Supplementary material

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Electrocardiography and cardiac magnetic resonance imaging in the detection of left ventricular hypertrophy: the impact of indexing methods

Brief title: ECG and CMR imaging in the detection of LVH

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Supplementary Table S1. Summary of electrocardiographic and cardiac magnetic resonance imaging criteria used for the diagnosis of left ventricular hypertrophy.

ECG-LVH criteria	**Cutoff values for the diagnosis of LVH**
R wave amplitude in V_5 or V_6	> 2.6 mV [1]
Sokolow-Lyon voltage: S wave amplitude in V_1 + R wave amplitude in V_5 or V_6	> 3.5 mV [1]
Sokolow-Lyon product: (S wave amplitude in V_1 + R wave amplitude in V_5 or V_6) × QRS duration	≥ 371 mV × ms [2]
S wave amplitude in V_2 + R wave amplitude in V_5 or V_6	> 4.5 mV [1]
R wave amplitude in aVL	> 1.1 mV [1]
R wave amplitude in aVL × QRS duration	> 103 mV × ms [3]
Cornell voltage: R wave amplitude in aVL + S wave amplitude in V_3	> 2.8 mV (M) or > 2 mV (F) [1]
Cornell (voltage-duration) product: (R wave amplitude in aVL + S wave amplitude in V_3) × QRS duration (M), (R wave amplitude in aVL + S wave amplitude in V_3 + 0.8 mV) × QRS duration (F)	≥ 244 mV × ms [4]
Gubner-Ungerleider: R wave amplitude in I + S wave amplitude in III	> 2.5 mV [1]
Peguero-Lo Presti:	≥ 2.3 mV (F) or ≥ 2.8 mV (M) [5]

S_D (the deepest S-wave in any single lead) + S wave amplitude in V_4	
CMR-LVH criteria	**Cutoff values for the diagnosis of LVH**
LVM	> 148 g (M) or > 96 g (F) [6]
%pLVM	> 1.31 [7-9]
LVM/BSA(MESA)	> 106.2 g/m^2 (M) or > 84.6 g/m^2 (F) [8, 10]
LVM/BSA	> 72 g/m^2 (M) or > 55 g/m^2 (F) [6]
LVM/height$^{1.7}$	≥ 80 g/m$^{1.7}$ (M) or ≥ 60 g/m$^{1.7}$ (F) [8, 11]
LVM/height$^{2.7}$	> 45.1 g/m$^{2.7}$ (M) or > 38 g/m$^{2.7}$ (F) [8, 10]

BSA – body surface area; ECG – electrocardiography; F– female; LVH – left ventricular hypertrophy; LVM – left ventricular mass; M – male; MESA - Multi-Ethnic Study of Atherosclerosis; %pLVM – percent-predicted LVM.

Supplementary Table S2. Electrocardiographic criteria for the diagnosis of left ventricular hypertrophy parameters in patients with and without left ventricular hypertrophy based on percentage of predicted left ventricular mass.

ECG-LVH criteria parameters	**%pLVM > 1.31; n = 6**	**%pLVM ≤ 1.31; n = 47**	***P* value**
R wave amplitude in V_5 or V_6, mV	1.1 ± 0.7	1.3 ± 0.6	0.41
S wave amplitude in V_1 + R wave amplitude in V_5 or V_6, mV	2.7 ± 1.2	2.1 ± 0.7	0.07
(S wave amplitude in V_1 + R wave amplitude in V_5 or V_6) × QRS duration, mV × ms	262.9 ± 129.0	186.1 ± 73.7	**0.03**
S wave amplitude in V_2 + R wave amplitude in V_5 or V_6, mV	3.0 (2.2-4.2)	2.4 (1.9-3.1)	0.26
R wave amplitude in aVL, mV	0.7 (0.3-1.1)	0.3 (0.1-0.5)	0.07
R wave amplitude in aVL × QRS duration, mV × ms	63.8 (20.0-119.6)	27.5 (11.0-40.0)	0.07
R wave amplitude in aVL + S wave amplitude in V_3, mV	2.4 (1.4-2.8)	1.1 (0.8-1.7)	**0.01**
(R wave amplitude in aVL + S wave amplitude in V_3) × QRS duration (M), (R wave amplitude in aVL + S wave	233.8 (166.0-303.9)	120.0 (64.0-184.0)	**0.003**

amplitude in V_3 + 0.8 mV) × QRS duration (F), mV × ms			
R wave amplitude in I + S wave amplitude in III, mV	1.4 (0.6-2.1)	0.7 (0.5-1.1)	0.12
S_D + S wave amplitude in V_4, mV	3.4 (2.8-4.0)	2.0 (1.5-2.9)	**0.004**

Data are presented as mean ± standard deviation or median (interquartile range). For abbreviations see the description of Supplementary Table S1.

Supplementary Table S3. Electrocardiographic criteria for the diagnosis of left ventricular hypertrophy parameters in patients with and without left ventricular hypertrophy based on left ventricular mass indexed by body surface area according to cutoff values proposed by Multi-Ethnic Study of Atherosclerosis.

ECG-LVH criteria parameters	**LVM/BSA (MESA) > 106.2 g/m^2 (M) or > 84.6 g/m^2 (F); n = 8**	**LVM/BSA (MESA) ≤ 106.2 g/m^2 (M) or ≤ 84.6 g/m^2 (F); n = 45**	***P* value**
R wave amplitude in V_5 or V_6, mV	1.2 ± 0.7	1.3 ± 0.6	0.74
S wave amplitude in V_1 + R wave amplitude in V_5 or V_6, mV	2.6 ± 1.1	2.1 ± 0.7	0.10
(S wave amplitude in V_1 + R wave amplitude in V_5 or V_6) × QRS duration, mV × ms	251.7 ± 121.0	184.7 ± 72.5	**0.04**
S wave amplitude in V_2 + R wave amplitude in V_5 or V_6, mV	3.4 (2.2-4.1)	2.4 (1.9-3.1)	0.08
R wave amplitude in aVL, mV	0.5 (0.1-0.9)	0.3 (0.1-0.5)	0.38
R wave amplitude in aVL × QRS duration, mV × ms	41.8 (12.0-100.4)	28.0 (11.5-40.0)	0.34
R wave amplitude in aVL + S wave amplitude in V_3, mV	2.1 (1.5-2.7)	1.1 (0.8-1.7)	**0.004**
(R wave amplitude in aVL + S wave amplitude in V_3) × QRS duration (M), (R wave amplitude in aVL + S wave amplitude in V_3	206.3 (162.0-295.6)	116.0 (64.0-180.0)	**0.003**

+ 0.8 mV) × QRS duration (F), mV × ms			
R wave amplitude in I + S wave amplitude in III, mV	1.0 (0.5-1.8)	0.7 (0.5-1.1)	0.49
S_D + S wave amplitude in V_4, mV	3.4 (2.8-4.0)	2.0 (1.5-2.9)	< **0.001**

Data are presented as mean ± standard deviation or median (interquartile range). For abbreviations see the description of Supplementary Table S1.

Supplementary Table S4. Electrocardiographic criteria for the diagnosis of left ventricular hypertrophy parameters in patients with and without left ventricular hypertrophy based on left ventricular mass indexed by body surface area according to cutoff values proposed by Petersen et al. [6].

