ECOCARDIOCHIRURGIA 2012

Infarto miocardico a coronarie angiograficamente indenni

Una patologia rara che mette in discussione i nostri paradigmi

VI CONGRESSO NAZIONALE DI ECOCARDIO CHIRURGIA
MILANO 15-17 OTTOBRE 2012

Giovanni Corrado, FESC
Unità Operativa di Cardiologia
Ospedale Valduce – Como

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ECOCARDIOCHIRURGIA 2012

La prevalenza e la fisiopatologia di una malattia "diversa". *Quando le certezze vacillano e navighiamo a vista.*

Giovanni Corrado, FESC

CONFLITTI DI INTERESSI : NESSUNO

ECOCARDIOCHIRURGIA 2012

Infarto miocardico
a coronarie angiograficamente indenni

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Review

Myocardial infarction with angiographically normal coronary arteries

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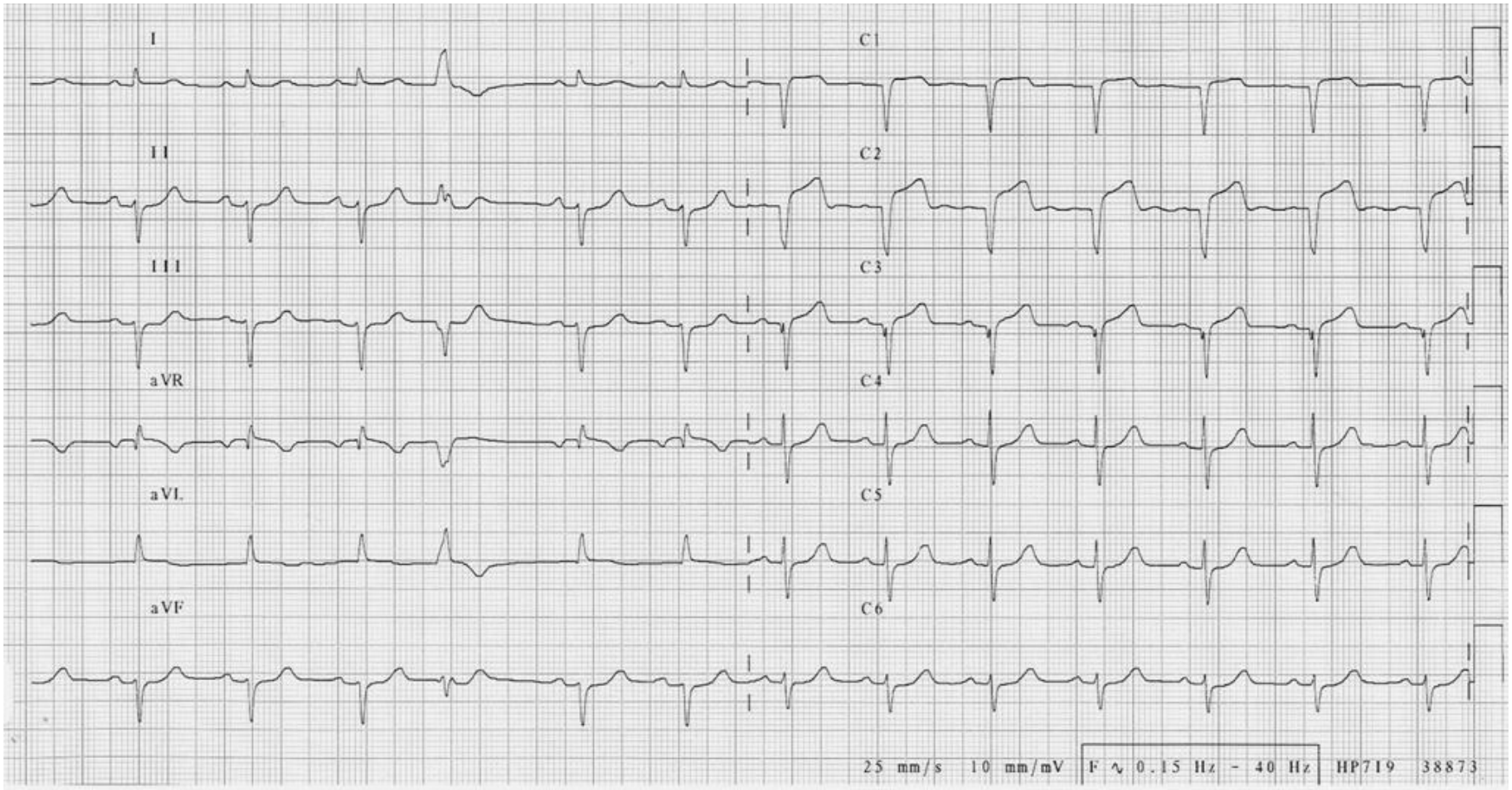
MINCA is now recognized as an important and fairly common subgroup of myocardial infarction . There are several reasons for this.

