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Clinical Characteristics, Metabolic Factors And Target Organ Damage In Patients With Uncontrolled Arterial Hypertension

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Abstract: Background: Despite significant progress in the pharmacological management of hypertension, uncontrolled arterial hypertension (UAH) remains a critical global health problem. The persistence of elevated blood pressure (BP) despite treatment is associated with increased cardiovascular morbidity, metabolic abnormalities, and irreversible damage to target organs.

Objective: To investigate the clinical and metabolic profile, modifiable risk factors, and structural organ damage among patients with uncontrolled arterial hypertension in Uzbekistan.

Methods: A prospective observational study was conducted among 362 patients aged 35–75 years with stage II–III hypertension who failed to achieve target BP (<140/90 mmHg) despite ongoing therapy. Clinical parameters (BMI, HR, BP), biochemical markers (glucose, lipids, uric acid, creatinine), and instrumental data (echocardiography, funduscopy) were analyzed. GFR was calculated using the CKD-EPI equation. Statistical processing was performed with SPSS v26 using t-test, χ^2 test, and logistic regression.

Results: Men comprised 57.3% of the sample (mean age 58.2 ± 9.1 years). The main metabolic disorders were obesity (64%), dyslipidemia (48%), hyperuricemia (41%), and hyperglycemia (35%). Frequent BP surges (>1/week) occurred in 38% of patients and were associated with significantly higher left ventricular mass index (129 ± 15 vs. 112 ± 12 g/m²; $p < 0.01$), microalbuminuria (46%), and reduced GFR < 60 mL/min/1.73 m² (27%). Independent predictors of uncontrolled BP included obesity (OR = 2.1; 95% CI 1.2–3.8), hyperuricemia (OR = 1.9; 95% CI 1.1–3.2), and HR > 80 bpm (OR = 1.6; 95% CI 1.03–2.5).

Conclusion: UAH represents a multifactorial condition where metabolic imbalance and organ involvement interact to sustain poor BP control. Addressing obesity, hyperuricemia, and lifestyle determinants should be prioritized to improve BP regulation and reduce cardiovascular risk.

Keywords: Uncontrolled hypertension, risk factors, hyperuricemia, obesity, target organ damage, left ventricular hypertrophy.

Introduction: Arterial hypertension (AH) is one of the leading non-communicable diseases, affecting over 1.3 billion adults worldwide and contributing to approximately 10 million deaths annually [1, 2]. Although the use of antihypertensive drugs has expanded globally, only about half of treated patients achieve target BP levels [3]. Uncontrolled hypertension remains a major cause of stroke, ischemic heart disease, and chronic kidney disease [4, 5]. In low- and middle-income countries—including those of Central Asia—BP control rates remain unsatisfactory. In Uzbekistan, previous studies indicate that only 35–40%

of treated hypertensive patients maintain optimal control [6, 7]. Among the major contributors to therapy resistance are: metabolic comorbidities such as obesity and hyperuricemia; suboptimal adherence to therapy and complex medication regimens; insufficient home BP monitoring and delayed therapy adjustments; lifestyle and dietary factors, including high sodium intake and low physical activity. Given the increasing burden of cardiovascular disease in post-COVID conditions, exploring metabolic and clinical determinants of uncontrolled hypertension in local populations has both clinical and public health relevance.

METHODS

Study Population

This prospective study was conducted between 2022 and 2024 at the Tashkent Medical Academy and the Republican Cardiology Center.

Inclusion criteria: Adults aged 35–75 years with documented hypertension (≥140/90 mmHg); Ongoing antihypertensive therapy ≥ 6 months; Lack of BP control (<140/90 mmHg) during follow-up visits. Exclusion criteria: Secondary hypertension, pregnancy, severe heart failure (NYHA IV), or acute coronary events in the last 6 months. Clinical and Laboratory Evaluation. All participants underwent a standardized examination including: Anthropometrics: BMI, waist circumference, waist–hip ratio; Hemodynamics: Mean BP (three consecutive readings, 2 min apart), HR, and BP variability; Laboratory tests: fasting glucose, total cholesterol, HDL-C, LDL-C, triglycerides, uric acid, creatinine; Instrumental diagnostics: echocardiography for LV mass index (LVMI), diastolic function, and relative wall thickness; funduscopy to assess hypertensive retinopathy. Renal function: GFR estimated via the CKD-EPI formula; microalbuminuria measured by immunoturbidimetric assay.

Statistical Analysis

Continuous variables were presented as mean ± SD. Group comparisons used the Student t-test (for normal distributions) or Mann–Whitney U test (for non-normal distributions). Categorical data were analyzed with χ^2 tests. Logistic regression identified independent predictors of uncontrolled BP. A $p < 0.05$ was considered statistically significant.

RESULTS

Demographic and Clinical Characteristics

Among 362 participants, men accounted for 57.3% and women 42.7%. The mean BMI was 31.4 ± 3.8 kg/m², consistent with class I obesity. Obesity was present in 64% of subjects, while 41% had hyperuricemia and 35% hyperglycemia. Patients with frequent hypertensive surges (>1/week) showed significantly higher: LVH prevalence (72% vs 55%; $p < 0.01$), mean LVMI (129 ± 15 vs 112 ± 12 g/m²; $p < 0.01$), and microalbuminuria (46% vs 31%; $p < 0.05$). Metabolic Findings: The average fasting glucose was 6.4 ± 1.1 mmol/L, mean uric acid — 414 ± 86 µmol/L. Dyslipidemia occurred in 48% of patients, primarily with elevated LDL-C and triglycerides. Target Organ Damage: Renal impairment (GFR < 60 mL/min/1.73 m²) was observed in 27% of participants. LVH was the most prevalent form of cardiac remodeling (72%), with concentric hypertrophy predominating. Predictors of Poor BP Control. Multivariate logistic regression revealed: Obesity (OR = 2.1; 95% CI 1.2–3.8; $p < 0.01$), Hyperuricemia (OR = 1.9; 95% CI 1.1–3.2; $p < 0.05$), Heart rate > 80 bpm (OR = 1.6; 95% CI 1.03–2.5; $p < 0.05$) as independent predictors of UAH.

DISCUSSION

The findings demonstrate a strong interplay between metabolic dysfunction and poor BP control. Obesity contributes to increased sympathetic activity, sodium retention, and RAAS activation, while hyperuricemia promotes endothelial dysfunction and arterial stiffness [8–10]. Our results align with international evidence, such as the SPRINT trial (2015) and the PURE study (2020), confirming that metabolic comorbidities predict adverse cardiovascular outcomes and complicate BP management. The high prevalence of LVH (72%) and CKD (27%) in this cohort underscores the need for integrated care at the primary level. According to ESC/ESH 2023 guidelines [11], comprehensive control strategies—including weight loss, dietary sodium restriction, and pharmacological uric acid management—are crucial for resistant hypertension.

CONCLUSION

Uncontrolled hypertension represents a complex interplay of metabolic, hemodynamic, and behavioral factors. The presence of obesity, hyperuricemia, and high heart rate significantly increases the risk of target organ damage.

Integrating lifestyle interventions, weight reduction, and uric acid control into hypertension management could substantially improve BP regulation and reduce cardiovascular risk.

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