

Dolor torácico agudo y ECG - ¿es necesaria la angiografía coronaria inmediata?

Kjell Nikus, MD, PhD

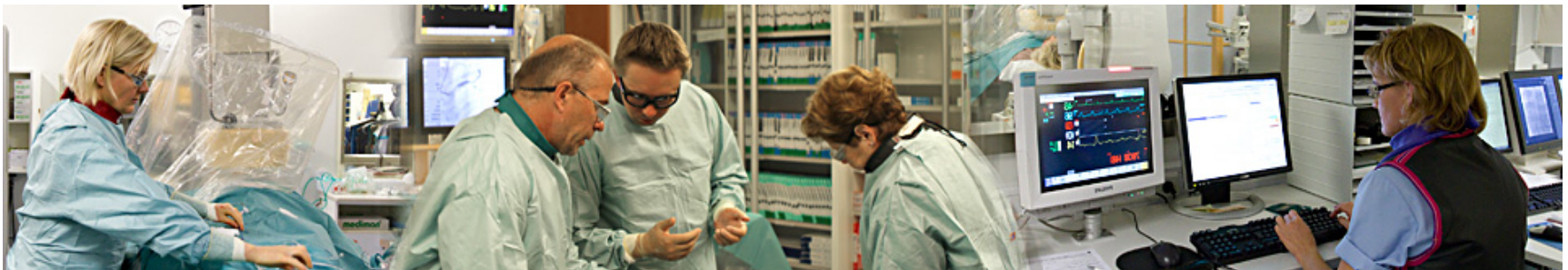
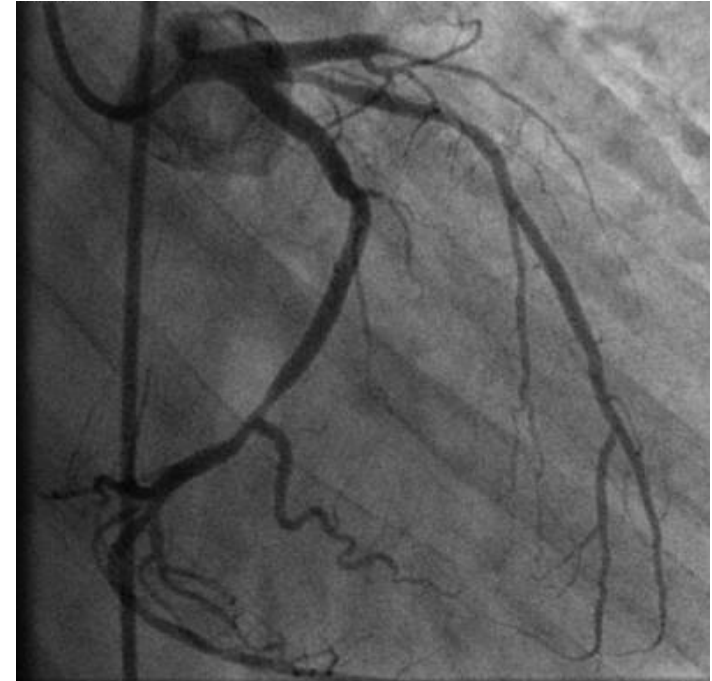
Heart Center, Tampere University Hospital, Finlandia

y

Samuel Sclarovsky, MD, PhD

Universidad de Tel Aviv, Israel

Hay casos claros...



Pero otros son más complejos...

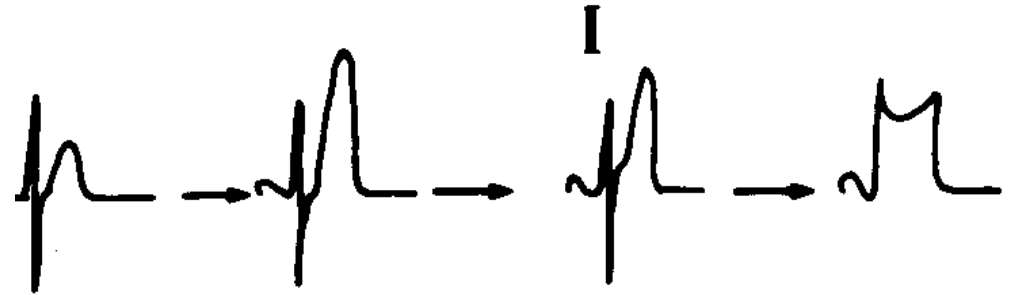


FACTORES QUE AFECTAN LOS CAMBIOS ECG/EGM ISQUÉMICOS

- Mecanismo fisiopatológico
 - Oferta vs. demanda isquémica
 - Oclusión total, estenosis, espasmo
- Duración de la isquemia
- Isquemia transmural vs. subendocárdica
- Gravedad de la isquemia
 - Protección miocárdica (flujo colateral, preacondicionamiento, segunda arteria)
- Localización vs. electrodo/s – propiedades de conductor de volumen (distancia, etc.), dirección del vector
- Cambios ECG basales → Importancia de la comparación
 - (BR, MP, HVI, WPW, rotación, corazón horizontal vs. vertical)
- Variación en la anatomía coronaria

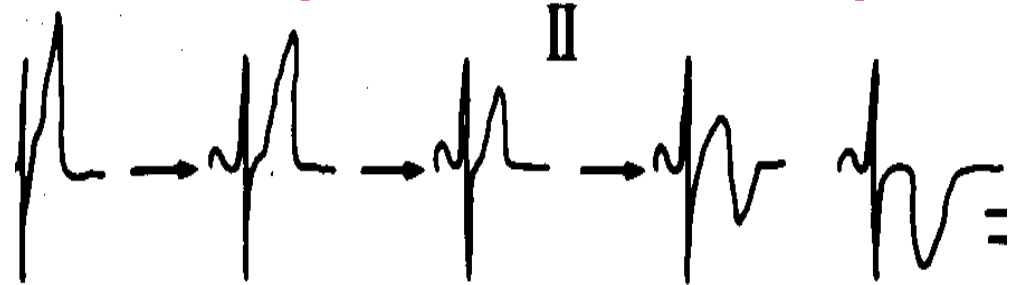
Secuencia de cambios ECG en la oclusión coronaria

Etapa I
Oclusión aguda

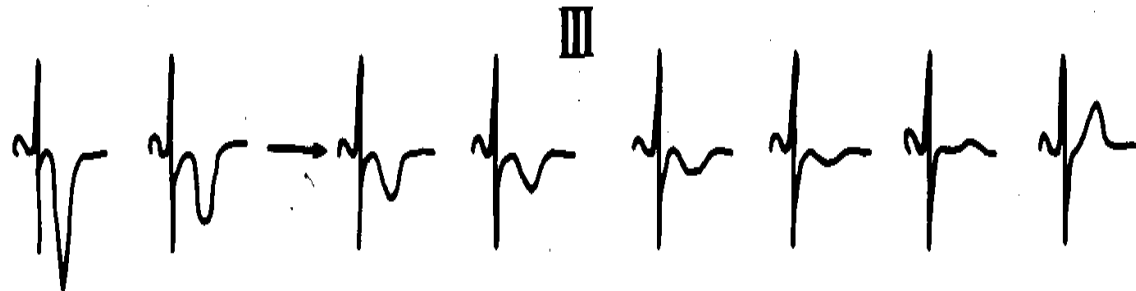


¡Este ECG puede registrarse en cualquiera de estas etapas!

Etapa II
Reperusión



Etapa III
Restauración del metabolismo celular



Third universal definition of myocardial infarction

Kristian Thygesen, Joseph S. Alpert, Allan S. Jaffe, Maarten L. Simoons, Bernard R. Chaitman and Harvey D. White: the Writing Group on behalf of the Joint ESC/ACCF/AHA/WHF Task Force for the Universal Definition of Myocardial Infarction

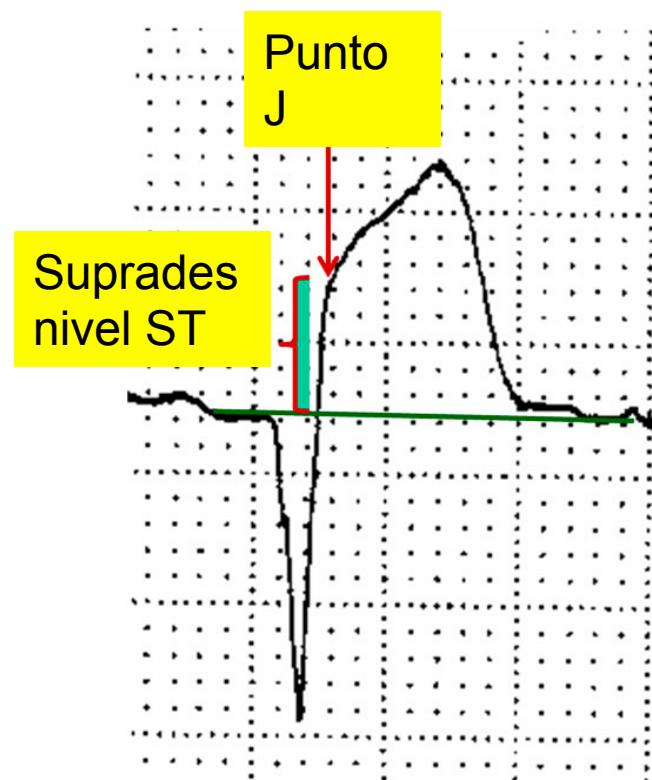
Table 3 ECG manifestations of acute myocardial ischaemia (in absence of LVH and LBBB)

ST elevation

New ST elevation at the J point in two contiguous leads with the cut-points: ≥ 0.1 mV in all leads other than leads V_2 – V_3 where the following cut points apply: ≥ 0.2 mV in men ≥ 40 years; ≥ 0.25 mV in men < 40 years, or ≥ 0.15 mV in women.

ST depression and T wave changes

New horizontal or down-sloping ST depression ≥ 0.05 mV in two contiguous leads and/or T inversion ≥ 0.1 mV in two contiguous leads with prominent R wave or R/S ratio > 1 .



La definición de supradesnivel ST es clara, pero...no todo supradesnivel ST es IMEST y por otro lado, la oclusión aguda de la arteria coronaria puede estar presente sin supradesnivel ST que cumpla con los criterios definidos en las guías

“ESTNI” (supradesnivel ST no isquémico)

Table 1

Common patterns of NISTE

STE secondary to LVH
STE secondary to conduction defect (LBBB) and nonspecific IVCD
Early repolarization pattern (notched J-point mainly in anterolateral leads)
Normal variant of STE (nonischemic STE mainly V2-V3)
Concave STE
Old myocardial infarction/ aneurysm
Spontaneously reperfused myocardial infarction
Pericarditis
Brugada syndrome
Wolf-Parkinson-White syndrome (pre-excitation)
Takotsubo syndrome (apical ballooning syndrome)
Hypercalcemia
Hyperkalemia