1. First, during more than two decades coronary angiography has been an important tool in the investigation of patients with NSTEMI or STEMI.
2. Second, during the last 5 years, stress cardiomyopathy or Takotsubo syndrome, fulfilling the diagnostic criteria of myocardial infarction has received much attention.
3. Third, the new definition of myocardial infarction, including sensitive and specific troponin assays, has increased the accuracy to detect myocardial infarction and thus increased the total number of events.

The proportion of MINCA of all myocardial infarctions is uncertain and dependent on the age of the patients, the diagnostic work-up and the type of myocardial infarction (NSTEMI/STEMI) with a likely frequency of 3–4%

♀ 68 aa ECG 1



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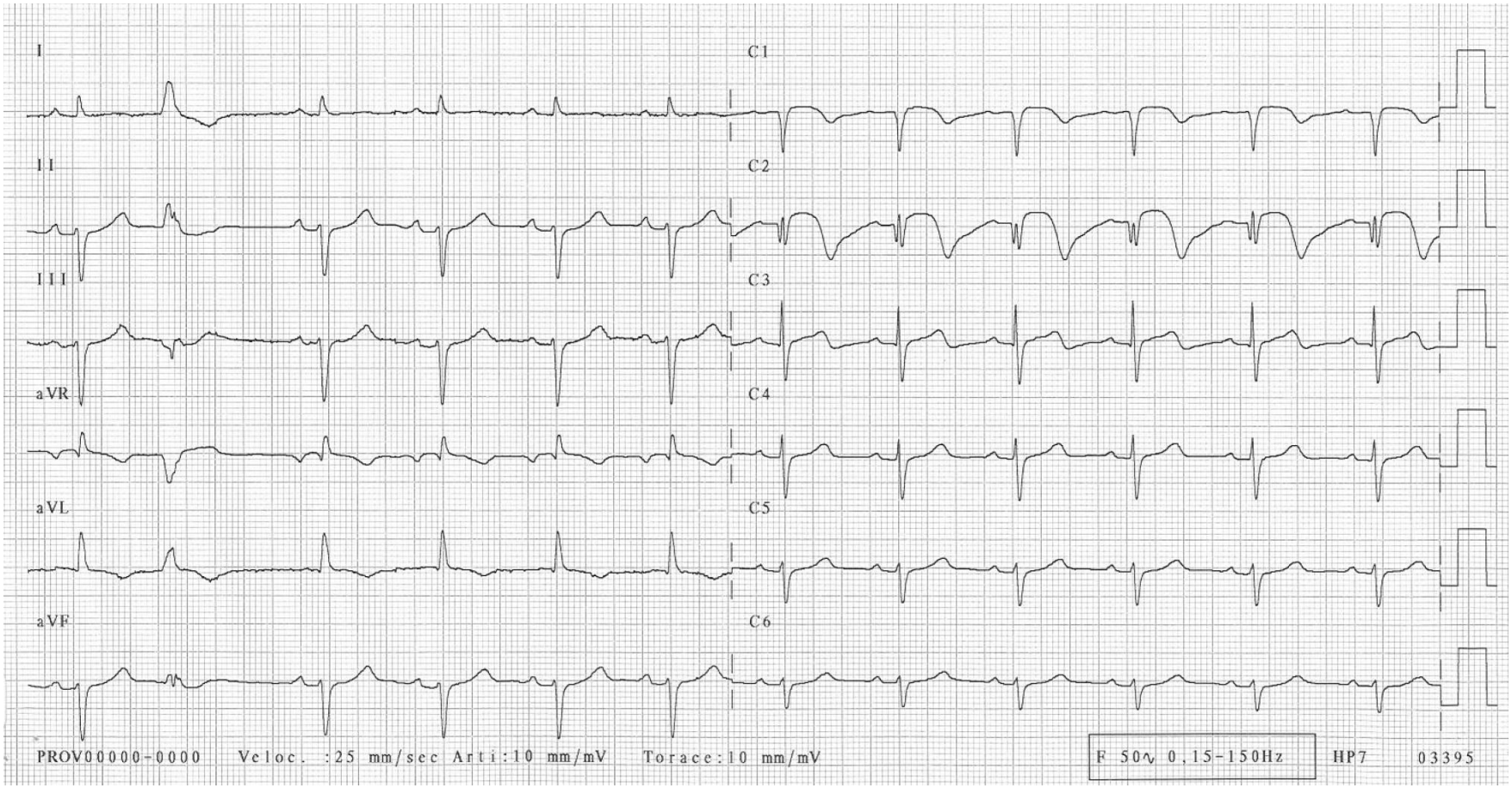
♀ 68 aa ECG 2



