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ORIGINAL

COMPLEXITY ANALYSIS OF DYSRHYTHMIA AND CARDIAC DYSFUNCTION IN ELDERLY ATHLETIC PATIENTS USING DIAGNOSTIC MARKER OPTIMIZATION DEPTH LEARNING MODEL

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ABSTRACT

Objective: To compare differences of various indexes of cardiac function among elderly athletic patients with essential hypertension with abnormal circadian rhythm, and to explore relationship between CAP and abnormal changes of blood pressure circadian rhythm and its influencing factors in athletic patients with essential hypertension. **Methods:** A total of 190 athletic patients with Han nationality who were treated in General Hospital of Ningxia Medical University from September 2019 to February 2021 were selected, including 96 males and 94 females, aged (59.74+12.75) years old, their blood pressure circadian rhythms were detected, and nighttime rhythms were calculated Blood pressure drop rate, and divided into anti-configuration, non-configuration, configuration; To examine difference between CAP and reflected wave gain index (AI), ankle-brachial pulse wave velocity, velocity (baPWV) and ankle-brachial index mutual relationship. **Result:** ①The nSBP, nDBP and MAP of anti-configuration were higher than those of non-configuration and configuration. ② The dDBP and MAP of anti-configuration and non-configuration were lower than those of configuration. ③For every 10 years of age of hypertensive athletic patients, risk of reverse-type hypertension increased to 1.17 times; for every 10 years of medical history, risk of reverse-type hypertension increased to 1.16 times. ④For every 10 mmHg increase in central arterial pressure, risk of hypertension in reverse configuration increased by 1.13 times; for every 10 increase in correction index of central arterial pressure enhancement index (AIx75) at 75 beats heart rate, risk of hypertension in reverse configuration increased by 10. Sex increased to 1.26 times: baPWV was closely related to occurrence of hypertension in reverse configuration ($P<0.05$). **Conclusion:** The central arterial pulse pressure is related to rate of nocturnal blood pressure drop, and there is a certain relationship with occurrence of reverse configuration hypertension.

KEYWORDS: blood pressure; central arterial pressure; abnormal circadian rhythm; elderly; hypertension; cardiac function

1. INTRODUCTION

Hypertension is a common clinical disease and its incidence is increasing year by year. It is main risk factor for cerebrovascular accident, heart failure, coronary heart disease and other diseases. Globally, hypertension has been regarded as a major public health problem. In 2004, survey report on status quo of residents' nutrition and health in my country showed that 18.8% of residents in our country were 18 years old and above suffering from hypertension, and it is estimated that number of athletic patients in country exceeded 160 million (Zhao et al., 2021). Compared with ten years ago, prevalence of hypertension has increased by 31%, increasing number of athletic patients to 70 million. Therefore, hypertension has become a hot topic researched by scholars at home and abroad, and more and more people's attention has been paid to it.

In nature, there is a phenomenon of periodic and regular changes in all life activities including single cells, higher animals and plants, and human beings, indicating that this phenomenon of life activities has obvious activity rhythms. Similarly, (Di Raimondo et al., 2021) found that blood pressure changes throughout day in hypertensive athletic patients are also rhythmic, that is, blood pressure circadian rhythm (BPCR). The changes of blood pressure circadian rhythm are regulated by various factors such as nerves and body fluids in human body. Now, most of them believe that changes of blood pressure circadian rhythm are closely related to activity of sympathetic nervous system. It was found that circadian rhythm of blood pressure disappeared, decrease of blood pressure at night was reduced, and increase of sympathetic nerve excitability led to increase of plasma catecholamine levels, autonomic dysfunction, and cardiovascular system was under impact of high blood pressure levels for a long time (Rhoads, Balagee, & Thomas, 2020). The hypoxic state of blood severely damages target organs. In this study, blood pressure circadian rhythm variability was used as a predictor of cardiovascular events in athletic patients (Leng, Zhang, Cui, Zeng, & Hu, 2020). In some patients with essential hypertension, circadian rhythm of blood pressure may appear to weaken or disappear, which is medically called athletic patients with non-configurational hypertension. The degree of target organ damage in athletic patients with non-configurational hypertension is significant, and risk of cardiovascular and cerebrovascular complications is high, which is an independent risk factor for death in athletic patients with hypertension.

ABPM is main method to quantitatively evaluate circadian rhythm variability in blood pressure at this stage. Ambulatory blood has advantages of convenience and non-invasiveness. By using ambulatory blood recorder to measure blood value of human body every 30min or 60min within 24 hours, it can directly display change curve of 24h ambulatory blood, average blood throughout day, and automatic blood. Day or night average blood, work average blood and proportion of blood increase. Compared with incidental blood (CBP) method, continuously improved and perfect ABPM technology has many advantages that are irreplaceable (Casagrande, Favieri, Langher, et al., 2020). The diagnosis and treatment of blood plays a pivotal role, which opens up new fields and prospects for exploration and research of hypertension.

Facing constantly changing and fluctuating human blood, ABPM can measure a more real situation than CBP in subject's 24-hour daily life; ABPM captures a large amount of information, comprehensive, and high repeatability and accuracy of information; eliminates need for , "white coat effect" and "clinic effect"; it is convenient, fast, and saves human resources; ABPM can better analyze and judge clinical value and significance of blood fluctuations by comparing with records of daily life, which is more conducive to diagnosis and treatment of blood. High blood. It is commonly used in diagnosis of "white coat" hypertension, "reverse white coat", hypertensive nighttime hypertension, refractory hypertension, hypotension, gestational hypertension, and elderly hypertension.