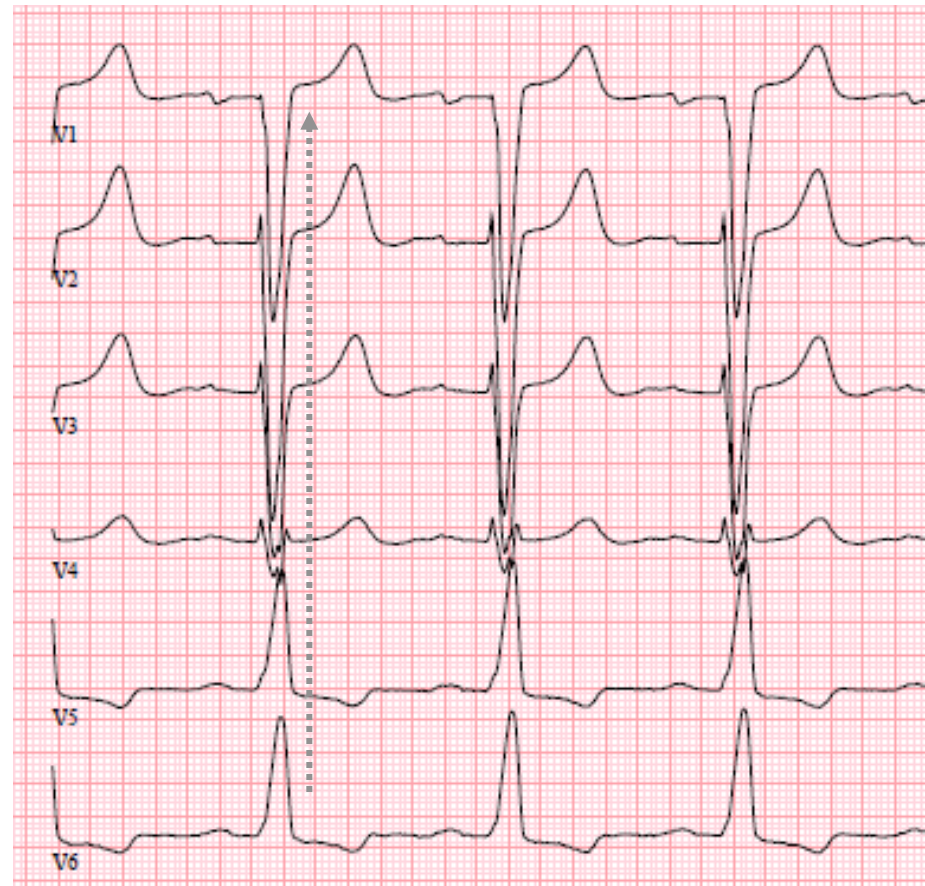
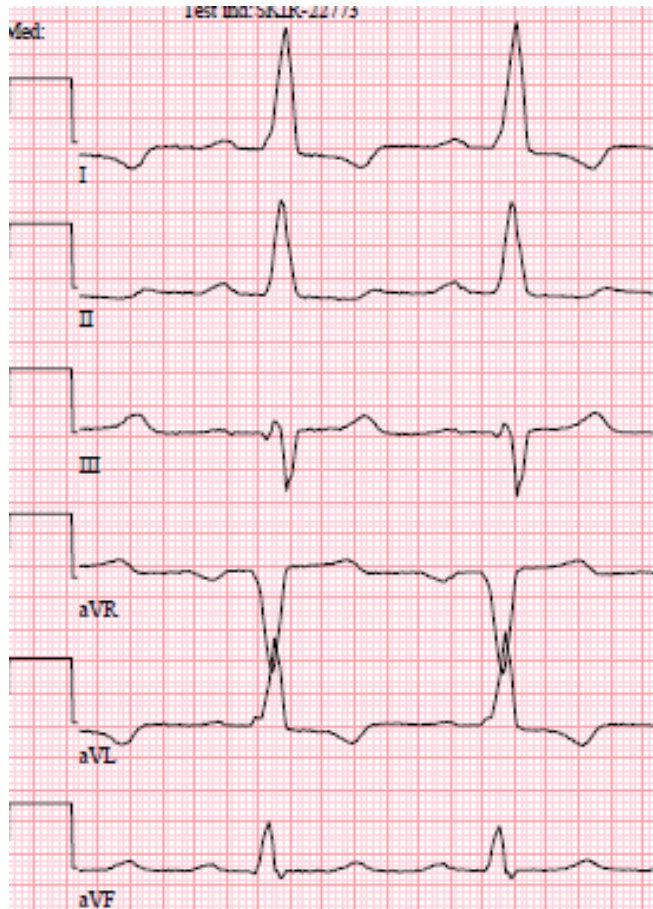
Huang HD et al JECG 2011

Etiologies for false-positive STEMI

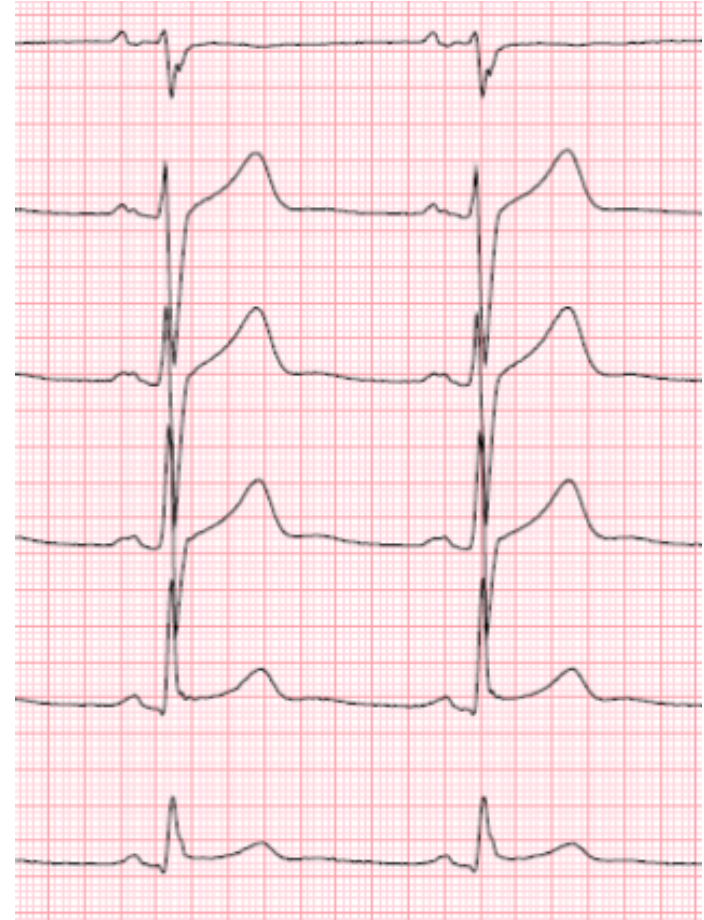
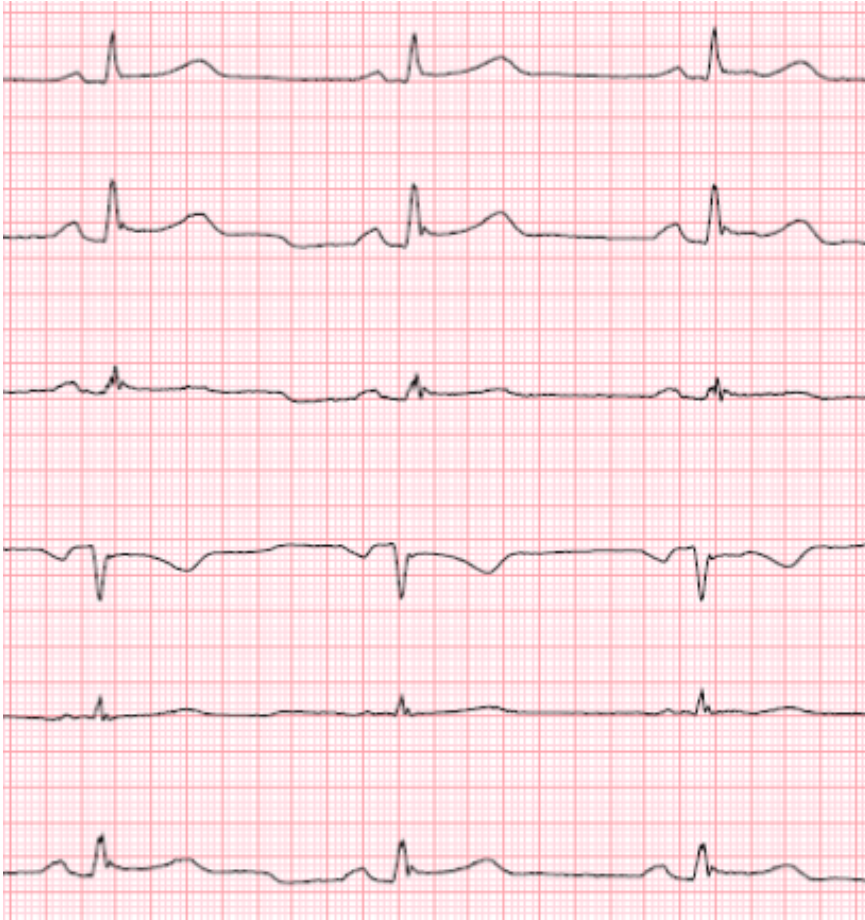
Etiologies	n
Total false-positive STEMI patients (n = 31)	
Coronary spasm (including 2 patients with myocardial bridge)	11
Ventricular tachyarrhythmia status post-CPR	4
Previous MI	4
Acute perimyocarditis	4
Left ventricular hypertrophy	3
Takotsubo cardiomyopathy	3
Aortic dissection	1
Tachycardia related	1
Positive ED biomarker results (n = 13)	
Coronary spasm	4
Ventricular tachyarrhythmia status post-CPR	1
Previous MI	2
Acute perimyocarditis	2
Left ventricular hypertrophy	2
Takotsubo cardiomyopathy	1
Tachycardia related	1

Chung S-L et al. Am J Emerg Med 2013

Remodelado crónico, por ejemplo en estenosis aórtica: infradesnivel ST como cambio primario en V5-V6, supradesnivel ST recíproco en V1-V2



Paciente masc., 71 años, con PCR elevada. Sin fiebre o infección evidente.



PR Depression Is Useful in the Differential Diagnosis of Myopericarditis and ST Elevation Myocardial Infarction

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Markku Eskola, Ph.D.,† and K.E.J. Airaksinen, Ph.D.*

*From the *Department of Medicine, Turku University Hospital, Turku, Finland; †Tampere Heart Center, Tampere, Finland*

Background: Deviation of the PR segment is a common but often ignored ECG finding in acute myopericarditis, but seems to be rare in the acute phase of ST elevation myocardial infarction (STEMI). Since rapid bedside differential diagnosis of acute myopericarditis and STEMI is essential, we decided to assess the diagnostic power of PR depressions in patients presenting with ST elevations in the emergency room.

Methods: Thirty-four consecutive patients with acute myopericarditis and 46 STEMI patients presenting with ST elevations fulfilling the criteria for STEMI were included. The first ECG recorded in the emergency room was analyzed with a focus on the PR segment. The diagnoses of myopericarditis and STEMI were ascertained with clinical follow-up together with rise in troponin levels, and in the STEMI patients also with coronary angiography.

Results: In myopericarditis, the most common location for PR depression was lead II (55.9%), while this ECG finding least likely appeared in lead aVL (2.9%). PR depression in any lead had a high sensitivity (88.2%), but fairly low specificity (78.3%) for myopericarditis. The combination of PR depressions in both precordial and limb leads had the most favorable predictive power to differentiate myopericarditis from STEMI (positive 96.7% and negative power 90%).

Conclusions: Our present observations show that PR segment analysis is a powerful tool in the differential diagnosis of myopericarditis and STEMI. This simple information should be added to the diagnostic workup of patients presenting with ST elevations.

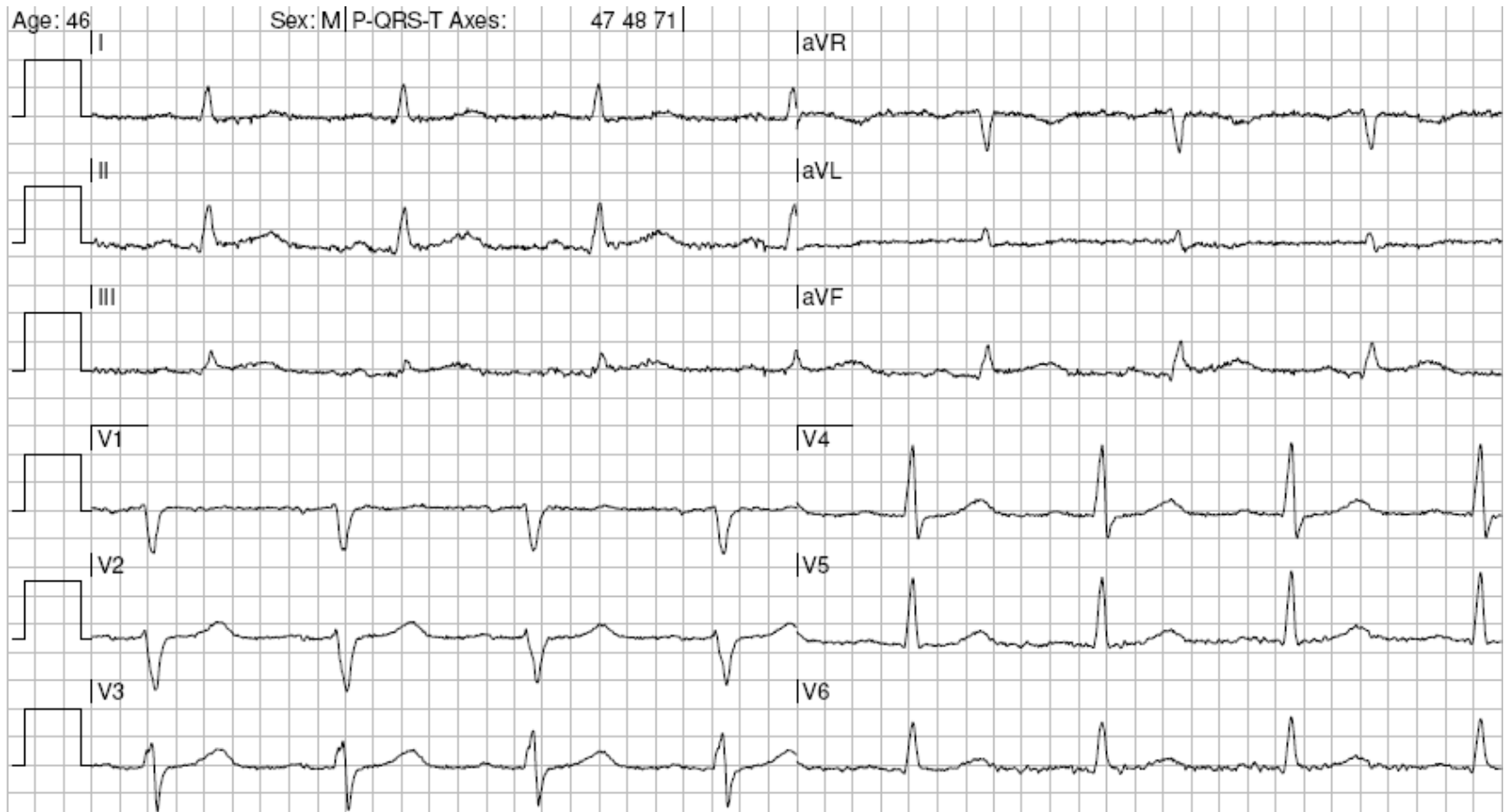
Ann Noninvasive Electrocardiol 2012;17(2):141–145