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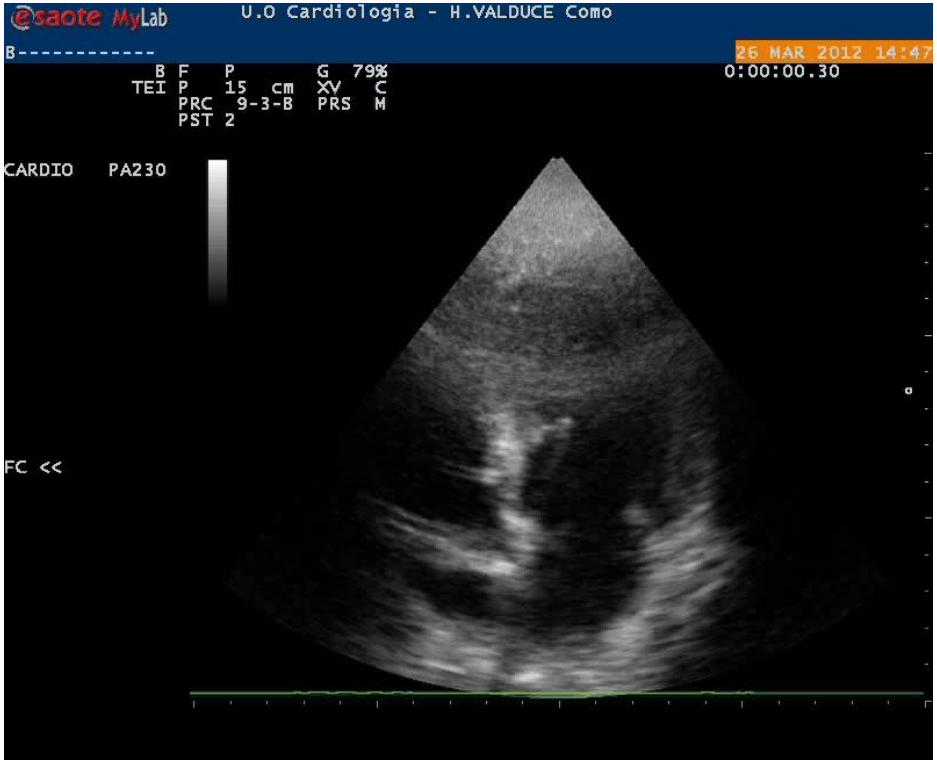
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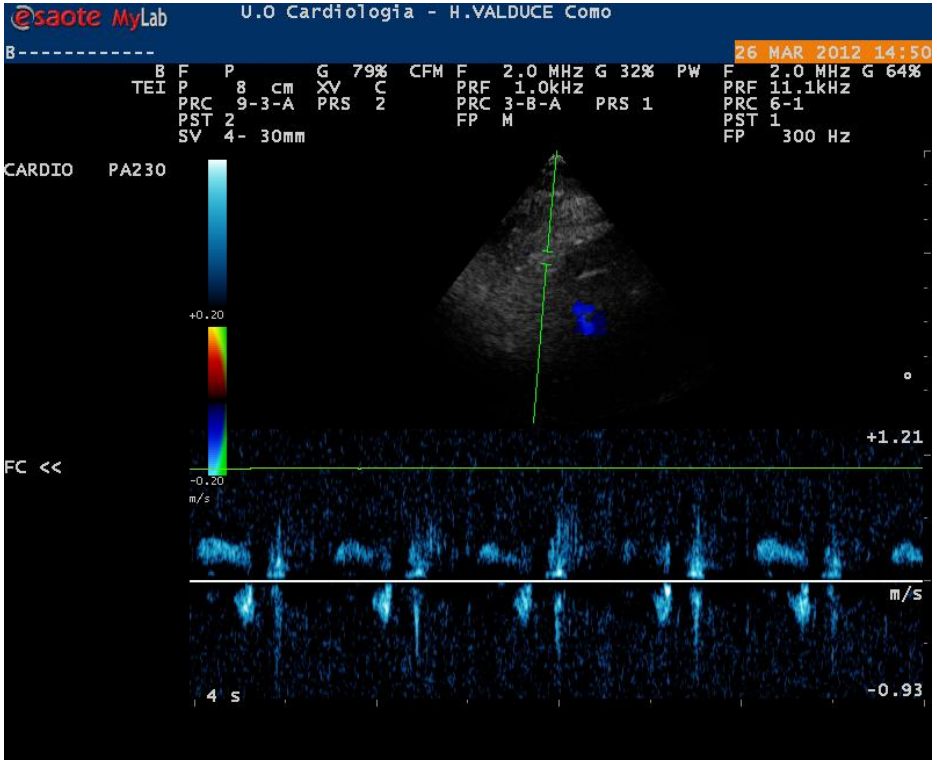
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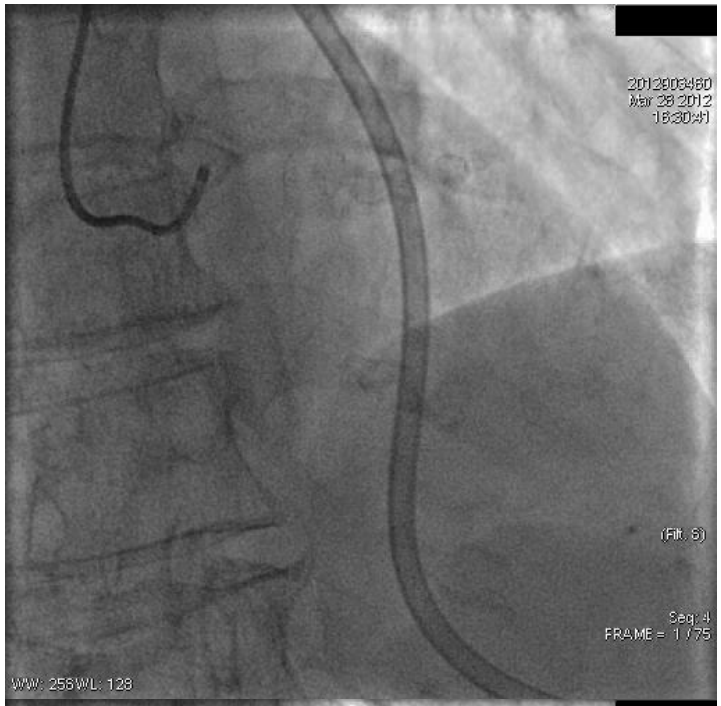
