

## Supplementary material

*Wiliński J, Skwarek A, Borek R, et al. Right ventricular wall thickness indexed to body surface area as an echocardiographic predictor of acute pulmonary embolism in high risk patients. Kardiol Pol. 2022.*

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Table S1. Clinical characteristics of the study participants

	<b>Whole study group (n = 91)</b>	<b>Patients with acute PE (n = 49)</b>	<b>Patients without acute PE (n = 42)</b>	<b>P-value</b>
Male gender	41 (45.05)	22 (44.9)	19 (45.24)	0.97
Age, years	70 (58–79)	70 (58–79)	70 (58.5–79)	0.76
Body mass, kg	75.18 (17.72)	77.2 (16.57)	72.82 (18.9)	0.25
Height, m	1.66 (0.08)	1.65 (0.09)	1.66 (0.1)	0.84
BMI, kg/m <sup>2</sup>	27.12 (5.73)	26.93 (8.82)	25.9 (7.76)	0.34
BSA, m <sup>2</sup>	1.85 (0.25)	1.92 (0.4)	1.85 (0.35)	0.24
HR, bpm	90 (75–105)	90 (75–105)	94 (78.5–110)	0.29
Arterial hypertension	58 (63.74)	27 (55.1)	31 (73.81)	0.06
Hyperlipidemia	42 (46.15)	18 (36.73)	24 (57.14)	0.05
Diabetes mellitus	19 (20.88)	12 (24.49)	7 (16.67)	0.36
CAD	31 (34.07)	9 (18.37)	22 (52.38)	<0.001
CHF	29 (31.87)	10 (20.41)	19 (45.24)	0.01
AF (present or prior)	11 (12.09)	4 (8.16)	7 (16.67)	0.33

History of stroke	2 (2.20)	0 (0)	2 (4.76)	0.21
Smoking				0.30
Now	6 (6.59)	4 (8.16)	2 (4.76)	
In the past	14 (15.38)	5 (10.20)	9 (21.43)	
Smoking intensity, pack-years (for patients that ever smoked n = 20)	27.5 (12.25–40)	25 (4–35)	30 (15–40)	0.34
Chronic lung disease	11 (12.09)	3 (6.12)	8 (19.05)	0.1
Active malignancy	13 (14.29)	6 (12.24)	7 (16.67)	0.55
History of malignancy	4 (4.40)	3 (6.12)	1 (2.38)	0.52
Acute infection	25 (27.47)	13 (26.53)	12 (28.57)	0.83
Wells rule — original version, points	3 (1.5–4.5)	3 (1.5–5.5)	1.5 (1.12–4.5)	0.11
Revised Geneva rule — original version, points	5 (4–6)	5 (4–7)	5 (4.12–6)	0.51

Number of cases (percentage) for categorial data, mean (standard deviation [SD]) for continuous data with normal distribution, median (interquartile range [IQR]) otherwise

Abbreviations: AF, arterial fibrillation, BMI, body mass index; BSA, body surface area; CAD, coronary artery disease; CHF, chronic heart failure; HR, heart rate; PE, pulmonary embolism

Table S2. Biochemical parameters of patients with pulmonary embolism and without pulmonary embolism

	<b>Patients with acute PE (n = 49)</b>	<b>Patients without acute PE (n = 42)</b>	<b>P-value</b>
	Median (Q1–Q2)	Median (Q1–Q2)	
Troponin T, pg/ml	26.13 (11.48–61.39)	23.77 (14.49–62.18)	0.99
NT-proBNP, pg/ml	1243 (180–7058)	1905.5 (395– 6741.75)	0.48
D-dimer, µg/ml	5.65 (2.91–9.62)	3.2 (1.48–4.54)	<0.001
Creatinine, mg/dl	0.87 (0.71–1.1)	0.92 (0.66–1.18)	0.77
Creatinine clearance, ml/min	67.2 (47.82–108.32)	72.66 (44.53–100.93)	0.98
Glucose, mg/dl	122 (102–149)	120 (100–139)	0.47
WBC, ×10 <sup>9</sup> cells/l	9 (6.75–10.85)	9.2 (7.8–12.4)	0.55
Hemoglobin, g/dl	13.5 (12.15–14.75)	13.2 (11.2–14.2)	0.29
Platelets, ×10 <sup>3</sup> cells/l	221 (191–282)	247 (174–310)	0.52
TSH, µIU/ml	1.27 (0.79–2.02)	1.35 (0.92–2.38)	0.54
CRP, mg/l	33.02 (12.57–83.86)	16 (4.72–76.74)	0.06

Abbreviations: CRP, C reactive protein; NT-proBNP, N-terminal pro hormone B-type natriuretic peptide; PE, pulmonary embolism; TSH, thyroid stimulating hormone; WBC, white blood cells

*Table S3.* Selected echocardiographic parameters and their derivatives indexed to height and body surface area. Indexation to height was made by dividing value of a parameter by height [m], indexation to BSA was made by dividing values by BSA [m<sup>2</sup>].