Using ambulatory blood to monitor athletic patients' blood has been proved to be superior to other blood detection methods, but it is far from enough to comprehensively and systematically understand and study occurrence and development of hypertension. It has been confirmed that heart and blood vessels will produce a series of structural, morphological and functional changes in process of hypertension, namely cardiovascular remodeling. Long-term hypertension can lead to decreased left ventricular diastolic function and left ventricular hypertrophy, which are important risk factors for cardiovascular events (Burnier et al., 2020). Under physiological state, 24-hour blood fluctuation of human body is often manifested as day high and night low. This circadian rhythm characteristic generally does not change with change of external environment and is inherent in living body (Vallelonga et al., 2019; Zhang, Sun, Jiang, Yang, & Chen, 2021).

2. Materials and methods

2.1 Source of cases

A total of 190 athletic patients with essential hypertension in xxxxxx hospital from 2019-09 to 2021-12 were selected, including 96 males and 94 females, aged 45-75 (59.74±12.75) years old.

2.2 Case exclusion criteria

①Exclude athletic patients with cardiogenic embolism, such as recent myocardial infarction (<5 weeks), atrial flutter and atrial fibrillation with or without mural thrombus, rheumatic heart disease, mitral valve stenosis or artificial valve, patent foramen ovale. ②Exclude severe obesity, that is, more than 20% of ideal body weight. ③Athletic Patients with liver and kidney disease and peripheral arterial disease were excluded. ④Exclude heavy smokers and drinkers. ⑤Athletic Patients whose data is not complete enough to be sorted and analyzed.

2.3 Normal control

There were 40 cases, 24 males and 16 females, aged 43 to 69 years old, with an average age of 56.69±10.04 years. All of them were healthy people who were not found to have organic diseases through medical history, physical examination, electrocardiogram, ultrasound, X-ray, liver and kidney function, blood lipids, blood sugar and other tests.

2.4 Instruments

The ABMP non-invasive portable ambulatory blood monitor produced in United States is a Vivid 7 color Doppler ultrasound system developed by GE, M3S phased array probe, detection depth is 12cm, frequency is 2~4 MHz, and scanning angle is 90°.

2.5 Inspection method

Athletic Patients who underwent ambulatory blood monitoring stopped taking antihypertensive drugs 3 days before measurement. Select upper arm with high blood and a suitable cuff according to conventional blood measurement method, fix balloon sensor or center at brachial artery pulse, and patient can engage in normal activities during monitoring period. Still, measurement time is from 08:00~10:00 to 08:00~10:00 next day. The measurement interval was that cuff was automatically inflated once every 30 minutes during day (06:00~22:00), and cuff was automatically inflated once every 60 minutes at night (22:00~06:00 next day).

The recording time must be greater than 22h. To avoid measurement errors due to human motion, patient should remain still during cuff inflation. The cuff begins to deflate when an audible signal is heard during measurement. During deflation of cuff, patient should be aware that subject should stand with his arms drooping naturally, with his hands inserted into pockets of his pants or his fingers hooked on belt. If you are sitting upright, place your lower arm on a table or pad. Movements like moving a finger during cuff inflation should also be avoided. Instruments can be removed for short periods of time to do other things. The ABP monitor must be turned off to remove cuff from upper arm, but must not be turned on. Then you have to put it on as it is. It is necessary for doctor to tell patient to wear cuff correctly. The patient must never forget to turn on ABP monitor again.

The instrument should be placed on one side of body in order to prevent pressure tube from being compressed and bent during sleep. If currently, no measurement needs to be taken, patient can temporarily turn off instrument to interrupt measurement and do not forget to turn instrument on again.

Cardiac ultrasonography is performed by specialists in Color Doppler Ultrasound Room of Special Inspection Department of xxxxxx Hospital. The subject should be in left lateral decubitus position, keep breathing calm, if image is not clear, adjust overall position, take a deep breath and then be naive, explore at left edge of sternum or under xiphoid process, and take test after completing routine cardiac ultrasound examination.

In apical four-chamber view, sampling volume was taken at cusp of mitral valve, peak flow velocity in early and late diastole was detected, and E/A ratio was recorded, and then switched to tissue Doppler velocity mode, and sampling volume was placed in mitral valve. Post-circular interval, peak early and late diastolic velocity were measured, and Ea/Aa ratios were recorded.

2.6 Ambulatory blood Monitoring (ABPM)

The blood load value refers to ratio of number of times measured systolic or diastolic blood exceeds normal reference value to total number of blood measurements during monitoring process. The trend graph of blood over time is a graph obtained by dividing a day into multiple time intervals in units of 1 hour or half an hour.

The domestic reference standards in my country's 2005 Hypertension Guidelines (Revised Edition) are: 24h average blood <130/80mmHg, daytime average <135/85mmHg, and nighttime average <125/75mmHg. Under normal circumstances, average nighttime blood is 10% to 15% lower than daytime blood value. When this value is >10%, it is configuration blood, when this value is less than 10%, it is non-configuration blood.

