

WALKING POSTER PRESENTATION

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Electrocardiographic detection of left atrial enlargement in arterial hypertension: re-calibration against cardiac magnetic resonance

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Background

Both American and European guidelines on the management of arterial hypertension advise that an electrocardiogram (ECG) be routinely performed in all patients with arterial hypertension. The ECG may demonstrate evidence of left atrial enlargement (LAE), which has adverse prognostic implications in hypertension. We sought to determine the accuracy of 5 ECG criteria of LAE in a hypertensive cohort relative to cardiac magnetic resonance (CMR) gold-standard. We also sought to investigate the confounding effect of obesity.

Methods

Consecutive referrals for CMR (1.5T) from a tertiary hypertension clinic were reviewed. Patients with any concomitant cardiac pathology other than hypertension were excluded. ECGs were assessed, blinded to the CMR data, for:

- 1) P wave >110 ms
- 2) P mitrale (notched P wave with inter-peak duration >40 ms)
- 3) P wave axis <30°
- 4) Area of negative P terminal force in lead V1 (NPTF-V1) > 40 ms·mm
- 5) Positive P terminal force in aVL (PPTF-aVL) >0.5 mm

LA volume (LAV), excluding LA appendage and pulmonary vein confluence, was measured at maximum atrial diastole using the biplane area-length method, which has previously been validated against LA short axis cine stack measurements. LAV were indexed to

body surface area. LAE was defined as ≥ 55 ml/m² (>2 standard deviations above the mean published references value for normal, healthy volunteers). CMR analysis was performed blinded to ECG data. Sensitivity, specificity, positive predictive value, negative predictive value and accuracy were calculated. Area under the receiver operator curve analysis was performed.

Results

130 patients were included (age: 51.4 ± 15.1 years, 47% male, 51% obese, systolic blood pressure: 171 ± 29 mmHg, diastolic blood pressure: 97 ± 15 mmHg).

The prevalence of LAE by CMR was 26% and the prevalence by ECG varied from 1% (P mitrale) to 27% (P axis < 30°), and was 46% when ≥ 1 ECG LAE criteria were present (Figure 1). There was no significant difference in mean indexed LA volume when ≥ 1 ECG LAE criterion was present compared to when no ECG LAE criteria were present (47 ± 15 vs 50 ± 15 ml/m², $P = 0.235$). All the individual ECG LAE criteria were more specific than sensitive (Figure 1), with specificities ranging from 70% (P axis <30°) to 99% (P mitrale). Subgroup analysis by obesity is demonstrated in Figure 2. Obesity attenuated the specificity of most of the individual ECG LAE criteria. Obesity correlated with significant lower specificity (48% vs 65%, $P < 0.05$) and a trend towards lower sensitivity (59% vs 43%, $P = 0.119$) when ≥ 1 ECG criteria of LAE were present

Conclusions

Individual ECG criteria of LAE in hypertension are specific, but not sensitive, for identifying anatomical LAE, relative to CMR. LAE in hypertension should not be

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	Prevalence ECG LAE (%)	ROC-AUC (95 th CI)	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	ACC (%)
P > 110 ms	9	0.497 (0.384 – 0.610)	9	91	25	74	69
P mitrale	1	0.495 (0.382 – 0.608)	0	99	0	74	73
P axis < 30°	27	0.437 (0.328 – 0.546)	18	70	17	71	56
NPTF-V1 > 40 ms.mm	17	0.465 (0.355 – 0.576)	12	81	18	72	63
PPTF-aVL > 0.5 mm	8	0.502 (0.389 – 0.616)	9	92	27	74	70
Any ECG criteria for LAE	46	0.387 (0.279 – 0.495)	29	48	17	65	43

Figure 1 Diagnostic performance of the various ECG parameters at detecting left atrial enlargement. (LAE = left atrial enlargement, ROC-AUC = receiver operator curve-area under curve, CI = confidence interval, PPV = positive predictive value, NPV = negative predictive values, ACC = accuracy)

	Prevalence ECG LAE (%)	ROC-AUC (95 th CI)	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	ACC (%)
P > 110 ms							
Non-obese	10	0.515 (0.352 – 0.679)	12	91	33	74	70
Obese	9	0.519 (0.357 – 0.681)	12	92	33	75	72
P mitrale							
Non-obese	2	0.529 (0.364 – 0.695)	0	98	0	74	73
Obese	0	0.500 (0.340 – 0.660)	0	100	0	75	75
P axis < 30°							
Non-obese	21	0.560 (0.395 – 0.725)	29	83	38	76	68
Obese	34	0.467 (0.309 – 0.625)	29	64	22	73	55
NPTF-V1 > 40 ms.mm							
Non-obese	11	0.504 (0.342 – 0.667)	12	89	29	73	68
Obese	21	0.478 (0.320 – 0.636)	18	78	21	74	63
PPTF-aVL > 0.5 mm							
Non-obese	6	0.537 (0.371 – 0.703)	12	96	50	75	73
Obese	10	0.469 (0.314 – 0.625)	6	88	14	73	67
Any ECG criteria for LAE							
Non-obese	41	0.620 (0.462 – 0.778)	59	65	38	81	63
Obese	51	0.475 (0.315 – 0.635)	47	48	24	73	48

Figure 2 Gender subgroup analysis of diagnostic performance of the various ECG parameters at detecting left atrial enlargement. (LAE = left atrial enlargement, ROC-AUC = receiver operator curve-area under curve, CI = confidence interval, PPV = positive predictive value, NPV = negative predictive values, ACC = accuracy)

excluded on the basis of the ECG, particularly in obese subjects.

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