# Study on 24 hour-blood pressure variability in essential hypertensive patients aged over 60 years, treated at 108 Military Central Hospital

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**Summary**

*Objective*: Investigation of clinical features, risk factors, 24 hour-blood pressure variability and the relationship between cardiovascular risk factors and 24 hour blood pressure (BP) variability in hypertensive patients over 60 years of age. *Subject and method*: 83 essential hypertensive patients were treated in A1 Department - 108 Military Central Hospital, from July 2016 to October 2017. Patients were followed 24-hour ambulatory blood pressure monitoring (24-H ABPM) in A11 Department. Prospective, cross-sectional descriptive study. *Result:* The most common clinical symptom was headache (62.6%), there was 37.3% asymptomatic hypertension. All risk factors were high, the highest risk factors were salty food and dyslipidemia (67.5% and 61.4%). The average value of blood pressure both during the day, night and 24 hours were high. The percentage of hypertension in the daytime 66.3%; nighttime 95.2% and 24 hours 77.1%. The patient with non-dipper 73.5%, morning surge 65.1%, the proportion of the nocturnal dipper was 16.9%. The factors that increased the risk of non-dipper and morning surge were: Age ≥ 70 (OR = 3.69 and 2.67, p<0.05), type 2 diabetes mellitus (OR = 4.32 and 4.46, p<0.05), dyslipidemia (OR = 3.42 and 4.67; p<0.05); Detection time of hypertension > 5 years increased the risk of nocturnal non-dipper (OR = 3.45, p<0.05). Patients with more than 3 cardiovascular risk factors had 4.28 fold risk non-dipper compared to patients with less than 3 risk factors for p<0.05. *Conclusion*: The average value of blood pressure both during the day, night and 24 hours were increased. Most hypertensive patients have nocturnal non-dipper, over half of them appeared morning surge. The high age ≥ 70, type 2 diabetes mellitus, dyslipidemia increased the risk of nocturnal non-dipper and morning surge. Detection time of hypertension > 5 years increased the risk of nocturnal non-dipper.

*Keywords:* Essential hypertension, 24-hour ambulatory blood pressure monitoring.

## 1. Background

Hypertension is a common and high mortality rate disease. That tends to increase in many countries as well as in Vietnam. According to some studies, the rate of the hypertension in the world is estimated at 29.2% (1.56 billion people) in 2025. Although drugs and treatments are constantly developing, the mortality and morbidity rate is still high. WHO estimates that there are annually 7.5 million deaths [7]. In Vietnam, according to the National Program on Prevention of Hypertension in the period 2010 - 2015, in 8 provinces, the hypertensive rate is 47.3% [3]. Therefore, the elderly patient with hypertension is a worrying health problem. The disease is progressing silently, but there are many serious complications such as: Stroke, heart failure, myocardial infarction… Many studies have shown that when blood pressure is controlled well, serious complications can be prevented. Blood pressure is not constant that

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change from time to time. Non-dipping status has been shown to be associated with a higher prevalence of target organ damage and vascular events. 24h-ABPM can be able to measure, record and analyze all BP index and BP morphology for 24 hours. The European Society of Hypertension guidelines have recognized the value of hypertensive variability in clinical practice [5], [8]. Therefore, we conducted this study with the objectives: I*nvestigation of clinical features, risk factors, 24 hour BP variability, and the relatioship between cardiovascular risk factors with 24 hour BP variability in hypertensive patients over 60 years of age.*

## 2. Subject and method

### *2.1. Subject*

Study population: 83 essential hypertensive patients were treated in A1 Department - 108 Military Central Hospital, from July 2016 to October 2017.

*Inclusion criterias*

Essential hypertensive patients were diagnosed based on JNC VI and recommendation of Vietnam National Heart Association in 2015.

Over 60 years of age.

*Exclusion criterias*

Secondary hypertension.

Patients were suffering from acute disease.

Patients disagree to participate in research.

### *2.2. Method*

Research design: Prospective, cross-sectional descriptive study.