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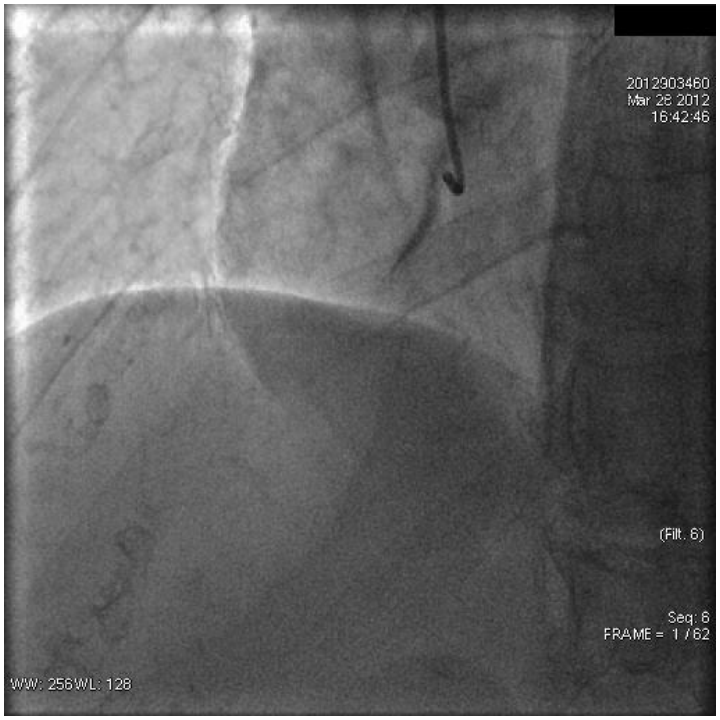
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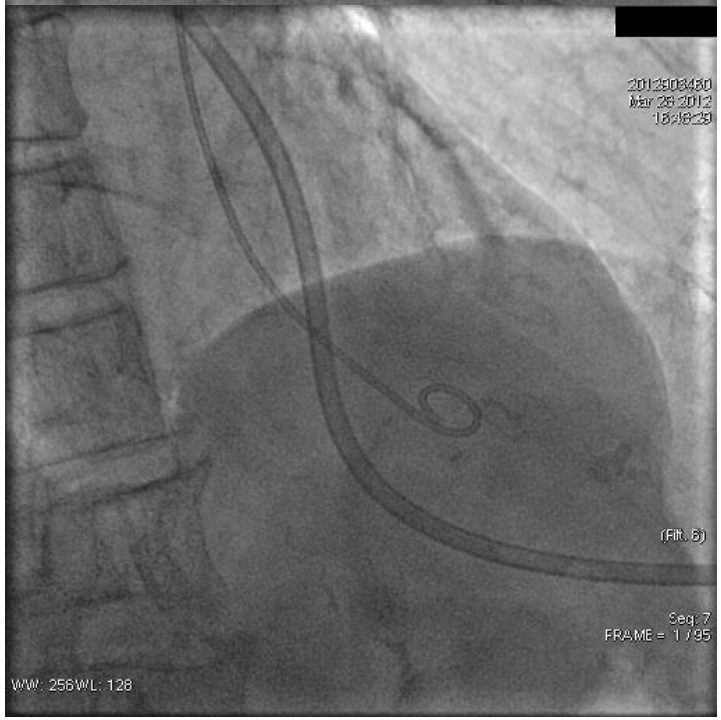
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i am irked !
totally !
Takotsubo
left
ventricle
Striped Giraffe Press © 2005