Algunas causas de IMEST no reconocidas en la sala de emergencias

- A veces el cambio isquémico primario (= supradesnivel ST) puede ser menos evidente que el infradesnivel ST secundario (recíproco)
- El supradesnivel ST puede ser leve y aparecer en sólo 1 derivación (*Birnbaum Y et al. Eur Heart J 1993*)
- IM antiguo con onda Q

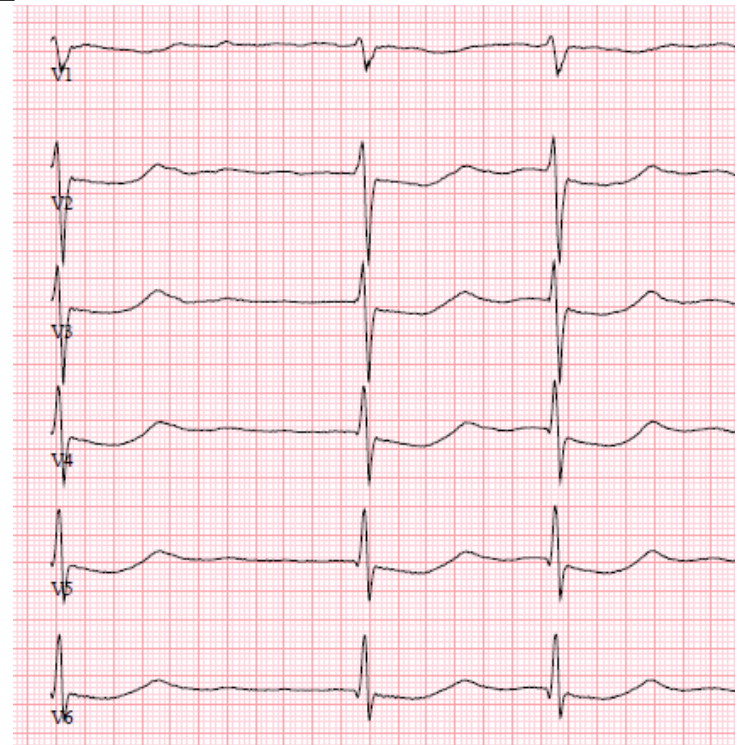
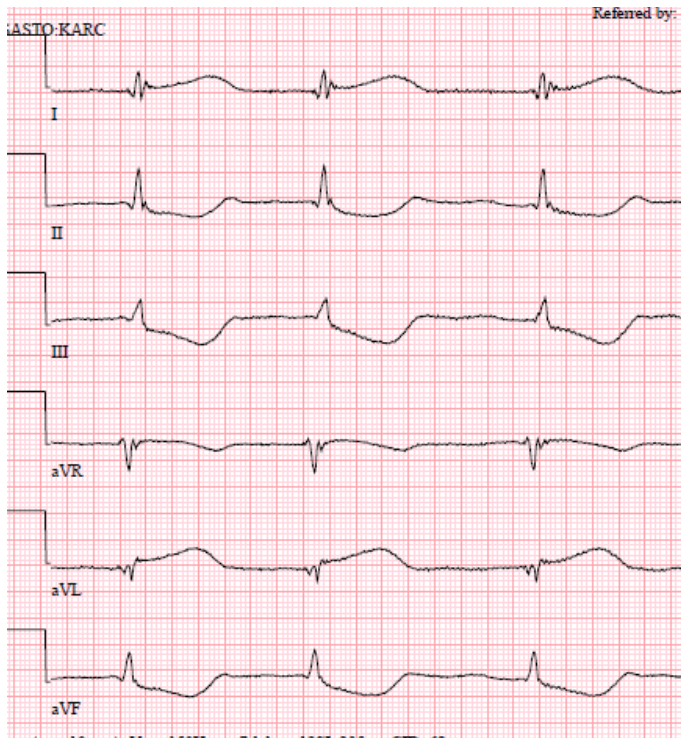
Supradesnivel ST límitrofe en II, III y aVF

Observen los cambios ST recíprocos en aVL



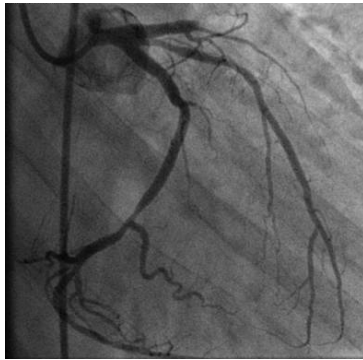
IMEST que puede diagnosticarse
erróneamente como IMSEST (oclusión de la
rama diagonal)

Ocho derivaciones con infradesnivel ST
El cambio primario es el supradesnivel ST en I,
aVL

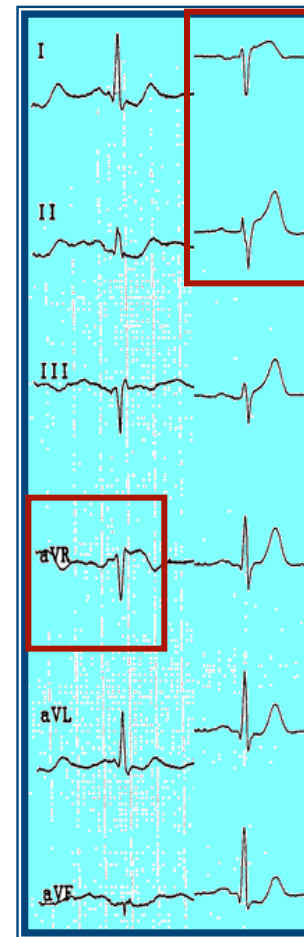
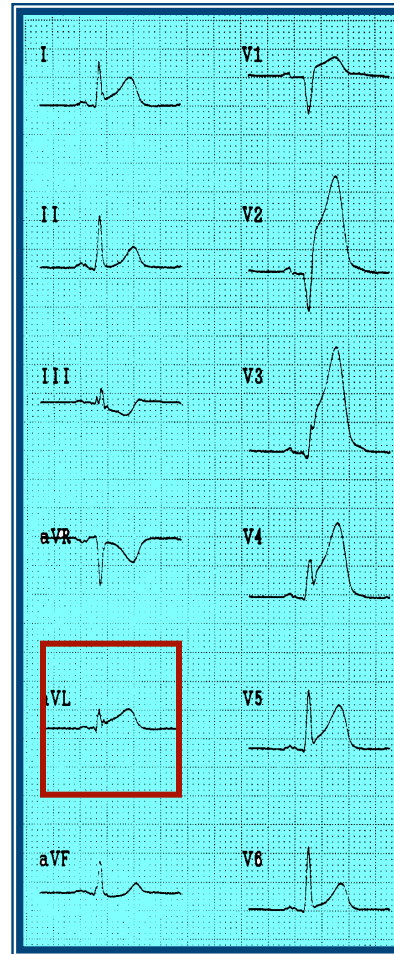


50 mm/seg

Oclusiones de la DAI muy proximales pueden presentar supradesnivel ST sólo en V1-V2 (y aVR)



“patrón aVL”
~3/4



“patrón aVR/
V1” ~1/4

*Eskola MJ et al. Int J
Cardiol 2009*

Un grupo de trabajo propuso una clasificación fisiopatológica de SCA en vez de una clasificación categórica basada en forma estricta en las presentaciones ECG

Electrocardiographic classification of acute coronary syndromes: a review by a committee of the International Society for Holter and Non-Invasive Electrocardiology[☆]

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Juan Cinca, MD,^j Peter Clemmensen, MD,^h Markku Eskola, MD,^a Miquel Fiol, MD,ⁱ
Diego Goldwasser, MD,^j Anton Gorgels, MD,^g Samuel Sclarovsky, MD,^c Shlomo Stern, MD,^k
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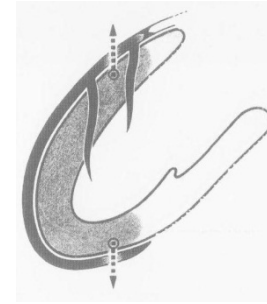
^jCardiology Service-Institut Català de Ciències Cardiovasculars, Hospital Santa Creu i Sant Pau, Barcelona, Spain

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^lCardiovascular Research Institute Maastricht, Maastricht, The Netherlands

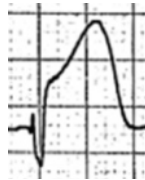
^mCardiology Division of the Department of Medicine, University of Rochester Medical Center, Rochester, New York, USA

A. Isquemia transmural



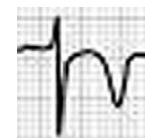
Supradesnivel ST

- Típico
- Equivalente a IMEST: "imagen en espejo"



Cambios en la onda T

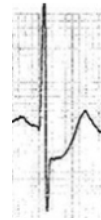
- Ondas T prominentes
 - Inversión de onda T
- ("huellas" post-isquémicas)



B. Isquemia subendocárdica

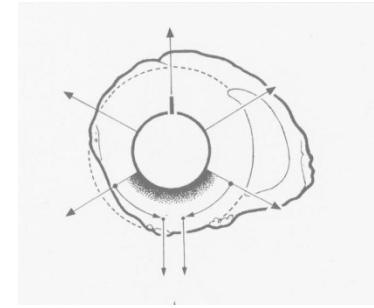
Cambios ST/T

- Isquemia circunferencial
- Isquemia regional



ECG normal

Factores que pueden confundir



Las guías internacionales de IMEST más recientes indican la importancia de reconocer “presentaciones ECG atípicas”

Guías de la ESC sobre IMEST 2012

Table 5 Atypical ECG presentations that deserve prompt management in patients with signs and symptoms of ongoing myocardial ischaemia

• LBBB
• Ventricular paced rhythm
• Patients without diagnostic ST-segment elevation but with persistent ischaemic symptoms
• Isolated posterior myocardial infarction
• ST-segment elevation in lead aVR

ECG = electrocardiogram; LBBB = left bundle branch block.

Síndrome coronario agudo sin
supradesnivel ST - ¿indicaciones
de angiografía inmediata?



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Journal of Electrocardiology 45 (2012) 463–475

JOURNAL OF
Electrocardiology

www.jecgonline.com

Common pitfalls in the interpretation of electrocardiograms from patients with acute coronary syndromes with narrow QRS: a consensus report[☆]

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Alessandro Sionis, MD,^g Juan Cinca, MD,^g Jose A. Barrabes, MD,^h Olle Pahlm, MD,ⁱ
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¹ University of North Carolina, Chapel Hill, NC, USA

Table 1

More common pitfalls in the ECG interpretation: see ECG pattern, type of ACS and involved artery, zone involved, and recommended management

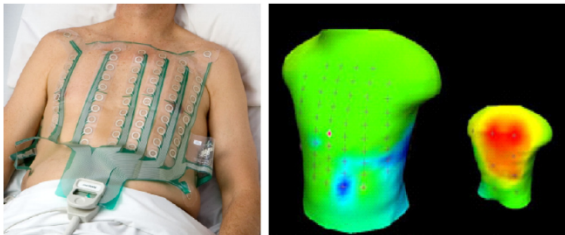
	ECG patterns	Type of ACS and involved artery	Zone and characteristics of involvement	Management
A	ST depression in V ₁ -V ₄ : in the acute phase, prominent ST depression in V ₁ without significant terminal positive T wave in V ₁ -V ₂ See Figs. 1A, 3, and 4.	Probably, it is true STE-ACS (STE-ACS equivalent) due to LCX occlusion (rarely distal RCA). Patients have ongoing active symptoms.	Transmural lateral involvement	Emergent PCI
B	Leads V ₁ -V ₄ : isoelectric ST segment with tall, wide, positive T wave. Often a transient pattern See Fig. 1B1	Hyperacute phase of STE-ACS. Patient with angina Repeat ECG in few minutes Evolving to LAD total occlusion. Patients usually have ongoing active symptoms.	Anterior subendocardial involvement evolving to transmural involvement	Probably emergent PCI
C	Leads V ₁ -V ₄ : ST↓ plus tall positive T wave that evolves to Q wave MI. The change occurs in hours. See Figs. 1B3, 5 (right), 6, and 9B	NSTE-ACS evolving to STE-ACS usually in hours Usually LAD subocclusion evolving to total occlusion Patients usually have ongoing symptom.	Nontransmural involved wall evolving to transmural involvement.	Emergent PCI
D.	Leads V ₁ -V ₃ : isoelectric ST segment with mild negative T wave in V ₁ -V ₃ See Fig. 8.	Resolution phase of NSTEMI-ACS. LAD subocclusion Patients usually have resolution of symptoms.	No transmural involvement	Most probably urgent PCI