Procedure: All patients were examined, determined risk factors, necessary blood biochemical tests, echocardiography and 24 hour ambulatory blood pressure monitoring.

Instrument: TONOPORT-V Germany 2014 blood pressure monitor, located at A11 Department - 108 Military Central Hospital.

Measurements: Daytime from 7:00 to 21:59 minutes, every 60 minutes. Nighttime from 22:00 to 6:59 minutes, every 120 minutes.

*Evaluation criterias*

Hypertension assessment: According to the guideline of Vietnam National Heart Association in 2015.

Blood pressure morphology: The nocturnal dipping ratio of systolic and diastolic blood pressure was calculated: % HA = (average BP daytime - average BP nighttime): Average BP daytime × 100%. Non-dipper are defined as those who show a reduction in BP of less than 10% between the average day and night BP. Dipper: The nocturnal dipping ratio from 10% to 20%. In contrast extreme dippers are those in whom average BP values are less than 20% lower at night. Defining morning surge as the increase of systolic or diastolic BP at least 20/15mmHg from the lowest BP during sleep to the average of the first two hours after waking.

Diabetes diagnosis: According to the diagnostic criteria of American Diabetes Associtation (2010) and Viet Nam Diabetes Mellitus (2012).

Dyslipidemia diagnosis: According to the endocrine - metabolism diagnostic and treatment guide of Department of health (2015).

Descriptive statistical analysis was carried out using SPSS 20.0.

## 3. Result

### *3.1. General characteristics*

**Table 1. Several characteristics**

| Characteristics | | Patients (n = 83) | Rate (%) |
|---|---|---|---|
| Sex | Male | 81 | 97.6 |
| | Female | 2 | 2.4 |
| Age (year) | 60 - 69 | 33 | 39.8 |

| | | | |
|---|---|---|---|
| | 70 - 79 | 30 | 36.1 |
| | ≥ 80 | 20 | 24.1 |
| | $\bar{X}$ ± SD | 72.9 ± 9.32 | |
| Detection time of hypertension (year) | < 5 | 26 | 31.3 |
| | 6 - 10 | 23 | 27.7 |
| | ≥ 10 | 34 | 41.0 |
| | $\bar{X}$ ± SD | 10.04 ± 6.05 | |

Almost of male was 97.6%, the average age was high (72.9 ± 9.32). Age of 60 - 69 accounted for common (39.8%). Time to detect hypertension ≥ 10 accounted for highest (41.0%), time of hypertension 6 - 10 (27.7%). The rate of hypertensive patients < 5 years 31.3%.

**Table 2. Risk factors**

| Risk factors | | Patients (n = 83) | Ratio (%) |
|---|---|---|---|
| Smoke history | Yes | 42 | 50.6 |
| | No | 41 | 49.4 |
| Eat saline | Yes | 56 | 67.5 |
| | No | 27 | 32.5 |
| Dyslipdemia | Yes | 51 | 61.4 |
| | No | 32 | 38.6 |
| Diabetes | Yes | 42 | 50.6 |
| | No | 41 | 49.4 |
| Hypertensive family history | Yes | 50 | 60.3 |
| | No | 33 | 39.7 |

Eat saline and dyslipdemia accounted for high (67.5% and 61.4%). 42 patients suffered from diabetes mellitus (50.6%). 50 patients had a hypertensive family history (60.3%).

### *3.2. 24-hour ambulatory blood pressure characteristics*

**Table 3. Risk factors of the research objects**

| Time | Daytime | Nighttime | 24 hours |
|---|---|---|---|
| Average systolic BP (mmHg) | 140.55 ± 10.22 | 133.72 ± 9.86 | 137.81 ± 9.91 |
| Average diastolic BP (mmHg) | 81.14 ±11.07 | 79.14 ± 11.57 | 80.60 ± 10.59 |
| Average BP (mmHg) | 101.01 ± 9.76 | 97.29 ± 9.88 | 99.68 ± 7.32 |
| Average heartbeat (cycle/minute) | 77.67 ± 11.55 | 70.53 ± 12.01 | 75.47 ± 11.02 |

The average value of blood pressure both during the day, night and 24 hours increased. Daytime systolic BP was higher than nighttime systolic BP.