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

Definition of myocardial infarction

Criteria for acute myocardial infarction

The term acute myocardial infarction (MI) should be used when there is evidence of myocardial necrosis in a clinical setting consistent with acute myocardial ischaemia. Under these conditions any one of the following criteria meets the diagnosis for MI:

- Detection of a rise and/or fall of cardiac biomarker values [preferably cardiac troponin (cTn)] with at least one value above the 99th percentile upper reference limit (URL) and with at least one of the following:
  - Symptoms of ischaemia.
  - New or presumed new significant ST-segment–T wave (ST–T) changes or new left bundle branch block (LBBB).
  - Development of pathological Q waves in the ECG.
  - Imaging evidence of new loss of viable myocardium or new regional wall motion abnormality.
  - Identification of an intracoronary thrombus by angiography or autopsy.
- Cardiac death with symptoms suggestive of myocardial ischaemia and presumed new ischaemic ECG changes or new LBBB, but death occurred before cardiac biomarkers were obtained, or before cardiac biomarker values would be increased.
- Percutaneous coronary intervention (PCI) related MI is arbitrarily defined by elevation of cTn values (>5 x 99th percentile URL) in patients with normal baseline values (≤99th percentile URL) or a rise of cTn values >20% if the baseline values are elevated and are stable or falling. In addition, either (i) symptoms suggestive of myocardial ischaemia or (ii) new ischaemic ECG changes or (iii) angiographic findings consistent with a procedural complication or (iv) imaging demonstration of new loss of viable myocardium or new regional wall motion abnormality are required.
- Stent thrombosis associated with MI when detected by coronary angiography or autopsy in the setting of myocardial ischaemia and with a rise and/or fall of cardiac biomarker values with at least one value above the 99th percentile URL.
- Coronary artery bypass grafting (CABG) related MI is arbitrarily defined by elevation of cardiac biomarker values (>10 x 99th percentile URL) in patients with normal baseline cTn values (≤99th percentile URL). In addition, either (i) new pathological Q waves or new LBBB, or (ii) angiographic documented new graft or new native coronary artery occlusion, or (iii) imaging evidence of new loss of viable myocardium or new regional wall motion abnormality.

Eur Heart J. **2012 Aug 24.**

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Eur Heart J. 2012 Aug 24.

Table 2 Universal classification of myocardial infarction

Type 1: Spontaneous myocardial infarction
Spontaneous myocardial infarction related to atherosclerotic plaque rupture, ulceration, fissuring, erosion, or dissection with resulting intraluminal thrombus in one or more of the coronary arteries leading to decreased myocardial blood flow or distal platelet emboli with ensuing myocyte necrosis. The patient may have underlying severe CAD but on occasion non-obstructive or no CAD.
Type 2: Myocardial infarction secondary to an ischaemic imbalance
In instances of myocardial injury with necrosis where a condition other than CAD contributes to an imbalance between myocardial oxygen supply and/or demand, e.g. coronary endothelial dysfunction, coronary artery spasm, coronary embolism, tachy-/brady-arrhythmias, anaemia, respiratory failure, hypotension, and hypertension with or without LVH.
Type 3: Myocardial infarction resulting in death when biomarker values are unavailable
Cardiac death with symptoms suggestive of myocardial ischaemia and presumed new ischaemic ECG changes or new LBBB, but death occurring before blood samples could be obtained, before cardiac biomarker could rise, or in rare cases cardiac biomarkers were not collected.
Type 4a: Myocardial infarction related to percutaneous coronary intervention (PCI)
Myocardial infarction associated with PCI is arbitrarily defined by elevation of cTn values >5 x 99th percentile URL in patients with normal baseline values (≤99th percentile URL) or a rise of cTn values >20% if the baseline values are elevated and are stable or falling. In addition, either (i) symptoms suggestive of myocardial ischaemia, or (ii) new ischaemic ECG changes or new LBBB, or (iii) angiographic loss of patency of a major coronary artery or a side branch or persistent slow- or no-flow or embolization, or (iv) imaging demonstration of new loss of viable myocardium or new regional wall motion abnormality are required.
Type 4b: Myocardial infarction related to stent thrombosis
Myocardial infarction associated with stent thrombosis is detected by coronary angiography or autopsy in the setting of myocardial ischaemia and with a rise and/or fall of cardiac biomarkers values with at least one value above the 99th percentile URL.
Type 5: Myocardial infarction related to coronary artery bypass grafting (CABG)
Myocardial infarction associated with CABG is arbitrarily defined by elevation of cardiac biomarker values >10 x 99th percentile URL in patients with normal baseline cTn values (≤99th percentile URL). In addition, either (i) new pathological Q waves or new LBBB, or (ii) angiographic documented new graft or new native coronary artery occlusion, or (iii) imaging evidence of new loss of viable myocardium or new regional wall motion abnormality.