2.7 Detection of left ventricular function related index

Echocardiography, peak flow velocity (E) at early stage of mitral orifice ventricular filling, peak flow velocity at late stage (A) and E/A value, peak myocardial velocity in early diastole (Ea), peak myocardial velocity in late diastole (Aa) and Ea /Aa ratio. Left ventricular diastolic dysfunction assessment criteria:

1) "pseudo-normal" left ventricular filling: 1<E/A<2 and Ea/Aa<1. 2)Restrictive filling of left ventricle: left ventricular compliance was severely reduced, and left atrial enlargement was accompanied by no increase in filling pressure. The descending slope of E peak increases: due to increased left ventricular end-diastolic pressure, pressure difference between left atrium and left ventricle decreases during left atrial systole, which reduces ventricular filling ratio during atrial systole, and A peak velocity is very low or even disappears. E/ A>2Ea/Aa<l.

3. Results

There were no differences in age, sex composition ratio, smoking, drinking, blood sugar, triglyceride, total cholesterol, HDL-C, LDL-C and body mass index; ② reverse configuration The average medical history of athletic patients (9.83±9.88) years and average medical history of non-configuration (5.47±7.31) years were higher than average medical history of configuration (3.90+4.42) years; see Table 1, Figure 1, Figure 2.

Table 1: Basic clinical characteristics of hypertensive patients($\bar{x} \pm s$)

PARAMETER	CONFIGURATION	NON-CONFIGURATIONAL	ANTI-CONFIGURATION
Number of cases (male/female)	59(29/30)	75(40/35)	60(30/30)
Age (years)	58.13±11.60	58.13±11.58	58.44±11.20
Medical history (years)	3.91±4.41	5.46± 7.30[a]	9.84± 9.89[a]
Smoking (%)	46.56	52.06	50.84
Drinking alcohol (%)	48.28	49.33	52.55
Blood sugar (mmol/L)	5.31±0.43	5.25±0.66	5.33±0.54
Triacylglycerol (mmol/L)	2.12±1.43	2.00±1.22	1.95±1.19
Total cholesterol (mmol/L)	4.82±0.88	4.76±0.92	4.52±0.76
HDL-C(mmol/L)	1.11±0.29	1.11±0.32	1.04±0.26
LDL-C (mmol/L)	2.88±0.67	2.83±1.00	2.72±0.68
Body mass index (kg/m^2)	24.32±2.83	25.14±3.46	25.05±2.27