**Table 4. Features of 24-hour ambulatory blood pressure monitoring**

| Time of hypertension | Patients (n = 83) | Ratio (%) |
|---|---|---|
| 24-hour hypertension | 64 | 77.1 |
| Daytime hypertension | 55 | 66.3 |
| Nighttime hypertension | 79 | 95.2 |

The percentage of nighttime hypertension was extremely high (95.2%), daytime hypertension (66.3%) and 24-hour hypertension (77.1%).

**Table 5. Features of day-night blood pressure variability**

| Variability of BP | | Patients (n = 83) | Ratio (%) |
|---|---|---|---|
| Dipping status (n = 83) | Extreme dipper | 2 | 2.4 |
| | Dipper | 14 | 16.9 |
| | Non-dipper | 61 | 73.5 |
| | Riser dipper | 6 | 7.2 |
| Morning surge (n = 83) | Yes | 54 | 65.1 |
| | No | 29 | 34.9 |

The variability of day-night BP is mainly non-dipper which has a high rate (73.5%). There are 2 extremely dipper patients (2.4%) and 6 riser dipper patients (7.2%). The majority of patients have morning surge (65.1%).

### *3.3. The relationship between some cardiovascular risk factors and 24h-BP variability*

**Table 6. The relationship between some cardiovascular risk factors and 24h-BP variability**

| Characteristics | Non-dipper (n = 75) (OR, p) | Morning surge (n = 83) (OR, p) |
|---|---|---|
| Age ≥ 70 | 3.69 (<0.05) | 2.67 (<0.05) |
| Hypertensive duration > 5 years | 3.45 (<0.05) | 1.83 (>0.05) |
| BMI ≥ 23 | 2.94 (>0.05) | 1.89 (>0.05) |
| Type 2 diabetes | 4.32 (<0.05) | 4.46 (<0.05) |
| Dyslipidemia | 3.42 (<0.05) | 4.67 (<0.05) |

Most of the risk factors had a significant impact on non-dipper hypertension. The patients over 70 years of age, the hypertensive duration over 5 years, type 2 diabetes and dyslipidemia increased the risk of non-dipper hypertension with OR = 3.69, 3.45, 4.32, 3.42 respectively and p<0.05. We didn't see the relationship between obesity with non-dipper hypertension.

We didn't see the relationship between long hypertensive duration, obesity with early morning surge. The age ≥ 70, type 2 diabetes or dyslipidemia increased the risk of the morning surge with OR from 2.67 to 4.67 (p<0.05).

The risk of non-dipper hypertension of the patients having more than 3 cardiovascular risk factors was 4.28 times higher than in the patients having under 3 risk factors (OR = 4.28, p<0.05).

## 4. Discussion

### *4.1. General characteristics, clinical characteristics and risk factors of the study subjects*

Age, sex: Age is a random and important risk factor in clinical practice. Age-related hypertension is a major cause of increased prevalence and frequency of hypertension in older age groups. Our study is carried on a very high average age range (72.9 ± 9.32 years), which is much higher than that of Dang Duy Quy (2012) [2] of 60.28 ± 11.49, Pai-Feng Hsu et al (2016) was 55.9 ± 12.4 [6]. The difference is that our research was conducted primarily on patients who are senior military officers and most of them were already in the older ages, which also explains why the proportion of women in our study only accounted for a very low 2.4%.

Time to detect hypertension: Hypertension is a silent disease, most patients with hypertension are not recognized or have been diagnosed but not treated and the disease is only known when they have clinical signs or complications. Therefore, when they come to hospital, they have suffered from hypertension for a long time. The detection time of hypertensive patients in our study was over 10 years (41%), the average

duration of hypertension was 10.04 ± 6.05 years. Thus, the older the patients are, the prevalence of hypertension increases.