ECG-LVH criteria parameters	**LVM/BSA** **> 72 g/m^2 (M) or** **> 55 g/m^2 (F); n = 38**	**LVM/BSA** **≤ 72 g/m^2 (M) or** **≤ 55 g/m^2 (F); n = 15**	***P* value**
R wave amplitude in V_5 or V_6, mV	1.4 ± 0.6	1.2 ± 0.6	0.42
S wave amplitude in V_1 + R wave amplitude in V_5 or V_6, mV	2.3 (1.9-3.3)	2.1 (1.6-2.5)	0.06
(S wave amplitude in V_1 + R wave amplitude in V_5 or V_6) × QRS duration, mV × ms	253.0 (148.0-308.0)	176.0 (132.0-239.1)	0.14
S wave amplitude in V_2 + R wave amplitude in V_5 or V_6, mV	3.0 (2.2-4.1)	2.4 (1.8-3.1)	0.25
R wave amplitude in aVL, mV	0.7 (0.2-0.9)	0.3 (0.1-0.5)	0.10
R wave amplitude in aVL × QRS duration, mV × ms	56.0 (16.0-93.5)	26.0 (11.3-40.0)	0.10
R wave amplitude in aVL + S wave amplitude in V_3, mV	1.5 ± 0.8	1.1 ± 0.5	0.12
(R wave amplitude in aVL + S wave amplitude in V_3) × QRS duration (M), (R wave amplitude in aVL + S wave amplitude in V_3	152.2 ± 86.7	110.2 ± 60.5	0.09

+ 0.8 mV) × QRS duration (F), mV × ms			
R wave amplitude in I + S wave amplitude in III, mV	1.2 (0.6-1.7)	0.7 (0.5-1.1)	0.46
S_D + S wave amplitude in V_4, mV	3.3 (2.6-3.9)	2.0 (1.5-2.9)	**0.04**

Data are presented as mean ± standard deviation or median (interquartile range). For abbreviations see the description of Supplementary Table S1.

Supplementary Table S5. Electrocardiographic criteria for the diagnosis of left ventricular hypertrophy parameters in patients with and without left ventricular hypertrophy based on left ventricular mass indexed by heigh$^{1.7}$ according to cutoff values proposed by Multi-Ethnic Study of Atherosclerosis.

ECG-LVH criteria parameters	**LVM/height$^{1.7}$ ≥ 80 g/m$^{1.7}$ (M) or ≥ 60 g/m$^{1.7}$ (F); n = 9**	**LVM/height$^{1.7}$ < 80 g/m$^{1.7}$ (M) or < 60 g/m$^{1.7}$ (F); n = 44**	***P* value**
R wave amplitude in V_5 or V_6, mV	1.2 ± 0.6	1.3 ± 0.6	0.70
S wave amplitude in V_1 + R wave amplitude in V_5 or V_6, mV	2.6 ± 1.0	2.1 ± 0.7	0.10
(S wave amplitude in V_1 + R wave amplitude in V_5 or V_6) × QRS duration, mV × ms	251.8 ± 113.2	183.1 ± 72.6	**0.02**
S wave amplitude in V_2 + R wave amplitude in V_5 or V_6, mV	3.0 (2.2-4.1)	2.4 (1.8-3.1)	0.18
R wave amplitude in aVL, mV	0.7 (0.2-0.9)	0.3 (0.1-0.5)	0.20
R wave amplitude in aVL × QRS duration, mV × ms	56.0 (16.0-93.5)	26.0 (11.3-40.0)	0.16
R wave amplitude in aVL + S wave amplitude in V_3, mV	2.1 (1.3-2.7)	1.1 (0.8-1.7)	**0.02**
(R wave amplitude in aVL + S wave amplitude in V_3) × QRS duration (M), (R wave amplitude in aVL + S wave amplitude in V_3	176.0 (164.0-294.3)	112.0 (64.0-176.0)	**0.002**

+ 0.8 mV) × QRS duration (F), mV × ms			
R wave amplitude in I + S wave amplitude in III, mV	1.2 (0.6-1.7)	0.7 (0.5-1.1)	0.26
S_D + S wave amplitude in V_4, mV	3.3 (2.6-3.9)	2.0 (1.5-2.9)	**0.004**

Data are presented as mean ± standard deviation or median (interquartile range). For abbreviations see the description of Supplementary Table S1.

Supplementary Table S6. Electrocardiographic criteria for the diagnosis of left ventricular hypertrophy parameters in patients with and without left ventricular hypertrophy based on left ventricular mass indexed by heigh$^{2.7}$ according to cutoff values proposed by Multi-Ethnic Study of Atherosclerosis.

ECG-LVH criteria parameters	**LVM/height$^{2.7}$ > 45.1 g/m$^{2.7}$ (M) or > 38 g/m$^{2.7}$ (F); n = 8**	**LVM/height$^{2.7}$ ≤ 45.1 g/m$^{2.7}$ (M) or ≤ 38 g/m$^{2.7}$ (F); n = 45**	***P* value**
R wave amplitude in V_5 or V_6, mV	1.1 ± 0.6	1.3 ± 0.6	0.35
S wave amplitude in V_1 + R wave amplitude in V_5 or V_6, mV	2.5 ± 1.1	2.1 ± 0.7	0.17
(S wave amplitude in V_1 + R wave amplitude in V_5 or V_6) × QRS duration, mV × ms	244.8 ± 118.9	185.9 ± 74.1	0.07
S wave amplitude in V_2 + R wave amplitude in V_5 or V_6, mV	2.6 (2.1-4.0)	2.4 (1.9-3.2)	0.38
R wave amplitude in aVL, mV	0.7 (0.2-0.9)	0.3 (0.1-0.5)	0.14
R wave amplitude in aVL × QRS duration, mV × ms	63.8 (12.0-101.8)	27.5 (11.5-40.0)	0.14
R wave amplitude in aVL + S wave amplitude in V_3, mV	1.9 (2.7-1.3)	1.1 (0.8-1.8)	**0.03**
(R wave amplitude in aVL + S wave amplitude in V_3) × QRS duration (M), (R wave amplitude in aVL + S wave amplitude in V_3	176.0 (162.0-295.6)	116.0 (64.0-184.0)	**0.005**

+ 0.8 mV) × QRS duration (F), mV × ms			
R wave amplitude in I + S wave amplitude in III, mV	1.4 (0.5-1.8)	0.7 (0.5-1.1)	0.20
S_D + S wave amplitude in V_4, mV	3.4 (2.6-4.0)	2.0 (1.6-2.9)	**0.01**

Data are presented as mean ± standard deviation or median (interquartile range). For abbreviations see the description of Supplementary Table S1.

Supplementary Table S7. Electrocardiographic criteria for the diagnosis of left ventricular hypertrophy in patients with and without left ventricular hypertrophy based on percentage of predicted left ventricular mass.

