Transient Prominent Anterior QRS Forces in a patient with acute total proximal obstruction of Left Anterior Descending Artery with reversion after useful Percutaneous Coronary Intervention

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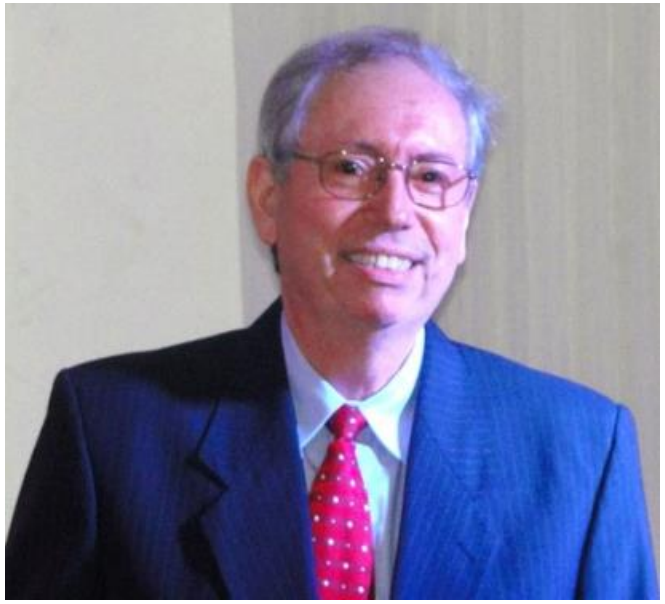

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Case Report

Main complaint: precordial pain and fainting.

Elderly, female patient (83 years old): diabetic, dyslipidemic, and with hypothyroidism. She was admitted in the ER due to symptoms of syncope, which she mentions has been happening to her since she was 38 years old, associated to different troubles. After recovering consciousness, she reported oppressive precordial pain and dyspnea. The ECG made at the time revealed complete right bundle branch block, left anterior fascicular block, and ventricular repolarization alterations (VRA), left ventricular enlargement (LVE) and positive myocardial necrosis biomarkers (troponin T; 0.3/ml). A diagnostic hypothesis of non-ST segment elevation acute coronary syndrome was made, and diagnostic coronary angiography was requested, which could not be done as her consciousness got depressed again, presented hypertensive peak and renal dysfunction. She mentioned precordial pain associated to nausea and dyspnea 3 months before, with no previous investigation. She was sent to the ICU to continue with her care. She was admitted alert, cooperative, in Glasgow 15 with no deficit, and good respiratory pattern and asymptomatic hypertension. BP 203/105 mmHg, HR 80 bpm, split regular heart rhythm, rhythmic and normal sounds with no murmurs.

Echo: 16/10, discrete increase of left ventricular volume for the biotype (33 mm/m2), discrete concentric LV hypertrophy and preserved overall and segmentary LV contractility.

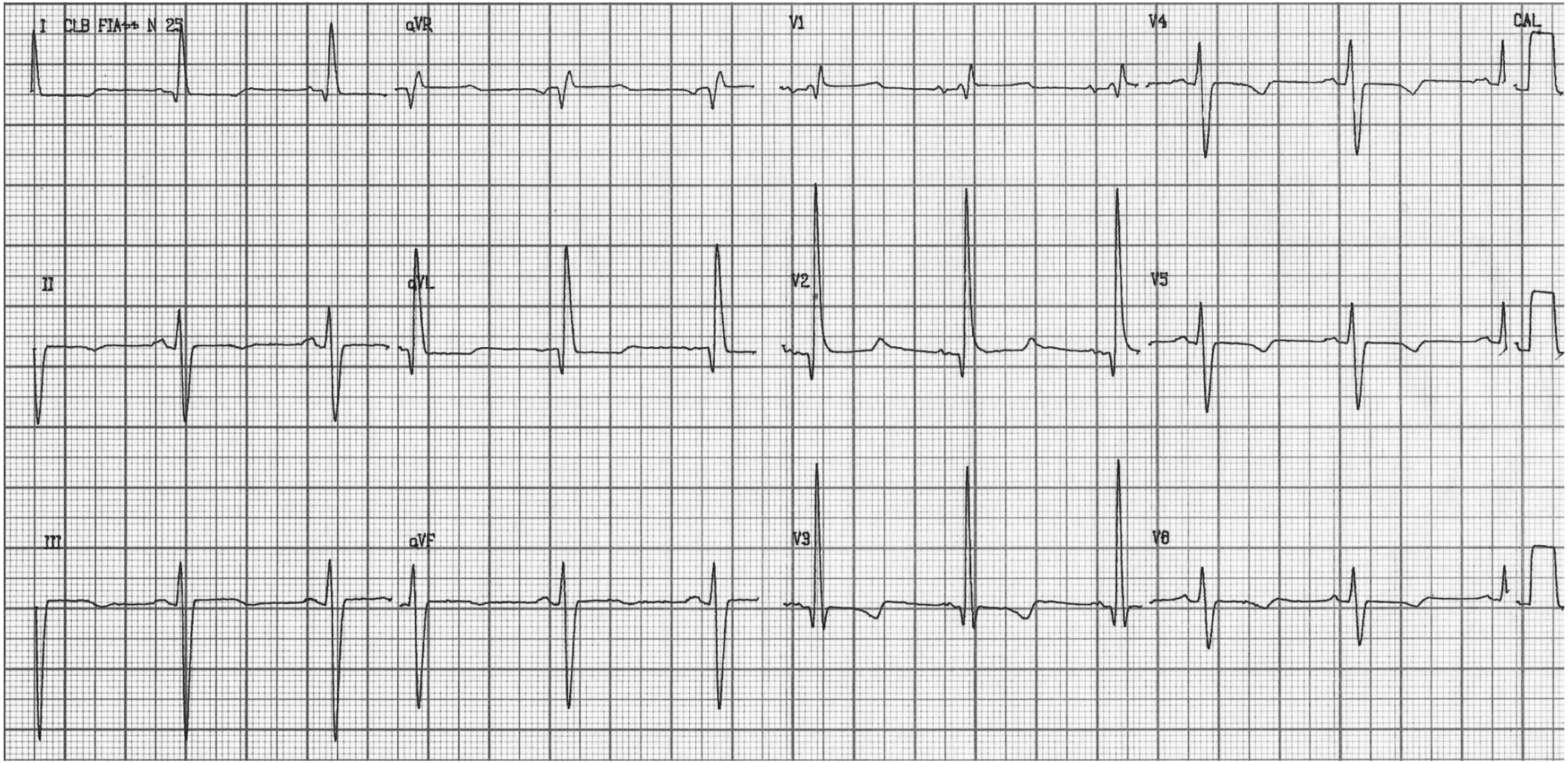
Raimundo and Andres.

Questions

1.What is the electro-vectorcardiographic diagnosis?

2.What is / are the causes of the transient prominent anterior QRS forces (PAF)? And Why?