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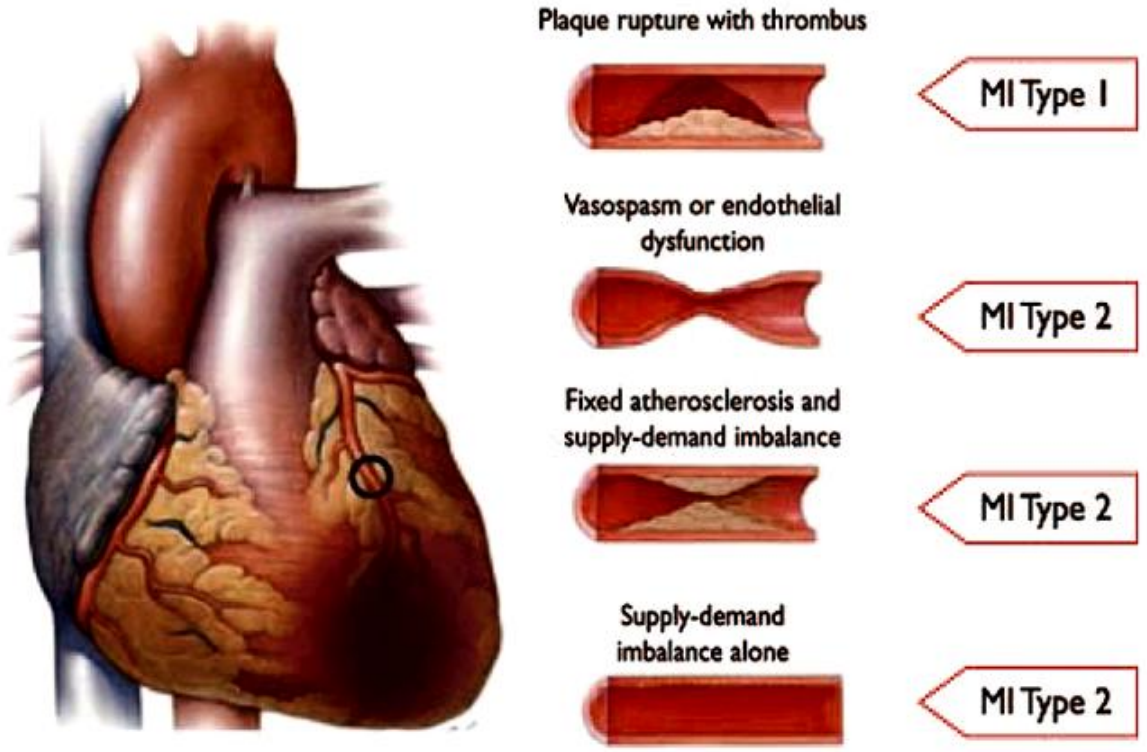

Figure 2 Differentiation between myocardial infarction (MI) types 1 and 2 according to the condition of the coronary arteries.

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Third universal definition of myocardial infarction

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- MI can be recognised by clinical features, including **ECG**, elevated values of **biomarkers** of myocardial necrosis, and by **imaging**, or may be defined by pathology.
- MI is defined in pathology as myocardial cell death **due to prolonged ischaemia**

Third universal definition of myocardial infarction

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Table 5 Common ECG pitfalls in diagnosing myocardial infarction

False positives
• Early repolarization
• LBBB
• Pre-excitation
• J point elevation syndromes, e.g. Brugada syndrome
• Peri-/myocarditis
• Pulmonary embolism
• Subarachnoid haemorrhage
• Metabolic disturbances such as hyperkalaemia
• Cardiomyopathy
• Lead transposition
• Cholecystitis
• Persistent juvenile pattern
• Malposition of precordial ECG electrodes
• Tricyclic antidepressants or phenothiazines
False negatives
• Prior MI with Q-waves and/or persistent ST elevation
• Right ventricular pacing
• LBBB