Positive ECG-LVH criteria	**%pLVM > 1.31; n = 6**		**%pLVM ≤ 1.31; n = 47**		**McNemar test[#]**	***P* value**
	TP	**FN**	**FP**	**TN**		
R wave amplitude in V_5 or V_6 >2.6 mV	0 (0.0%)	6 (100.0%)	1 (2.1%)	46 (97.9%)	**0.13**	1*
S wave amplitude in V_1 + R wave amplitude V_5 or V_6 >3.5 mV	2 (33.3%)	4 (66.7%)	2 (4.3%)	45 (95.7%)	**0.69**	0.06*
(S wave amplitude in V_1 + R wave amplitude in V_5 or V_6) × QRS duration ≥371 mV × ms	1 (16.7%)	5 (83.3%)	0 (0.0%)	47 (100.0%)	**0.06**	0.11*
S wave amplitude in V_2 + R wave amplitude in V_5 or V_6 >4.5 mV	0 (0.0%)	6 (100.0%)	2 (4.3%)	45 (95.7%)	**0.29**	1*
R wave amplitude in aVL >1.1 mV	1 (16.7%)	5 (83.3%)	2 (4.3%)	45 (95.7%)	**0.45**	0.31*
R wave amplitude in aVL × QRS duration >103 mV × ms	2 (33.3%)	4 (66.7%)	2 (4.3%)	45 (95.7%)	**0.69**	0.06*
R wave amplitude in aVL + S wave amplitude in V_3 >2.8 m (M) or >2 mV (F)	1 (16.7%)	5 (83.3%)	1 (2.1%)	46 (97.9%)	**0.22**	0.22*

(R wave amplitude in aVL + S wave amplitude in V_3) × QRS duration (M), (R wave amplitude in aVL + S wave amplitude in V_3 + 0.8 mV) × QRS duration (F) ≥244 mV × ms	3 (50.0%)	3 (50.0%)	2 (4.3%)	45 (95.7%)	**1**	**0.008***
R wave amplitude in I + S wave amplitude in III >2.5 mV	0 (0.0%)	6 (100.0%)	1 (2.1%)	46 (97.9%)	**0.13**	1*
S_D + S wave amplitude in V_4 ≥2.3 mV (F) or ≥2.8 mV (M)	6 (100.0%)	0 (0.0%)	18 (38.3%)	29 (61.7%)	< 0.001	**0.006***
At least one positive ECG-LVH criterion	6 (100.0%)	0 (0.0%)	20 (42.6%)	27 (57.4%)	< 0.001	**0.01***

Data are presented as number (percentage). *Fisher exact test (exact significance, 2-tailed). FN – false negative; FP – false positive; TN – true negative; TP – true positive. For other abbreviations see the description of Supplementary Table S1.

Supplementary Table S8. Electrocardiographic criteria for the diagnosis of left ventricular hypertrophy in patients with and without left ventricular hypertrophy based on left ventricular mass indexed by body surface area according to cutoff values proposed by Petersen et al. [6].

Positive ECG-LVH criteria	**LVM/BSA > 72 g/m^2 (M) or > 55 g/m^2 (F); n = 38**		**LVM/BSA ≤ 72 g/m^2 (M) or ≤ 55 g/m^2 (F); n = 15**		**McNemar test#**	***P* value**
	TP	**FN**	**FP**	**TN**		
R wave amplitude in V_5 or V_6 >2.6 mV	1 (2.6%)	37 (97.4%)	0 (0.0%)	15 (100.0%)	< 0.001	1*
S wave amplitude in V_1 + R wave amplitude V_5 or V_6 >3.5 mV	3 (7.9%)	35 (92.1%)	1 (6.7%)	14 (93.3%)	< 0.001	1*
(S wave amplitude in V_1 + R wave amplitude in V_5 or V_6) × QRS duration ≥371 mV × ms	1 (2.6%)	37 (97.4%)	0 (0.0%)	15 (100.0%)	< 0.001	1*
S wave amplitude in V_2 + R wave amplitude in V_5 or V_6 >4.5 mV	2 (5.3%)	36 (94.7%)	0 (0.0%)	15 (100.0%)	< 0.001	1*
R wave amplitude in aVL >1.1 mV	3 (7.9%)	35 (92.1%)	0 (0.0%)	15 (100.0%)	< 0.001	0.55*

R wave amplitude in aVL × QRS duration >103 mV × ms	4 (10.5%)	34 (89.5%)	0 (0.0%)	15 (100.0%)	< 0.001	0.57*
R wave amplitude in aVL + S wave amplitude in V_3 >2.8 m (M) or >2 mV (F)	2 (5.3%)	36 (94.7%)	0 (0.0%)	15 (100.0%)	< 0.001	1*
(R wave amplitude in aVL + S wave amplitude in V_3) × QRS duration (M), (R wave amplitude in aVL + S wave amplitude in V_3 + 0.8 mV) × QRS duration (F) ≥244 mV × ms	5 (13.2%)	33 (86.8%)	0 (0.0%)	15 (100.0%)	< 0.001	0.31*
R wave amplitude in I + S wave amplitude in III >2.5 mV	1 (2.6%)	37 (97.4%)	0 (0.0%)	15 (100.0%)	< 0.001	1*
S_D + S wave amplitude in V_4 ≥2.3 mV (F) or ≥2.8 mV (M)	21 (55.3%)	17 (44.7%)	3 (20.0%)	12 (80.0%)	0.003	**0.02**
At least one positive ECG-LVH criterion	22 (57.9%)	16 (42.1%)	4 (26.7%)	11 (73.3%)	0.01	**0.04**

Data are presented as number (percentage). *Fisher exact test (exact significance, 2-tailed). For abbreviations see the description of Supplementary Table S1 and S7.

Supplementary Table S9. Electrocardiographic criteria for the diagnosis of left ventricular hypertrophy in patients with and without left ventricular hypertrophy based on left ventricular mass indexed by body surface area according to cutoff values proposed by Multi-Ethnic Study of Atherosclerosis.

Positive ECG-LVH criteria	**LVM/BSA (MESA) > 106.2 g/m^2 (M) or > 84.6 g/m^2 (F); n = 8**		**LVM/BSA (MESA) ≤ 106.2 g/m^2 (M) or ≤ 84.6 g/m^2 (F); n = 45**		**McNemar test[#]**	***P* value**
	TP	**FN**	**FP**	**TN**		
R wave amplitude in V_5 or V_6 >2.6 mV	0 (0.0%)	8 (100.0%)	1 (2.2%)	44 (97.8%)	0.04	1*
S wave amplitude in V_1 + R wave amplitude V_5 or V_6 >3.5 mV	2 (25.0%)	6 (75.0%)	2 (4.4%)	43 (95.6%)	**0.29**	0.1*
(S wave amplitude in V_1 + R wave amplitude in V_5 or V_6) × QRS duration ≥371 mV × ms	1 (12.5%)	7 (87.5%)	0 (0.0%)	45 (100.0%)	0.02	0.15*
S wave amplitude in V_2 + R wave amplitude in V_5 or V_6 >4.5 mV	0 (0.0%)	8 (100.0%)	2 (4.4%)	43 (95.6%)	**0.11**	1*
R wave amplitude in aVL >1.1 mV	1 (12.5%)	7 (87.5%)	2 (4.4%)	43 (95.6%)	**0.18**	0.39*
R wave amplitude in aVL × QRS duration >103 mV × ms	2 (25.0%)	6 (75.0%)	2 (4.4%)	43 (95.6%)	**0.29**	0.1

R wave amplitude in aVL + S wave amplitude in V_3 >2.8 m (M) or >2 mV (F)	1 (12.5%)	7 (87.5%)	1 (2.2%)	44 (97.8%)	**0.07**	0.28*
(R wave amplitude in aVL + S wave amplitude in V_3) × QRS duration (M), (R wave amplitude in aVL + S wave amplitude in V_3 + 0.8 mV) × QRS duration (F) ≥244 mV × ms	3 (37.5%)	5 (62.5%)	2 (4.4%)	43 (95.6%)	**0.45**	**0.02***
R wave amplitude in I + S wave amplitude in III >2.5 mV	0 (0.0%)	8 (100.0%)	1 (2.2%)	44 (97.8%)	0.04	1*
S_D + S wave amplitude in V_4 ≥2.3 mV (F) or ≥2.8 mV (M)	8 (100.0%)	0 (0.0%)	16 (35.6%)	29 (64.4%)	< 0.001	**0.001***
At least one positive ECG-LVH criterion	8 (100.0%);	0 (0.0%)	18 (40.0%)	27 (60.0%)	< 0.001	**0.002**

Data are presented as number (percentage). *Fisher exact test (exact significance, 2-tailed). For abbreviations see the description of Supplementary Table S1 and S7.