1. IMEST en "espejo"

Oclusión de la circunfleja izquierda

- Sensibilidad del ECG para detectar oclusión coronaria aguda:
 - DAI 85-90%
 - ACD 70-90%
 - CXI 32-50%

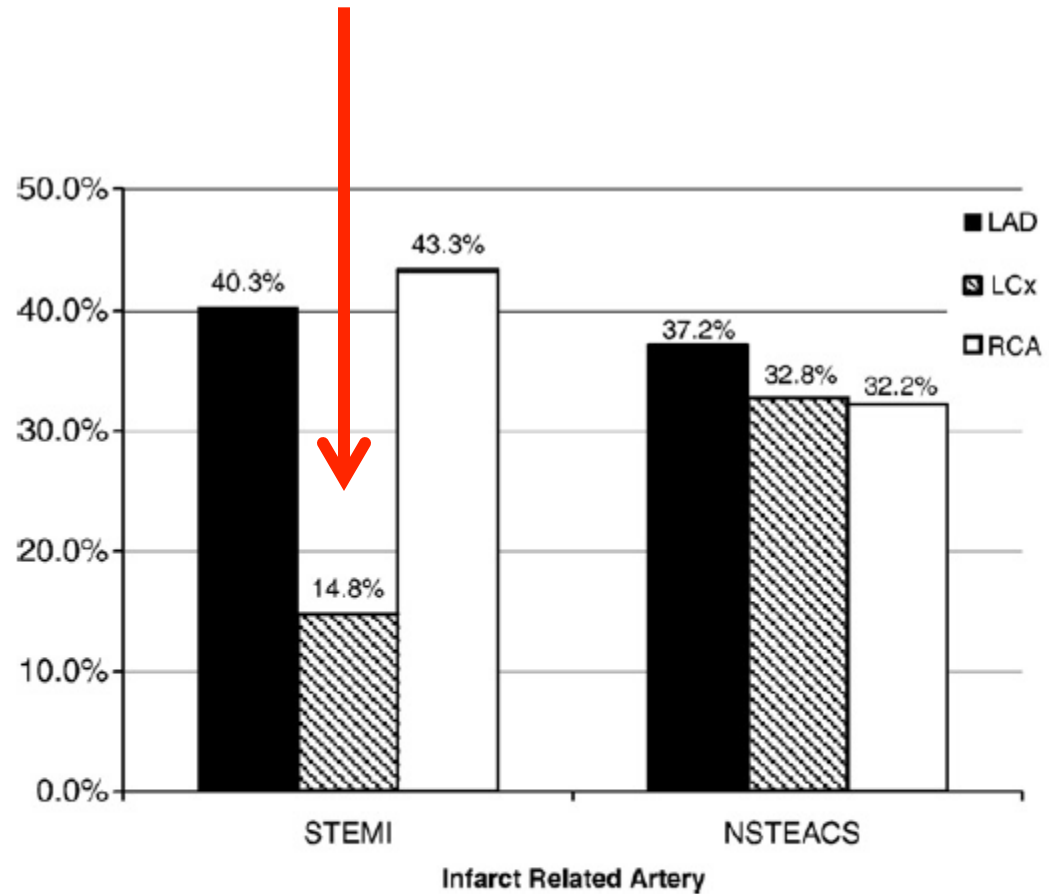
Figure 3



Eighty-lead ECG body surface mapping system; application (left panel) and color map in a patient with posterior myocardial infarction (right panel). Images reproduced with permission from HeartScape Technologies, Inc, Columbia, Maryland.

Role of additional leads
Neill J et al. Coron Art Dis
2010 Krishnaswamy et al. Am
Heart J 2009

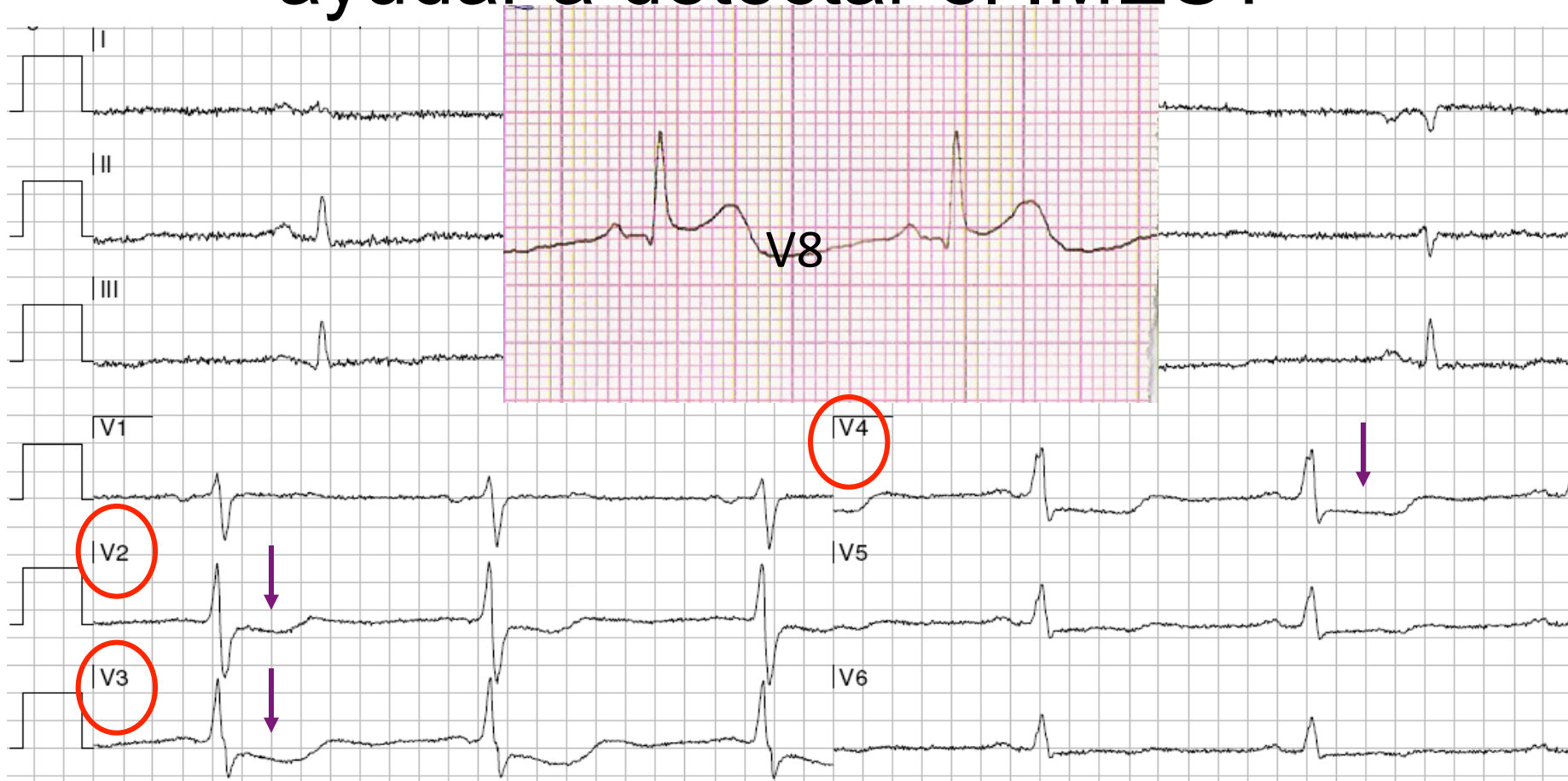
n=11.250
3 estudios
randomizados



Identification of the culprit vessel in major trials of STEMI and NSTEMI/UA.^{6-8,20}

Krishnaswamy et al. Am Heart J 2009

Supradesnivel ST en V2-V4 – las derivaciones posteriores pueden ayudar a detectar el IMEST



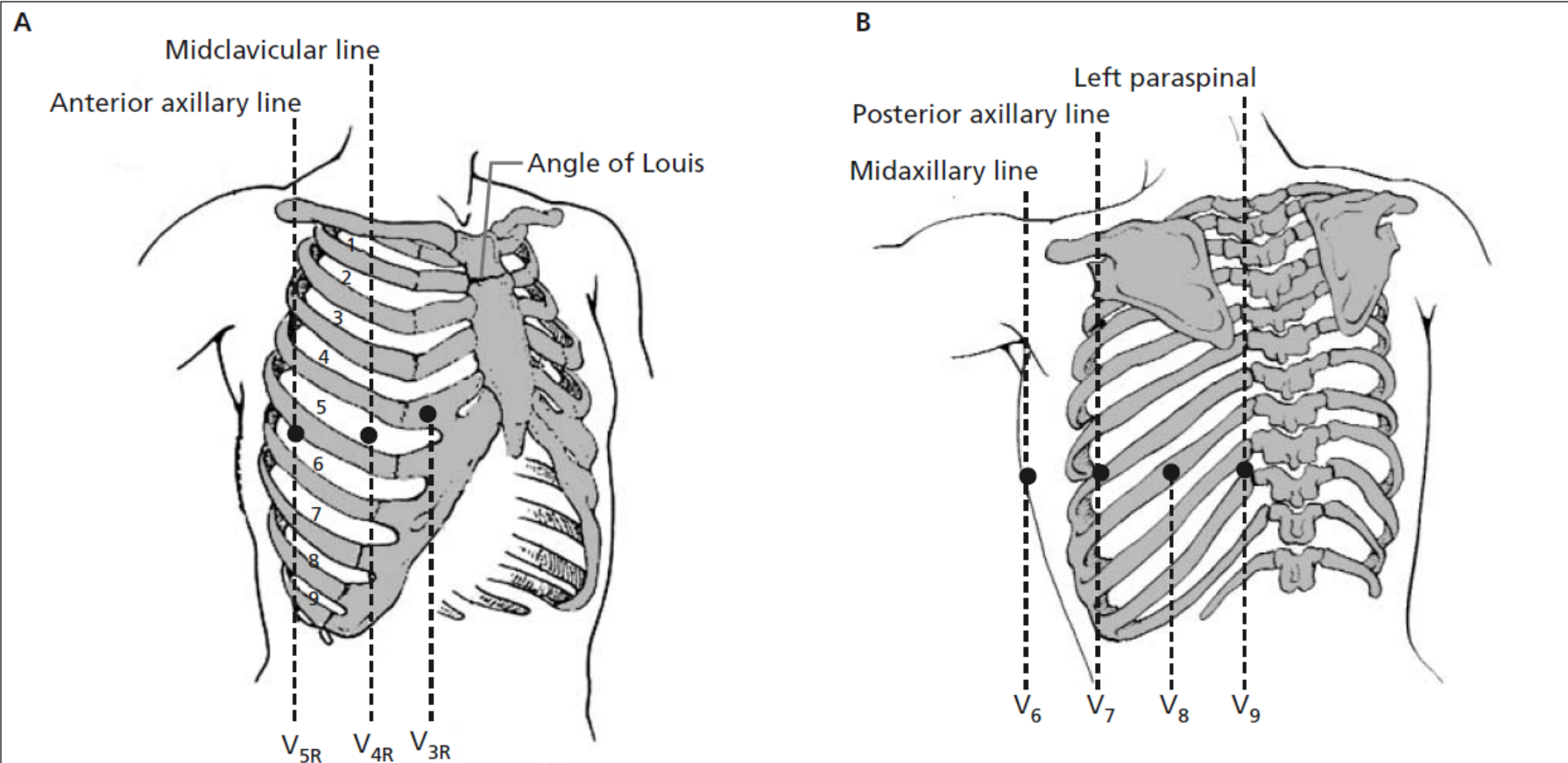


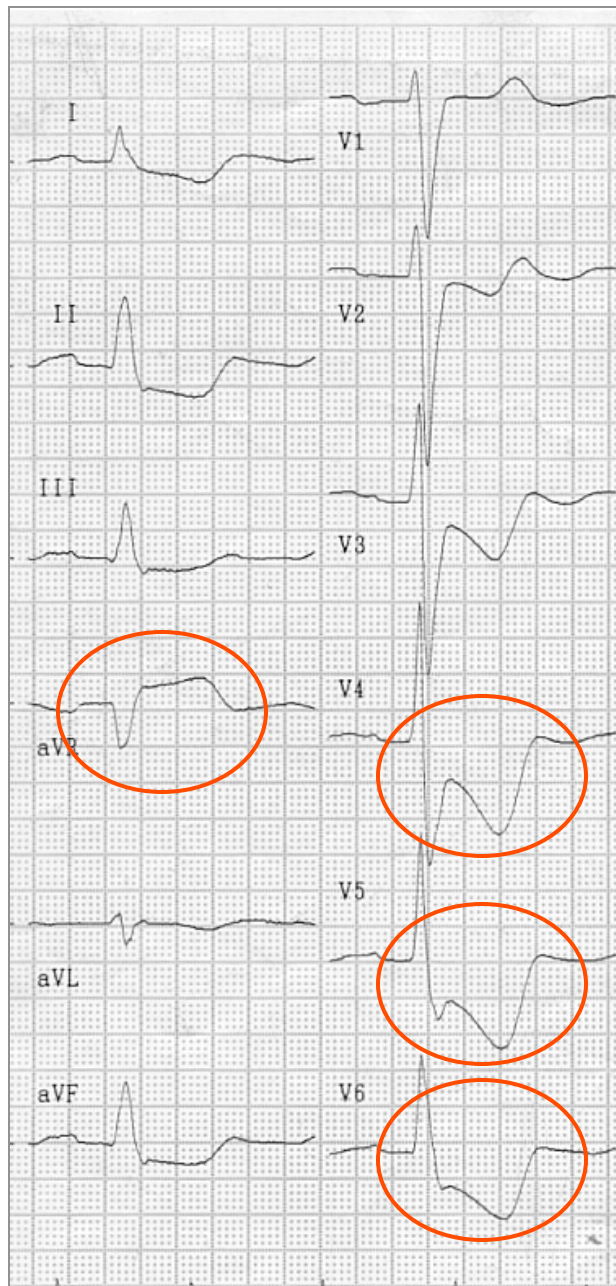
Figure 1 Locations of electrodes for the posterior and right ventricular leads. (A) Locations for right ventricular leads V_{3R} through V_{5R}: V_{3R} is located halfway between V_{2R} (or V₁) and V_{4R}, V_{4R} is located at the right midclavicular line in the fifth intercostal space, V_{5R} is located at the right anterior axillary line at the same horizontal level as V_{4R}. (Modified from Drew and Ide.¹²) (B) Location for posterior leads: V₇ is located at the posterior axillary line at the same level as V₄ through V₆, V₈ is located halfway between V₇ and V₉, and V₉ is at the left paraspinal line at the same level as V₄ through V₆.

