center has 12,500 mostly middle-income Caucasian white registered patients and 11 family physicians.⁶ Approval from an ethical review board was not necessary, because the study had no influence on patient treatment, and the collected data could not be linked to individual patients by the researchers, to ensure patient privacy. No research staff members were involved; the study was performed within routine patient care by a regularly staffed clinic.

Participants and Data Collection

All consecutive patients who underwent OBP30 in our center from February through July 2016 were enrolled in the study, until at least 200 patients were enrolled. Exclusion criteria were a change in medication between last recorded OBP reading and subsequent OBP30 and previous OBP30 during the study period.

OBP30 was performed if the treating physician considered it necessary based on national guidelines,⁷ and usually took place several days after the consultation during which OBP was determined. No measurements were performed for study purposes only. OBP30 was performed by the center assistants, and data collection forms were filled out afterwards by the treating physicians. The forms included questions about the reasons for ordering OBP30, how the patient would have been treated if OBP30 had not been available, and how the patient was actually treated, taking OBP30 results into account.

Variables

OBP was the last blood pressure measured in the office by either the family physician or the assistant before it was decided to order OBP30. All physicians used a man-

ual sphygmomanometer; the assistants used an automated device. OBP30 was obtained with a Welch Allyn 6100 series blood pressure monitor (purchase price around US \$2,100). All devices were gauged annually.

Statistical Methods

IBM SPSS Statistics version 24 was used to calculate geometric means, proportions, and differences with 95% CIs. The 95% CIs were constructed through bootstrapping. The statistical significance of the differences between subgroups was assessed with a multivariable linear regression model with age category, gender, and history of cardiovascular disease and/or diabetes mellitus as determinants.

RESULTS

Two hundred seven patients were enrolled by 11 physicians. Six patients were excluded (2 because OBP was missing, 2 due to technical problems with OBP30, 2 because medication was started between last OBP and OBP30), leaving 201 patients for analysis. The mean age of these patients was 68.6 years (SD 13.2 years), 56.7% were women, 19.9% had cardiovascular disease, and 20.4% had diabetes mellitus. The most important reasons to order OBP30 were suspected white-coat hypertension, new diagnosis of hypertension, inconsistent office readings, monitoring of medication effect, suspected therapy resistance, and suspected episodes of hypotension (Table 1).

The mean systolic OBP30 was on average 22.8 mm Hg lower than the mean systolic OBP (95% CI, 19.8-26.1 mm Hg), and the mean diastolic OBP30 was on average 11.6 mm Hg lower than the mean diastolic OBP (95% CI, 10.2-13.1 mm Hg; Table 2).

Table 1. Mean Difference Between OBP30 and OBP Stratified by Reason to Request OBP30

Reasons to request OBP30	N ^b	Difference Between OBP and OBP30 ^a	
		Systolic (mm Hg)	Diastolic (mm Hg)
Suspected white-coat hypertension	75	29.6 (25.1-34.7)	14.4 (11.8-16.9)
New diagnosis of hypertension	42	19.7 (14.6-24.8)	10.8 (7.5-14.2)
Inconsistent office readings	23	22.3 (14.5-30.4)	11.4 (7.2-15.2)
To monitor medication effect	62	20.1 (15.0-25.8)	9.9 (7.6-12.4)
Suspected therapy resistance	13	28.4 (15.5-40.4)	8.2 (4.1-12.2)
Suspected episodes of hypotension	4	21.8 (11.5-37.0)	16.8 (13.5-21.5)
Other	7	13.7 (4.3-24.0)	7.7 (0.1-13.9)

OBP30 = automated office blood pressure monitoring during 30 minutes; OBP = office blood pressure.

^a OBP minus OBP30.

^b Multiple reasons may apply for a single patient.

Table 2. Mean Blood Pressure: OBP30 Compared With OBP

Patient Group	N	Systolic OBP (95% CI), mm Hg	Systolic OBP30 (95% CI), mm Hg	Systolic Difference (95% CI), mm Hg	Diastolic OBP (95% CI), mm Hg
All patients	201	163.8 (161.5-166.2)	140.9 (138.4-143.5)	22.8 (19.8-26.1)	88.9 (87.4-90.4)
Men	87	162.5 (159.6-165.5)	141.9 (138.6-145.5)	20.6 (16.8-24.4)	90.0 (87.8-92.0)
Women	114	164.7 (161.5-167.8)	140.2 (136.8-143.5)	24.5 (20.7-28.7)	88.1 (86.1-90.0)
Aged <70 yrs	100	157.8 (155.4-160.0)	142.7 (139.5-146.1)	15.1 (11.5-18.2)	91.7 (89.8-93.7)
Aged >70 yrs	101	169.7 (166.1-173.4)	139.2 (135.8-142.8)	30.5 (26.5-34.7)	86.2 (84.1-88.4)
Without CVD or DM	132	162.0 (159.1-164.8)	140.1 (136.9-143.1)	21.9 (18.5-25.8)	89.5 (87.7-91.3)
With CVD or DM	69	167.2 (163.2-171.1)	142.6 (138.7-146.7)	24.6 (19.6-29.4)	87.8 (85.6-90.5)

CVD = cardiovascular disease (myocardial infarction, angina pectoris, stroke, transient ischemic attack); DM = diabetes mellitus; OBP30 = automated office blood pressure monitoring during 30 minutes; OBP = office blood pressure.