	Original values [unit]			Values indexed to height [unit/m]			Values indexed to body surface area [unit/m <sup>2</sup> ]		
	PE	NO PE		PE	NO PE		PE	NO PE	
Parameters, x	Median (IQR)	Median (IQR)	<i>P</i> -value	Median (IQR)	Median (IQR)	<i>P</i> -value	Median (IQR)	Median (IQR)	<i>P</i> -value
LAd PLAX, mm	42 (38–48)	46 (40–51)	0.11	25.63 (22.92–28.96)	27.53 (24.39–31.67)	0.08	22.88 (21.23–24.8)	24.31 (22.36–27.34)	0.02
LA EDA, cm <sup>2</sup>	22.3 (18.2–26.55)	23.3 (20.2–31.1)	0.06	13.43 (10.58–15.81)	13.96 (11.82–18.93)	0.04	11.92 (9.25–13.5)	12.92 (11.25–16.5)	0.01
LVEDd, mm	44 (41–50.25)	48 (42–53)	0.17	26.91 (24.72–29.1)	28.83 (25.88–31.62)	0.10	24.14 (21.04–26.54)	25.38 (23.42–28.4)	0.04
LVTd, mm	41 (36.5–47.5)	45 (38–50)	0.21	25.32 (21.6–27.98)	26.22 (22.75–30.56)	0.17	22.59 (19.41–24.42)	24.23 (21.68–26.82)	0.03
LVEF, %	57 (51.75–60)	56 (43–63)	0.48						
M annulus, mm	41 (36.5–45)	42 (37–45)	0.55	24.18 (21.86–26.68)	25.28 (22.09–27.38)	0.42	21.95 (19.19–24.68)	22.91 (20.05–25.82)	0.11
RVOT prox., mm PLAX	31 (28–34)	31 (28.25–32)	0.62	17.98 (16.2–20.92)	18.02 (16.88–20.25)	0.95	16.08 (14.21–18.5)	16.51 (15.36–18.3)	0.26
RVD1, mm	39 (37–43)	39 (37–42.75)	0.94	23.57 (22.27–26.08)	24.42 (21.75–25.59)	0.82	21.08 (18.6–24.64)	21.09 (19.51–23.65)	0.74
T annulus, m	41 (36–44)	41 (37–44)	0.89	24.71 (22.07–26.77)	24.55 (22.42–26.4)	0.97	20.98 (19–24.02)	21.96 (19.73–24.43)	0.34
RVWT, mm	5 (4–5)	5 (5–6)	0.046	2.94 (2.6–3.16)	3.09 (2.91–3.67)	0.02	2.58 (2.38–2.92)	2.82 (2.54–3.64)	0.005

