OBESITY, LEFT VENTRICULAR REMODELING, AND 24-HOUR BLOOD PRESSURE PROFILE IN MILITARY PERSONNEL WITH ARTERIAL HYPERTENSION: A CONTEMPORARY CLINICAL ASSESSMENT

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Abstract

Background. Obesity is a major modifiable risk factor for cardiovascular disease and strongly contributes to the development of hypertension and left ventricular (LV) remodeling. Military personnel represent a unique population with high cardiometabolic risk due to occupational stress and lifestyle patterns.

Objective. To investigate the relationship between body mass index (BMI), LV structural remodeling, and circadian blood pressure (BP) profile in hypertensive servicemen.

Methods. A total of 112 male servicemen aged 40–56 years were included. Participants underwent anthropometric evaluation, echocardiography, and 24-hour ambulatory BP monitoring (ABPM). They were stratified into three groups: (1) hypertension with obesity (n=41), (2) hypertension with overweight (n=37), and (3) normotensive controls (n=34). Statistical analysis included ANOVA and χ^2 test with $p<0.05$ considered significant.

Results. Servicemen with hypertension and obesity had higher LV mass index (122.4 ± 12.8 g/m²) compared to overweight hypertensives (108.6 ± 10.3 g/m²) and controls (92.7 ± 8.9 g/m², $p<0.001$). The prevalence of concentric remodeling was 48.8% in the obesity group vs 27.0% in the overweight group and 8.8% in controls. ABPM showed higher 24-h systolic BP in the obesity group (136.7 ± 11.2 mmHg) compared with overweight (128.3 ± 9.7 mmHg, $p=0.004$). Non-dipper patterns were more frequent in obesity (51.2%) than in overweight (29.7%) and controls (11.7%).

Conclusion. In hypertensive servicemen, obesity exacerbates LV remodeling and is associated with higher 24-h BP and unfavorable circadian profiles. These findings highlight the importance of targeted screening and weight control strategies in military populations.

Introduction

Hypertension remains the leading global contributor to premature mortality and cardiovascular morbidity. According to the WHO Global Report 2021, approximately

1.28 billion adults worldwide suffer from hypertension, with increasing prevalence in low- and middle-income countries. Among men of working age, particularly those serving in the military, the combination of psychosocial stress, irregular sleep, and suboptimal lifestyle habits increases cardiometabolic risk. Obesity is a critical driver of hypertension and LV remodeling. The 2018 ESC/ESH guidelines and the 2021 European Society of Cardiology consensus emphasize that obesity not only raises BP but also independently contributes to LV hypertrophy and diastolic dysfunction. Recent studies (2017–2025) show that increased BMI correlates with concentric remodeling and adverse ambulatory BP profiles, especially the non-dipper pattern [1,2,5].

ABPM is the gold standard for assessing out-of-office BP. It provides insights into circadian variability, nocturnal dipping, and morning surge, all of which have prognostic implications. Evidence confirms that nocturnal hypertension and non-dipping are closely linked to early LV remodeling and worse outcomes.

Aim: To evaluate the impact of obesity on LV remodeling and circadian BP profile in hypertensive military servicemen using echocardiography and ABPM.

Methods

Study Population. A total of 112 male servicemen aged 40–56 years (mean 45.9 ± 3.1 years) were examined. Hypertension was diagnosed per 2018 ESC/ESH Guidelines.

Groups: (1) Hypertension + Obesity (n=41), (2) Hypertension + Overweight (n=37), (3) Controls (n=34).

Inclusion criteria: male sex, active service, age 40–56, stage I–II hypertension. Exclusion: diabetes, IHD, HF, secondary hypertension, chronic kidney/liver disease, prior antihypertensive therapy.

Examinations: anthropometry, office BP, labs, echocardiography (LVEDD, LVMI, RWT, remodeling types), 24-h ABPM (SBP, DBP, PP, circadian patterns).

Statistics: SPSS v25.0, ANOVA + Tukey, χ^2 test, $p<0.05$ significant.

Results

Obese servicemen had higher BMI and office BP compared with both overweight hypertensives and controls, highlighting the impact of obesity on BP burden (Table 1. Clinical characteristics).

Table 1.

Clinical characteristics of study participants

Parameter	Controls (n=34)	Overweight (n=37)	Obesity (n=41)	p-value
Age (years)	45.1 ± 2.9	46.3 ± 3.0	46.8 ± 3.3	0.212
BMI (kg/m²)	23.4 ± 1.8	28.1 ± 1.6	33.5 ± 2.1	<0.001

Office SBP (mmHg)	124.6 ± 6.2	138.7 ± 7.8	144.2 ± 8.6	<0.001
Office DBP (mmHg)	78.2 ± 5.1	86.5 ± 6.0	91.8 ± 6.7	<0.001

LVMI and relative wall thickness progressively increased with BMI. Concentric hypertrophy was more common in the obesity group (48.8%), supporting obesity as a driver of concentric remodeling (Table 2 Echocardiography).

Table 2.

Echocardiographic parameters

Parameter	Controls	Overweight	Obesity	p-value
LVEDD (mm)	49.2 ± 2.8	51.4 ± 3.0	53.1 ± 3.2	0.014
LVMI (g/m²)	92.7 ± 8.9	108.6 ± 10.3	122.4 ± 12.8	<0.001
RWT	0.38 ± 0.04	0.42 ± 0.05	0.46 ± 0.06	0.003
Concentric hypertrophy %	8.8	27.0	48.8	<0.001

Obese hypertensives had significantly higher 24-h SBP/DBP and more frequent non-dipping (51.2%), reflecting combined structural and functional disturbances (Table 3. ABPM):

Table 3.

ABPM parameters and circadian BP profiles

Parameter	Controls	Overweight	Obesity	p-value
24-h SBP (mmHg)	118.4 ± 7.6	128.3 ± 9.7	136.7 ± 11.2	<0.001
24-h DBP (mmHg)	74.5 ± 5.3	82.6 ± 6.2	88.4 ± 6.9	<0.001
Pulse pressure (mmHg)	43.9 ± 4.2	45.7 ± 5.0	48.3 ± 5.5	0.041
Non-dipper (%)	11.7	29.7	51.2	<0.001
Dipper (%)	82.3	62.2	41.5	<0.001

Discussion

This study shows that hypertensive servicemen with obesity demonstrate greater LV mass index, higher prevalence of concentric remodeling, and unfavorable ABPM profiles. Our findings are consistent with recent evidence linking obesity to concentric hypertrophy and impaired nocturnal BP regulation [3,4,6]. Mechanisms include sympathetic overdrive, sodium retention, systemic inflammation, and sleep apnea.

ABPM revealed that non-dipping was common in obese hypertensives, in agreement with large-scale studies showing its association with LV hypertrophy and stroke risk. Military service conditions—stress, irregular sleep—may amplify these effects.

Strengths: homogeneous cohort, objective ABPM and echo. Limitations: cross-sectional design, modest sample size, no tissue Doppler/strain. Future work: interventional studies to test whether weight loss and circadian BP normalization reverse LV remodeling.

Conclusion

In hypertensive military personnel, obesity is associated with greater LV remodeling, higher 24-h BP, and a higher prevalence of non-dipping. Echocardiography combined with ABPM enhances early risk stratification. Preventive programs targeting weight management and nocturnal BP control are essential to reduce cardiovascular risk in this population.

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