The differences between OBP and OBP30 were larger for patients aged 70 years or older than for patients younger than 70 years for both systolic and diastolic blood pressure ($P < .001$ for difference between subgroups, while $P > .15$ for difference between subgroups in all other pairings studied).

The mean OBP30 was lower than the mean OBP for all reasons for ordering OBP30 (Table 1).

Based on OBP alone, physicians said they would have started or intensified medication regimens in 79.1% of the studied cases (95% CI, 73.6%-84.6%; Table 3). In fact, with the results of OBP30 available, they did so in 24.9% of cases (95% CI, 18.9%-30.9%).

DISCUSSION

In our study, set in a primary health care center, blood pressure readings obtained with OBP30 were on average much lower than routine OBP readings (22.8 mm Hg systolic, 11.6 mm Hg diastolic). The differences between OBP and OBP30 were greater for patients aged 70 years or older. Whereas family physicians would have intensified the antihypertensive medication regimens in 79.1% of the patients based on OBP alone, this proportion was 24.9% with OBP30 available.

Our study has several strengths. First, since the study was set in a primary health care center without the use of research staff, the results are generalizable to primary care. Second, OBP30 became available in our center very recently. Therefore, the participating

physicians could realistically estimate how they would have coped without OBP30 results. Third, all data were collected prospectively. The study also had a number of limitations. First, the participating physicians were asked only after they received OBP30 results how they would have treated the patients based on OBP alone. This timing may have influenced their response to the question. Second, our study was performed in a single site. It is conceivable that at a different center, OBP or OBP30 results would be different because of differences in populations served or measurement techniques used. Third, physicians ordered OBP30 mainly upon observing high blood pressure readings. Therefore regression towards the mean could have played a role: repeated OBP readings, if ordered, could also on average have been lower than the index readings.

Two notable previous studies have investigated OBP30 in general practice. One found that systolic blood pressure measured with OBP30 was identical to that measured with daytime ambulatory blood pressure monitoring.⁵ The other found that OBP30 readings

Table 3. Physicians' Treatment Advice Based on All Available Information Including OBP, but Ignoring OBP30 Results, and Based on All Available Information Including OBP30 Results

Medication Decision ^a	Treatment Advice Ignoring OBP30 Results		Treatment Advice Including OBP30 Results		Difference % (95% CI)
	N	% (95% CI)	N	% (95% CI)	
Intensified	159	79.1 (73.6-84.6)	50	24.9 (18.9-30.9)	-54.2 (-61.7 to -46.8)
Unchanged	34	16.9 (11.4-22.4)	134	66.7 (59.7-72.6)	49.8 (41.3-58.2)
Reduced	3	1.5 (0.0-3.5)	15	7.5 (4.0-11.4)	6.0 (3.0-9.5)
Other	5	2.5 (0.5-4.5)	2	1.0 (0.0-2.5)	-1.5 (-3.5-0.5)

OBP30 = automated office blood pressure monitoring during 30 minutes; OBP = office blood pressure.

^a Intensified = medication was added or the dosage was increased. Unchanged = includes patients who continued on the same dosage and patients who were not on antihypertensive medication. Reduced = medication was stopped or the dosage was decreased.

Diastolic OBP30 (95% CI), mm Hg	Diastolic Difference (95% CI), mm Hg
77.3 (75.7-78.9)	11.6 (10.2-13.1)
80.1 (77.5-82.7)	9.9 (7.7-12.0)
75.2 (72.9-77.5)	12.9 (10.9-14.8)
83.2 (81.0-85.5)	8.5 (6.7-10.5)
71.5 (69.6-73.6)	14.7 (12.6-16.7)
77.6 (75.5-79.8)	11.8 (10.0-13.6)
76.8 (74.0-79.8)	11.1 (8.6-13.8)

were on average 7.6 mm Hg lower than OBP measurements.⁸ In contrast to ours, the latter study included patients not selected by their family physicians and used standardized OBP instead of routine OBP.

Further research on this subject is needed: our results need to be replicated in other sites. OBP30 should be compared with other automated office-based means that have the potential to distinguish between white-coat hypertension and sustained hypertension, such as the BpTRU (BpTRU Medical Devices Ltd).⁹ Finally, the influence of OBP30-based blood pressure treatment on the number of medications prescribed, and on the occurrence of side effects and cardiovascular morbidity and mortality should be evaluated.

In conclusion, OBP30 yields lower blood pressure readings than routine OBP in patients selected by their family physicians, even patients not suspected of having white-coat hypertension. In our study, the use of OBP30 in this select patient population led to much less intensification of anti-hypertensive medications regimens. OBP30 is a promising method to reduce overtreatment of white-coat hypertension in primary health care.

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Submitted July 14, 2016; submitted, revised, November 13, 2016; accepted November 25, 2016.

Key words: ambulatory blood pressure monitoring; white-coat hypertension; primary health care

Funding support: The authors received no financial or other material support for the work.

Acknowledgements: We would like to express our gratitude to our colleagues Filian Looman, Germa Joppe, Loek Tan, Mieke Derksen, Kees Esser, Rachel Braunstahl, Mark Hofhuis, Zineb el Hamidi, Wouter de Ruijter and the assistants of Gezondheidscentrum Ommoord in Rotterdam, the Netherlands, for their comments to the study design and their help with the collection of the data.

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