Guías de la ESC sobre IMEST 2012

Table 4 Recommendations for initial diagnosis

Recommendations	Class ^a	Level ^b	Ref ^c
A 12-lead ECG must be obtained as soon as possible at the point of FMC, with a target delay of ≤ 10 min.	I	B	17, 19
ECG monitoring must be initiated as soon as possible in all patients with suspected STEMI.	I	B	20, 21
Blood sampling for serum markers is recommended routinely in the acute phase but one should not wait for the results before initiating reperfusion treatment.	I	C	-
The use of additional posterior chest wall leads ($V_7-V_9 \geq 0.05$ mV) in patients with high suspicion of infero-basal myocardial infarction (circumflex occlusion) should be considered.	IIa	C	-

2. Isquemia subendocárdica circunferencial (global)



1. Imagen clínica que indica síndrome agudo coronario
2. Infradesnivel ST generalizado (≥ 6 derivaciones)
3. Infradesnivel ST máximo V4-V5
4. T negativa V4-V5
5. Supradesnivel ST $\geq 0,5$ mm aVR
6. Cambios transitorios

Menos específico en el caso de taquicardia o HVI

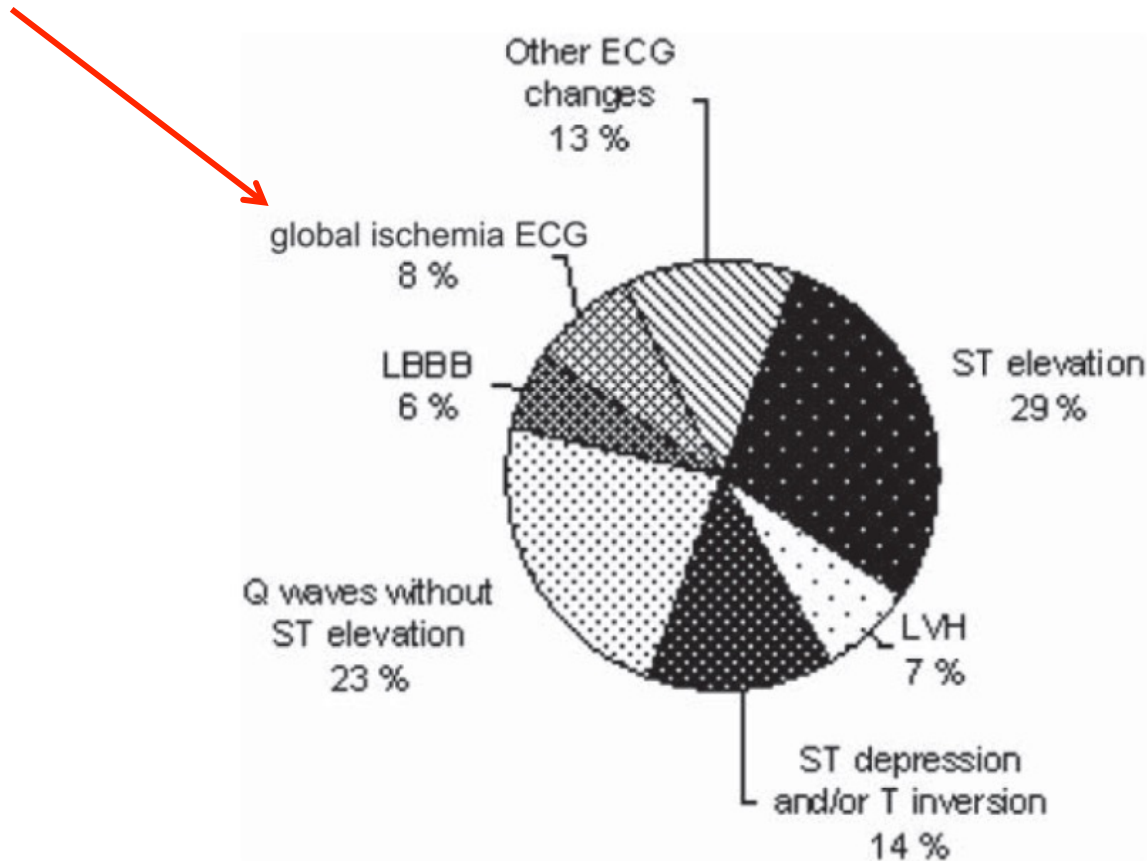
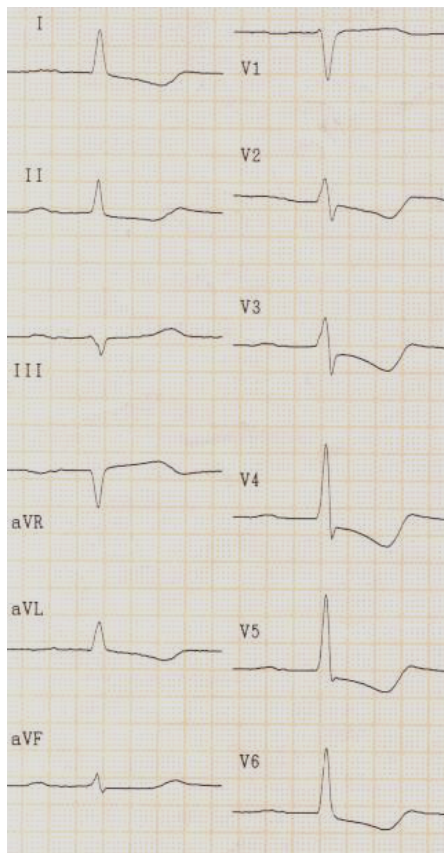


Figure 2. Distribution of ECG changes of all consecutive patients admitted with acute coronary syndrome. Rates are based on the TACOS study, $n = 1,188$.



- *Left main coronary obstruction—lead aVR ST elevation and infero-lateral ST depression: The presence of ST-depression >0.1 mV in eight or more surface leads, coupled with ST elevation in aVR and/or V1 but an otherwise unremarkable ECG, suggests ischaemia due to multivessel or left main coronary artery obstruction, particularly if the patient presents with haemodynamic compromise.*²⁸

ESC STEMI guidelines 2012



INFRADESNIVEL ST Y ONDAS T ASIMÉTRICAS INVERTIDAS SIN TAQUICARDIA

- Isquemia extensa causa reducción global en el flujo coronario*
- Esto resulta en relajación deteriorada del ventrículo izquierdo**
- El aumento resultante en la PDFVI induce isquemia subendocárdica grave†
- Esto resulta en un patrón ECG distintivo‡

- *Palacios I, Morvell SB, Powel WJ. *Circulation* 1976; 39:744
- ** Baim DS, Grossman W. *Grossman's cardiac catheterisation, angiography, and intervention*. Lippincott Williams & Wilkins, 2001; 382.
- † Visner MS, Arentzen CE, Parrish DG et al. *Circulation* 1985; 71: 610-9.
- ‡ Sclarovsky S. *Electrocardiography of acute myocardial ischaemic syndromes*. London: Martin Dunitz, 1999:10

INFRADESNIVEL ST CON ONDA T POSITIVA

La isquemia regional, no extensa, subendocárdica puede manifestarse como infradesnivel ST*

Ondas T altas y picudas**

Probablemente sean causadas por potasio extracelular†, relacionado con la hiperpolarización miocítica

Por una abertura del canal de K-ATP‡

*Guyton R, McClenathan JH, Newman G et al. *Am J Cardiol* 1977;40:373

**Sclarovsky S, Birnbaum Y, Solodky Y et al. *Int J Cardiol* 1994;46:37-47

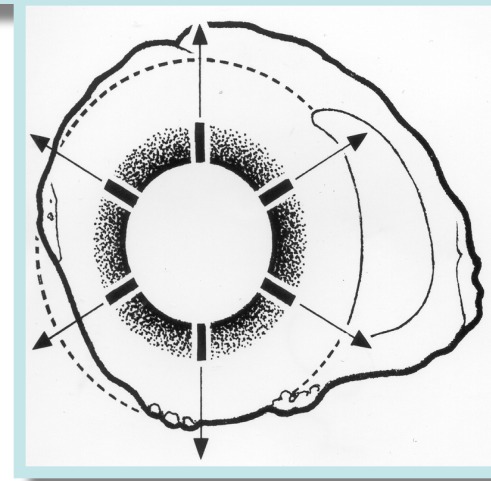
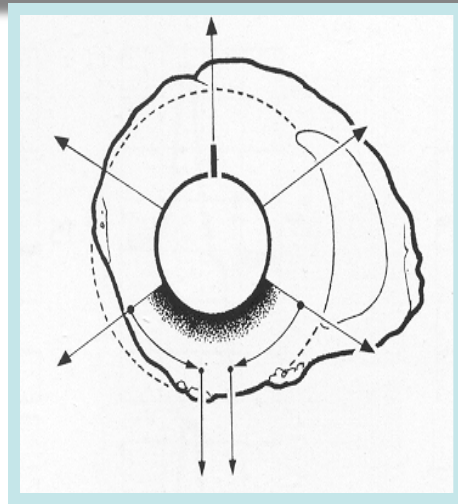
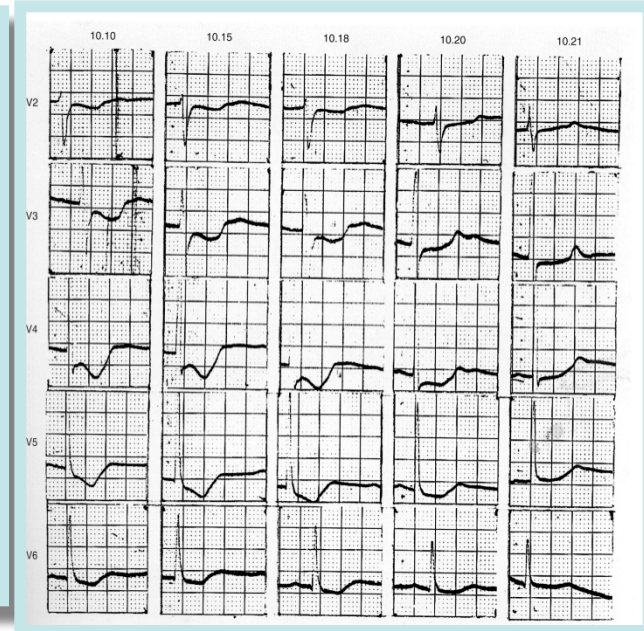
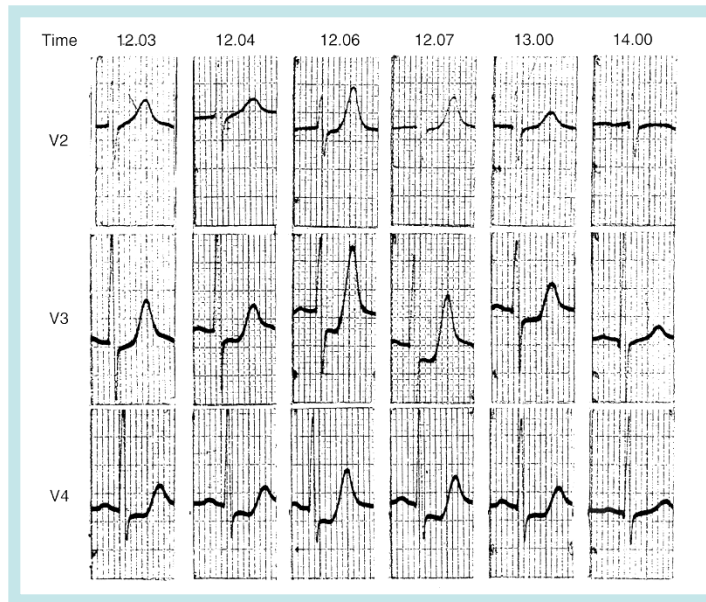
†Katz AM. *Physiology of the heart*. 3rd ed. Lippincott Williams & Wilkins, 2001: 644