RV EDA, cm <sup>2</sup>	18.1 (15.2– 20.6)	17.5 (12.47– 20.75)	0.37	10.51 (9.39– 12.47)	10.7 (8.1– 12.47)	0.50	9.2 (8.28– 10.58)	9.58 (7.86– 11.14)	0.97
RV ESA, cm <sup>2</sup>	11.25 (8.55– 13.5)	9.55 (7.47– 13.03)	0.19	6.66 (5.02– 8.25)	5.75 (4.71– 7.55)	0.21	5.48 (4.54– 7.66)	5.27 (4.44– 6.97)	0.46
FAC, %	39.09 (30.48– 46.38)	41.28 (32.23– 49.3)	0.51						
TAPSE, mm	20 (15– 23)	19 (15– 24)	0.96	11.76 (9.38– 14.02)	11.84 (8.7– 14.67)	0.97	10.29 (8.42– 12.22)	9.85 (8.21– 13.85)	0.74
PA, mm	26.5 (23.75– 28)	27 (25– 30)	0.25	15.83 (14.18– 17.07)	16.05 (14.88– 18.39)	0.20	13.86 (12.35– 15.17)	14.56 (13.19– 16.76)	0.06
Act, ms	74 (59– 91.5)	81 (67– 111)	0.05						
TRV max, m/s	2.87 (2.42– 3.58)	3 (2.5– 3.4)	0.82						
PASP, mm Hg	38 (27– 55.25)	38.5 (30– 50.25)	0.76						
T annulus S', cm/s	14 (12.25– 16.75)	14 (10– 18)	0.7						
RA EDV, mL	66 (43– 87)	59.5 (48.25– 79.25)	0.59	38.2 (26.06– 53.01)	35.09 (28.36– 47.1)	0.74	33.77 (23.3– 46.08)	33.08 (24.73– 45)	0.82
RA EDA, cm <sup>2</sup>	20.9 (17.17– 24.53)	20.55 (17.82– 25.65)	0.8	12.29 (10.15– 14.82)	12.3 (10.57– 15.83)	0.72	11.09 (8.61– 13.06)	11.3 (9.59– 13.85)	0.38
RA ESA, cm <sup>2</sup>	12.8 (10.25– 20.88)	14.6 (11.4–18)	0.53	7.65 (6.22– 12.21)	8.39 (7.22– 11.27)	0.51	6.82 (5.42– 10.77)	7.94 (6.55– 10.49)	0.24
VCI max, mm	19 (16– 22)	18 (16– 22)	0.8	11.18 (9.73– 12.89)	11.11 (9.66– 13.5)	0.66	9.82 (8.58– 11.09)	9.99 (8.94– 12.61)	0.21
VCI collapsibility, %	75 (47.68– 100)	100 (55.56– 100)	0.36						

Abbreviations: Act, pulmonary flow acceleration time; EDA, end-diastolic area; EDV, end-diastolic volume; ESA, end-systolic area; FAC, fractional area change; M annulus, mitral valve diameter; LA, left atrium; LAd, left atrium diameter; LV, left ventricle; LVEF, left ventricular ejection fraction; LVEDd, left ventricular end-diastolic diameter; LVTD, left ventricular transverse diameter; PA, pulmonary artery; PASP, pulmonary artery systolic pressure; PLAX, parasternal window- long-axis views; RA, right atrium; RV, right ventricle; RVD1, basal right ventricle linear dimension; RVOT, right ventricular outflow tract; T annulus, tricuspid annulus diameter; TAPSE, tricuspid annular plane systoli excursion; TRV, tricuspid regurgitation peak velocity; VCI, vena cava inferior; WT, wall thickness

*Table S4.* Transthoracic echocardiographic signs met in acute pulmonary embolism according to [1, 8] in our study

	Patients with acute PE (n = 49)		Patients without acute PE (n = 42)		<i>P</i> -value
	N	%	N	%	
Enlarged RV (RVOT prox)	28	57.14	24	57.14	1
Enlarged RV (RVD1)	16	32.65	15	35.71	0.76
Enlarged RV (EDA indexed to BSA)	9	18.37	7	16.67	0.83
FAC <35%	10	20.41	6	14.29	0.44
Enlarged RA (RAEDV indexed to BSA)	29	59.18	25	59.52	0.97
RVTD/LVTD ratio >1.0	19	38.78	12	28.57	0.42
McConnell sign	4	8.16	1	2.38	0.37
Flattened intraventricular septum in systole	2	4.08	1	2.38	1
Flattened intraventricular septum in diastole	3	6.12	5	11.9	0.46

Distended inferior vena cava with diminished inspiratory collapsibility [%]	7	14.29	8	19.05	0.54
Act <60 ms	15	30.61	6	14.29	0.07
60/60 sign	7	14.29	3	7.14	0.33
Mobile thrombus detected in right heart cavities	6	12.24	0	0	0.03
TAPSE < 16 cm/s	13	26.53	13	30.95	0.64
S' velocity of tricuspid annulus <9.5 cm/s	7	14.29	8	19.05	0.54
Midsystolic notch at pulmonary valve flow	12	24.49	6	14.29	0.22
Pericardial effusion	3	6.12	4	9.52	0.7
Shunt through interatrial septum	0	0	0	0	
Hypokinesia of RV free wall	12	24.49	5	11.9	0.12

