The Frequency of Adverse Prognostic Features Detected with Ambulatory Blood Pressure Monitoring in the Practice of a Preventive Ambulatory System from Tîrgu Mureș

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Background: Twenty four hour ambulatory blood pressure monitoring (24-H ABPM) plays an important role in the management of hypertensive patients. The aim of our study was to determine the frequency of seven known adverse prognostic features in an ambulatory assisted hypertensive patient population.
Methods: The study included all the 957 hypertensive patients with a performed 24-H ABPM, examined in the 2008–2011 period in a preventive ambulatory cardiology system. The studied adverse prognostic features were: daytime systolic blood pressure (BP) >140 mmHg, daytime diastolic BP >90 mmHg, nighttime systolic BP >125 mmHg, nighttime diastolic BP >75 mmHg, nocturnal dipping <10%, early morning hypertension >140/90 mm Hg, pulse pressure >53 mm Hg. Patient data were introduced in an integrated patient data management system as an electronic health record. The frequency of adverse prognostic features was compared in type 2 diabetic versus non-diabetic patients, and in patients with or without manifest cardiovascular complications (ischemic heart disease, stroke, lower extremity arterial disease).
Results: The frequency of the studied adverse prognostic features was as follows: high daytime systolic BP 38.1%, high daytime diastolic BP 21.4%, high nighttime systolic BP 45.5%, high nighttime diastolic BP 31.3%, absent nocturnal dipping 59.9%, morning hypertension 33.6%, high pulse pressure 51.5%, morning surge 5.1%. A large proportion of subjects (86.2%) had one or more adverse features reported on the 24-H ABPM.
Conclusions: In clinical practice there is a frequent association of multiple adverse prognostic features of ambulatory blood pressure monitoring. The presence of some prognostic features is associated with the presence of diabetes, stroke history, ischemic heart disease or lower extremity arterial disease.

Keywords: hypertension, ambulatory blood pressure monitoring, morning surge, pulse pressure, dipping

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Introduction

Twenty four hour ambulatory blood pressure monitoring (24-H ABPM) plays an important role in the management of hypertensive patients. Information obtained on 24-H ABPM has been shown to be of prognostic significance [1]. Clinical outcome studies demonstrated the superior prognostic value of 24-H ABPM in predicting cardiovascular complications of hypertension, compared to office blood pressure monitoring [2,3]. In this article we focus on eight ABPM parameters shown to be associated with an adverse cardiovascular prognosis.

The purpose of our study was to determine the frequency of seven known adverse prognostic features in an ambulatory assisted hypertensive patient population.

Material and methods

The study included all the 957 hypertensive patients with a performed 24-H ABPM, examined between 2008–2011 in the Procardia preventive ambulatory cardiology center in Târgu Mureș, Romania.

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All patients had indication for performing ABPM according to the ESC 2007 guidelines:

- considerable variability of office BP found during the same visit or over different visits;
- high office BP measured in subjects with low total cardiovascular risk;
- marked discrepancy between BP values measured in the office and at home;
- suspected resistance to drug treatment;
- suspected hypertensive episodes, particularly in elderly and diabetic patients [1].

We used the IEM Stolberg MobilOGraph ABPM system. The sex distribution of the studied patients was 44.7% males, average age 58.8 years, and 55.2% females, average age 62.9 years. The studied adverse prognostic features were: daytime systolic blood pressure (BP) >140 mmHg, daytime diastolic BP >90 mmHg, nighttime systolic BP >125 mmHg, nighttime diastolic BP >75 mmHg, nocturnal dipping <10%, morning hypertension >140/90 mm Hg, pulse pressure >53 mm Hg. Morning surge was defined as a rise in BP >55 mm Hg, reported to the lowest nighttime reading.

Table I. Average risk factor level of the studied patients

	N	Mean	SD
Diastolic BP	957	77.0	11.9
Systolic BP	957	132.9	16.9
Nighttime diastolic BP	957	69.2	15.0
Nighttime systolic BP	957	123.4	24.5
Daytime systolic BP	957	136.3	17.9
Daytime diastolic BP	957	80.1	13.0
Diurnal index	957	7.6	8.3
Age	957	61.1	12.7
Total cholesterol	471	203.7	45.6
LDLcholesterol	327	132.4	42.1
HDLcholesterol	362	42.5	13.7
Triglyceride	473	179.6	70.1
Fasting glucose	480	101.7	29.9
Creatinin	381	1.1	3.1
BMI	895	31.3	21.0

The majority of patients (64.3%) were grade 2 hypertensive patients, 32.1% were grade 3, and a few patients were grade 1 (3.6%). Both treated and untreated hypertensive patients were included. Characteristics of the studied population are summarized in Table I.