‡Kondo T, Kubota I, Tachibana H et al. *Cardiovasc Res* 1996; 31: 683-87

- **Levine y Ford describieron el infarto subendocárdico circunferencial por primera vez: la imagen clínica, ECG, anatomía miocárdica y coronaria.**
(Levine H ; Ford R. Circulation 1950;1:246-62)
- **5 de 6 casos se debieron a obstrucción mecánica o aterosclerótica de la arteria coronaria principal izquierda, uno tenía enfermedad de tres vasos grave.**
- **Ninguno pudo reproducir este tipo de IM en experimentos animales**
- **Levine estaba tan convencido de sus hallazgos que dijo: “Parece que la naturaleza puede ofrecer las condiciones para el experimento mucho más fácilmente que un fisiólogo”.**

Angina inestable con infradesnivel ST: con onda T negativa vs. onda T positiva

*Sclarovsky S.
Electrocardio-
graphy of
acute
myocardial
ischaemic
syndromes.
London: Martin
Dunitz*



Importancia de la dirección de la onda T en el SCA con infradesnivel ST

Table 4. In-Hospital Follow-Up

	Group I (T−) n = 25 (%)	Group II (T+) n = 25 (%)	P-value
Clinical signs of heart failure	40	4	0.005
Ejection fraction			
30–49%	42	8	0.008
≥50%	58	92	0.008
CABG	76	20	<0.001
PCI	12	52	0.005
In-hospital mortality	24	0	0.02

CABG = coronary artery bypass grafting; PCI = percutaneous coronary intervention.

Importancia de la dirección de la onda T en el SCA con infradesnivel ST

Table 2. Coronary Angiography Findings

Number of Diseased Vessel	Group I (T−) n = 25 (%)	Group II (T+) n = 25 (%)	P Value
0-VD	0	8	0.49
1-VD	0	56	<0.001
2-VD	0	8	0.49
Nonsevere 3-VD	0	20	0.05
Severe 3-VD	24	0	0.02
LM-CAD or LME-CAD	76	8	<0.001

LM-CAD = left main coronary artery disease; LME-CAD = left main equivalent coronary artery disease; VD = vessel disease.

Table 3. The Sensitivity, Specificity, Positive Predictive Value (PPV) and Negative Predictive Value (NPV) for the ECG Pattern with Transient ST-Segment Depression and Negative T Waves During Pain, Maximally in Leads V_{4-5} , to Predict Different Coronary Artery Disease Severity in Angiography

Angiography Findings	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Severe 3-VD	100	57	24	100
LM- or LME-CAD	91	79	76	92
Severe 3-VD or LM- or LME-CAD	93	100	100	92

La isquemia subendocárdica circunferencial es un marcador independiente de un mal resultado en el SCA

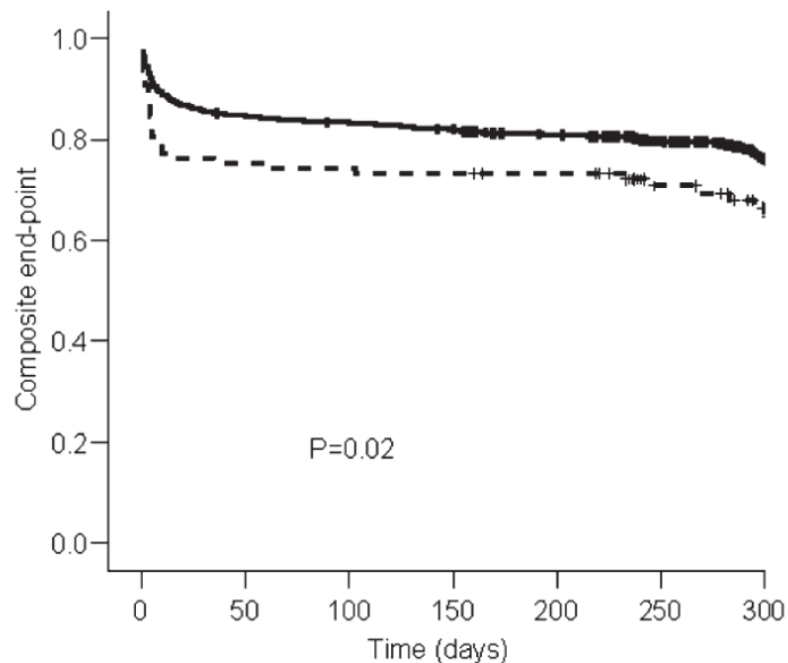


Figure 3. The rate of composite end-points at 10-month follow-up according to the ECG at admission presented by the Kaplan-Meier curve (dashed line: global ischemia ECG, solid line: all other ECG categories).

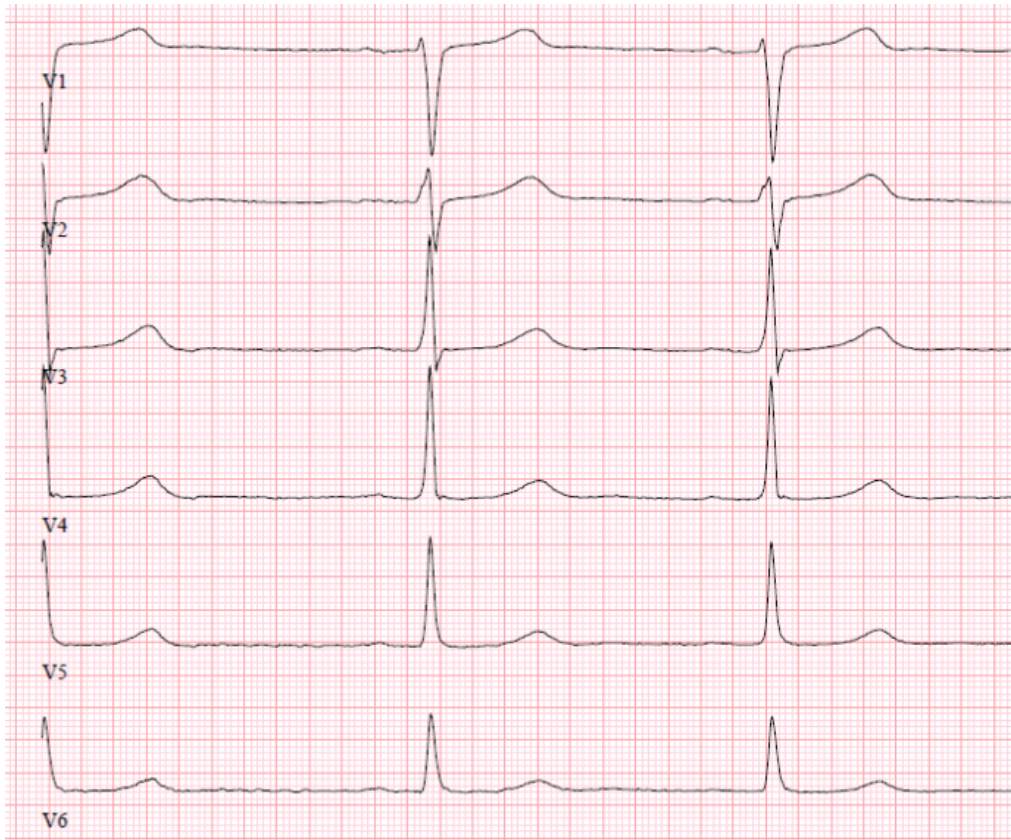
Table III. Variables retained in the final multivariate Cox proportional hazards model examining the rate of composite end-points at 10-month follow-up.

	Hazard ratio	95% CI	P value
Age	1.04	1.03–1.05	<0.001
Global ischemia ECG pattern	1.40	1.02–1.91	0.035
Gender	1.10	0.90–1.36	0.363
Systolic blood pressure	0.97	0.94–1.00	0.053
Plasma creatinine	1.003	1.002–1.004	<0.001
Diabetes	1.48	1.07–2.05	0.017
No diabetes	1		
Diabetes mellitus type I	2.65	1.16–6.07	0.021
Diabetes mellitus type II	1.12	0.91–1.39	0.227
Diuretic use on admission	1.24	0.998–1.54	0.052

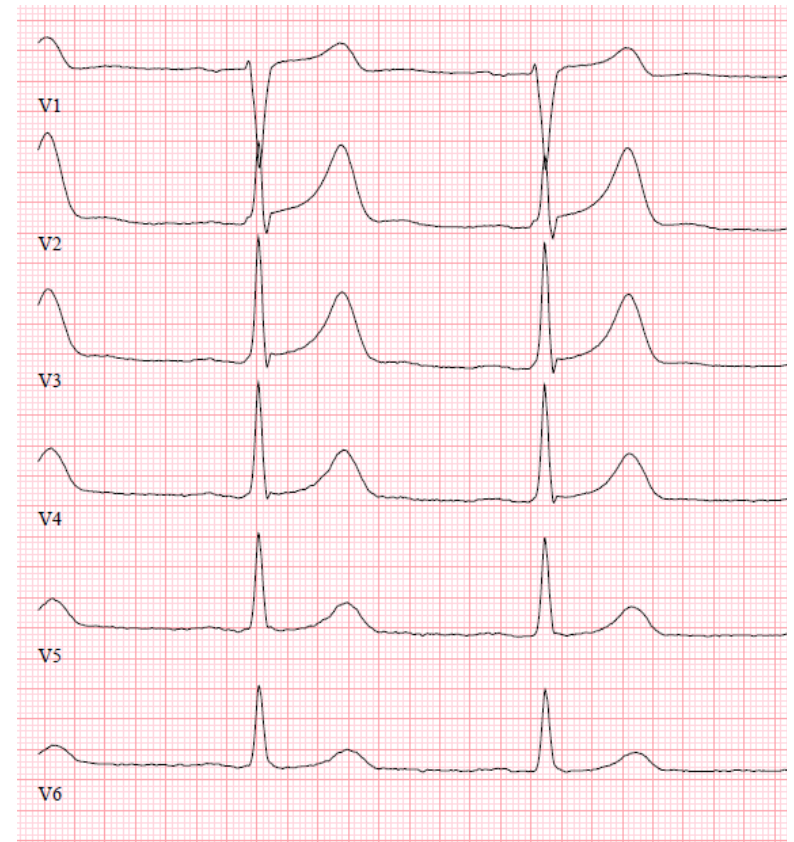
CI = confidence interval; ECG = electrocardiogram.