Supplementary Table S10. Electrocardiographic criteria for the diagnosis of left ventricular hypertrophy in patients with and without left ventricular hypertrophy based on left ventricular mass indexed by height$^{1.7}$ according to cutoff values proposed by Multi-Ethnic Study of Atherosclerosis.

Positive ECG-LVH criteria	**LVM/height$^{1.7}$ ≥ 80 g/m$^{1.7}$ (M) or ≥ 60 g/m$^{1.7}$ (F); n = 9**		**LVM/height$^{1.7}$ < 80 g/m$^{1.7}$ (M) or < 60 g/m$^{1.7}$ (F); n = 44**		**McNemar test$^{\#}$**	***P* value**
	TP	**FN**	**FP**	**TN**		
R wave amplitude in V_5 or V_6 >2.6 mV	0 (0.0%)	9 (100.0%)	1 (2.3%)	43 (97.7%)	0.02	1*
S wave amplitude in V_1 + R wave amplitude V_5 or V_6 >3.5 mV	2 (22.2%)	7 (77.8%)	2 (4.5%)	42 (95.5%)	**0.2**	0.13*
(S wave amplitude in V_1 + R wave amplitude in V_5 or V_6) × QRS duration ≥371 mV × ms	1 (11.1%)	8 (88.9%)	0 (0.0%)	44 (100.0%)	0.008	0.17*
S wave amplitude in V_2 + R wave amplitude in V_5 or V_6 >4.5 mV	0 (0.0%)	9 (100.0%)	2 (4.5%)	42 (95.5%)	**0.07**	1*
R wave amplitude in aVL >1.1 mV	1 (11.1%)	8 (88.9%)	2 (4.5%)	42 (95.5%)	**0.1**	0.44*
R wave amplitude in aVL × QRS duration >103 mV × ms	2 (22.2%)	7 (77.8%)	2 (4.5%)	42 (95.5%)	**0.2**	0.13*

R wave amplitude in aVL + S wave amplitude in V_3 >2.8 m (M) or >2 mV (F)	1 (11.1%)	8 (88.9%)	1 (2.3%)	43 (97.7%)	0.04	0.31*
(R wave amplitude in aVL + S wave amplitude in V_3) × QRS duration (M), (R wave amplitude in aVL + S wave amplitude in V_3 + 0.8 mV) × QRS duration (F) ≥244 mV × ms	3 (33.3%)	6 (66.7%)	2 (4.5%)	42 (95.5%)	**0.29**	**0.03***
R wave amplitude in I + S wave amplitude in III >2.5 mV	0 (0.0%)	9 (100.0%)	1 (2.3%)	43 (97.7%)	0.02	1*
S_D + S wave amplitude in V_4 ≥2.3 mV (F) or ≥2.8 mV (M)	8 (88.9%)	1 (11.1%)	16 (36.4%)	28 (63.6%)	< 0.001	**0.007***
At least one positive ECG-LVH criterion	8 (88.9%)	1 (11.1%)	18 (40.9%)	26 (59.1%)	< 0.001	**0.01***

Data are presented as number (percentage). *Fisher exact test (exact significance, 2-tailed). For abbreviations see the description of Supplementary Table S1 and S7.

Supplementary Table S11. Electrocardiographic criteria for the diagnosis of left ventricular hypertrophy in patients with and without left ventricular hypertrophy based on left ventricular mass indexed by height$^{2.7}$ according to cutoff values proposed by Multi-Ethnic Study of Atherosclerosis.

Positive ECG-LVH criteria	**LVM/height$^{2.7}$ > 45.1 g/m$^{2.7}$ (M) or > 38 g/m$^{2.7}$ (F); n = 8**		**LVM/height$^{2.7}$ ≤ 45.1 g/m$^{2.7}$ (M) or ≤ 38 g/m$^{2.7}$ (F); n = 45**		**McNemar test$^{\#}$**	***P* value**
	TP	**FN**	**FP**	**TN**		
R wave amplitude in V_5 or V_6 >2.6 mV	0 (0.0%)	8 (100.0%)	1 (2.2%)	44 (97.8%)	0.04	1*
S wave amplitude in V_1 + R wave amplitude V_5 or V_6 >3.5 mV	2 (25.0%)	6 (75.0%)	2 (4.4%)	43 (95.6%)	**0.29**	0.1*
(S wave amplitude in V_1 + R wave amplitude in V_5 or V_6) × QRS duration ≥371 mV × ms	1 (12.5%)	7 (87.5%)	0 (0.0%)	45 (100.0%)	0.02	0.15*
S wave amplitude in V_2 + R wave amplitude in V_5 or V_6 >4.5 mV	0 (0.0%)	8 (100.0%)	2 (4.4%)	43 (95.6%)	**0.12**	1*
R wave amplitude in aVL >1.1 mV	1 (12.5%)	7 (87.5%)	2 (4.4%)	43 (95.6%)	**0.18**	0.39

R wave amplitude in aVL × QRS duration >103 mV × ms	2 (25.0%)	6 (75.0%)	2 (4.4%)	43 (95.6%)	**0.29**	0.1*
R wave amplitude in aVL + S wave amplitude in V_3 >2.8 m (M) or >2 mV (F)	1 (12.5%)	7 (87.5%)	1 (2.2%)	44 (97.8%)	0.07	0.28*
(R wave amplitude in aVL + S wave amplitude in V_3) × QRS duration (M), (R wave amplitude in aVL + S wave amplitude in V_3 + 0.8 mV) × QRS duration (F) ≥244 mV × ms	3 (37.5%)	5 (62.5%)	2 (4.4%)	43 (95.6%)	**0.45**	**0.02***
R wave amplitude in I + S wave amplitude in III >2.5 mV	0 (0.0%)	8 (100.0%)	1 (2.2%)	44 (97.8%)	0.04	1*
S_D + S wave amplitude in V_4 ≥2.3 mV (F) or ≥2.8 mV (M)	7 (87.5%)	1 (12.5%)	17 (37.8%)	28 (62.2%)	< 0.001	**0.02***
At least one positive ECG-LVH criterion	7 (87.5%)	1 (12.5%)	19 (42.2%)	26 (57.8%)	< 0.001	**0.02***

Data are presented as number (percentage). *Fisher exact test (exact significance, 2-tailed). For abbreviations see the description of Supplementary Table S1 and S7.

Supplementary Table S12. Correlations between electrocardiographic criteria for the diagnosis of left ventricular hypertrophy parameters and left ventricular mass, according to indexed and non-indexed left ventricular mass.