Risk factors: Most of the risk factors for hypertension in our study were high smoking rates (50.6%), eat saline (67.5%), dyslipidemia (61.4%); diabetes mellitus (50.6%), family history of hypertension (60.3%). This is suitable for local and foreign authors such as Nguyen Duc Hai (2015) [4], Dang Duy Quy (2012) [2]. Because most of our patients are male and at the same time, older age is also a favorable factor for risk factors such as diabetes mellitus and hyperlipidemia.

### *4.2. Features of 24-hour ambulatory blood pressure monitoring*

Average daily and night systolic blood pressure was higher than normal value (Table 3). Over time, we met all the types of hypertension such as: daytime hypertension (66.3%), hypertension 24 hours (77.1%), hypertension at night was the highest rate (95.2%) (Table 4). The results of our study were higher than those of Dang Duy Quy (2012) [2]; Nguyen Duc Hai (2015) [4]. This showed that we need to pay more attention to the night blood pressure index - which is often overlooked, especially in the elderly. It is recommended that patients should take medication before sleeping to prevent hypertension at night. For elderly patients, the medication is appropriate for the duration of the rest and activities of the individual. Well controlling of blood pressure at night not only helps the doctor control blood pressure 24 hours but also limits the complications for patients. Our study found that patients with systolic hypertension were primarily associated with hypertensive characteristics in older patients.

The forms of 24 hour blood pressure variability (Table 5): Our study found that the proportions of non-dipper hypertension, extreme dipper, rise dipper were 73.5%, 2.4% and 7.2%, respectively. Therefore, the rate of non-dipper hypertension was up to 83.1%. The results of several authors showed that the people who had non-dipper hypertension during bedtime were highly at risk of target organ damage. High blood pressure in the morning when waking up is normal physiological phenomena but the more rapidly it increases, the more risk of stroke and coronary artery are. Studies have also shown that rates of myocardial infarction and stroke generally peak in the early morning hours after waking up. In our study, the majority of patients had morning surge at 65.1%. This is similar to Cao Thuc Sinh (2006) [1], K Madin et al in England. Hence, these patients should take antihypertensive drugs in the evening to control morning surge better.

### *4.3. The relationship between some cardiovascular risk factors and 24-hour blood pressure variability*

The correlation between cardiovascular risk factors and non-dipper hypertension: Results of Table 7 showed that age $\geq$ 70, duration of hypertension > 5 years, type 2 diabetes, dyslipidemia were mostly related to non-dipper hypertension during bedtime and morning surge. Especially, age $\geq$ 70, diabetes increased the risk of non-dipper hypertension during bedtime by 3.67 and 4.32 times compared with patients aged < 70 years and did not have diabetes. Nguyen Duc Hai (2015) [4] in the study of this issue also gave the same results. Dyslipidemia increased the risk of morning surge at 4.67 times. Many studies have also shown that risk factors such as: Diabetes, lipid disorders… promote atherosclerosis and affect blood pressure. Therefore, in order to treat hypertension, in addition to controlling the target of blood pressure well, the risk factors should also be adjusted, especially in older patients with target to reduce the complications.

## 5. Conclusion

Based on the study of 83 patients with primary hypertension, treated at A1 Department - 108 Military Central Hospital, we draw the following conclusions:

The average blood pressure at daytime, at night, 24 hours exceeded normal values, the

average of systolic blood pressure in daytime increased 140.55 ± 10.22mmHg. High blood pressure at night was 95.2%. The number of patients with non-dipper hypertension during night time was 73.5%, dipper-hypertension at night was 16.9%, 65.1% of patients had morning surge.

Factors increase the risk of non-dipper hypertension at night and morning surge: Age ≥ 70 (OR 3.69 and 2.67, p<0.02 - 0.03); type 2 diabetes mellitus (OR = 4.32 and 4.46, p<0.02 - 0.002), dyslipidemia (OR = 3.42 and 4.67, p<0.04 - 0.011), Detection of hypertension > 5 years increased the risk of non-dipper blood pressure (OR = 3.45, p=0.03). Patients with ≥ 3 cardiovascular risk factors had a 4.28-fold lower risk of hypotension at baseline compared with patients with < 3 risk factors for p=0.02.

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