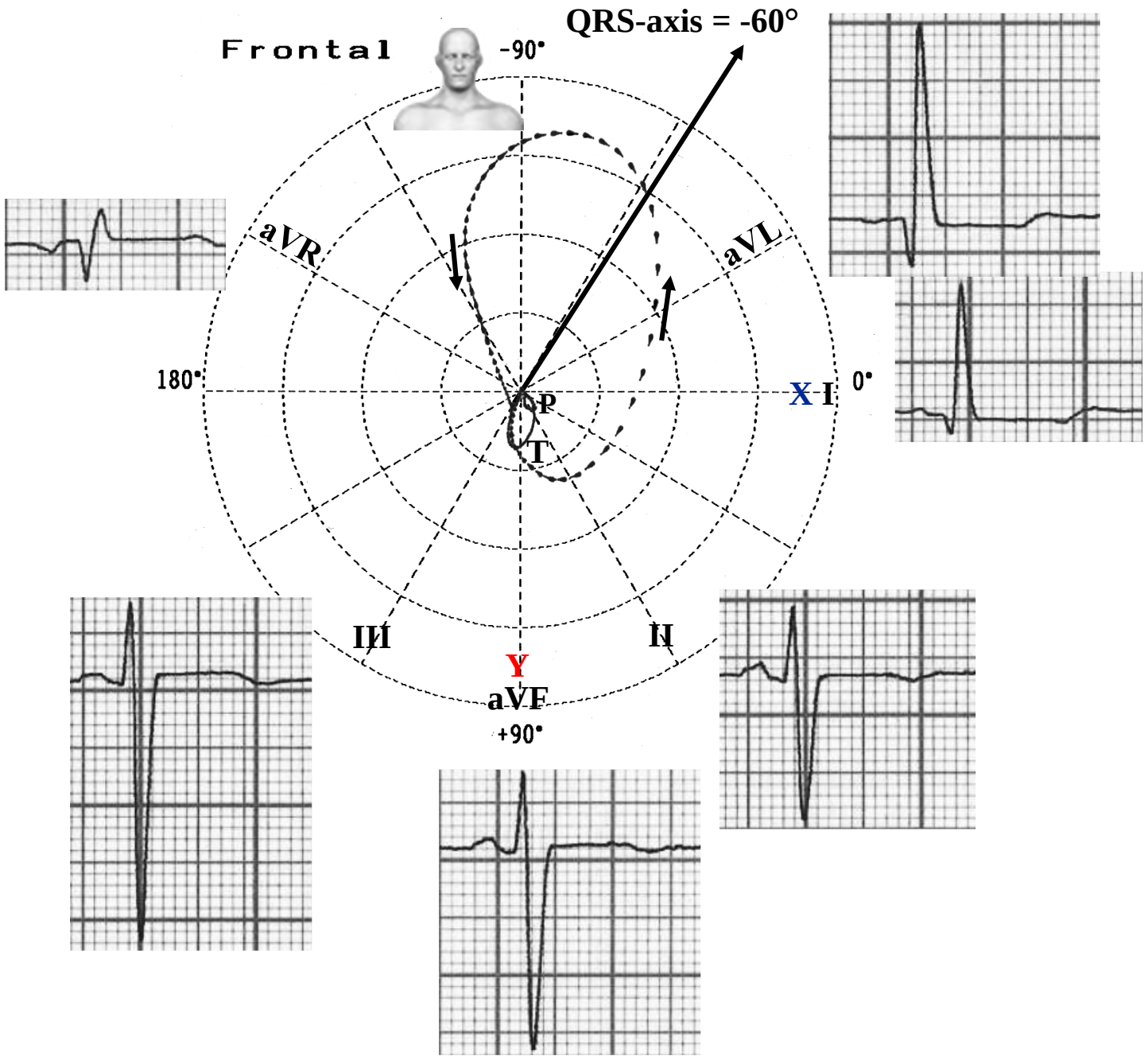
ECG before PCI



ECG diagnosis: sinus rhythm, heart rate bpm, P duration 120ms, PR interval 160ms, Extreme shift of SÂQRS in the left superior quadrant (QRS axis -60°), QRS duration 120 ms, qR I and aVL. SIII>SII, rIII > rII, SIII = 20mm, triphasic QRS pattern in V1 (rsR'), qR in V2 and qRs in V3 with rS in V4-V6.

Conclusion: Left atrial enlargement (P duration=120ms); Left anterior fascicular block **(**LAFB) Rosenbaum type IV (association of LAFB + LVH because SIII > 15mm); Left septal fascicular block (LSFB), degree of RBBB. Trifascicular block Trifascicular block not yet described in the literature.

ECG/VCG correlation in the frontal plane



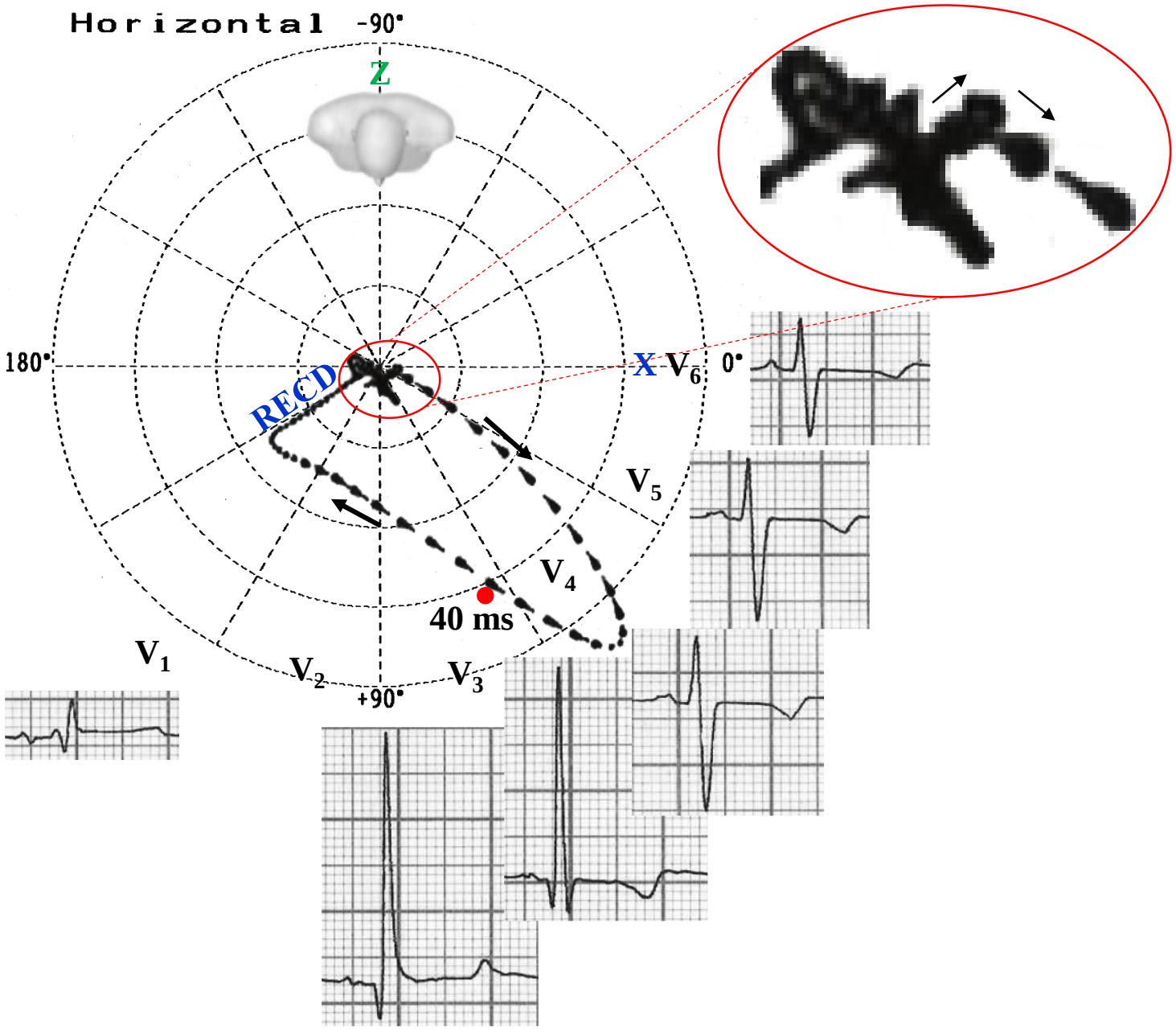
ECG

I. Extreme shift of SÂQRS in the left superior quadrant (QRS-axis = -60°)
II. rS in II, III and aVF.
III. r III > r II (it indicates CCW rotation in the FP). The voltage of the r waves is 3 to 5 mm in average
IV. SIII > SII: Left anterior fascicular block **(**LAFB);
V. SIII > 15mm. LAFB Rosenbaum type IV: association of LAFB + LVH because SIII > 15mm
VI. R- wave peak time in aVL ≥ 45 ms
VII. qR pattern in I and aVL
VIII. aVR begins with q or Q wave(in LAFB always begins with Q or q wave).