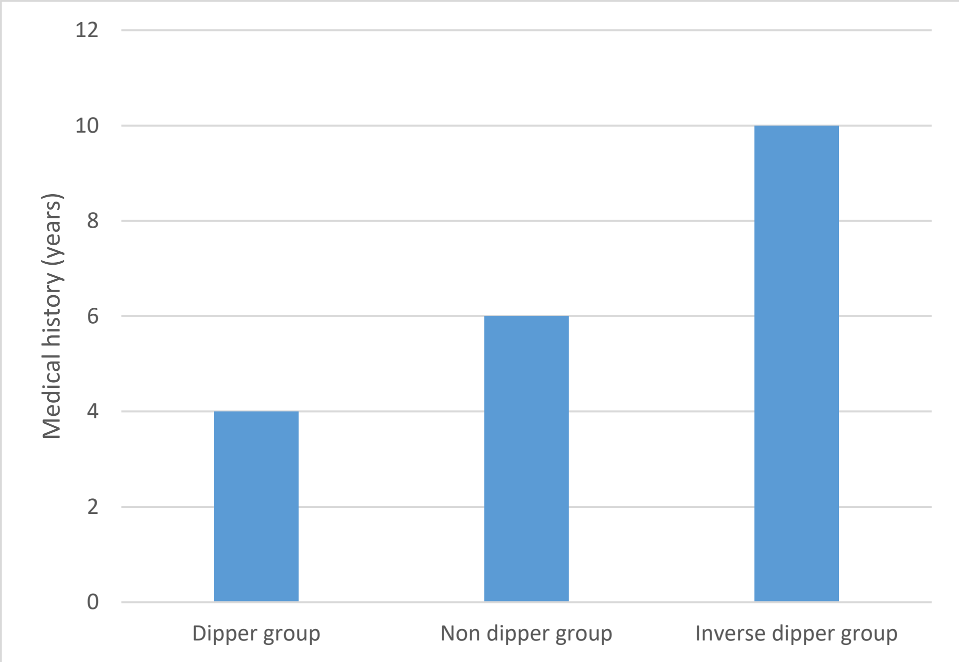

Figure 1: Comparison of medical history of hypertensive patients

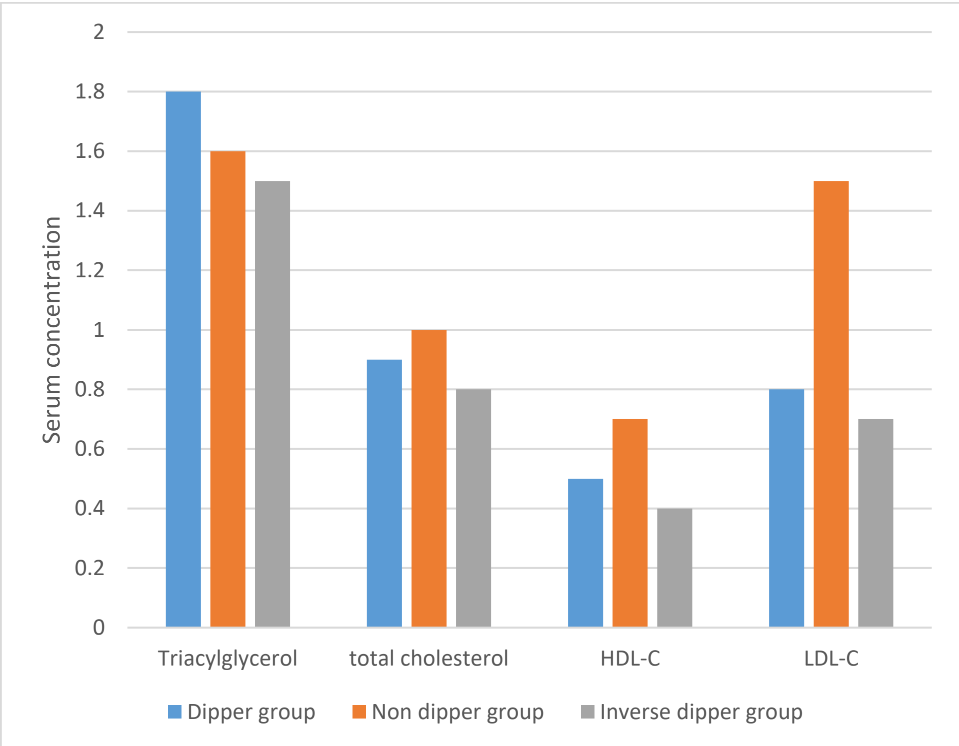

Figure 2: Basic clinical characteristics of hypertensive patients

The results of variance analysis of ambulatory blood-related indicators showed that: ①There was no statistical difference in 24hSBP and 24hDBP; ② The nSBP, nDBP and nMAP in anti-configuration were higher than those in non-configuration and configuration; ③ The dDBP and dMAP of anti-configuration and non-configuration were lower than those of configuration; see Table 2, Figure 3.

Table 2: Comparison of ambulatory blood parameters of hypertensive patients ($\bar{x} \pm s$)

PARAMETER	CONFIGURATION	NON-CONFIGURATIONAL	ANTI-CONFIGURATION
Number of cases (male/female)	59(29/30)	75(40/35)	60(30/30)
24hSBP(mmHg)	132.34±12.57	130.72±15.11	134.91±15.22
24hDBP(mmHg)	83.95±12.99	84.65±12.69	83.95±12.99
24hMAP(mmHg)	101.01±9.74	100.12±11.92	101.22±11.26
dSBP(mmHg)	139.22±13.34	133.84±155.58[b]	133.23±14.95[a]
dDBP(mmHg)	91.28±10.59	86.96±13.15[b]	84.18±12.36[a]
dMAP(mmHg)	106.22±10.45	102.51±12.25	100.42±11.22[a]
nSBP(mmHg)	120.24±11.57	125.82±14.82[b]	138.22±16.47[ac]
nDBP(mmHg)	77.25±9.32	80.95±12.84	85.13±12.64[a]
nMAP(mmHg)	91.65±8.82	96.48±11.82[a]	102.92±11.78[ac]

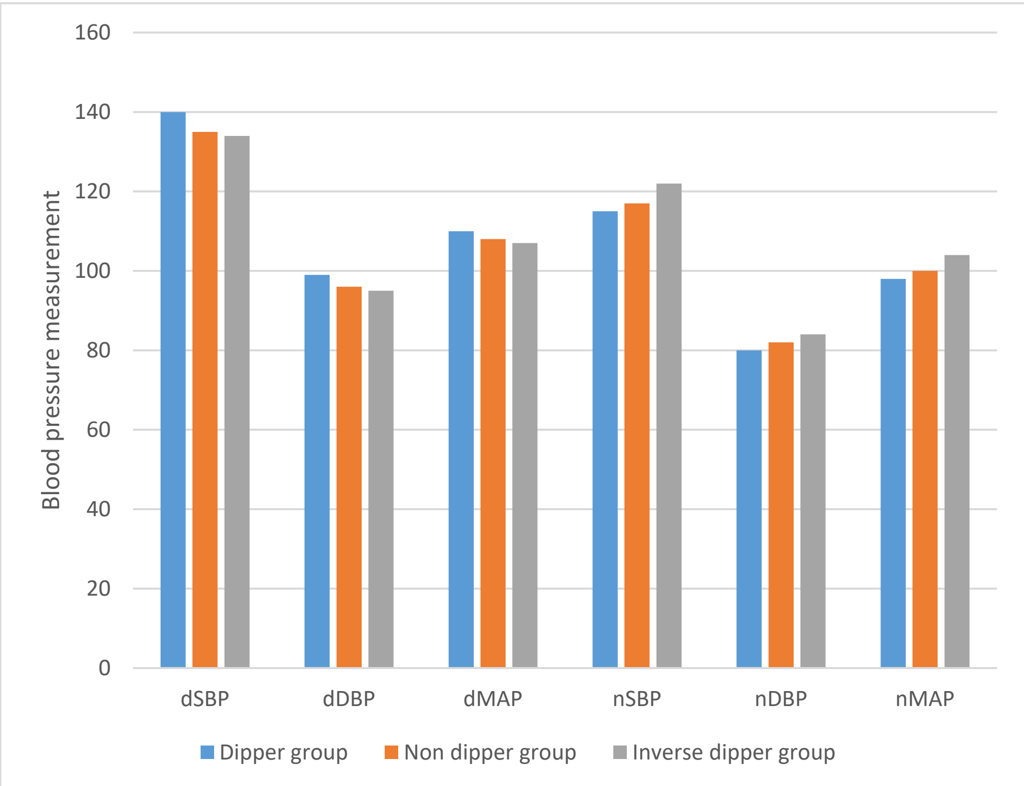

Figure 3: Comparison of ambulatory blood parameters of hypertensive patients

The results of variance analysis of ambulatory blood-related indicators showed that: ① there was no statistical difference in cSBP, cDBP, reflected wave pressure, AIx, and ankle-brachial index (P>0.05); ② central arterial pulse pressure, the baPWV was higher than that of non-configuration and configuration; ③AIx75 was different; see Table 3, Figure 4-6.

