Impaired exercise tolerance is associated with increased urine albumin excretion in the early stages of essential hypertension

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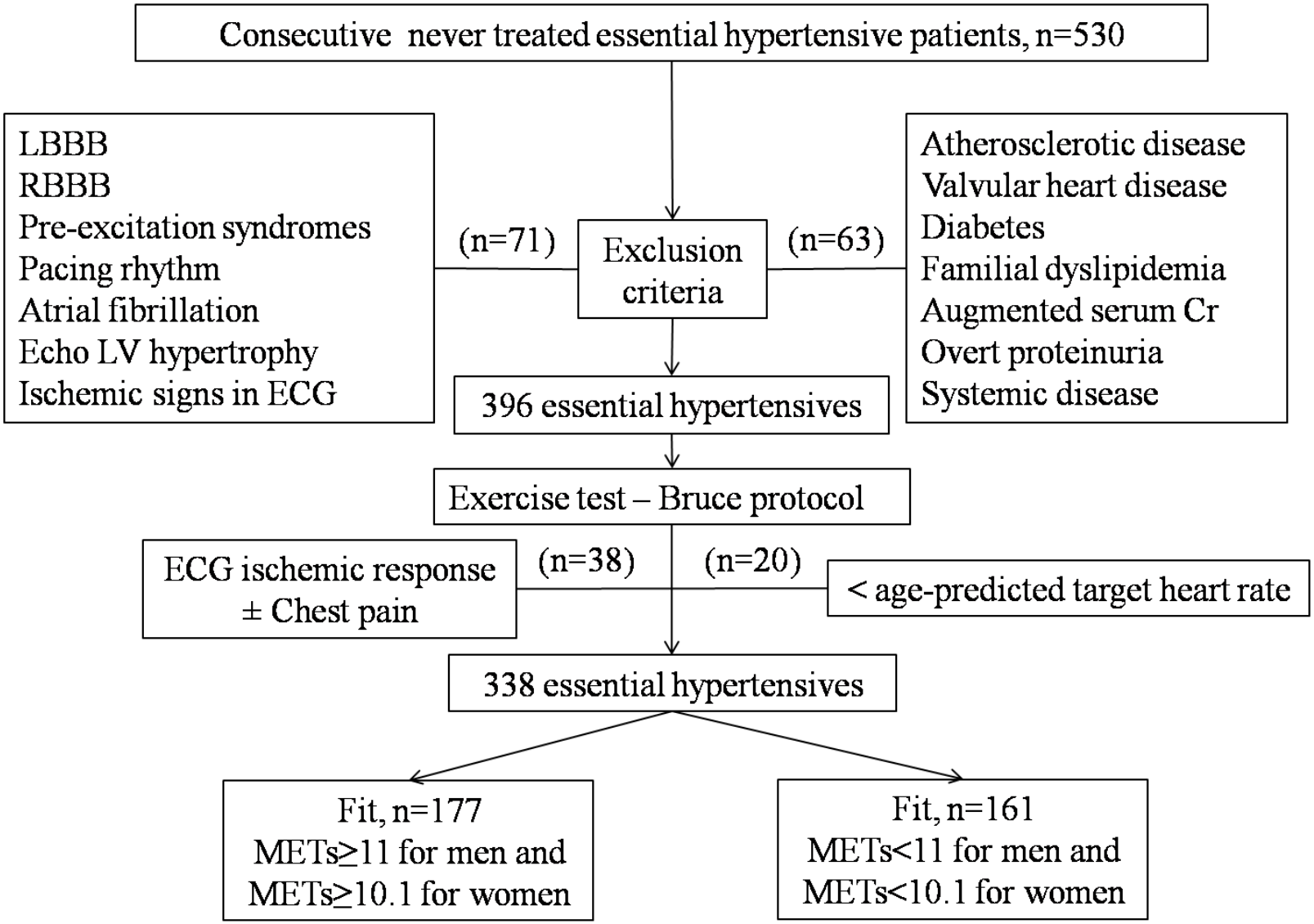
INTRODUCTION

- Decreased exercise capacity is predictive of mortality over and above demographics and standard CV risk factors
- Although several studies have examined the cardiac structural and functional determinants of exercise capacity, few have investigated the plausible associations between exercise capacity and renal damage

Study Purpose

We sought to investigate the relationship between impaired exercise capacity and target organ damage in the setting of untreated essential hypertension (EH)

Study population



Methods

- ✓ All the participants underwent 24hour ABPM and complete echocardiographic study including left ventricular (LV) diastolic function evaluation by pulsed tissue Doppler Imaging **(TDI)**, averaging diastolic mitral annular velocities **(Em, Am, Em/Am ratio)**
- ✓ Moreover, in all subjects urinary albumin excretion, expressed as the albumin to creatinine ratio (ACR), was determined as the mean of two non-consecutive morning spot urine samples.

