

Resting and post-exercise diastolic function in asymptomatic hypertensive diabetic patients with elevated NT-proBNP

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Funding Acknowledgements: None.

Background: The term "heart stress" has recently been introduced to identify asymptomatic individuals with cardiovascular risk factors and elevated plasma natriuretic peptide levels. However, it remains unclear whether such patients necessarily exhibit structural or functional cardiac abnormalities. Arterial hypertension and type 2 diabetes mellitus are major risk factors for the development of heart failure. Diastolic properties of the left ventricle (LV) are often impaired in this population.

The purpose of this study was to assess both resting and post-exercise LV diastolic function (DF) in hypertensive diabetic patients with elevated NT-proBNP levels.

Methods: Seventy-seven patients (mean age 62 ± 7 years; 31 males, 46 females) with uncomplicated arterial hypertension and type 2 diabetes mellitus were enrolled. Age-specific NT-proBNP cut-off values were applied: 75 pg/mL (<50 years), 150 pg/mL (50–74 years), and 300 pg/mL (≥ 75 years). Patients were divided into two groups: "heart stress" (elevated NT-proBNP) and "heart health" (normal NT-proBNP). Diastolic function was assessed using the 2024 BSE algorithm, including average E/e' ratio, left atrial (LA) volume index, and tricuspid regurgitation (TR) velocity. LA reservoir strain (LARs) was evaluated when only two criteria (one positive, one negative) were available. LARs $\geq 30\%$ or pump strain $\geq 14\%$ were considered normal; LARs $< 18\%$ was considered abnormal; values between 18–29% were categorized as borderline. The LA stiffness index was calculated as the E/e' ratio divided by LA global longitudinal strain (GLS). A diastolic stress test using a treadmill was considered positive if the average E/e' exceeded 14 and TR velocity exceeded 2.8 m/s during exercise.

Results: Thirty-two patients (41.5%) exhibited elevated age-specific NT-proBNP levels. There were no significant differences in age, sex, office blood pressure, glycated hemoglobin, LV mass index, or LV ejection fraction between the groups (Table). LA volume index, maximum TR velocity, LARs, and LA stiffness index were comparable. However, both resting and post-exercise E/e' ratios were significantly higher in the "heart stress" group ($p = 0.02$ and $p = 0.03$, respectively). A positive diastolic stress test was observed in 8 patients (10.4%) within the "heart stress" group, while all tests were negative in the "heart health" group.

Conclusions: Identification of "cardiac stress" via elevated NT-proBNP is a valid approach for detecting early cardiac dysfunction in asymptomatic hypertensive patients with type 2 diabetes mellitus. Further echocardiographic assessment revealed significant impairments in both resting and post-exercise DF. Diastolic stress testing found unrecognized heart failure in 25% of these patients. Early identification of this cohort is crucial for timely intervention.

Clinical and echocardiography parameters

Parameter	Normal NT-proBNP "Heart health" (n=45)	Elevated NT-proBNP "Heart stress" (n=32)	p
Age, years	62 (56-66)	63 (59-69)	0,19
LV mass index, g/m ²	83,5 (71-101)	93 (78-104)	0,09
LV ejection fraction, %	62 (57-67)	65 (60-68)	0,1
LA volume index, ml/m ²	31,9 (27,8-37,9)	33,4 (29,6-37,1)	0,47
Maximum TR velocity, m/s	2,3 (2,1-2,5)	2,28 (2,04-2,56)	0,7
Resting E/e' average	9,8 (8,9-10,9)	11,2 (9,7-14,1)	0,02
LARs, %	24 (18-27)	22 (17,5-27)	0,43
LA stiffness index	0,41 (0,34-0,56)	0,52 (0,4-0,69)	0,08
Post-exercise E/e' average	10,1 (8,4-12,6)	11,7 (9,4-14,8)	0,03
Positive diastolic stress-test, n (%)	0	8 (10,4)	

The values are given as median and interquartile range