VCG

I. Counterclockwise rotation of QRS loop.
II. Vector of initial 10 to 20 ms heading below
III. QRS loop located predominantly in the left superior quadrant

ECG/VCG correlation on frontal plane



ECG

- Increased R-wave ventricular activation time V1 and V2: ≥ 35 ms;
- Small (embryonic) q wave in V2 and V3;
- R wave "in crescendo" from V1 through V3 and decreasing from V4 to V6;
- ≥15 mm voltage R waves in V_2 and V_3;
- Absence of q wave in left precordial leads V_5, V_6 by absence of first septal vector (1_{AM}) or 1 anteromedial vector.

Note: all these criteria are valid in absence of RVH, septal hypertrophy or lateral wall MI and other causes of PAF.

VCG:

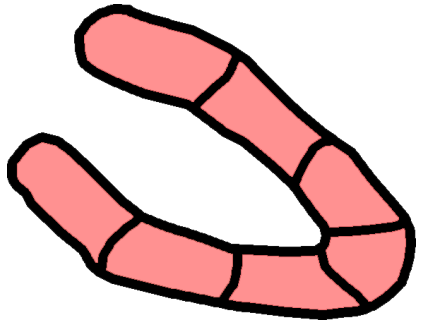
- QRS loop in the HP with an area predominantly located in the left anterior quadrant (≥ $^2/_3$ of the loop area facing the orthogonal X lead: 0º to ±180º);
- Absence of normal convexity to the right of the initial 20 ms of the QRS loop, anterior location of the 40 to 50 ms vector and clockwise QRS rotation in presence of advanced or complete LSFB or in association with RBBB.
- Additionally, triphasic (rsR') pattern in V1 and right end conduction delay (**RECD**) located on anterior right quadrant suggesting degree of right bundle branch block in association

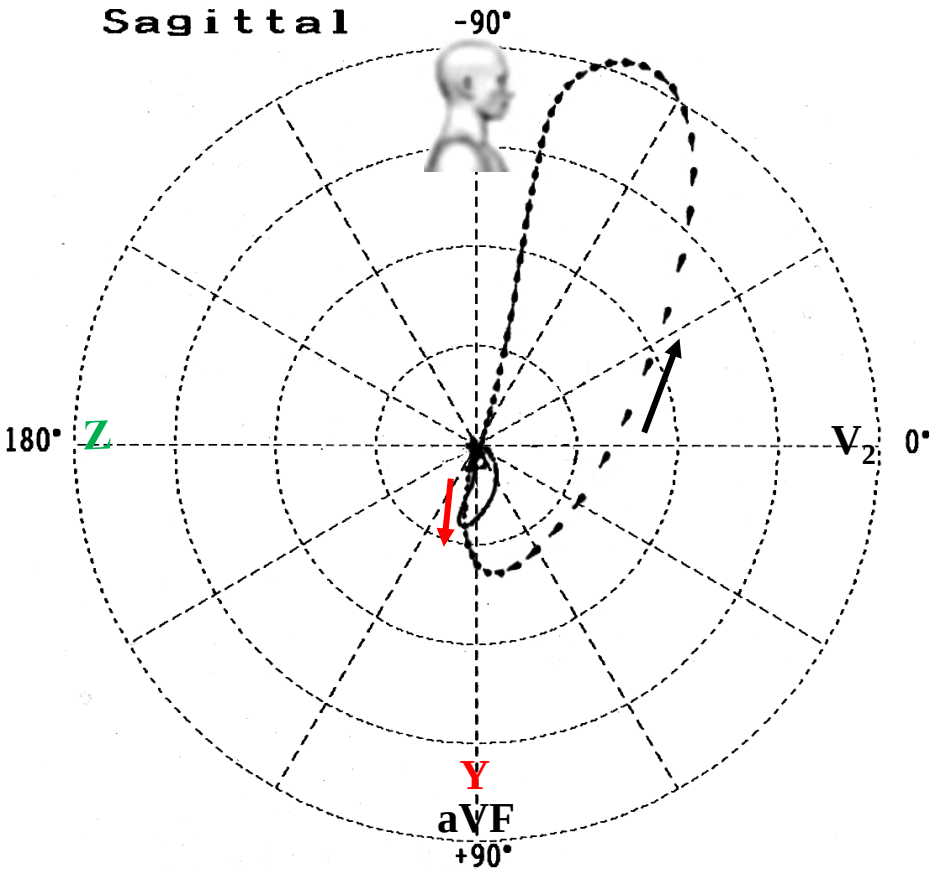
RECD: Right End Conduction Delay on right anterior quadrant:

ECG/VCG correlation in the right sagittal plane

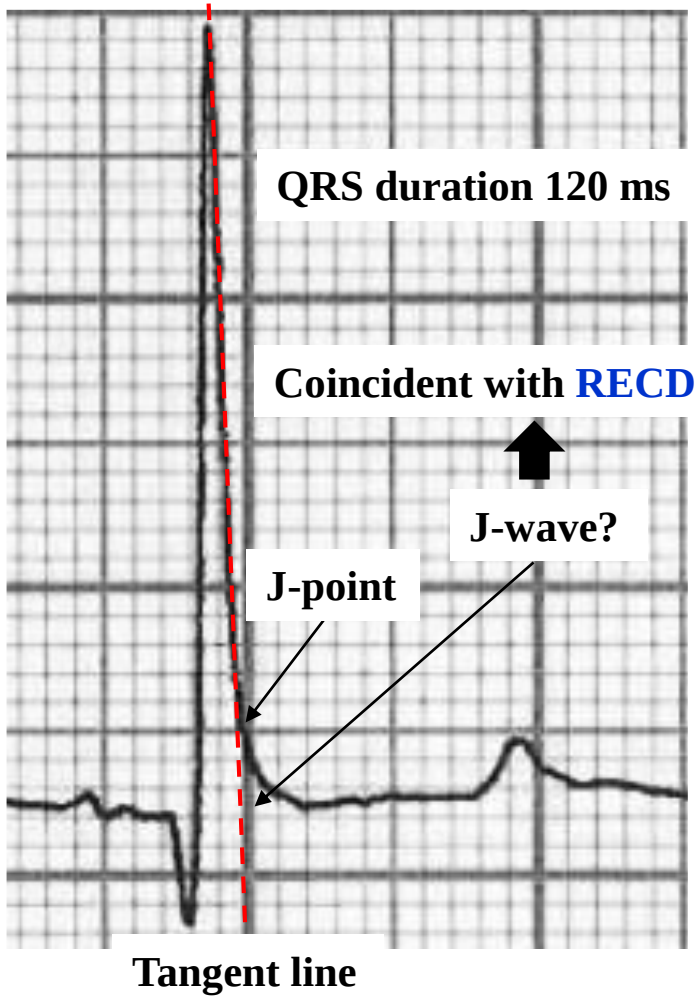
Initial vector of the 20 ms: as a consequence of the block in the left anterior fascicle and the left septal fascicle, the onset of ventricular activation will depend on the unblocked fascicle, i.e. the left posterior fascicle (LPF) that ends in the base of the posteromedial papillary muscle of the mitral valve in the posteroinferior region of the LV.

The activation of this area originates the so-called vector 1PI of the initial 20 ms, heading below, and minimally backward (**red arrow**).

