Correlation between atrial electrocardiographic indexes and left atrial enlargement in competitive athletes. From the ALMUDAINA case-control study

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Background: Left atrial (LA) remodelling and enlargement in athletes is a well-kown component of the athlete's heart. However, information about the correlation between of LA enlargement and atrial electrophysiological features in athletes is scarce.

Purpose: Our aim was to characterize LA enlargement, P-wave duration, and the prevalence of interatrial block (IAB) in competitive athletes (with and without LA enlargement) and in controls.

Methods: ALMUDAINA (Analysis of Left atrial Measurements of Ultrasound Dilation Among International and National Athletes) was a nationwide, cross-sectional study involving 9 hospitals and sport clinics across Spain. Cases fulfilled the international consensus definition of a competitive athlete and were currently engaged in skill, power, mixed or endurance disciplines at a national or international level. The following P-wave parameters were analysed: 1) duration 2) voltage in lead I and 3) the presence of interatrial block (IAB). LA enlargement was defined as an indexed volume by body surface area ≥34 ml/m^2, measured by transthoracic echocardiography. A contemporary cohort of otherwise healthy and active controls was used as a comparison group.

Results: Baseline clinical and echocardiographic characteristics of both cohorts are summarised in table 1 whereas electrocardiographic characteristics are displayed in table 2, respectively. 356 subjects were included, 308 athletes (mean age: 36.4±11.6 years) and 48 controls (mean age: 49.3±16.1 years). Athletes showed a higher mean LA indexed volume (29.8±8.6 vs. 25.6±8.0 mL/m^2, P=0.006) and higher prevalence of LA enlargement (113 [36.7%] vs. 5 [10.4%], P<0.001), but there were no relevant differences in P-wave duration (106.3±12.5 ms vs 108.2±7.7 ms; P=0.31), voltage in lead I (0.08±0.04 vs. 0.08±0,04 mV; P=0.79) and the prevalence of IAB (40 [13.0%] vs. 4 [8.3%], P=0.36). Only a case of advance IAB was detected, in an athlete without LA enlargement. Among athletes, those with LA enlargement (113, 36.7%) had higher P-wave duration (110.3±14.1 vs. 103.0±10.9 ms, P<0.001) and a higher prevalence of interatrial blockade (23 [20.4%] vs. 17 [8.8%], P=0.004), but similar voltage of P-wave in lead I (0.08±0.003 vs. 0.08±0.05 mV, P=0.689). In a multivariate analysis, competitive training was independently associated with LA enlargement (odds ratio [OR] 14.7, 95% confidence interval [CI] 4.7–44.0; P<0.001) but was not associated with P-wave duration (OR 1.02, 95% CI: 0.99–1.04; P=0.19) or IAB (OR 1.4, 95% CI 0.7–3.1; P=0.34).

Conclusions: LA enlargement is prevalent in adult competitive athletes. However, ECG indexes of atrial electrophysiology were not different from healthy controls. Our data suggest that LA enlargement and IAB are two different entities.

Table 1. Baseline clinical and echocardiographic characteristics of athletes and controls. Data are presented as frequencies (percentages) o mean (± standard deviation, SD), as appropriate. IVS, interventricular septum; LAiV, left atrial indexed volume; LV, left ventricle. LVEF, left ventricular ejection fraction; TAPSE, tricuspid annular plane systolic excursión; PW, posterior wall.

	Athletes (n = 308)	Controls (n = 48)	*P*
Age (years), mean ± SD	36.4 ± 11.6	49.3 ± 16.1	<.001
Women, n (%)	80 (26.0%)	20 (41.7%)	.02
Body mass index (kg/m^2), mean ± SD	22.5 ± 4.9	22.5 ± 3.5	.02
Comorbidities, n (%)			
Arterial hypertension	8 (2.6%)	12 (25.0%)	<.001
Dyslipidaemia	13 (4.2%)	15 (31.3%)	<.001
Smoker (former o present)	9 (2.9%)	13 (15.4%)	<.001
Diabetes	0	4 (8.3%)	<.001
LAiV (ml/m^2), mean ± SD	29.8 ± 8.6	25.6 ± 8.0	.006
Left atrial enlargement, n (%)	113 (36.7%)	5 (10.4%)	<.001
Mild	98 (31.8%)	5 (10.4%)	
Moderate	10 (3.2%)	0	
Severe	5 (1.6%)	0	
IVS thickness (mm), mean ± SD	9.7 ± 1.55	8.8 ± 1.6	.002
PW thickness (mm), mean ± SD	9.6 ± 2.7	9.1 ± 6.2	.53
LV end-diastolic diameter (mm), mean ± SD	51.6 ± 4.3	48.0 ± 5.7	<.001
LV end-systolic diameter (mm), mean ± SD	32.1 ± 4.2	27.4 ± 5.5	<.001
LV indexed mass (g/m^2), mean ± SD	96.0 ± 22.1	88.0 ± 11.3	.09
LVEF (%), mean ± SD	68.1 ± 5.1	72.9 ± 5.4	<.001
TAPSE (mm), mean ± SD	25.9 ± 2.7	23.2 ± 3.8	<.001
Transmitral filling pattern, n (%)			.483
Normal	273 (88.6%)	44 (91.7%)	
Impaired relaxation	34 (11.0%)	4 (8.3%)	
Pseudonormal o restrictive	1 (0.3%)	0	

Table 2. Electrocardiographic data analysis of athletes and controls. Data are presented as frequencies (percentages) o mean (± standard deviation, SD), as appropriate.

	Athletes (n = 308)	Controls (n = 48)	*P*
P-wave			
P-wave duration (ms), mean ± SD	106.3 ± 12.5	108.2 ± 7.7	.31
Voltage in lead DI (mV), mean ± SD	0.08 ± 0.04	0.08 ± 0.04	.79
Interatrial block, n (%)	40 (13.0%)	4 (8.3%)	.36
Other ECG parameters			
PR interval (ms), mean ± SD	167.0 ± 25.1	164.8 ± 21.5	.56
Right bundle branch block, n (%)			.05
No	259 (84.1%)	46 (95.8%)	
Incomplete	45 (14.6%)	1 (2.1%)	
Complete	3 (1.0%)	1 (2.1%)	
QRS complex duration (ms), mean ± SD	84.3 ± 11.2	84.8 ± 10.9	.79
QRS complex axis (º), mean ± SD	55.2 ± 30.1	49.7 ± 28.4	.23
QTc interval (ms), mean ± SD	392.8 ± 23.3	398.2 ± 26.2	.14