Table 3: Comparison of parameters of central arterial pressure and vascular stiffness of hypertensive patients ($\bar{x} \pm s$)

PARAMETER	CONFIGURATION	NON-CONFIGURATIONAL	ANTI-CONFIGURATION
Number of cases (male/female)	59(29/30)	75(40/35)	60(30/30)
cSBP(mmHg)	126.02 ± 14.88	129.52 ± 15.37	131.15 ± 17.51
cSBP(mmHg)	87.65 ± 8.55	88.08 ± 13.05	88.57 ± 12.49
cSBP(mmHg)	38.18 ± 10.44	41.25 ± 10.17	42.78 ± 11.85^{ac}
Reflected wave pressure	8.15 ± 5.93	10.48 ± 5.55	10.18 ± 6.55
AIx	20.08 ± 10.78	22.57 ± 9.03	22.19 ± 12.61
AIx75	20.06 ± 9.45	23.15 ± 13.54^{b}	22.76 ± 10.73
Ankle brachial index	1.16 ± 0.07	1.14 ± 0.08	1.15 ± 0.09
BaPWV(cm/s)	1581 ± 233.42	1673 ± 266.92	1824 ± 393.03^{ac}

Note: *cSBP: central arterial systolic blood; cDBP: central arterial diastolic blood; cPP: central arterial pulse pressure; AIx: central arterial pressure enhancement index; AIx75: 75 beats heart rate AIx correction index; baPWV: ankle-brachial pulse wave velocity. Compared with non-Configuration, a: P<0.01, b: P<0.05; compared with non-Configuration, c: P<0.05.*

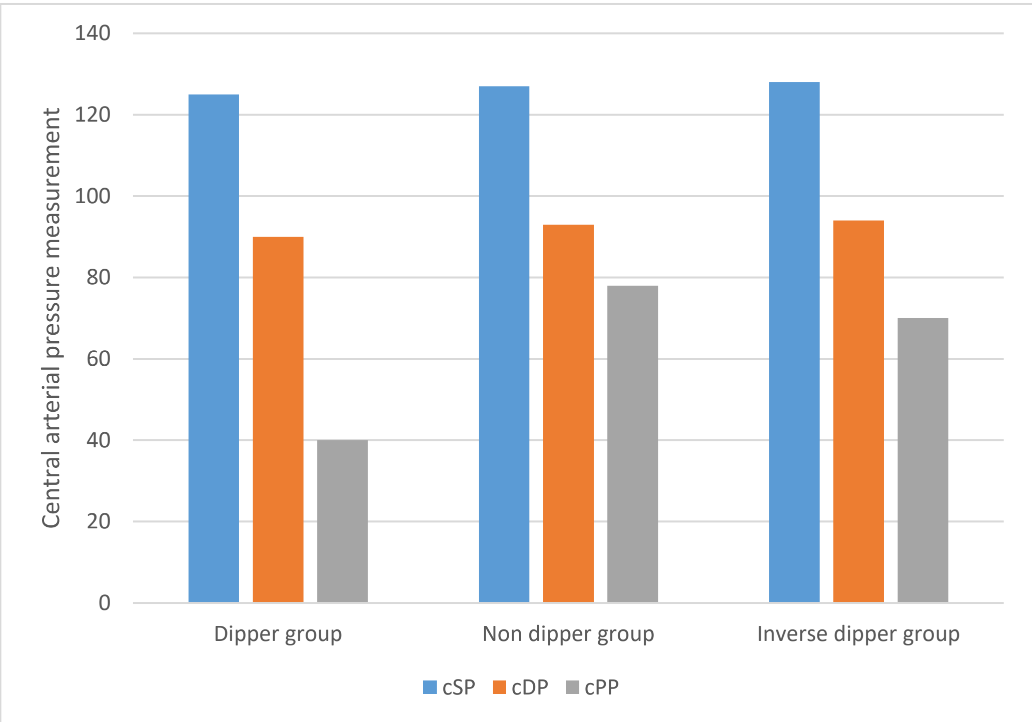

Figure 4: Comparison of central arterial pressure parameters of hypertensive patients