The "MedPrax" integrated patient data management system was used as an electronic health record. All data was recorded during current patient examinations. Data analysis was performed with the SPSS program.

The frequency of adverse prognostic features was compared in type 2 diabetic versus non-diabetic patients, and in patients with or without manifest cardiovascular complications (ischemic heart disease, stroke, lower extremity arterial disease). The chi square test was applied for assessing statistic difference.

Results

The frequency of the studied adverse prognostic features was as follows: high daytime systolic BP 38.1%, high daytime diastolic BP 21.4%, high nighttime systolic BP 45.5%, high nighttime diastolic BP 31.3%, absent nocturnal dipping 59.9%, morning hypertension 33.6%, high pulse pressure 51.5%, morning surge 5.1%. A large proportion of subjects (86.2%) had one or more adverse features reported on the 24-H ABPM.

The numbers of adverse prognostic features simultaneously present in the studied patients are presented in Table II.

Table II. Number of adverse prognostic features simultaneously present in the studied patients

Number adverse features	Frequency	Percentage
0	86	8.99%
1	181	18.91%
2	106	11.08%
3	139	14.52%
4	148	15.46%
5	149	15.57%
6	78	8.15%
7	70	7.31%
Total	957	100%

Our study included patients with diabetes (231 patients) and patients with established cardiovascular disease – ischemic heart disease (173 patients), stroke (152 patients), lower extremity arterial disease (172 patients).

Subgroup analysis showed a significantly higher frequency of adverse prognostic features in type 2 diabetic, versus non-diabetic patients, as presented in Table III.

Patients with ischemic heart disease had a significantly lower frequency of high daytime diastolic BP (17.6% versus 23.7%, p=0.028), high nighttime diastolic BP (27.4% versus 33.6%, p=0.026) and high pulse pressure (55.7% versus 49.0%, p=0.045) than patients without ischemic heart disease, with no significant difference in the other adverse prognostic features.

Patients with stroke had a significantly higher frequency of high pulse pressure versus patients without stroke (59.2% versus 50.1%, p=0.042), with no significant difference in the other adverse prognostic features.

Patients with lower extremity arterial disease (PAD) had a higher frequency of multiple adverse prognostic features, as seen in Table IV.

Discussions

Former cross-sectional and longitudinal studies [1,2,3] have shown the advantages of 24-H ABPM versus office blood pressure monitoring. These studies have shown that ambulatory blood pressure monitoring:

1. correlates with hypertension-related organ damage and its changes by treatment more closely than office blood pressure monitoring;
2. has a relationship with cardiovascular events that is steeper than that observed for office blood pressure

Table III. Frequency of adverse prognostic features in diabetic versus non diabetic patients

	Diabetic	Non-diabetic	p value
High daytime systolic BP	60.6%	46.0%	<0.0001
High daytime diastolic BP	31.1%	34.4%	0.38 (NS)
High nighttime systolic BP	68.3%	52.6%	<0.0001
High nighttime diastolic BP	29.4%	31.9%	0.51 (NS)
Absent nocturnal dipping	67.5%	57.5%	0.007
Morning hypertension	44.5%	30.1%	<0.0001
High pulse pressure	72.7%	55.7%	<0.0001

Table IV. Frequency of adverse prognostic features in patients with peripheral artery disease versus patients without PAD

	With PAD	Without PAD	p value
High daytime systolic BP	61.0%	47.0%	0.001
High daytime diastolic BP	29.0%	35.8%	0.09 (NS)
High nighttime systolic BP	68.0%	53.8%	0.001
High nighttime diastolic BP	31.3%	31.3%	0.052 (NS)
Absent nocturnal dipping	66.2%	58.5%	0.037
Morning hypertension	42.4%	31.7%	0.01
High pulse pressure	65.6%	58.5%	0.05

monitoring, with a greater prediction of cardiovascular risk than the prediction provided by office blood pressure values in the population, as well as in untreated and treated hypertensive patients;
3. measures more accurately than clinical blood pressure monitoring the extent of blood pressure reduction by treatment, because of a higher reproducibility over time and an absent or negligible "white coat" effect [1].