Clinical characteristics and laboratory findings

Parameter	Fit hypertensives (n=177)	Unfit hypertensives (n=161)	p
Age (years)	49.5 ± 8.8	54.0 ± 8.3	**<0.001**
Gender (males) (%)	67.8	66.4	0.81
Body mass index (kg/m^2)	27.6 ± 3.4	29.0 ± 4.0	**0.001**
Waist (cm)	95.2 ± 11.4	99.7 ± 12.1	**<0.001**
Smokers (%)	33.7	32.3	0.51
Office SBP (mmHg)	148.0 ± 16.6	149.2 ± 15.6	0.46
Office DBP (mmHg)	96.1 ± 9.5	96.1 ± 9.9	0.90
Office Pulse Pressure (mmHg)	52.1 ± 13.1	53.4 ± 13.7	0.41
Office heart rate (bpm)	76.5 ± 7.8	78.0 ± 9.2	0.24
24-h SBP (mmHg)	131.6 ± 11.3	134.2 ± 12.1	**0.043**
24-h DBP (mmHg)	83.6 ± 6.1	83.2 ± 5.6	0.64
24-h Pulse Pressure (mmHg)	47.9 ± 7.9	51.0 ± 9	**0.001**
24-h heart rate (bpm)	74.2 ± 9.4	74.6 ± 10.6	0.69
Glucose (mg/dl)	95.0 ± 11.5	98.7 ± 14	**0.01**
Serum creatinine (mg/dl)	0.94 ± 0.17	0.91 ± 0.16	0.06
eGFR	105.6 ± 26	107.3 ± 28	0.56
HbA1C	5.4 ± 0.4	5.4 ± 0.4	0.87
Total Cholesterol (mg/dl)	219.4 ± 44	223.8 ± 39	0.35
HDL Cholesterol (mg/dl)	51.4 ± 12	51.2 ± 13	0.86
LDL Cholesterol (mg/dl)	144.5 ± 31	152.0 ± 32	**0.04**
Triglycerides (mg/dl)	124.6 ± 60	117.5 ± 48	0.24
ACR (mg/g)	7 (5-10)	8 (5-19.5)	**0.003**
Microalbuminuria (%)	10.3	19.5	**0.035**

Echocardiographic parameters

Parameter	Fit hypertensives (n=177)	Unfit hypertensives (n=161)	P
mass index (gr/m^2)	83.7 ± 19	85.0 ± 19.3	0.56
Relative wall thickness	0.43 ± 0.08	0.44 ± 0.08	0.28
Left atrial diameter (mm)	37.3 ± 4.9	38.4 ± 4.2	**0.04**
E (m/s)	0.74 ± 0.16	0.75 ± 0.15	0.63
A (m/s)	0.73 ± 0.14	0.77 ± 0.14	**0.009**
E/A	1.04 ± 0.26	1.00 ± 0.27	0.15
Isovolumic Relaxation Time (ms)	93.2 ± 20	93.4 ± 19	0.92
Deceleration Time (ms)	229.3 ±51	229.2 ± 50	0.98
Em (cm/s)	9.1 ± 2.4	8.3 ± 2.4	**0.007**
Am (cm/s)	10.6 ± 1.8	10.8 ± 2.2	0.47
Em/Am	0.86 ± 0.22	0.78 ± 0.22	**0.002**
E/Em	8.8 ± 3.4	9.8 ± 3.1	**0.013**
Diastolic function	33.5	48.4	**0.007**

E/A = transmitral inflow velocities ratio, Em/Am = TDI-derived mitral annular velocities ratio

Data from exercise for fit and unfit hypertensives

Parameter	Fit hypertensives (n=177)	Unfit hypertensives (n=161)	P
Duration (min)	10.4 ± 1.4	7.3 ± 1.6	**<0.001**
METs (ml/kg/min)	12.3 ± 1.6	8.8 ± 1.5	**<0.001**
Resting SBP (mmHg)	133.0 ± 16.4	134.7 ± 16.3	0.35
Resting DBP (mmHg)	84.7 ± 9.9	83.6 ± 9.9	0.28
Resting Pulse Pressure (mmHg)	48.2 ± 12.8	51.1 ± 15.1	0.07
Resting heart rate (bpm)	84.5 ± 14.3	81.9 ± 13.4	0.10
Peak exercise SBP (mmHg)	187.2 ± 23	191.2 ± 24.7	0.12
Peak exercise DBP (mmHg)	90.5 ± 12	89.3 ± 12.1	0.39
Peak exercise Pulse Pressure (mmHg)	96.7 ± 21.2	101.9 ± 22.8	**0.031**
Peak exercise heart rate (bpm)	165.1 ± 13.4	153.6 ± 20.3	**<0.001**