ECG-LVH criteria parameters	**LVM (g)**	**%pLVM**	**LVM/BSA (g/m^2)**	**LVM/height$^{1.7}$ (g/m$^{1.7}$)**	**LVM/height$^{2.7}$ (g/m$^{2.7}$)**
R wave amplitude in V_5 or V_6, mV	0.12* (*P* = 0.41)	0.15* (*P* = 0.30)	0.17* (*P* = 0.22)	0.09* (*P* = 0.52)	0.07* (*P* = 0.63)
S wave amplitude in V_1 + R wave amplitude in V_5 or V_6, mV	0.24 (*P* = 0.09)	**0.31 (*P* = 0.02)**	**0.30 (*P* = 0.03)**	**0.30 (*P* = 0.03)**	**0.28 (*P* = 0.04)**
(S wave amplitude in V_1 + R wave amplitude in V_5 or V_6) × QRS duration, mV × ms	**0.27 (*P* < 0.05)**	**0.31 (*P* = 0.02)**	**0.32 (*P* = 0.02)**	**0.33 (*P* = 0.02)**	**0.31 (*P* = 0.02)**
S wave amplitude in V_2 + R wave amplitude in V_5 or V_6, mV	0.33 **(*P* = 0.01)**	0.28 **(*P* = 0.04)**	0.34 **(*P* = 0.01)**	**0.28 (P < 0.05)**	0.22 (*P* = 0.12)
R wave amplitude in aVL, mV	0.27 (*P* = 0.05)	0.28 **(*P* = 0.04)**	0.26 (*P* = 0.06)	**0.36 (*P* = 0.009)**	**0.37 (*P* = 0.006)**
R wave amplitude in aVL × QRS duration, mV × ms	**0.27 (*P* < 0.05)**	**0.28 (*P* < 0.05)**	**0.27 (*P* < 0.05)**	**0.37 (*P* = 0.007)**	**0.39 (*P* = 0.004)**

R wave amplitude in aVL + S wave amplitude in V_3, mV	**0.36 (*P* = 0.008)**	**0.33 (*P* = 0.02)**	**0.36 (*P* = 0.007)**	0.37 **(*P* = 0.007)**	0.38 **(*P* = 0.005)**
(R wave amplitude in aVL + S wave amplitude in V_3) × QRS duration (M), (R wave amplitude in aVL + S wave amplitude in V_3 + 0.8 mV) × QRS duration (F), mV × ms	0.24 (*P* = 0.09)	**0.34 (*P* = 0.01)**	**0.29 (*P* = 0.04)**	0.32 **(*P* = 0.02)**	0.38 **(*P* = 0.005)**
R wave amplitude in I + S wave amplitude in III, mV	0.21 (*P* = 0.14)	0.21 (*P* = 0.13)	0.20 (*P* = 0.15)	**0.30 (*P* = 0.03)**	**0.31 (*P* = 0.03)**
S_D + S wave amplitude in V_4, mV	**0.46 (*P* = 0.001)**	**0.48 (*P* < 0.001)**	**0.50 (*P* < 0.001)**	**0.44 (*P* = 0.001)**	**0.43 (*P* = 0.001)**

Data are presented as Pearson correlation coefficient* or Spearman rank correlation coefficient (*P* value). %pLVM – percent-predicted LVM. For other abbreviations see the description of Supplementary Table S1.

Supplementary Table S13. Positive predictive value, negative predictive value, accuracy and negative likelihood ratio of electrocardiographic criteria for the diagnosis of left ventricular hypertrophy. Data are shown for indexed and non-indexed left ventricular mass.

ECG-LVH criteria	**Indexed and non-indexed LVM**	**PPV (%) (95% CI)**	**NPV (%) (95% CI)**	**Accuracy (%) (95% CI)**	**NLR (95% CI)**
R wave amplitude in V_5 or V_6 >2.6 mV	LVM;	100.0; (*)	32.7 (31.5-33.9);	34.0 (21.5-48.3);	1.0 (0.9 -1.0);
	LVM/BSA (MESA);	0.0; (*)	84.6 (84.0-85.2);	83.0 (70.2-91.9);	1.0 (1.0-1.1);
	LVM/BSA;	100.0; (*)	28.9 (27.8-29.9);	30.2 (18.3-44.3);	1.0 (0.9 -1.0);
	LVM / height$^{1.7}$;	0.0; (*)	82.7 (82.0-83.3);	81.1 (68.0-90.6);	1.0 (1.0-1.1);
	LVM / height$^{2.7}$;	0.0; (*)	84.6 (84.0-85.2);	83.0 (70.2-91.9);	1.0 (1.0-1.1);
	%pLVH.	0.0. (*)	88.5 (88.0-88.9).	86.8 (74.7-94.5).	1.0 (1.0-1.1).
S wave amplitude in V_1 + R wave amplitude V_5 or V_6 >3.5 mV	LVM;	75.0 (25.2-96.4);	32.7 (29.4-36.1);	35.8 (23.1-50.2);	1.0 (0.8-1.1);
	LVM/BSA (MESA);	50.0 (14.1-85.9);	87.8 (82.7-91.5);	84.9 (72.4-93.3);	0.8 (0.5-1.2);
	LVM/BSA;	75.0 (25.3-96.4);	28.6 (25.3-32.0);	32.1 (19.9-46.3);	1.0 (0.8-1.2);
	LVM/ height$^{1.7}$;	50.0 (13.9-86.1);	85.7 (80.8-89.5);	83.0 (70.2-91.9);	0.8 (0.6-1.2);
	LVM / height$^{2.7}$;	50.0 (14.1-85.9);	87.8 (82.7-91.5);	84.9 (72.4-93.3);	0.8 (0.5-1.2);
	%pLVH.	50.0 (14.6-85.4).	91.8 (86.4-95.2).	88.7 (77.0-95.7).	0.7 (0.4-1.2).
(S wave amplitude in V_1 + R wave amplitude in	LVM;	100.0; (*)	32.7 (31.5-33.9);	34.0 (21.5-48.3);	1.0 (0.9 -1.0);
	LVM/BSA (MESA);	100.0; (*)	86.5 (83.2-89.3);	86.8 (74.4-94.5);	0.9 (0.7-1.1);