ABPM parameters with prognostic significance do not occur solely in everyday practice. The frequency of multiple adverse prognostic features in patients with 24-H ABPM in daily practice were similarly high in other studies [4,5].

Diabetic patients associate several adverse prognostic features. Data from the Spanish ABPM registry comparing diabetic and non-diabetic patient's ABPM profile described significantly higher daytime and nighttime blood pressure levels in diabetic patients. They also describe a significantly higher frequency of non-dipping profile in diabetic patients – the same situation as evidenced by our data [6]. These results suggest that blood pressure values in diabetic patients should be more frequently diagnosed and followed-up using an ABPM reading. Antihypertensive treatment should be adjusted individually in these patients to correct not only blood pressure values, but also circadian variability parameters (non-dipping pattern, morning surge).

Our data suggest an association of post-stroke status with high pulse pressure. The PIUMA study has also demonstrated that average 24-H pulse pressure was a strong independent predictor of cardiovascular morbidity (stroke and myocardial infarction) and mortality in apparently healthy subjects with essential hypertension [7].

The longitudinal prospective study of Kario et al. was the first that demonstrated the association between morning surge, and the frequency of silent ischemic strokes detected by magnetic resonance imaging [8]. They identified that patients in the upper decile of morning surge value (higher than 55 mmHg) had a higher baseline prevalence of silent ischemic strokes, and a higher stroke incidence in the 41 months follow-up interval than patients in lower deciles of the morning surge [8].

Our patients with a history of stroke did not have a significantly higher frequency of high morning surge, than patients without a stroke history. Post-stroke patients may have had a better control of blood pressure values with reduced morning surge values, while patients with high morning surge remain at a high risk for a future stroke event.

The current use of electronic patient records made available data for analysis.

Conclusions

1. In clinical practice there is a frequent association of multiple adverse prognostic features of ambulatory blood pressure monitoring.
2. In type 2 diabetic patients high daytime and nighttime blood pressure values were significantly more frequent than in non-diabetic patients. In these patients non-dipping pattern, morning surge and morning hypertension were significantly more frequent than in non-diabetic patients.
3. In patients with lower extremity arterial disease (LEAD) high daytime and nighttime blood pressure values were significantly more frequent than in patients without LEAD. In these patients the non-dipping pattern, morning surge and morning hypertension were significantly more frequent than in patients without LEAD.
4. Patients with stroke have a significantly higher frequency of high pulse pressure than patients without a stroke history. Contrary to other literature data, no significant difference was found in the frequency of morning surge and morning hypertension in patients with stroke, versus patients without stroke history.
5. Patients with ischemic heart disease had a significantly lower frequency of high diastolic daytime and nighttime blood pressure than patients without ischemic heart disease.

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References

1. Mancia G, De Backer G, Dominiczak A et al. Guidelines for the Management of Arterial Hypertension: The Task Force for the Management of Arterial Hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC). J. Hypertens. 2007;25(6):1105-1187.
2. Dolan E, Stanton A, Thijs L et al. Superiority of Ambulatory Over Clinic Blood Pressure Measurement in Predicting Mortality The Dublin Outcome Study. Hypertension. 2005;46(1):156-161.
3. Imai Y, Hozawa A, Ohkubo T et al. Predictive values of automated blood pressure measurement: what can we learn from the Japanese population – the Ohasama study. Blood Press Monit. 2001;6(6):335-339.
4. Madin K, Iqbal P. Twenty four hour ambulatory blood pressure monitoring: a new tool for determining cardiovascular prognosis. Postgrad Med J. 2006;82(971):548-551.
5. Iqbal P, Stevenson L. Cardiovascular Outcomes in Patients with Normal and Abnormal 24-Hour Ambulatory Blood Pressure Monitoring. Int J Hypertens. 2010;2011, doi:10.4061/2011/786912.
6. Gorostidi M, Sierra A de la, Gonzalez-Albarrn O, et al. Abnormalities in ambulatory blood pressure monitoring in hypertensive patients with diabetes. Hypertension Research. 2011;34(11):1185-1189.
7. Kario K, Pickering TG, Umeda Y, et al. Morning surge in blood pressure as a predictor of silent and clinical cerebrovascular disease in elderly hypertensives: a prospective study. Circulation. 2003;107(10):1401-1406.
8. Verdecchia P, Schillaci G, Borgioni C, et al. Ambulatory Pulse Pressure: A Potent Predictor of Total Cardiovascular Risk in Hypertension. Hypertension. 1998;32(6):983-988.