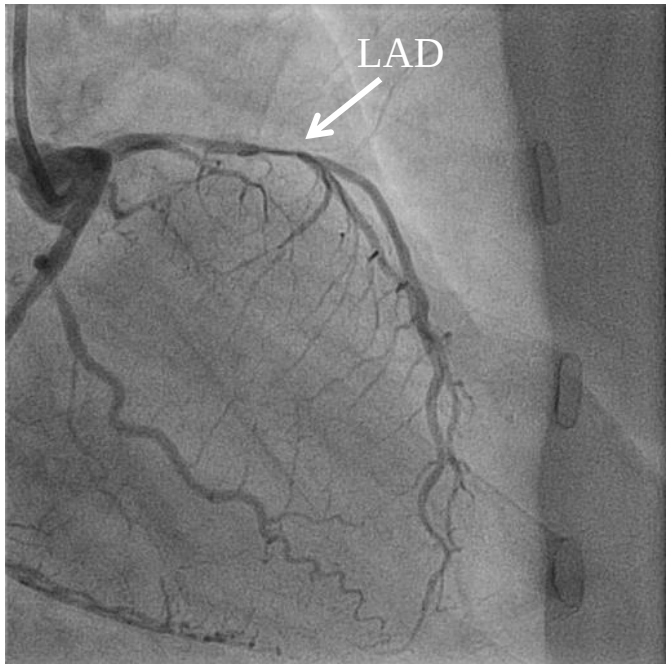


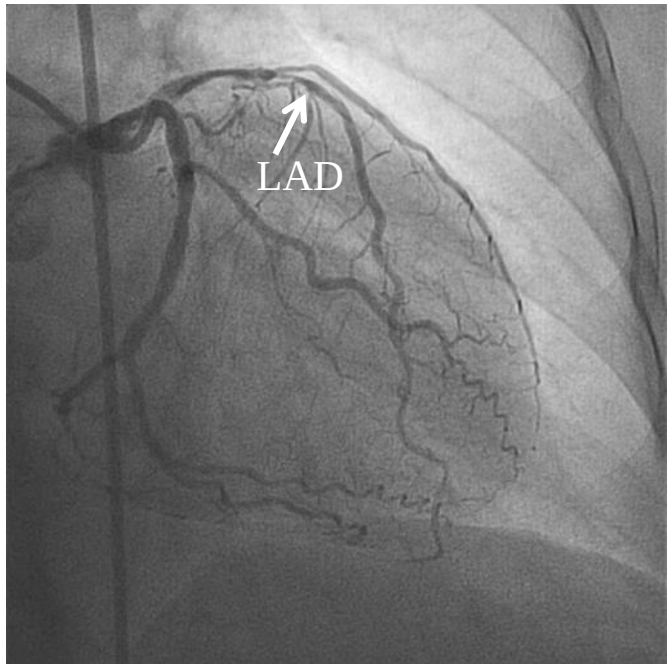


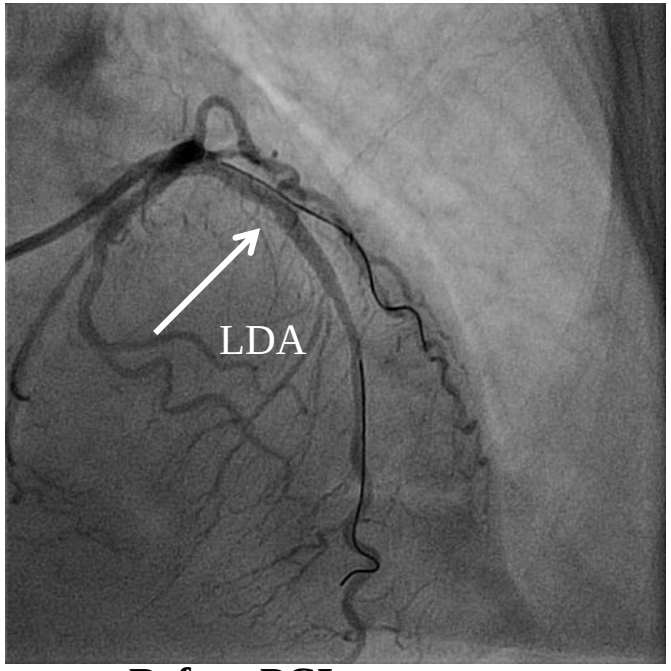
Prominent Anterior QRS Forces (PAF) RV2= 28mm

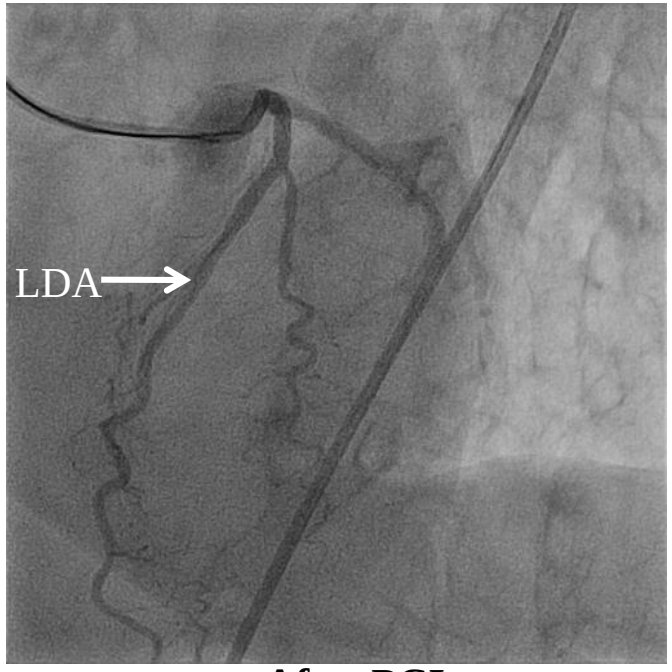


The initial 20 ms, heading below, and minimally backward (red arrow).