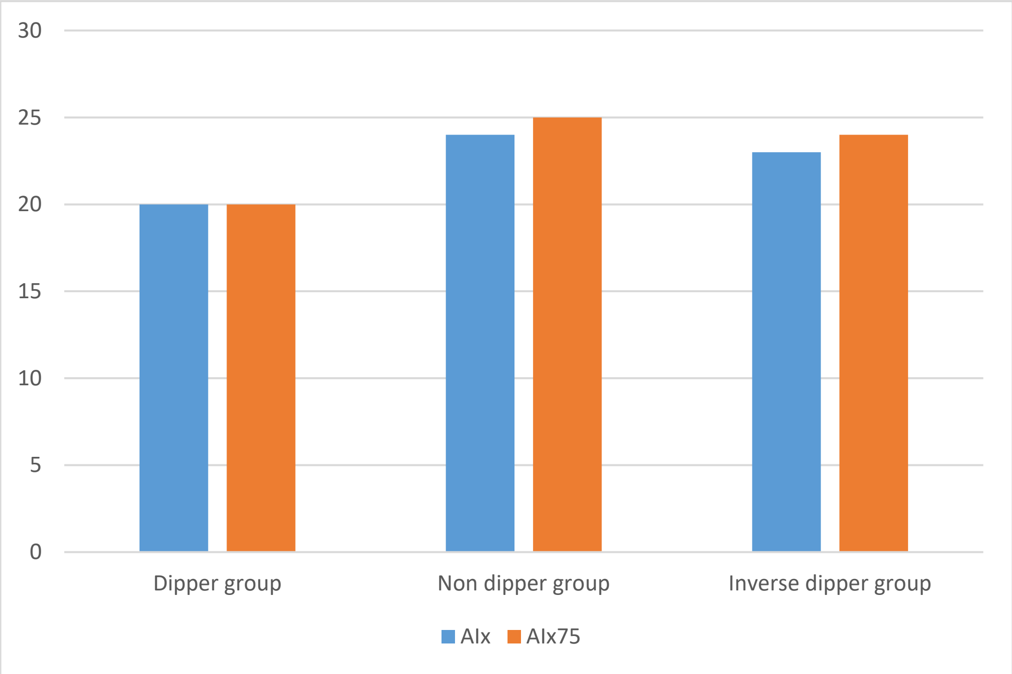

Figure 5: Comparison of AIx and AIx75 of hypertensive patients

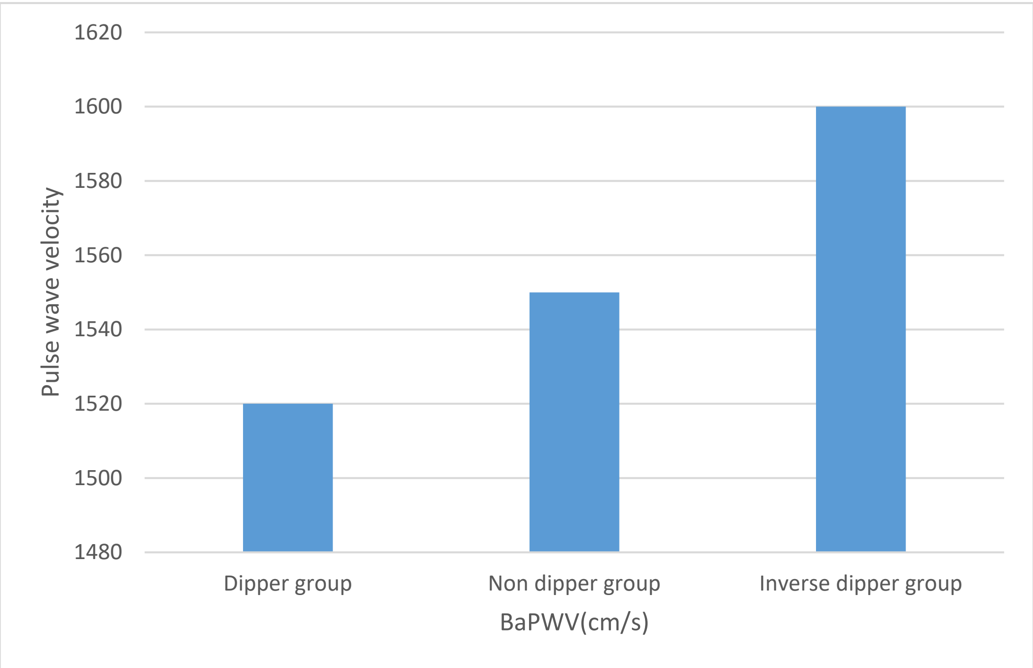

Figure 6: Comparison of vascular stiffness parameters of hypertensive patients

Multivariate regression analysis showed that central arterial pulse pressure, AIx75, baPWV, peripheral arterial dDBP, dMAP, nSBP, nDBP, nMAP, age, and medical history were associated with occurrence of hypertension in reverse configuration.

For every 10 mmHg increase in central arterial pulse pressure, risk of hypertension in reverse configuration increased to 1.13 times. The risk of blood increased to 1.26 times; for every 10mmHg increase in dDBP, risk of reverse configuration hypertension decreased to 0.97 times; For every 10mmHg increase in dMAP, risk of reverse configuration hypertension decreased to 0.51 times.

For every 10 years of age, risk of reverse-type hypertension increased to 1.17 times; for every 10 years of medical history, risk of reverse-type hypertension increased risk of hypertension increased to 1.16 times, see Figure 7, Table 4-5.