Abbreviations: Act, pulmonary flow acceleration time; BSA, body surface area; EDA, end-diastolic area; FAC, fractional area change; LVTD, left ventricular transverse diameter; PLAX, parasternal window- long-axis views; RA, right atrium; RAEDV, right atrium end-diastolic volume; RV, right ventricle; RVD1, basal right ventricle linear dimension; RVOT, right ventricular outflow tract; RVTD, right ventricular transverse diameter; TAPSE, tricuspid annular plane systolic excursion

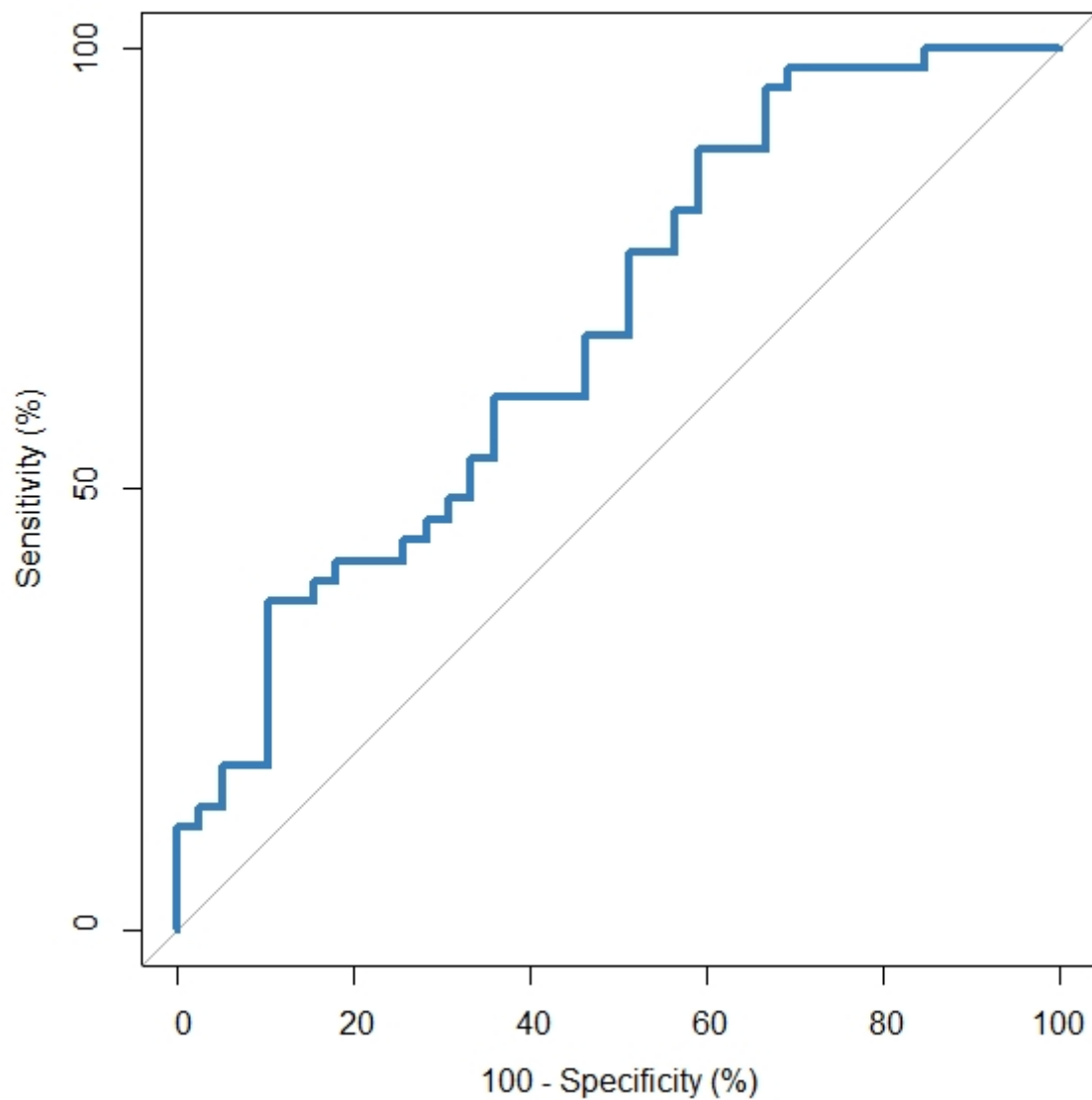
Table S5. Determinants of acute pulmonary embolism: single-predictor and multiple-predictor logistic regression analyses