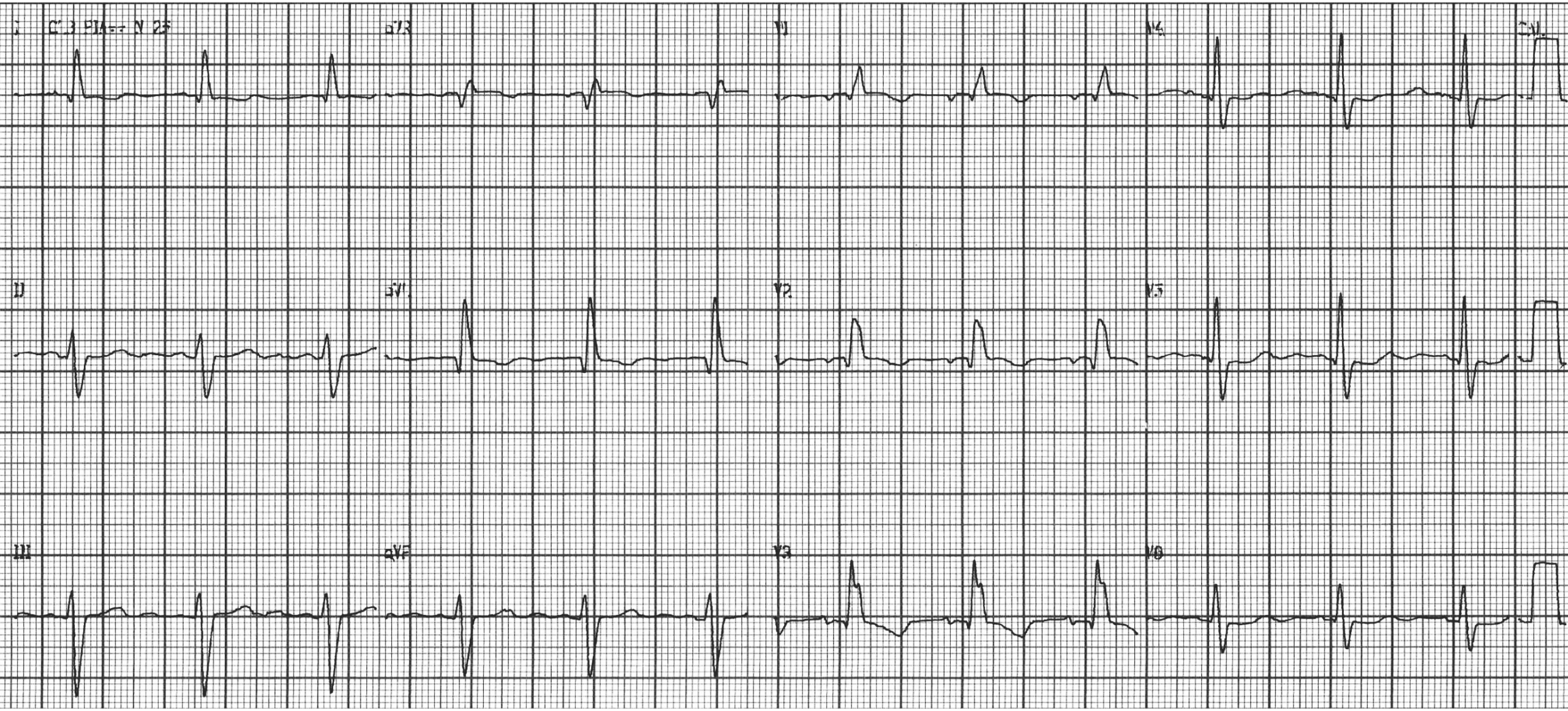






Before PCI **After PCI**

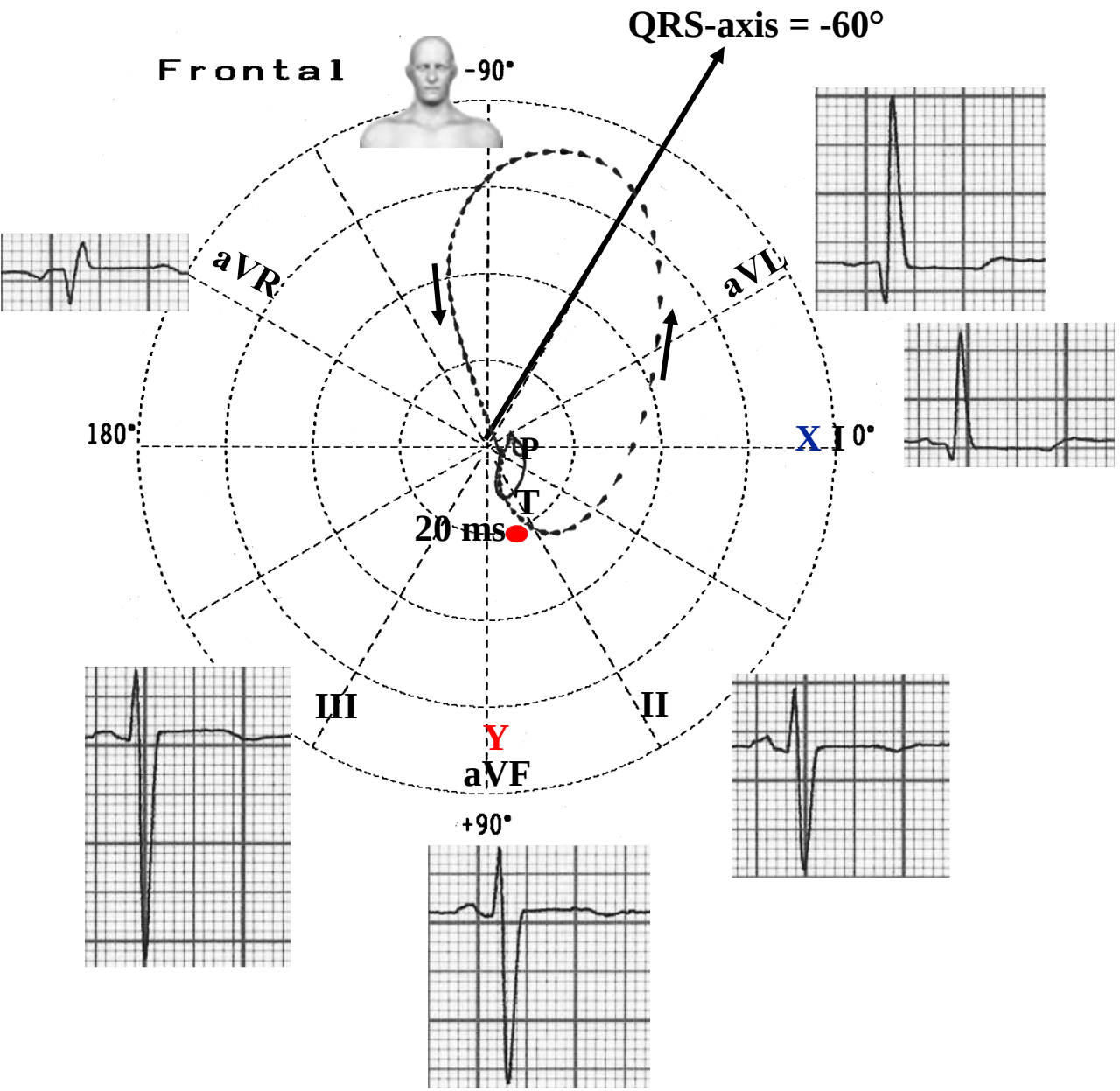
ECG: showing reversion of Prominent Anterior QRS Forces (PAF) after successful PCI



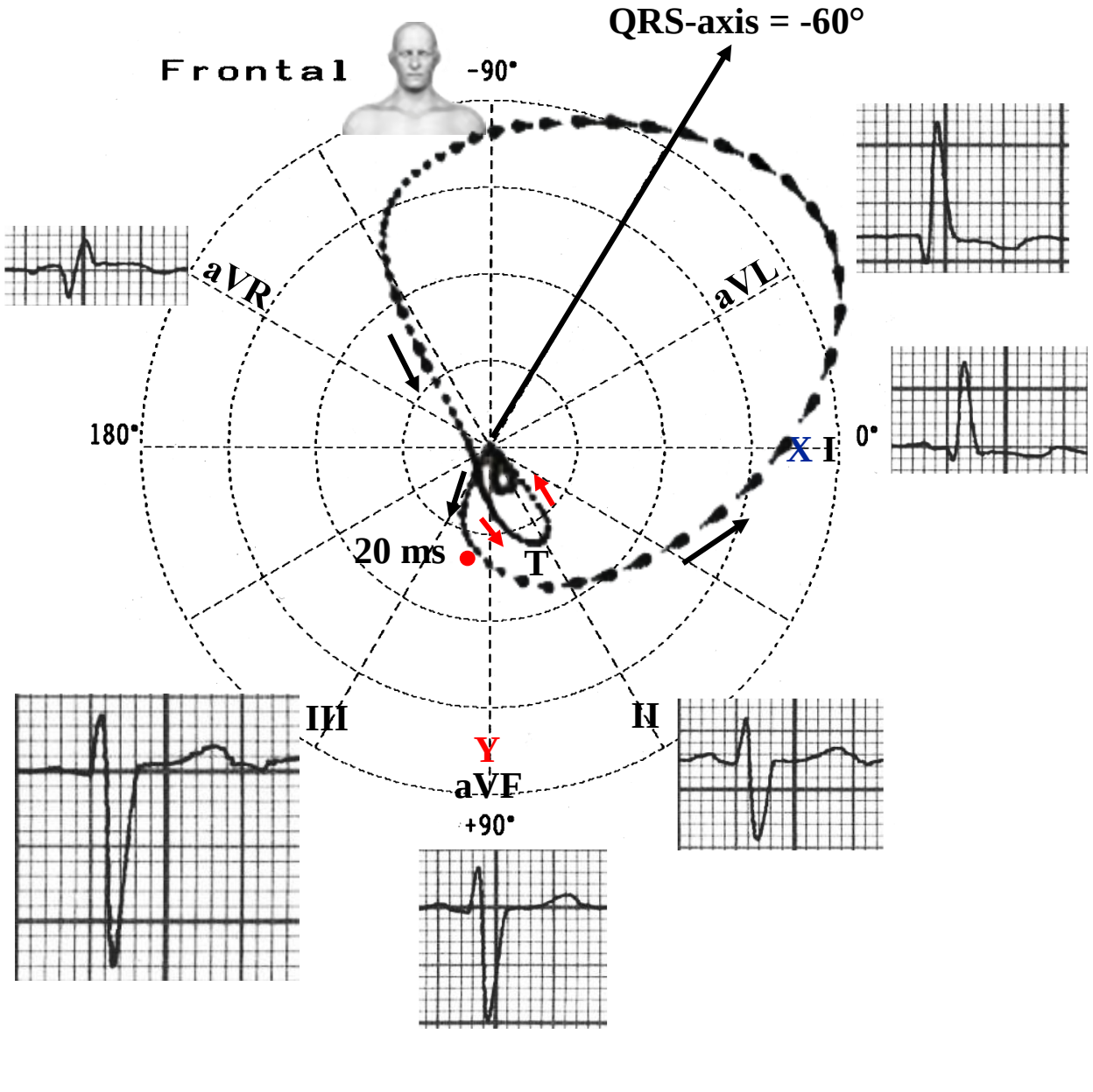
ECG diagnosis: LAFB + RBBB + Anteroseptal myocardial infarction: qR from V1 to V3