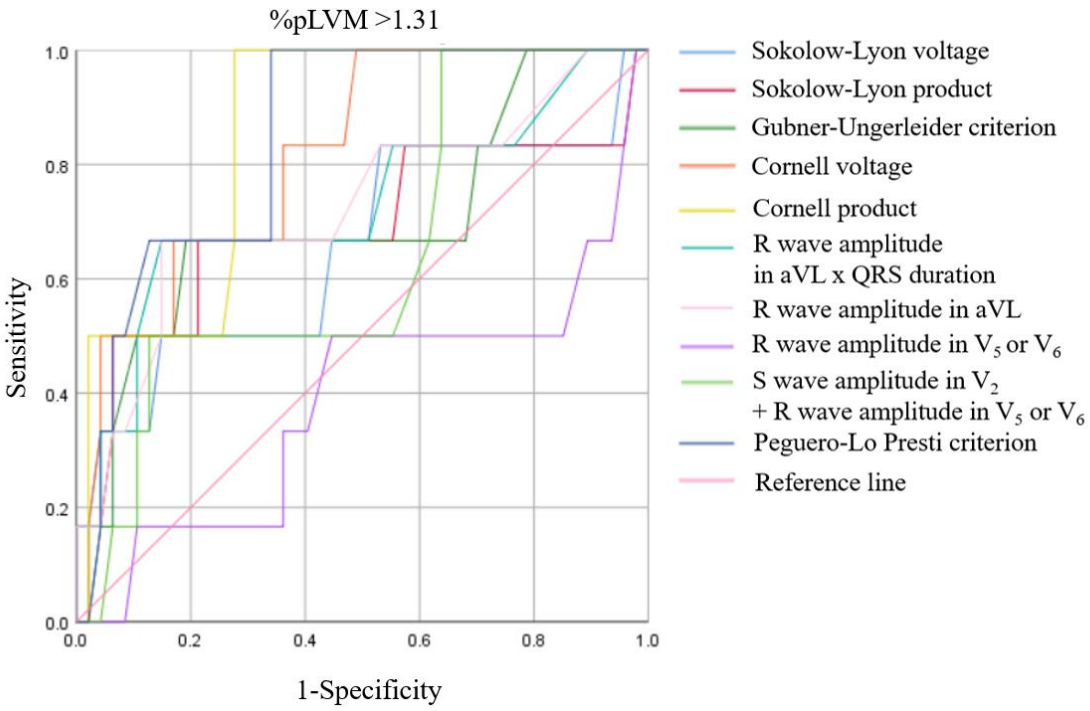
V_5 or V_6) × QRS duration ≥371 mV × ms	LVM/BSA;	100.0 (*);	28.9 (27.8-29.9);	30.2 (18.3-44.3);	1.0 (0.9 -1.0);
	LVM / height$^{1.7}$;	100.0 (*);	84.6 (81.4-87.4);	84.9 (81.4-87.4);	0.9 (0.7-1.1);
	LVM / height$^{2.7}$;	100.0 (*);	86.5 (83.2-89.3);	86.8 (74.7-94.5);	0.9 (0.7-1.1);
	%pLVH.	100.0 (*).	90.4 (86.8-93.1).	90.6 (79.3-96.9).	0.8 (0.6-1.2).
S wave amplitude in V_2 + R wave amplitude in V_5 or V_6 >4.5 mV	LVM;	50.0 (6.2-93.8);	31.4 (28.6-34.3);	32.1 (19.9-46.3);	1.0 (0.9-1.2);
	LVM/BSA (MESA);	0.0 (*);	84.3 (83.4-85.1);	81.0 (68.0-90.6);	1.1 (1.00-1.1);
	LVM/BSA;	100.0 (*);	29.4 (27.9-31.0);	32.1 (19.9-46.3);	1.0 (0.9-1.0);
	LVM / height$^{1.7}$;	0.0 (*);	82.4 (81.4-83.3);	79.3 (65.9-89.2);	1.1 (1.0-1.1);
	LVM / height$^{2.7}$;	0.0 (*);	84.3 (83.5-85.1);	81.1 (68.0-90.6);	1.1 (1.0-1.1);
	%pLVH.	0.0 (*).	88.2 (87.6-88.9).	84.9 (72.4-93.3).	1.0 (1.0-1.1).
R wave amplitude in aVL >1.1 mV	LVM;	100.0 (*);	34.0 (31.8-36.2);	37.7 (24.8-52.1);	0.9 (0.8-1.0);
	LVM/BSA (MESA);	33.3 (4.9-83.0);	86.0 (82.4-88.9);	83.0 (70.2-91.9);	0.9 (0.7-1.2);
	LVM/BSA;	100.0 (*);	30.0 (28.1-32.0);	34.0 (21.5-48.3);	0.9 (0.8-1.0);
	LVM / height$^{1.7}$;	33.3 (4.8-83.2);	84.0 (80.5-87.0);	81.1 (68.0-90.6);	0.9 (0.7-1.2);
	LVM / height$^{2.7}$;	33.3 (4.9-83.0);	86.0 (82.4-88.9);	83.0 (70.2-91.9);	0.9 (0.7-1.2);
	%pLVH.	33.3 (5.0-82.5).	90.0 (86.2-92.8).	86.8 (74.7-94.5).	0.9 (0.6-1.3).
R wave amplitude in aVL × QRS duration >103 mV × ms	LVM;	100.0 (*);	34.7 (32.1-37.4);	39.6 (26.5-54.0);	0.9 (0.8-1.0);
	LVM/BSA (MESA);	50.0 (14.1-85.9);	87.8 (82.7-91.5);	84.9 (72.4-93.3);	0.8 (0.5-1.2);

	LVM/BSA;	100.0 (*);	30.6 (28.4-33.0);	35.8 (23.1-50.2);	0.9 (0.8-1.0);
	LVM / height$^{1.7}$;	50.0 (13.9-86.1);	85.7 (80.8-89.5);	83.0 (70.2-91.9);	0.8 (0.6-1.2);
	LVM / height$^{2.7}$;	50.0 (14.1-85.9);	87.8 (82.7-91.5);	84.9 (72.4-93.3);	0.8 (0.5-1.2);
	%pLVH.	50.0 (14.6-85.4).	91.8 (86.4-95.2).	88.7 (77.0-95.7).	0.7 (0.4-1.2).
R wave amplitude in aVL + S wave amplitude in V_3 >2.8 m (M) or >2 mV (F)	LVM;	100.0 (*)	33.3 (31.6-35.1);	35.8 (23.1-50.2);	0.9 (0.9-1.0);
	LVM/BSA (MESA);	50.0 (6.5-93.5);	86.3 (82.8-89.1);	84.9 (72.4-93.3);	0.9 (0.7-1.2);
	LVM/BSA;	100.0 (*);	29.4 (27.9-31.0);	32.1 (19.9-46.3);	0.9 (0.9-1.0);
	LVM / height$^{1.7}$;	50.0 (6.4-93.6);	84.3 (80.9-87.2);	83.0 (70.2-91.9);	0.9 (0.7-1.2);
	LVM / height$^{2.7}$;	50.0 (6.5-93.5);	86.3 (82.8-89.1);	84.9 (72.4-93.3);	0.9 (0.7-1.2);
	%pLVH.	50.0 (6.7-93.3).	90.2 (86.5-93.0).	88.7 (77.0-95.7).	0.9 (0.6-1.2).
(R wave amplitude in aVL + S wave amplitude in V_3) × QRS duration (M), (R wave amplitude in aVL + S wave amplitude in V_3 + 0.8 mV) × QRS duration (F) ≥244 mV × ms	LVM;	100.0 (*);	35.4 (32.5-38.5);	41.5 (28.1-55.9);	0.9 (0.8-1.0);
	LVM/BSA (MESA);	60.0 (22.8-88.4);	89.6 (83.4-93.7);	86.8 (74.7-94.5);	0.7 (0.4-1.1);
	LVM/BSA;	100.0 (*);	31.3 (28.7-34.0);	37.7 (24.8-52.1);	0.9 (0.8-1.0);
	LVM / height$^{1.7}$;	60.0 (22.6-88.5);	87.5 (81.5-91.8);	84.9 (72.4-93.3);	0.7 (0.4-1.1);
	LVM / height$^{2.7}$;	60.0 (22.8-88.4);	89.6 (83.4-93.7);	86.8 (74.7-94.5);	0.7 (0.4-1.1);
	%pLVH.	60.0 (23.7-87.9).	93.8 (87.1-97.1).	90.6 (79.3-96.9).	0.5 (0.2-1.2).
R wave amplitude in I + S wave amplitude in III >2.5 mV	LVM;	100.0 (*);	32.7 (31.5-33.9);	34.0 (21.5-48.3);	1.0 (0.9-1.0);
	LVM/BSA (MESA);	0.0 (*);	84.6 (84.0-85.2);	83.0 (70.2-91.9);	1.0 (1.0-1.1);