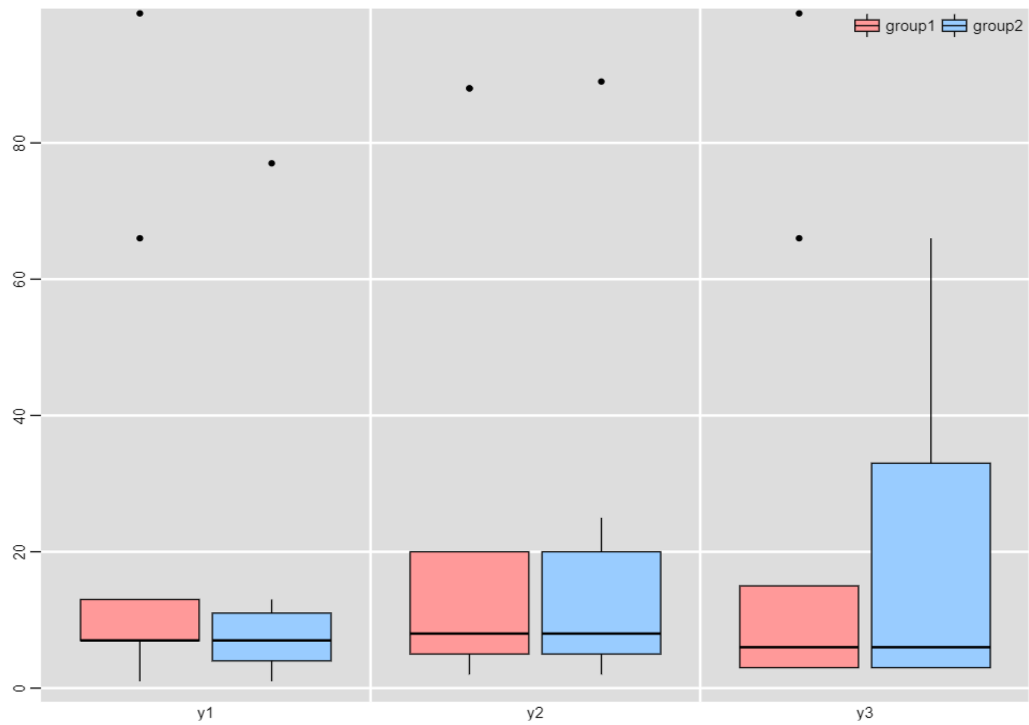

Figure 7: Comparison of left ventricular diastolic function between hypertensive N1 and N2

Table 4: Potential risk factors for hypertension in reverse Configuration

RISK FACTORS	VARIABLE ASSIGNMENT LABEL
Age	<40=0,40~49=1,50~59=2,60~69=3,7~=4
Medical history	<5=0,5~9=1,10~19=2,20~29=3,30~=4
dDBP	<60=0,60~69=1,70~79=2,80~89=3,90~=4
dMAP	<70=0,70~79=1,80~89=2,90~=3
nSBP	<90=0,90~99=1,100~109=2,109~=3
nDBP	<60=0,60~69=1,70~79=2,79~=3
nMAP	<70=0,70~79=1,80~89=2,90~=3
baPWV	<1400=0,1400~1599=1,1600~1799=2,1800~=3
cPP	<20=0,20~29=1,30~39=2,40~49=3,50~=4
AIx75	<10=0,10~19=1,20~29=2,30~39=3

Table 5: Logistic stepwise regression analysis results with hypertension in reverse Configuration as dependent variable ($\bar{x} \pm s$)

RISK FACTORS	B	WALD	P-VALUE	OR-VALUE	95%CL
Age	0.05	20.51	0.04	1.16	1.05~1.26
Medical history	0.09	13.88	0.01	1.15	1.04~1.22
dDBP	-0.05	4.63	0.02	0.96	0.93~0.98
dMAP	-0.06	29.95	0	0.51	0.42~0.67
nSBP	0.07	28.19	0.01	1.19	1.05~1.23
nDBP	0.05	8.88	0.01	1.12	1.01~1.16
nMAP	0.62	32.62	0	1.94	1.51~2.35
baPWV	0.01	10.69	0.05	1.28	1.00~1.42
AIx75	0.05	3.87	0.05	1.25	1.00~1.38
Constant term	7.36	0.02	-	-	-

4. Discussion

In recent years, great progress has been made in use of ambulatory blood and cardiac ultrasound technology in clinical research of hypertension (Kikuya, Asayama, & Ohkubo, 2019).Under normal circumstances, human blood has obvious fluctuations. The blood of normal people can show circadian rhythm changes, while changes in hypertensive athletic patients may weaken or disappear. The changes of circadian rhythm were mostly in shape of a "long-handled spoon" with two peaks and valleys, and blood level during day was higher than that at night. From 17:00 to 03:00, blood showed a slow downward trend, until it reached lowest point and then increased, and increase rate was faster in early morning. There are many factors such as nerves and body fluids, which regulate circadian rhythm of blood, and most of them are now believed to be closely related to activity of sympathetic nervous system during activity and sleep. If circadian rhythm appears to weaken or disappear, or nighttime blood level decreases, or increases, it is called "non-dipping" blood change (Casagrande, Favieri, Guarino, et al., 2020). "Non-scoop" blood changes make cardiovascular system in a state of long-term load, which can easily lead to left ventricular hypertrophy and abnormal left ventricular diastolic function9. The heart is in a state of high pressure load for a long time, which increases blood viscosity, which in turn causes disturbance of microcirculation perfusion, resulting in tissue ischemia and hypoxia, which eventually causes damage to heart, brain, and kidneys. Many literatures reported that athletic patients with hypertension accompanied by disappearance of circadian rhythm of blood will have an increase in level of plasma endothelin, and there may be a vicious circle between target organ damage-increased release of endothelin-circadian rhythm of blood and disappearance of circadian rhythm. (Spallone, 2018) Proves that incidence and mortality of cardiovascular disease in "non-configuration" athletic patients are higher than those in "configuration" athletic patients, and in development of hypertension, left ventricular systolic dysfunction often occurs in left ventricular diastolic function. After difference. Therefore, evaluation of left ventricular diastolic function in hypertensive athletic patients is far more important than evaluation of systolic function (van Twist et al., 2021). Therefore, by dividing hypertensive athletic patients into configuration and non-configuration to compare their LV diastolic function, we found that incidence of abnormal LV diastolic function in non-configuration was higher than that in configuration. It can be seen that abnormal circadian rhythm is closely related to damage of left ventricular diastolic function (Akbay, Çoner, Akıncı, Demir, & Toktamiş, 2021).