Table 1 Elevations of cardiac troponin values because of myocardial injury

Injury related to primary myocardial ischaemia
Plaque rupture
Intraluminal coronary artery thrombus formation
Injury related to supply/demand imbalance of myocardial ischaemia
Tachy-/brady-arrhythmias
Aortic dissection or severe aortic valve disease
Hypertrophic cardiomyopathy
Cardiogenic, hypovolaemic, or septic shock
Severe respiratory failure
Severe anaemia
Hypertension with or without LVH
Coronary spasm
Coronary embolism or vasculitis
Coronary endothelial dysfunction without significant CAD
Injury not related to myocardial ischaemia
Cardiac contusion, surgery, ablation, pacing, or defibrillator shocks
Rhabdomyolysis with cardiac involvement
Myocarditis
Cardiotoxic agents, e.g. anthracyclines, herceptin
Multifactorial or indeterminate myocardial injury
Heart failure
Stress (Takotsubo) cardiomyopathy
Severe pulmonary embolism or pulmonary hypertension
Sepsis and critically ill patients
Renal failure
Severe acute neurological diseases, e.g. stroke, subarachnoid haemorrhage
Infiltrative diseases, e.g. amyloidosis, sarcoidosis
Strenuous exercise

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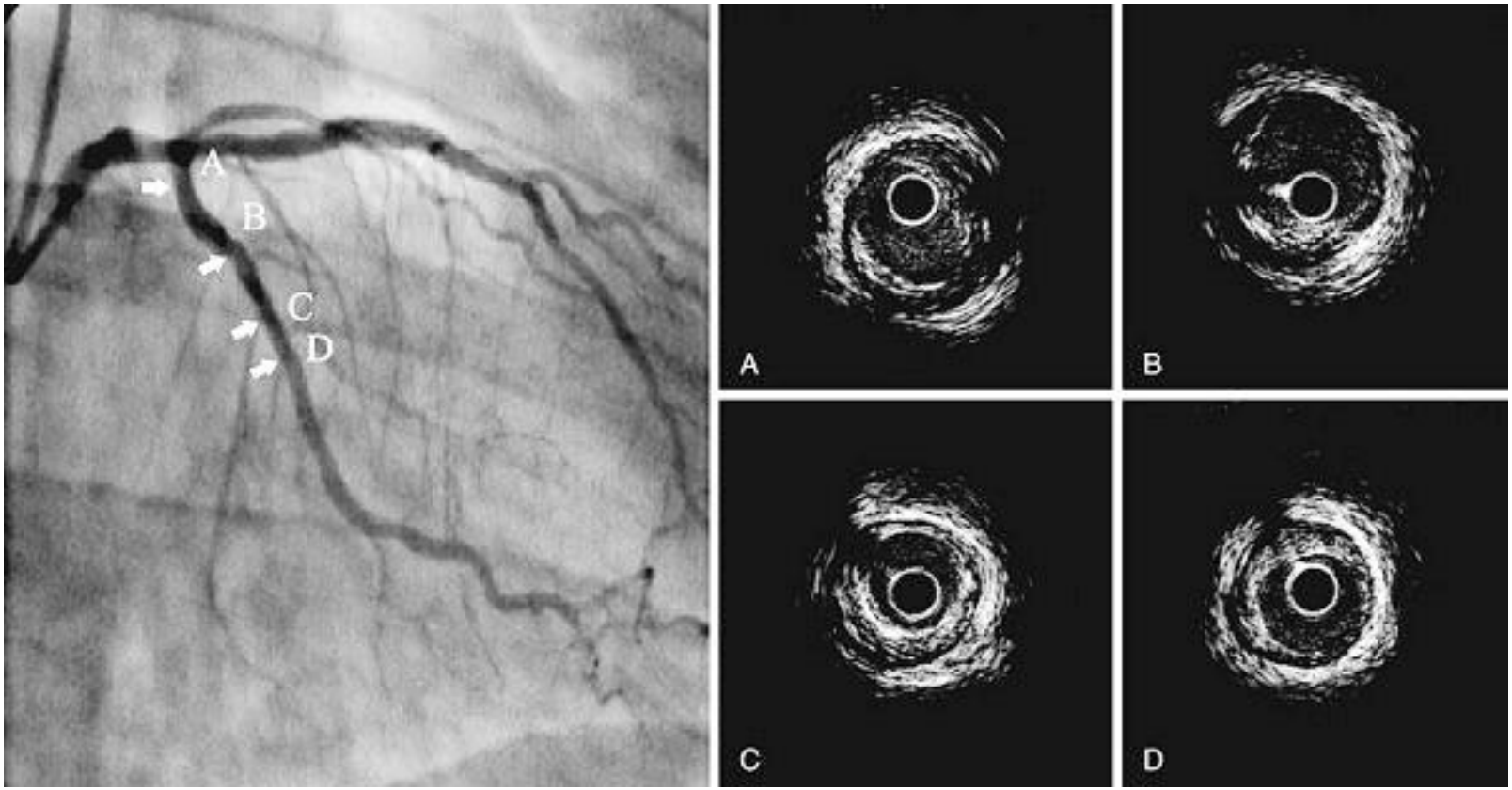
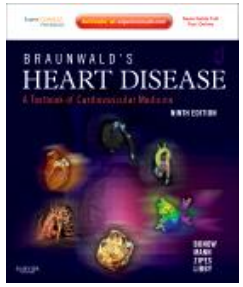
Infarto miocardico
a coronarie angiograficamente indenni