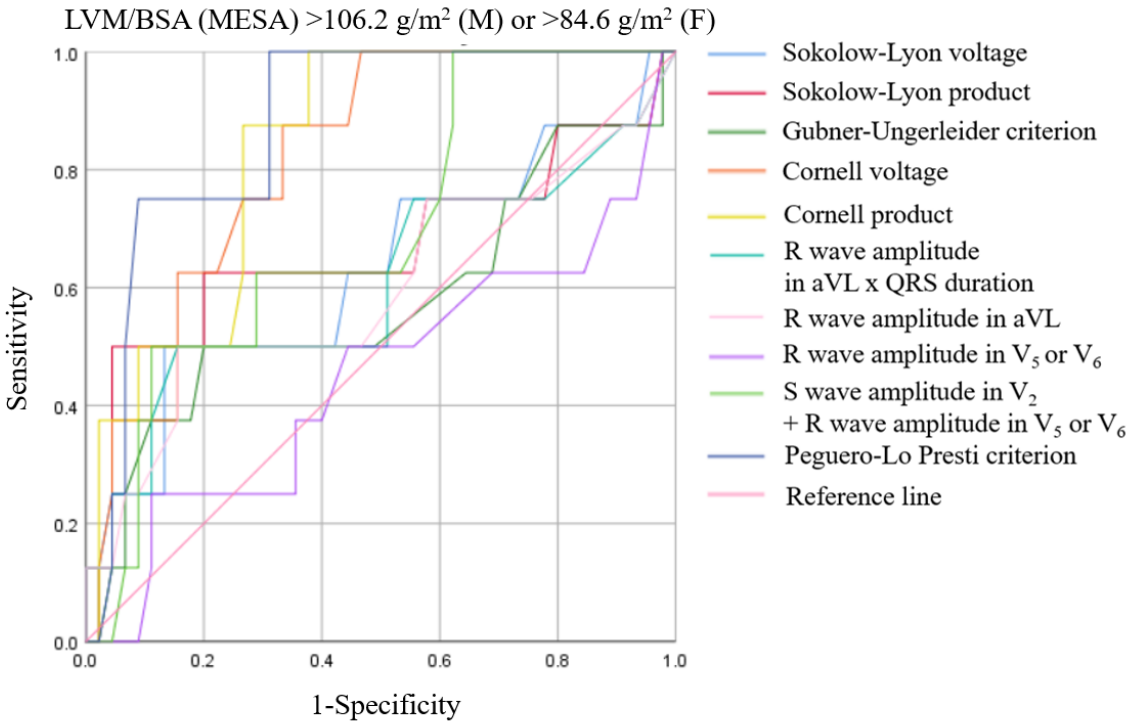
	LVM/BSA;	100.0 (*);	28.9 (27.8-29.9);	30.2 (18.3-44.3);	1.0 (0.9-1.0);
	LVM / height$^{1.7}$;	0.0 (*);	82.7 (82.0-83.3);	81.1 (68.0-90.6);	1.0 (1.0-1.1);
	LVM / height$^{2.7}$;	0.0 (*);	84.6 (84.0-85.2);	83.0 (70.2-91.9);	1.0 (1.0-1.1);
	%pLVH.	0.0 (*).	88.5 (88.0-88.9).	86.8 (74.7-94.5).	1.0 (1.0-1.1).
S_D + S wave amplitude in V_4 ≥2.3 mV (F) or ≥2.8 mV (M)	LVM;	87.5 (70.7-95.3);	48.3 (37.4-59.3);	66.0 (51.7-78.5);	0.5 (0.3-0.8)
	LVM/BSA (MESA);	33.3 (25.2-42.6);	100.0 (*);	69.8 (55.7-81.7);	0.0 (0.0-0.0);
	LVM/BSA;	87.5 (71.0-95.3);	41.4 (31.4-52.2);	62.3 (47.9-75.2);	0.6 (0.4-0.9);
	LVM / height$^{1.7}$;	33.3 (24.1-44.1);	96.6 (81.3-99.5);	67.9 (53.7-80.1);	0.2 (0.0-1.1);
	LVM / height$^{2.7}$;	29.2 (20.7-39.4);	96.6 (81.5-99.4);	66.0 (51.7-78.5);	0.2 (0.0-1.3);
	%pLVH.	25.0 (18.8-32.4).	100.0 (*).	66.0 (51.7-78.5).	0.0 (0.0-0.0).
At least one positive ECG-LVH criterion	LVM;	84.6 (36.3-60.2);	48.2 (36.3-60.2);	66.0 (51.7-78.5);	0.5 (0.3-0.8);
	LVM/BSA (MESA);	30.8 (23.7-38.9);	100.0 (*);	66.0 (51.7-78.5);	0.0 (0.0-0.0);
	LVM/BSA;	84.6 (69.5-93.0);	40.7 (29.8-52.7);	62.3 (47.9-75.2);	0.6 (0.4-0.9);
	LVM / height$^{1.7}$;	30.8 (22.5-40.4);	96.3 (80.1-99.4);	64.2 (49.8-76.9);	0.2 (0.0-1.2);
	LVM / height$^{2.7}$;	26.9 (19.3-36.2);	96.3 (80.3-99.4);	62.3 (47.9-75.2);	0.2 (0.0-1.4);
	%pLVH.	23.1 (17.7-29.5).	100.0 (*).	62.3 (47.9-75.2).	0.0 (0.0-0.0).

Data are presented as percentage (95% CI) or number (95% CI). (*)- 95% CI not available. CI – confidence interval; MESA - Multi-Ethnic Study of Atherosclerosis; NLR- negative likelihood ratio; NPV – negative predictive value; PPV – positive predictive value. For other abbreviations see the description of Supplementary Table S1.

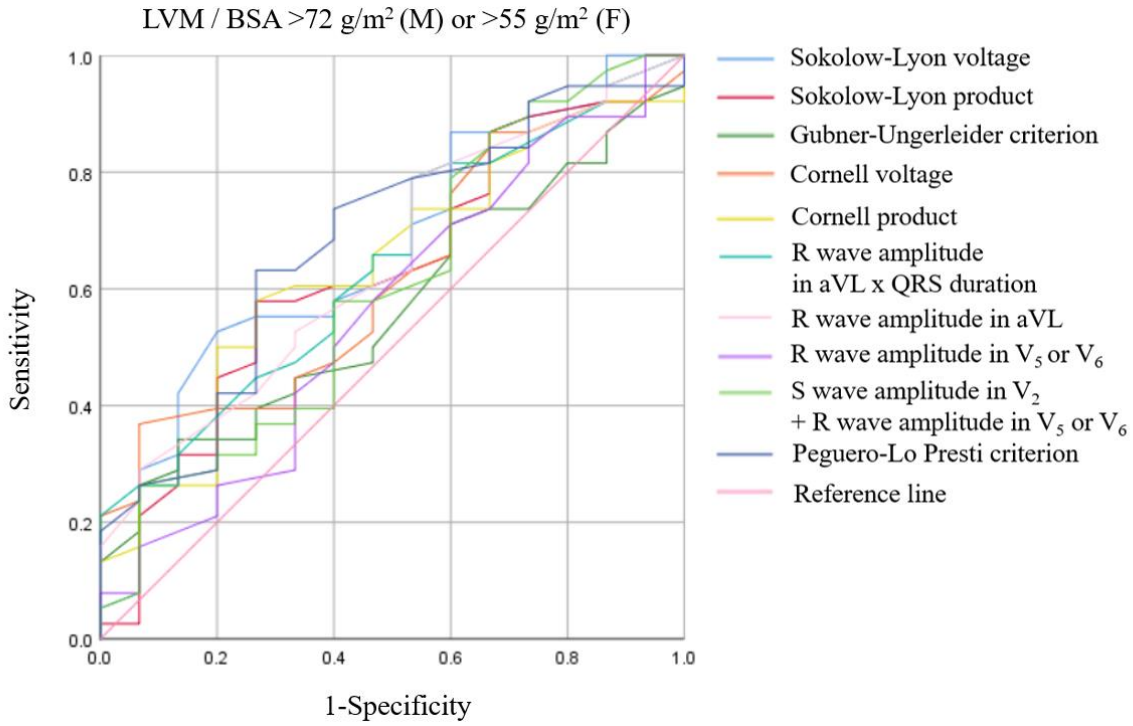
Supplementary Figure S1. Area under the curve of ECG-LVH criteria parameters representing the predictive performance of left ventricular hypertrophy based on percentage of predicted left ventricular mass.



