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ORIGINAL ARTICLE

Values of ambulatory blood pressure monitoring for prediction of cognitive function impairment in elderly hypertensive patients

Khaled S. Mahmoud [a,*], Tamer T. Ismail [a], Mohamad Saad [a], Laila A. Mohsen [b], Mohamed A. Ibrahiem [b], Nashaat A.A. Fadeel [c], Amr Sotouhy [a]

[a] *Cardiology Department, Al-Minya University Hospital, Egypt*
[b] *Radiology Department, Al-Minya University Hospital, Egypt*
[c] *Neuro-Psychiatry Department, Al-Minya University Hospital, Egypt*

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KEYWORDS

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Abstract *Background:* Hypertension has been shown to carry an increased risk not only for cerebrovascular stroke but also for cognitive impairment and dementia. Ambulatory blood pressure monitoring (ABPM) is a good predictor of cardiac, renal, and cerebral disease in middle-aged and older people with hypertension.

Patients and methods: The study included 77 elderly (mean age: 69 years) subjects. Based on the history of hypertension, office blood pressure, and ABPM, patients were classified into 2 groups, Group I: 22 persons as a control group and Group II: 55 hypertensive patients. The hypertensive group was further sub classified by using data of ABPM into dippers and non-dippers. Both groups were subjected to clinical examination, laboratory analysis, ABPM, Transthoracic Echocardiographic Examination, brain magnetic resonance imaging (MRI) and mini-mental state examination (MMSE) of their cognitive function.

Results: There was a statistically significant positive correlation between the cerebral MRI score and each of the average 24-h systolic, diastolic and mean arterial blood pressure, average morning systolic, diastolic, mean arterial blood pressure, average night systolic, diastolic and mean arterial blood pressure. There was also a statistically significant negative correlation between the MMSE

* Corresponding author. Tel.: +20 0867554403; mob.: +20 0102554137.
E-mail address: k.maghrby@hotmail.com (K.S. Mahmoud).

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score and the previous parameters. A non significant correlation was noted between the cerebral MRI score and the office systolic and diastolic blood pressure in hypertensive group.

Conclusion: The study demonstrated that hypertensive patients diagnosed by ABPM have significantly more impaired cognitive function than control subjects as proved by the mini-mental state examination and brain MRI score of white matter disease.

1. Introduction

High blood pressure (BP) is a risk factor for cerebrovascular disease, including stroke. Little is known about the importance of BP on the progression of microvascular disease of the brain, which has been associated with functional decline in mobility and cognition in older people.[1] An important advantage of ambulatory blood pressure (ABPM) measurement over office BP assessment, is its enhanced reproducibility. Numerous studies have demonstrated that ambulatory BP is a better predictor of cardiac, renal, and cerebral disease in middle-aged and older people with hypertension.[2] Small vessel disease of the brain may present as white matter hyperintensities (WMHs) and these are commonly present in the magnetic resonance images (MRI) of older persons with hypertension and other vascular disease risk factors.[3] These WMHs are clinically relevant in older people because they are associated with functional deterioration of mobility, cognition[4] and stroke.[5] They have been proposed as an intermediate marker in the research setting.[6]

2. The aim of the study

The aim of this study was to test the correlation of the 24-h ABPM data to the cognitive function of elderly hypertensive patients even if their office BP is normal.

3. Patients and methods

The study included 77 elderly patients (mean age: 69 years). Hypertension is considered present if the average clinic recorded BP reading exceeded 140/90 mmHg and/or if average 24-h BP reading exceeded 130/80 mmHg.[7,8] Based on history of hypertension, office blood pressure (average of 3 readings) and ABPM, patients were classified into two groups:

- **Group I**: 22 persons as a control group (no history of hypertension, and no office or ABPM evidence of hypertension).
- **Group II**: 55 hypertensive patients by history, office BP or ABPM.

The hypertensive group was further sub-divided according to the data of ABPM into dipper hypertensive (n = 18) and non-dipper hypertensive (n = 37) patients. Dipper means that there is drop in nocturnal BP than day blood pressure by 10–20% followed by an increase early in the morning.

Exclusion criteria: (1) Patients with underlying neurological disorders that would impair mobility or cognitive function. (2) Patients with severe or unstable cardiovascular disorders (e.g., myocardial infarction in the last 6 months, decompensated heart failure, stroke). (3) Diabetic patients. Diabetes mellitus was considered to be present if the patient was on anti diabetic medication or by abnormal HbA1C.[9] (4) Renal impairment patients. The estimated Glomerular Filtration Rate (eGFR) was calculated using Cockcroft-Gault formula.[10]

$$\text{eGFR} = \frac{[140 - \text{age in years}] \times \textit{weight } (kg)}{72 \times \textit{serum creatinine level } (mg/dL)} \times 0.85$$

The studied groups were subjected to:

(1) Personal history, history of previous acute coronary syndrome (ACS), interventions, diabetes mellitus and estimation of traditional risk factors as cigarette smoking and dyslipidemia.
(2) Clinical Examination, which included BP measurement. BP was measured in the supine position after 5 min of rest, using a large cuff when necessary, with a standard mercury sphygmomanometer.
(3) Laboratory analysis, which included random and fasting blood sugar, renal function tests and lipid profile after fasting for at least 12 h.
(4) Transthoracic Echocardiography: Two-dimensional, M-mode, Doppler and color-Doppler echocardiographic examinations were performed using GE Vivid III expert machine (GE Medical Systems, Waukesha, WI), equipped by Tissue-Doppler mode, with 2.5 MHz phase array transducer. M-mode, color flow mapping, pulsed and continuous wave Doppler recordings were obtained for each subject. Measurements of LV end-diastolic (EDD) and end-systolic diameters and of the interventricular septal (IVS) and posterior wall (PWT) thicknesses in diastole were obtained from a standard parasternal long-axis view according to the recommendations of the American Echocardiography society.[11] LV mass was calculated according to the formula as corrected by Devereux and Reichek.[12,13]
(5) 24-h ambulatory BP monitoring (ABPM): Subjects were fitted with a BP monitor (Contec ABPM50, Germany). Patients were monitored for 24 h, with readings being obtained every 30 min during day-time (8 AM–12 PM) and at 60-min intervals during night-time (12 PM–8 AM).
(6) Assessment of cognitive function: The mini-mental state examination (MMSE) or Folstein test is a brief 30-point questionnaire test that is used to screen for cognitive impairment.[14] It is used to estimate the severity of cognitive impairment. The questions of the MMSE include asking about Orientation (Time, date, day, month, year), Registration (Name three objects only once), Attention and calculation (Ask the patient to subtract 7 from 100 and then 7 from the result four more times), Recall (Ask the patient to repeat the names of the three objects learnt in the registration test) and Language (Score 1 point for each of two simple objects named). The scores from each step are added to give the total score. A score greater than or equal to 25 points (out