3. Cambios en la onda T

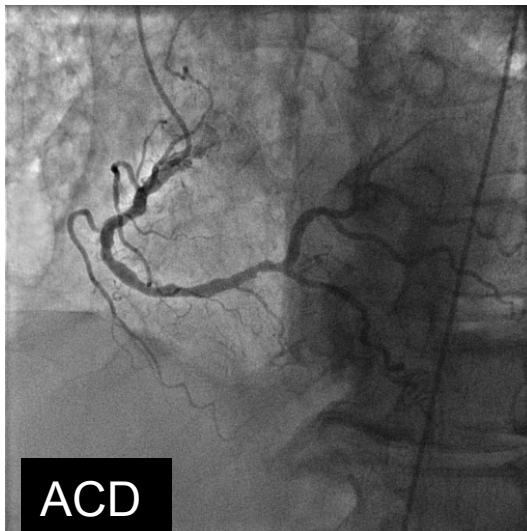
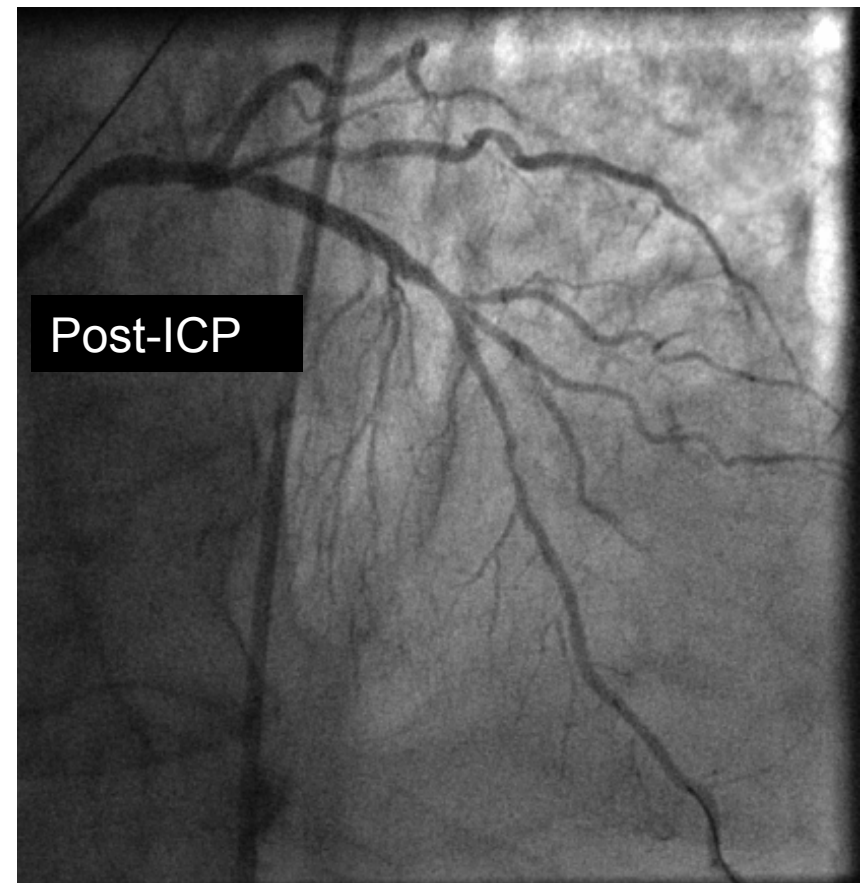
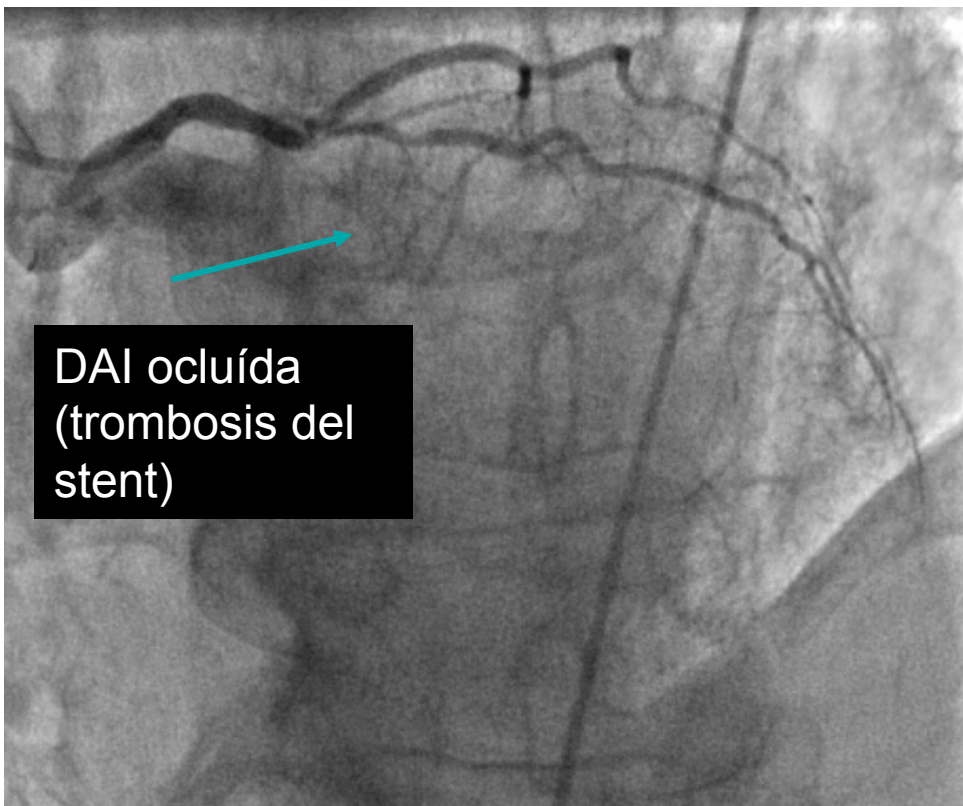
ECG antiguo



Dolor torácico



ECG 50 mm/seg

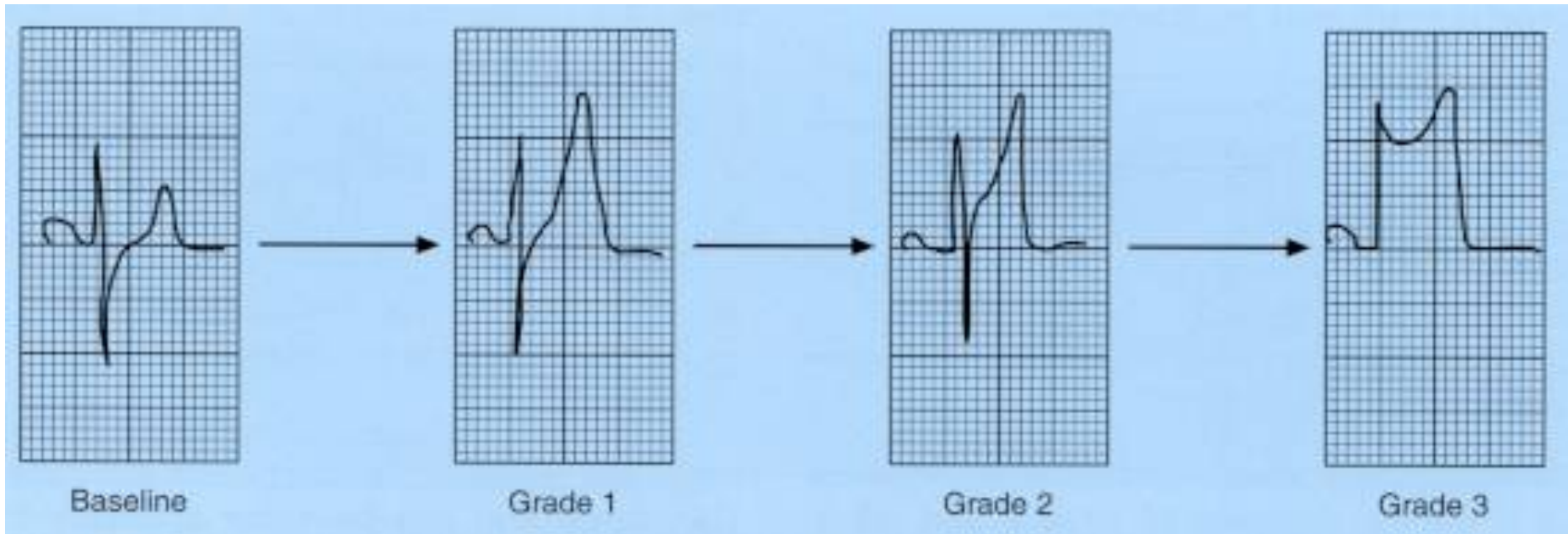


Nuevas ondas T prominentes V1-V4 (=DAI) y síntomas compatibles con IAM → considerar la angiografía aguda (protocolo de IMEST)

Por lo menos: ECG de seguimiento en 15-30 min

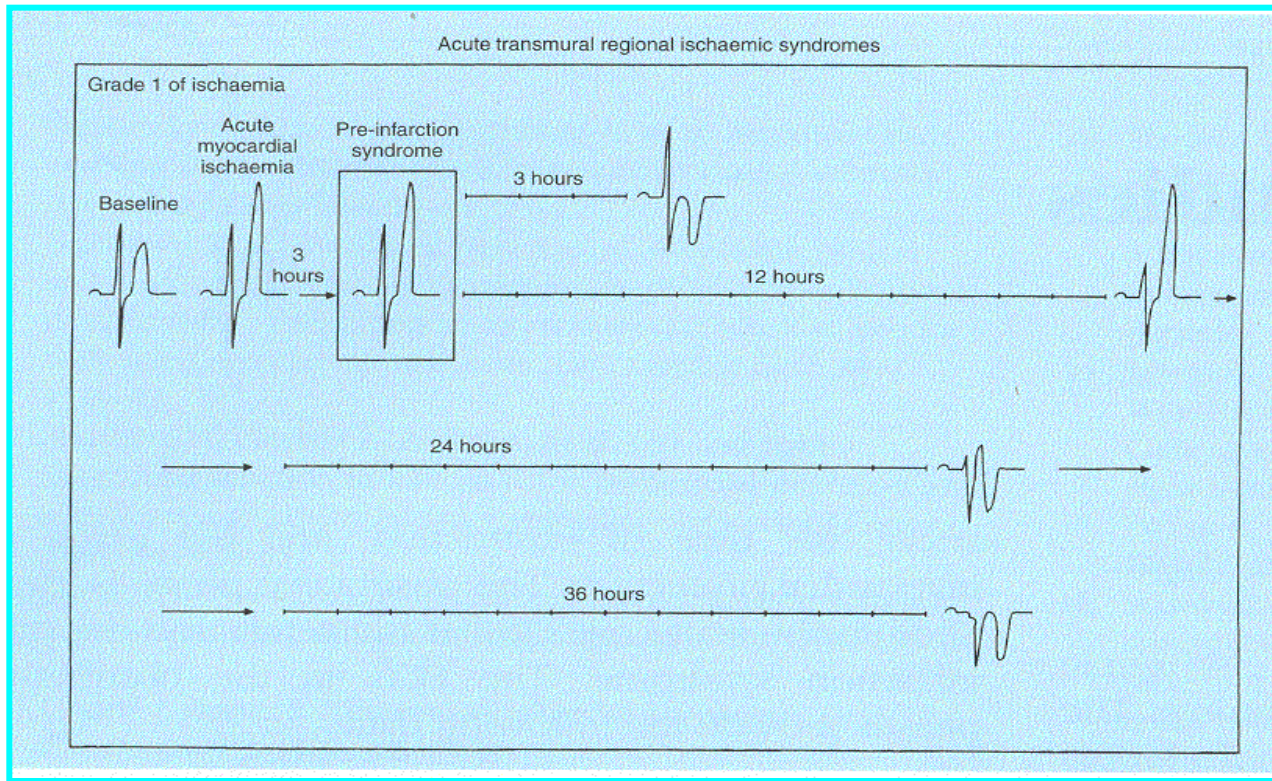
Pero: hipercalemia, diferencias individuales en la amplitud de la onda T...

Grado de isquemia de Sclarovsky-Birnbaum



Sclarovsky S et al. Isr J Med Sci 1990;26:525-33

Isquemia grado 1: desarrollo lento de ondas Q por miocardio bien protegido

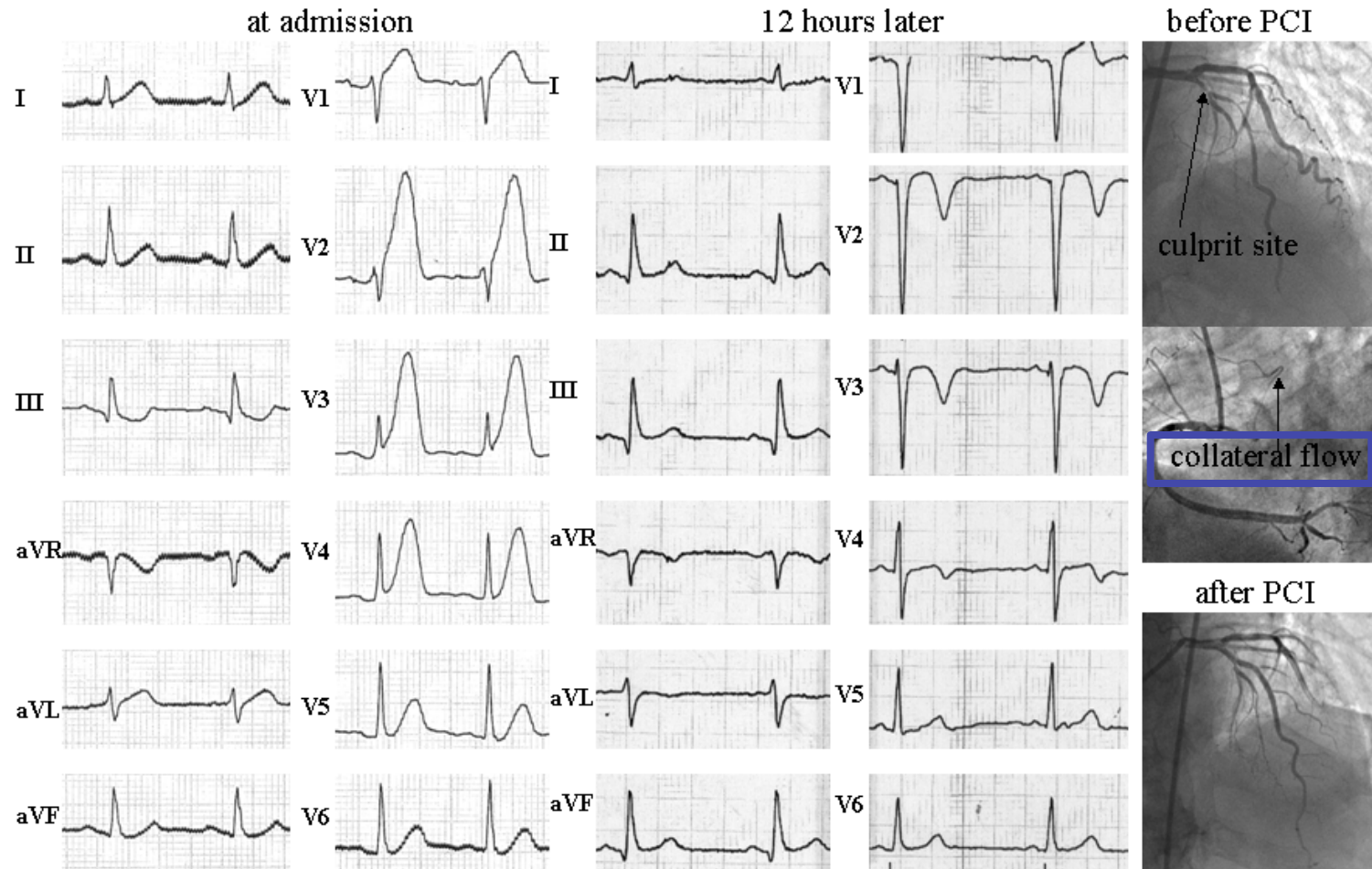


Sclarovsky S. Electrocardiography of acute myocardial ischaemic syndromes. London: Martin Dunitz

Guías de la ACCF/AHA sobre IMEST 2013

artery occlusion (9). Rarely, hyperacute T-wave changes may be observed in the very early phase of STEMI, before the development of ST elevation. Transthoracic echocardiography may provide evidence of focal wall motion abnormalities and facilitate triage in patients with ECG findings that are difficult to interpret. If doubt persists, immediate referral for invasive angiography may be necessary to guide therapy in the appropriate clinical context (10,11). Cardiac troponin is the preferred biomarker for diagnosis of MI.