ABPM can effectively exclude influence of iatrogenic, human factors or environmental factors when monitoring hypertension. For example, when some people go to outpatient clinic of hospital, their blood will exceed normal value when they face doctor, and when these people return home, their blood measured by themselves or with ambulatory blood will become normal. This phenomenon is medically called " The white coat effect". Nearly one-quarter of even-sided blood in traditional sense is mild or moderate, and hypertensive athletic patients are confirmed to have white-coat hypertension (Goswami et al., 2020). The "white coat effect" is caused by patient's emotional agitation, agitation or mental tension when facing doctor, and interference caused by this phenomenon can be easily eliminated by monitoring patient by ABPM (Kario, Hoshide, et al., 2020). When traditional blood measurement encounters athletic patients exercising, drinking and eating, error of measured blood value is too large and lacks true objectivity. ABPM overcomes its shortcomings well, and ambulatory blood can reflect changes of blood within 24 hours through a simple and intuitive graph, which provides a good way for clinical tracking and evaluation of hypertension. ABPM can also predict timing of sudden events such as cardiovascular and cerebrovascular events that may exist. Through a large number of epidemiological and pathophysiological investigations, it has been shown that a sudden increase in morning blood, that is, morning peak blood, will increase incidence of stroke and myocardial infarction grade sudden cardiac death. Confirmed that 24hSBP, 24hDBP, dSBPdDBP, nSBP and nDBP have a high correlation with early glomerular damage and cardiovascular and cerebrovascular diseases (Forte, De Pascalis, Favieri, & Casagrande, 2019). Therefore, it has been used more and more by medical workers. In addition, ABPM is more sensitive than office blood in assessing prognosis of hypertension. (Chen et al., 2021) shows that above is confirmed by using ABPM to track and monitor nearly 2,000 hypertensive athletic patients.

In clinical studies, hypertension can be roughly divided into athletic patients whose etiology is not clear. Medically, such athletic patients are classified as primary, and number of patients with hypertension accounts for more than 90% of total number of athletic patients with hypertension; in less than 10% of athletic patients, High blood in athletic patients caused by certain diseases, clinical manifestations are hypertension, and degree of hypertension changes with change of diseases, which is called secondary hypertension (Costello & Gumz, 2021). Hypertension is not only a symptom related to hypertension itself, but also an important risk factor for a variety of cardiovascular diseases, affecting function of heart, and ultimately leading to heart failure. The clinical application of ambulatory blood monitoring is superior to other blood monitoring methods. It further clarifies relationship between cardiac structure and blood, and provides a method for clinical research on occurrence and development of hypertension. Relevant literature shows that circadian rhythm of blood in athletic patients with secondary hypertension is higher than that in primary hypertension (Sieminski, Szypenbejl, & Partinen, 2018).

In primary hypertension, blood is mostly similar to that of normal people, and circadian rhythm of blood drop at night can be seen, while secondary hypertension (such as phagocytosis, tumor-induced hypertension, renal hypertension) mostly has no obvious circadian rhythm changes (Silvani, 2019). Accordingly, nocturnal blood drop has become an important condition for judging whether it is essential hypertension. Some athletic patients with secondary hypertension have elevated blood at night, but this is rarely case in patients with primary or primary hypertension (Di Raimondo, Musiari, & Pinto, 2020). In addition, some athletic patients with secondary hypertension have a weakened circadian rhythm, and decrease in nighttime blood is smaller than that of primary hypertension (Kario, Chirinos, et al., 2020). Therefore, by using ABPM technology and other laboratory tests combined with clinical data, it is easy to diagnose hypertension clinical data. type of diagnosis.

5. Conclusion

In conclusion, the study "Complexity Analysis of Dysrhythmia and Cardiac Dysfunction in Elderly Athletic Patients Using Diagnostic Marker Optimization Depth Learning Model" represents a significant advancement in understanding and managing heart-related conditions in elderly athletes. The depth learning model, tailored to optimize diagnostic markers for dysrhythmia and cardiac dysfunction, has shown promising results in accurately identifying and analyzing the complexities of these conditions in this specific patient group.

The findings underscore the unique cardiac challenges faced by elderly athletes, who often exhibit atypical manifestations of heart disease due to their long-term intensive training and physiological adaptations. The depth learning model's capability to discern subtle variations and patterns in cardiac markers specific to this demographic is a breakthrough, offering a more nuanced and effective approach to diagnosis and treatment planning. Moreover, this research highlights the potential of advanced machine learning techniques in revolutionizing cardiac care, particularly for specialized groups like elderly athletes. The model's precision and accuracy in interpreting complex data could lead to earlier detection of cardiac issues, personalized treatment strategies, and better patient outcomes. The study's conclusion advocates for the integration of such innovative technological approaches in clinical practice, emphasizing the need for continuous development and validation of these tools. It paves the way for a new era in cardiac healthcare, where technology-driven solutions are adeptly aligned with the unique needs of different patient populations, including the often-overlooked category of elderly athletes. This approach promises not only to enhance the quality of care but also to extend the active and healthy years in the lives of these seasoned sports enthusiasts.

Data Availability

The experimental data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declared that they have no conflicts of interest regarding this work.

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