ECG/VCG correlation in the frontal plane

Before PCI



After PCI

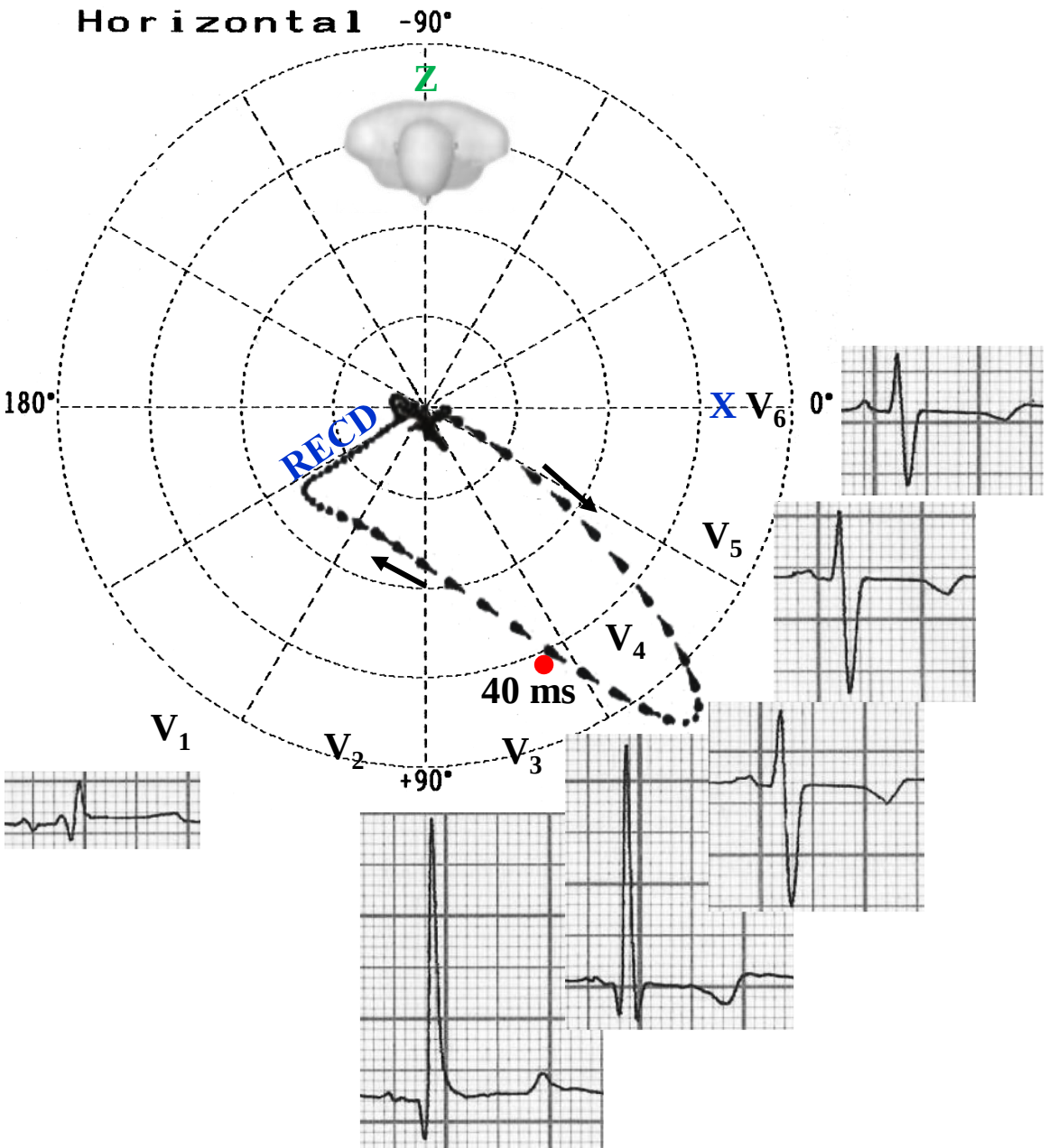


ECG/VCG correlation in the Frontal Plane

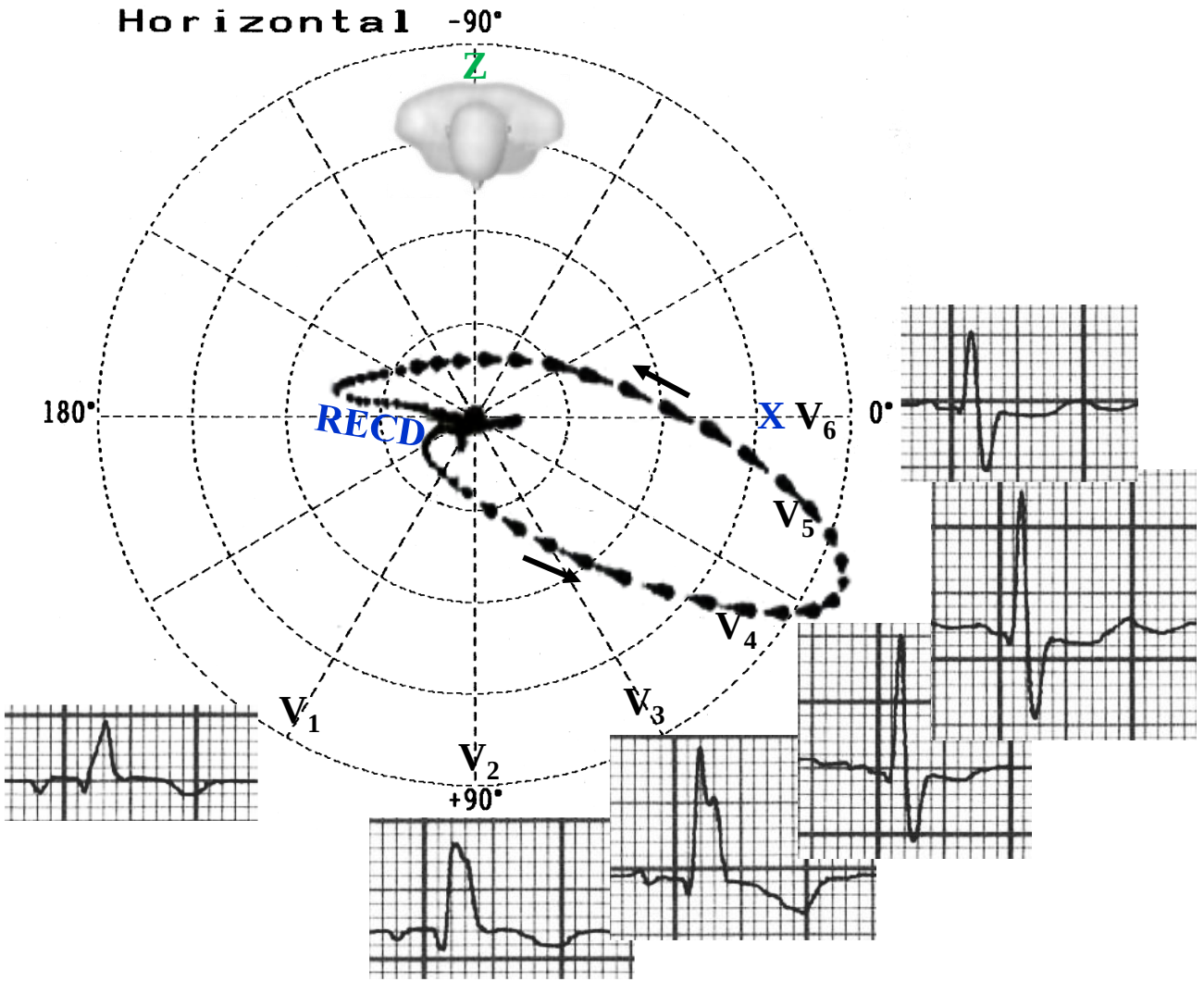
	Before PCI	After PCI
QRS axis	**-60°**	**-60°**
III	rS- S= 23mm: LAFB Rosembaum type IV (associated with LVH)	rS S= 13mm: LAFB Rosembaum standard type I
Voltage of the r wave in III	7mm	4mm
Initial 20 ms vector	On **left** and inferior quadrant (LAFB+ LSFB)	On **right** and inferior quadrant(LAFB)
ECG/VCG diagnosis	LAE+ LAFB+ LVH	LAE+ LAFB