Single predictor analysis			
	OR	95% CI	<i>P</i> -value
Arterial hypertension	0.44	0.17–1.04	0.07
Hyperlipidemia	0.44	0.19–1.00	0.05
CAD	0.21	0.08- 0.51	0.001
CHF	0.31	0.12–0.77	0.01
Smoking intensity	0.98	0.95–1.02	0.28
D-dimer	1.25	1.09–1.47	0.003
CRP	1.00	0.99–1.01	0.96
LA PLAX	0.95	0.90–1.01	0.10
LA EDA	0.94	0.88–1.00	0.06
LVEDd	0.97	0.92- 1.02	0.20
RV wall thickness	0.56	0.31–0.91	0.04
RV ESA	1.00	0.93–1.08	0.74
PA	0.92	0.82–1.03	0.16
LAd PLAX indexed to BSA	0.86	0.75–0.96	0.01
LA EDA indexed to BSA	0.88	0.77–0.98	0.03
LVEDd indexed to BSA	0.90	0.81–1.00	0.04
LVTD indexed to BSA	0.87	0.76–0.97	0.14
M annulus indexed to BSA	0.92	0.82–1.02	0.11
RV wall thickness indexed to BSA	0.26	0.01–0.60	0.004
RA ESA indexed to BSA	0.98	0.86–1.12	0.80
PA indexed to BSA	0.81	0.66–0.96	0.02
VCI max indexed to BSA	0.90	0.75–1.05	0.19
Mobile thrombus detected in right heart cavities	—	—	0.99
RVWT indexed to height	0.37	0.139– 0.842	0.03
LA EDA indexed to height	0.90	0.81–1.00	0.05



Multiple-predictor analysis			
CAD	0.240	0.063–0.811	0.03
CHF	0.748	0.181–3.089	0.68
D-dimer	1.279	1.069–1.573	0.01
LA PLAX indexed to BSA	0.978	0.774–1.232	0.85
LVEDd indexed to BSA	1.026	0.847–1.248	0.80
PA indexed to BSA	0.982	0.696–1.362	0.92
LA EDA indexed to BSA	0.959	0.783–1.161	0.67
RVWT indexed to BSA	0.283	0.075–0.898	0.046

Abbreviations: BSA, body surface area; CAD, coronary artery disease; CHF, chronic heart failure; CRP, C reactive protein; EDA, end-diastolic area; EDd, end-diastolic dimension; ESA, end-systolic area; LA, left atrium; LV, left ventricle; M annulus, mitral valve annulus diameter; PA, pulmonary artery; PLAX, parasternal window- long-axis views; RA, right atrium; RV, right ventricle; SE, standard error; TD, transverse diameter; VCI, vena cava inferior



*Figure S1.* Receiver-operating characteristic (ROC) analysis of the right ventricle wall thickness indexed to body surface area (RVWT indexed to BSA) in the prediction of acute pulmonary embolism (PE) in 91 patients with high clinical probability of acute PE. The obtained area under the curve (AUC) was 0.68 (95% CI, 0.56–0.80;  $P = 0.002$ ), the upper cut-off value of 3.19 mm/m<sup>2</sup> with accuracy 60% predicted acute PE. Its sensitivity was 0.14 (95% CI, 0.06–0.27) and specificity equaled 0.69 (95% CI, 0.53–0.82)