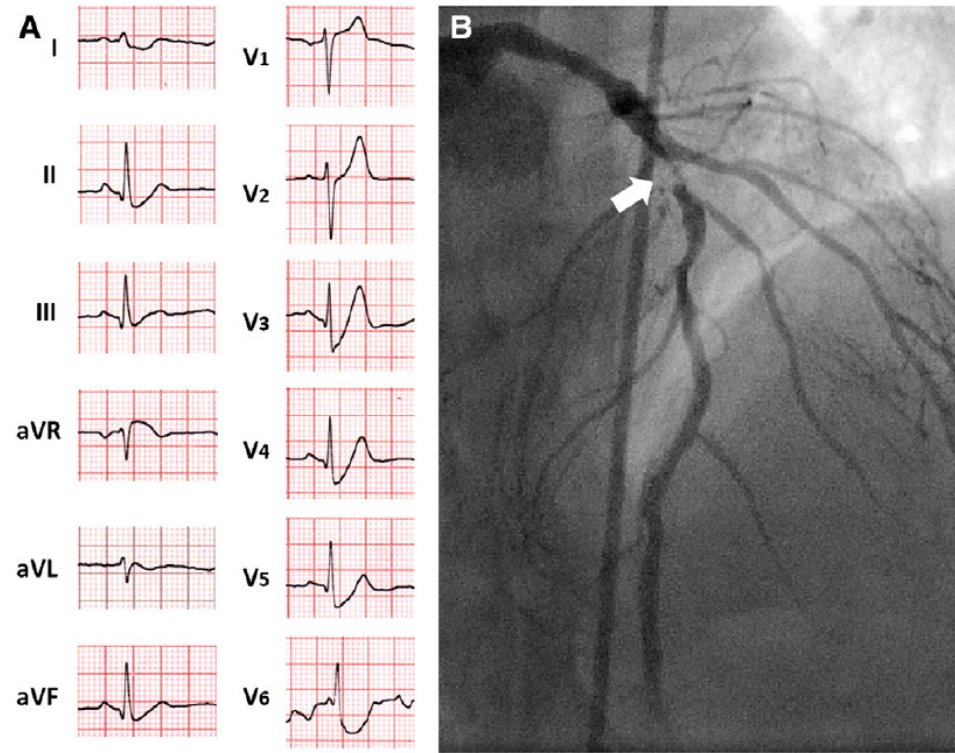
Onda T prominente y oclusión de la DAI subtotal



Cortesía de: Zhan Zhong-qun

Isquemia regional subendocárdica
-infradesnivel ST
-onda T positiva

*Sclarovsky S. Electrocardiography
of acute myocardial ischaemic
syndromes. London: Martin Dunitz*



ELSEVIER

Journal of Electrocardiology 44 (2011) 533–537

www.jecgonline.com

Prominent precordial T waves as a sign of acute anterior myocardial
infarction: electrocardiographic and angiographic correlations☆☆☆

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Received 3 May 2011

“Onda T hiperaguda persistente”

[Europ Heart J Acute Cardiovasc Care](#). 2012 Dec;1(4):344-8. doi: 10.1177/2048872612466537.

Interpretation of acute myocardial infarction with persistent 'hyperacute T waves' by cardiac magnetic resonance.

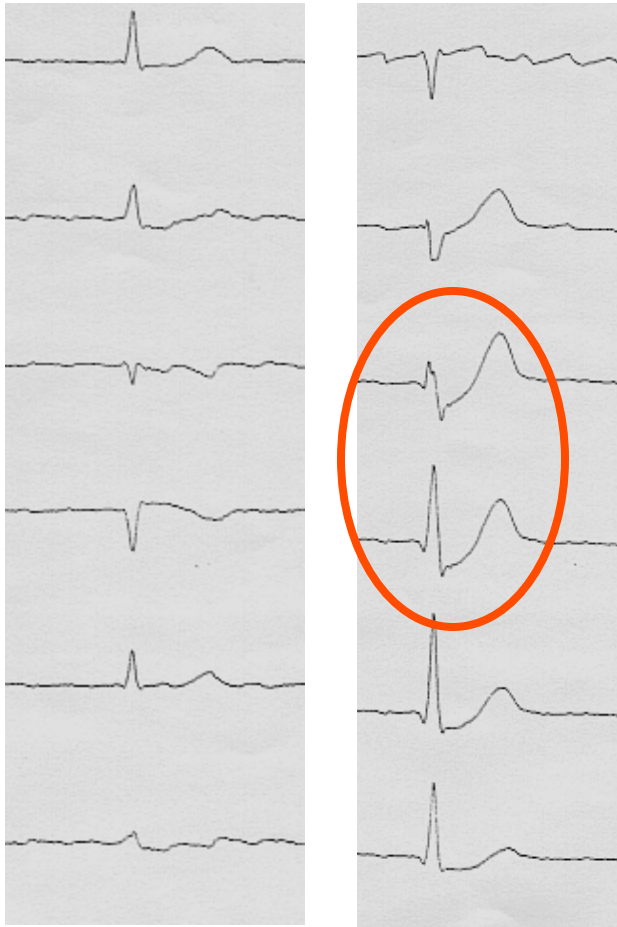
[Zorzi A](#), [Perazzolo Marra M](#), [Migliore F](#), [Tarantini G](#), [Iliceto S](#), [Corrado D](#).

CMR findings resembled those of typical anterior myocardial infarction with nearly transmural necrosis in the large myocardial area supplied by LAD. Accordingly, persistent hyperacute T waves should be regarded as an equivalent to ST-segment elevation and immediate reperfusion therapy should be considered.

Isquemia subendocárdica regional que progresa a isquemia transmural grado 3

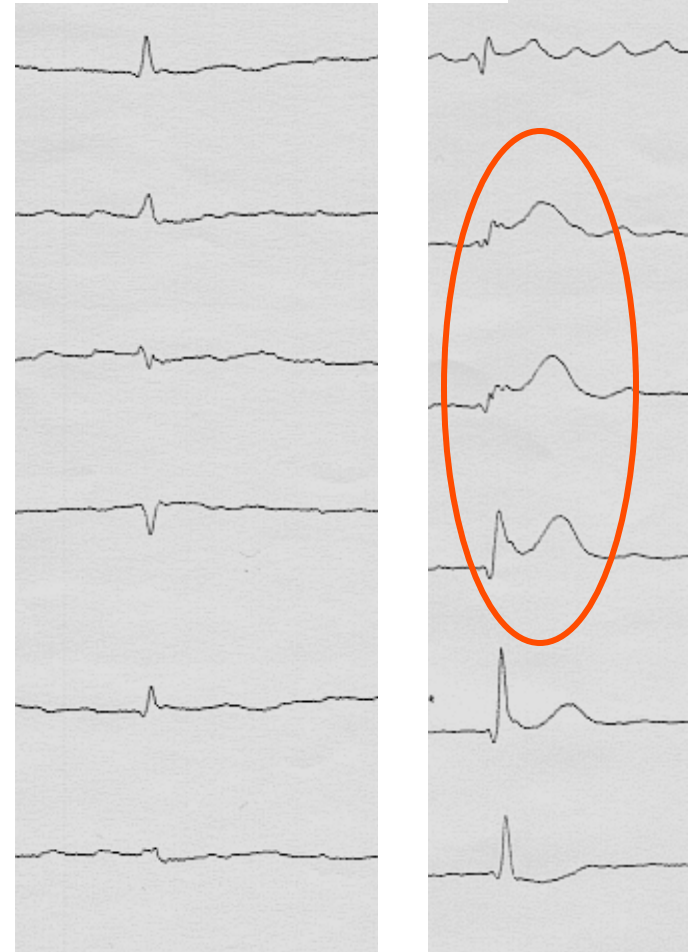
3

16.33



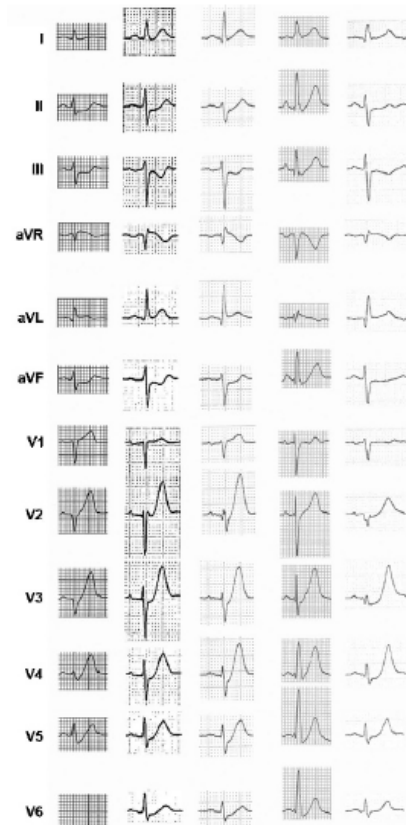
Resucitación
de fibrilación
ventricular

18.20



Persistent precordial “hyperacute” T-waves signify proximal left anterior descending artery occlusion

N J Verouden,¹ K T Koch,¹ R J Peters,¹ J P Henriques,¹ J Baan,¹ R J van der Schaaf,¹ M M Vis,¹ J G Tijssen,¹ J J Piek,¹ H J Wellens,² A A Wilde,¹ R J de Winter¹



Results: We identified patients with a static, distinct ECG pattern without ST-segment elevation and an occlusion of the proximal LAD artery during urgent coronary angiography before PCI. Of 1890 patients who underwent primary PCI of the LAD artery, we could identify 35 patients (2%) with this distinct ECG pattern. The ECG showed ST-segment depression at the J-point of at least 1 mm in precordial leads with upsloping ST-segments continuing into tall, symmetrical T-waves. Patients with this distinct ECG pattern were younger, more often male and more often had hypercholesterolaemia compared to patients with anterior myocardial infarction and ST-segment elevation.

Time from symptom onset to ECG recording (minutes) (median (IQR)) 98 (57–145)

This ECG pattern was invariably associated with a culprit lesion located in the proximal LAD artery, which was occluded in the majority of cases. Therefore, these patients qualify for immediate reperfusion therapy, preferably with primary PCI. In all patients included in this study, the characteristic ECG pattern immediately resolved after PCI of the LAD artery. The

Heart 2009;**95**:1701–1706.

A pesar de oclusión coronaria aguda el ECG de 12 derivaciones puede ser normal o sin cambios nuevos

- ECG no registrado durante los síntomas
- Oclusión distal de la arteria coronaria circunfleja izquierda (CXI)
- Área pequeña de isquemia (oclusión de rama lateral)
- BRI o retardo de conducción intraventricular no específico ($QRS > 120$ ms)
- ECG de marcapasos

Notas finales

- Desde el punto de vista del ECG, los signos precoces de IMEST agudo (~ oclusión aguda y repentina de arteria coronaria) son: ondas T prominentes hiperagudas, supradesnivel ST sin ondas Q o inversiones de onda T, e infradesnivel ST en V1/V2-V3/V4 (equivalente de IMEST en espejo)

Notas finales

- A causa de los cambios ECG a veces muy dinámicos, también signos posteriores del proceso de isquemia/infarto en evolución pueden estar presentes precozmente luego del inicio de los síntomas
- Se recomienda la telecardiología dentro de las redes del IMEST regional para mejorar el diagnóstico y acortar el ECG a los tiempos del dispositivo.