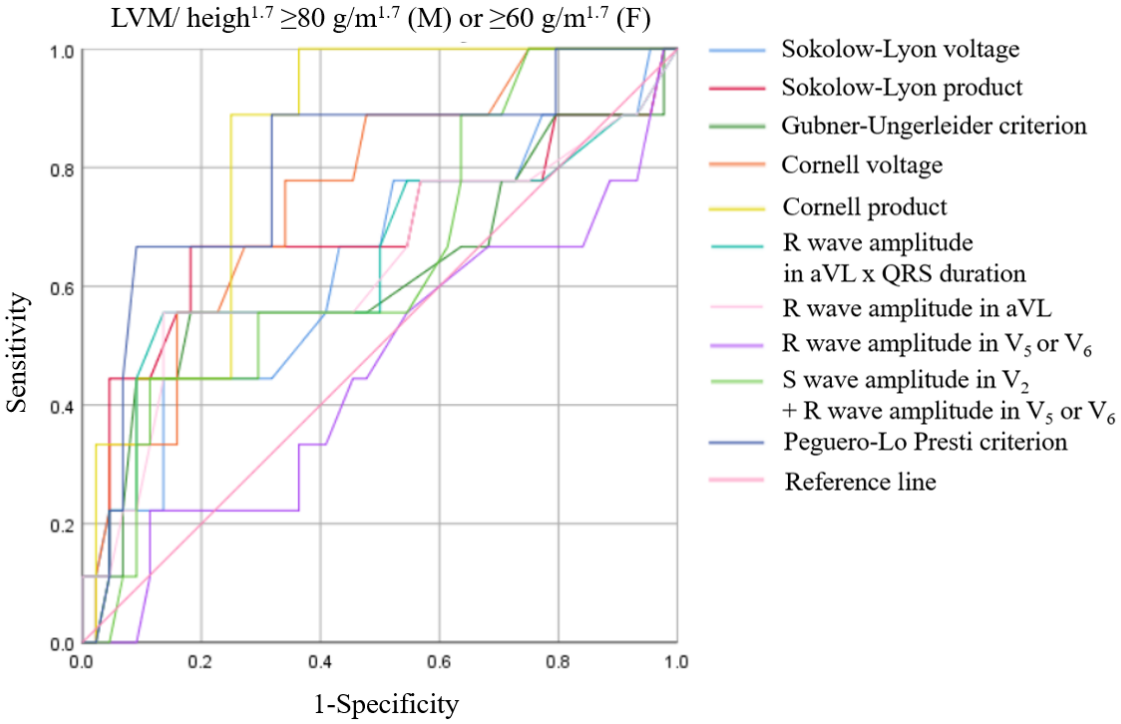
Supplementary Figure S2. Area under the curve of ECG-LVH criteria parameters representing the predictive performance of left ventricular hypertrophy based on left ventricular mass indexed by body surface area according to cutoff values proposed by Multi-Ethnic Study of Atherosclerosis.



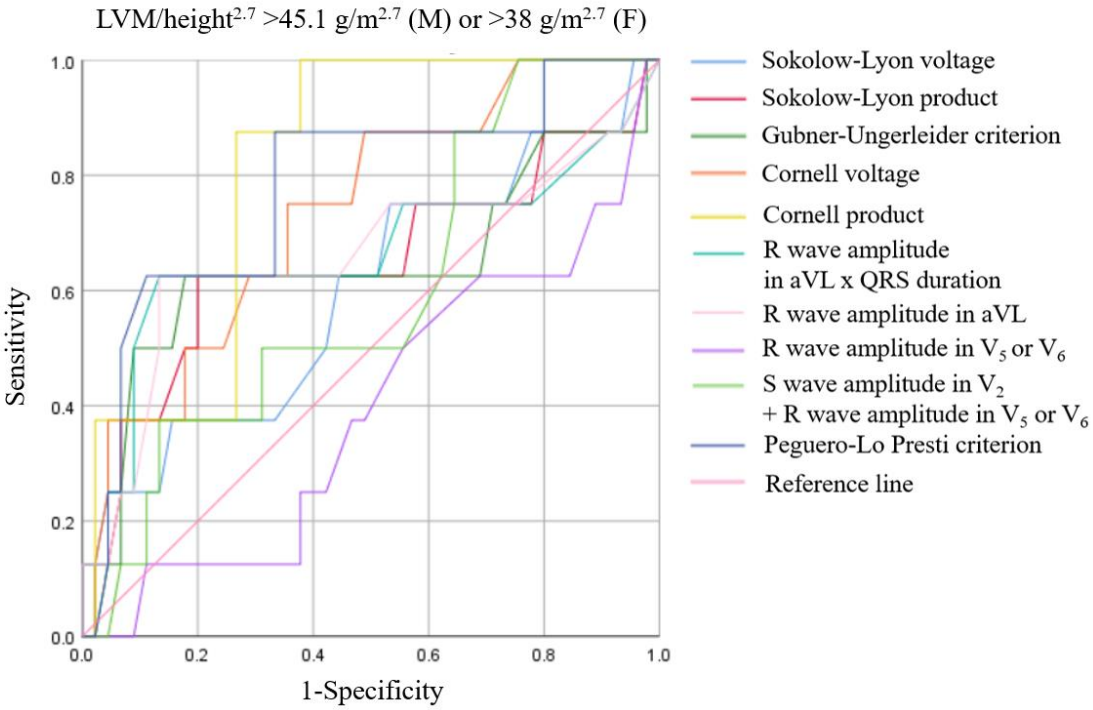
Supplementary Figure S3. Area under the curve of ECG-LVH criteria parameters representing the predictive performance of left ventricular hypertrophy based on left ventricular mass indexed by body surface area according to cutoff values proposed by Petersen et al. [6].



Supplementary Figure S4. Area under the curve of ECG-LVH criteria parameters representing the predictive performance of left ventricular hypertrophy based on left ventricular mass indexed by heigh$^{1.7}$ according to cutoff values proposed by Multi-Ethnic Study of Atherosclerosis.



Supplementary Figure S5. Area under the curve of ECG-LVH criteria parameters representing the predictive performance of left ventricular hypertrophy based on left ventricular mass indexed by heigh$^{2.7}$ according to cutoff values proposed by Multi-Ethnic Study of Atherosclerosis.



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