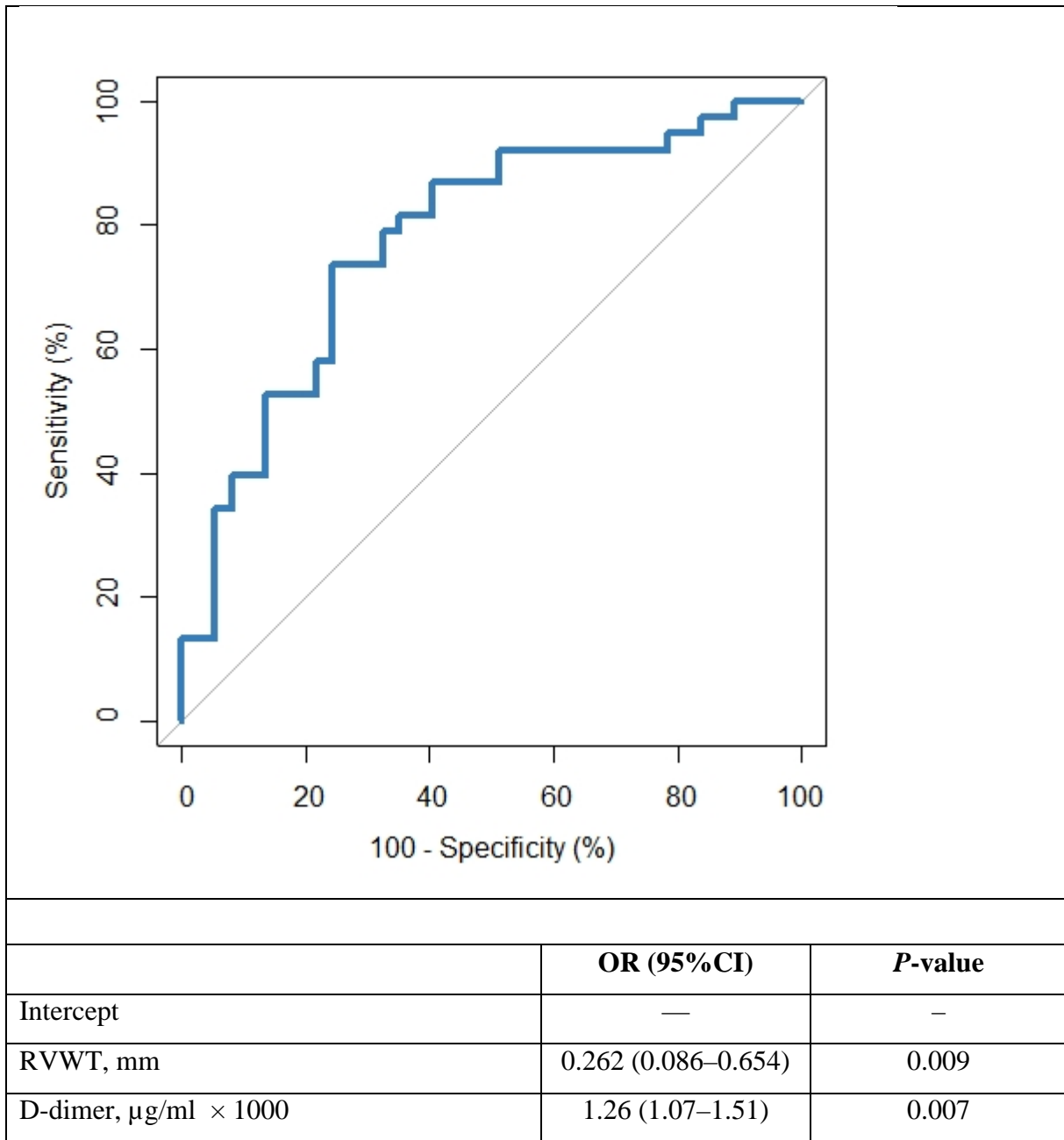


Figure S2. Logistic regression model predicting PE based on RVWT and D-dimer level

$\beta$ , logistic regression coefficients, SE, standard error; OR, odds ratio

### **The exclusion criteria**

The exclusion criteria comprised the CTPA contraindications, incomplete echocardiograms or inadequate quality of TTE, severe valvular defects, tricuspid valve replacement, confirmed chronic thromboembolic pulmonary hypertension.

### **Echocardiographic assessment**

TTE was performed within 24 hours after admission to the ward by an experienced sonographer cardiologist using a commercially available echocardiographic systems of Vivid S6 and Vivid S60N (General Electric Company, Boston, Massachusetts, United States of America). The measurements were performed in accordance with the current guidelines including an extended analysis of the right heart with the use of classic echocardiography with electrocardiography monitoring to determine the phases of heart cycle [8, 9]. The average values of each single parameter were calculated from 3 to 5 cardiac cycles using the incorporated software of the ultrasound machines.

### **Detailed statistical analysis**

Regression analysis was used to determine the independent predictors of PE in the study group. Parameters that differed between PE and non PE group were tested in univariate logistic regression analysis. Due to small number of events we had to limit number of predictors in multivariate model. Parameters that were significant ( $P < 0.05$ ) as single predictors were then used in the multivariable analysis. If a parameter and its derivative indexed to height or derivative indexed to BSA showed statistical significance, the one with the lowest P value was used. Receiver-operating characteristic (ROC) analysis was performed to assess model accuracy.