ECG/VCG correlation in the Horizontal Plane

Before PCI



After PCI

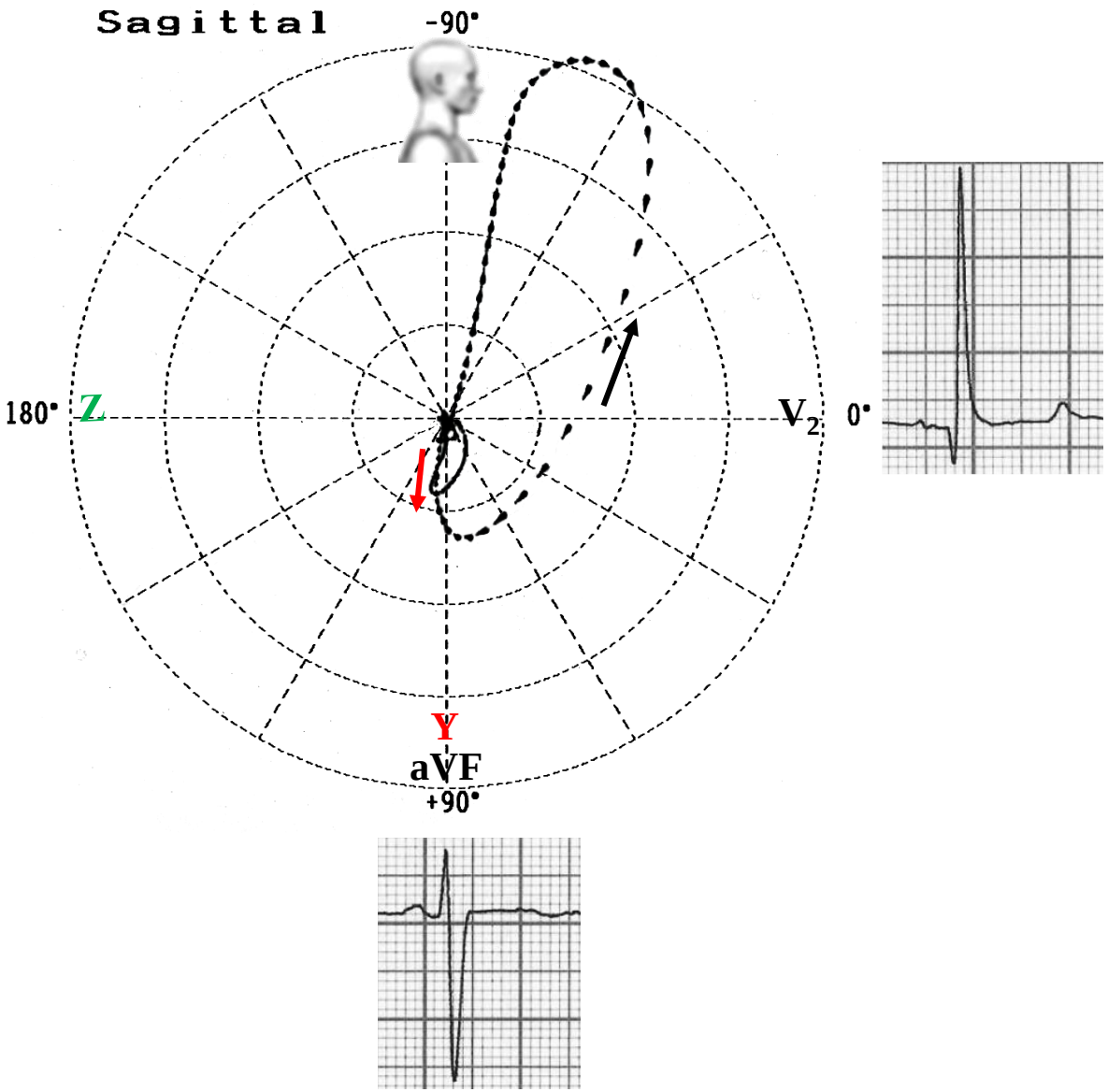


ECG/VCG correlation in the Horizontal Plane

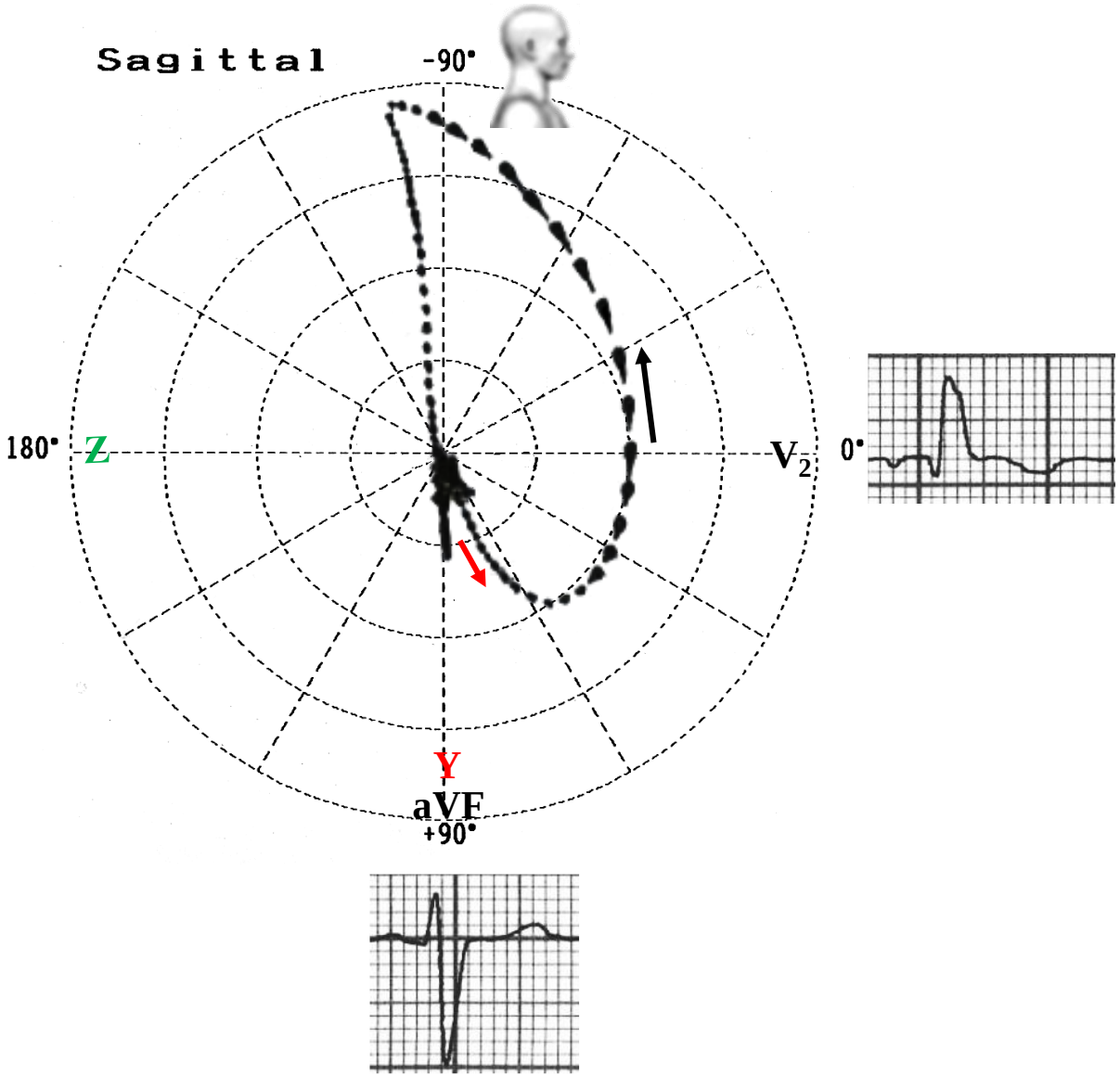
	Before PCI	After PCI
QRS-loop rotation		**Counter Clockwise**
Prominent Anterior QRS Forces (PAF)	Present	Absent
Right End Conduction Delay	On right **anterior** quadrant	On right **posterior** quadrant
QRS-loop shape and QRS duration	With an area predominantly located in the left anterior quadrant ($\geq {}^{2}/_{3}$ of the loop area facing the orthogonal X lead: 0º to ±180º). QRSd = 120ms	RBBB type I or Grishman type QRSd 120ms
QRS in V_1	Triphasic: rsR'	Biphasic qR
QRS in V_2	qR. R≥15 mm Voltage R wave in V_2 = 27mm. J-wave insinutation	qR R wave in V_2 = 6mm
QRS in V_3	qRs R wave = 24mm	qR with notched R wave Voltage R wave in V_3 = 9mm
QRS in V_4	rS followed by negative T wave	qRs followed by negative T wave
QRS in V_5	rS followed by negative T wave Absence of q wave in left precordial leads V_5, V_6 by absence of first septal vector (1_{AM}) or first anteromedial vector.	qRs followed by positive T wave
QRS in V_6	rS followed by negative T wave Absence of q wave in left precordial leads V_5, V_6 by absence of first septal vector (1_{AM}) or first anteromedial vector.	qRs followed by positive T wave
ECG/VCG diagnosis	LSFB + degree of RBB	RBBB + anteroseptal myocardial