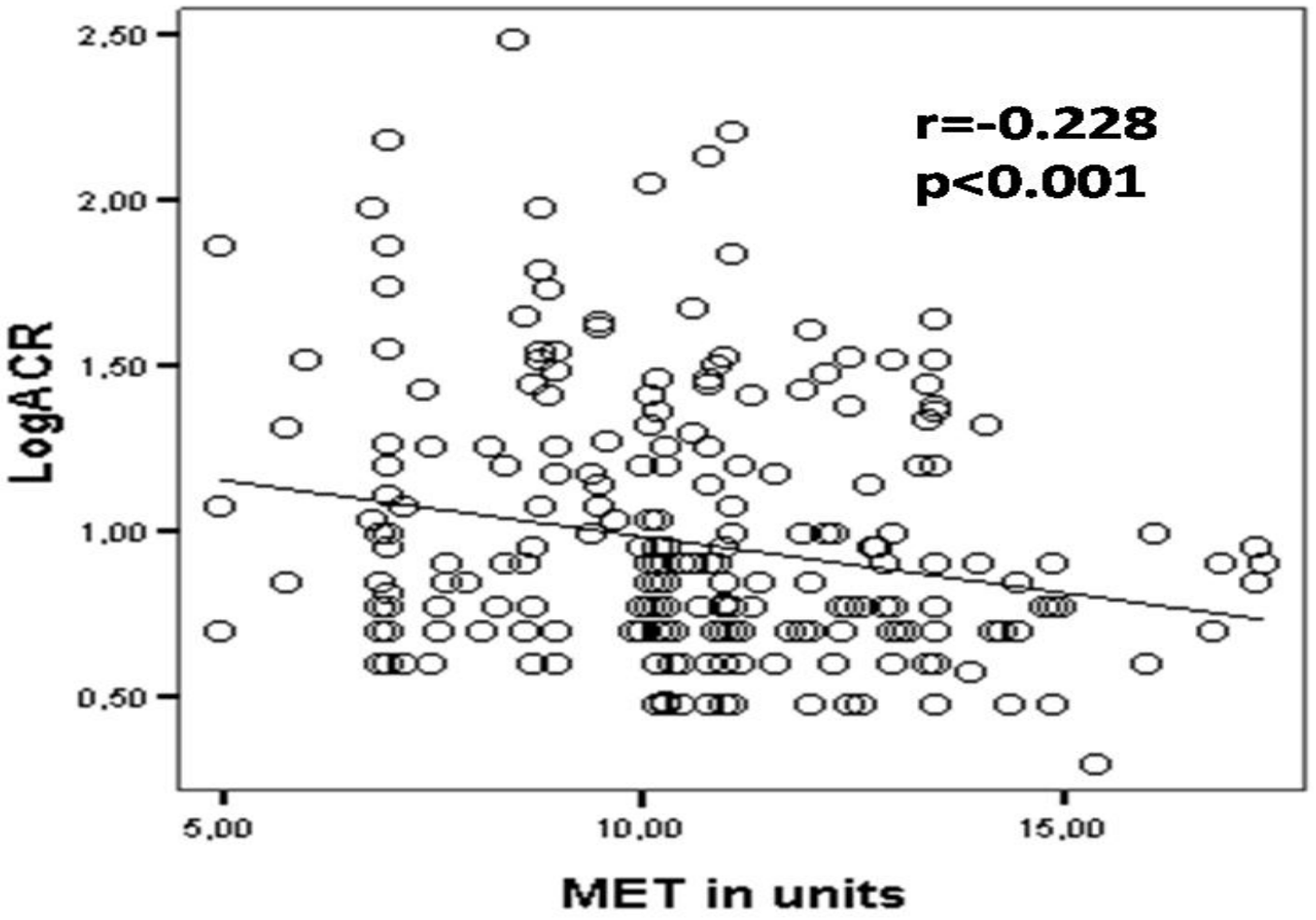
METs = Metabolic equivalents, SBP & DBP = systolic & diastolic blood pressure

Independent predictors of METs in stepwise multiple linear regression analysis

Variable	B	*Beta*	Multiple R	*P*
Age	-0.091	-0.338	0.405	**<0.001**
Gender	1.446	0.274	0.505	**<0.001**
Body mass index	-0.148	-0.304	0.556	**<0.001**
LogACR	-0.955	-0.151	0.576	**0.004**

Age, sex, body mass index, logACR, E/Em and 24-hour systolic BP were included in the analysis

METs = Metabolic equivalents, ACR = albumin to crtinine ratio


r=-0.228
p<0.001
LogACR
2,50
2,00
1,50
1,00
0,50
5,00
10,00
15,00
MET in units

Conclusions

- Newly-diagnosed essential hypertensive subjects with diminished exercise tolerance are characterized by increased albumin excretion levels even before the development of LV hypertrophy.
- According to our results, albuminuria assessment could be used to identify patients with impaired physical activity, providing additional prognostic information and underscoring the importance of its measurement in the whole spectrum of hypertensive disease.