ECG/VCG correlation in the right sagittal plane

Before PCI

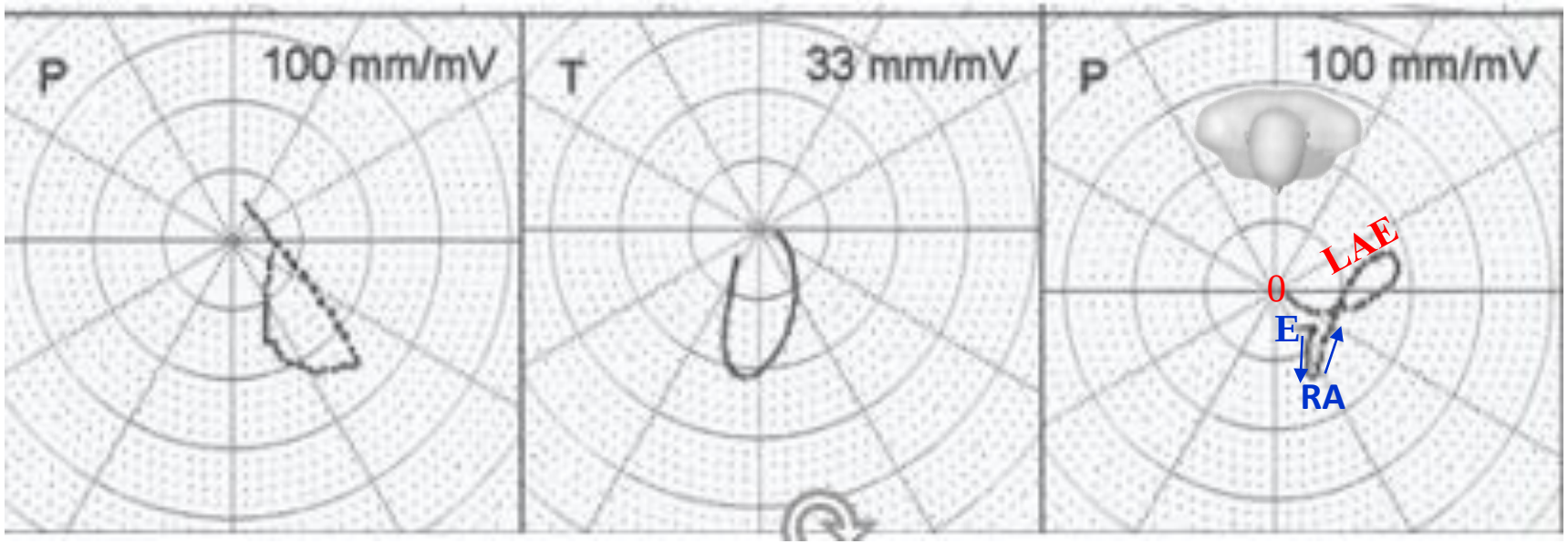


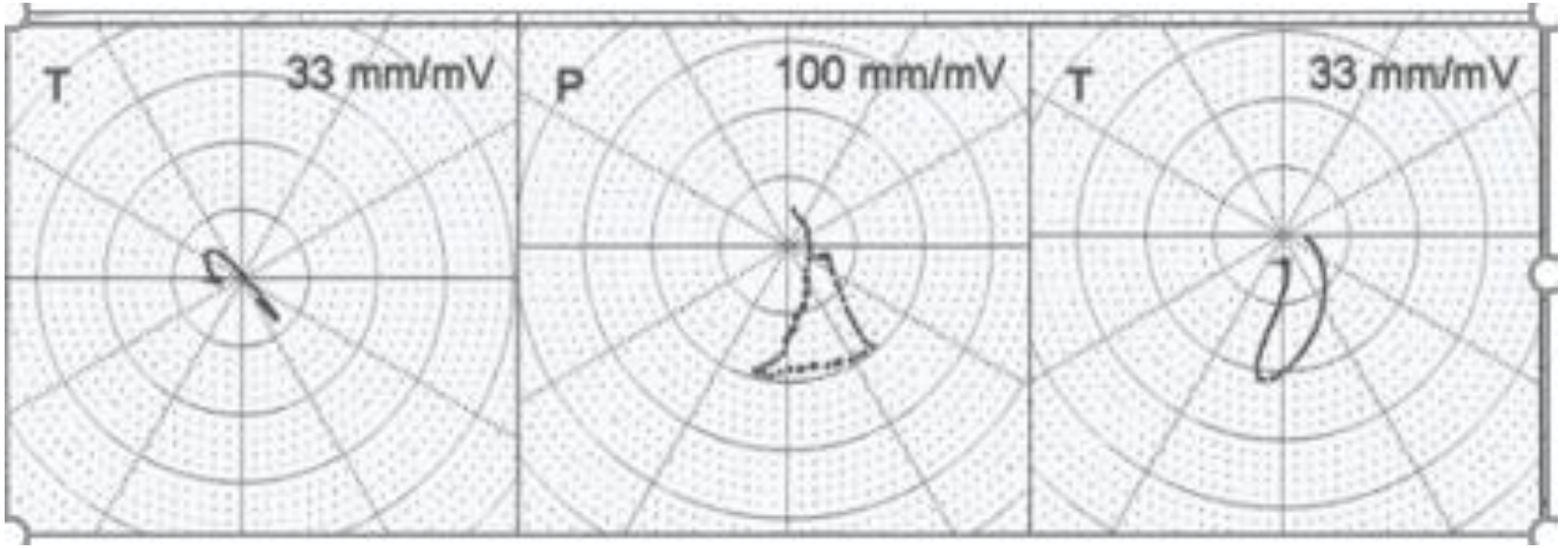
After PCI



ECG/VCG correlation in the Right Sagittal Plane

	Before PCI	After PCI
Initial 20ms of QRS loop	To down and backward: By absence of first septal vector (1_{AM}) or first anteromedial vector.	To down and anterior
QRS-loop location	Predominantly on anterior and superior quadrant	Predominantly on anterior and superior quadrant with final portion on superior posterior quadrant
V_2	qR. R≥15 mm Voltage R wave in V_2 = 27mm	qR R wave in V_2 = 6mm
ECG/VCG diagnosis	LSFB	RBBB+ anterior infarction


P
100 mm/mV
T
33 mm/mV
P
100 mm/mV
LAE
0
E
RA


T
33 mm/mV
P
100 mm/mV
T
33 mm/mV