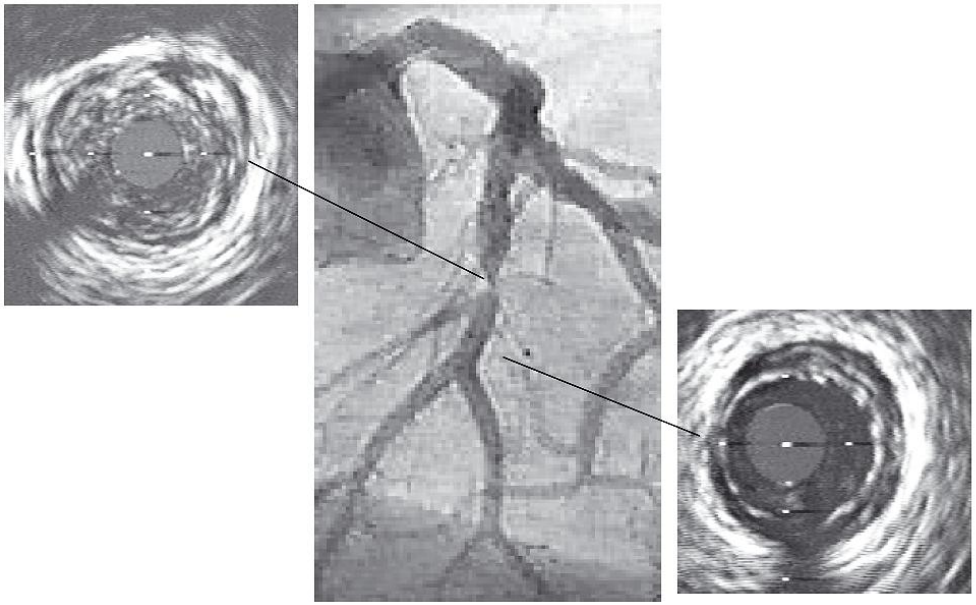
“Angiograficamente indenni” significa “indenni” ?

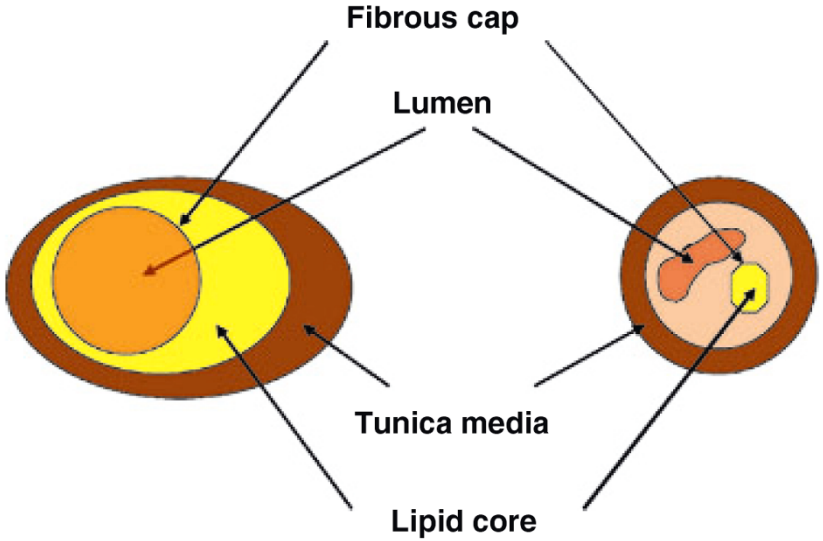




Multiple IVUS images demonstrating the diffuse nature of coronary atherosclerosis in a coronary artery with minimal lumen narrowing. The coronary angiogram shows the sites of the IVUS cross sections in the left circumflex artery.

IVUS





External remodelling:

plaque not determining significant changes in lumen patency

Internal remodelling:

plaque determining significant stenosis

Review | Journal of INTERNAL MEDICINE

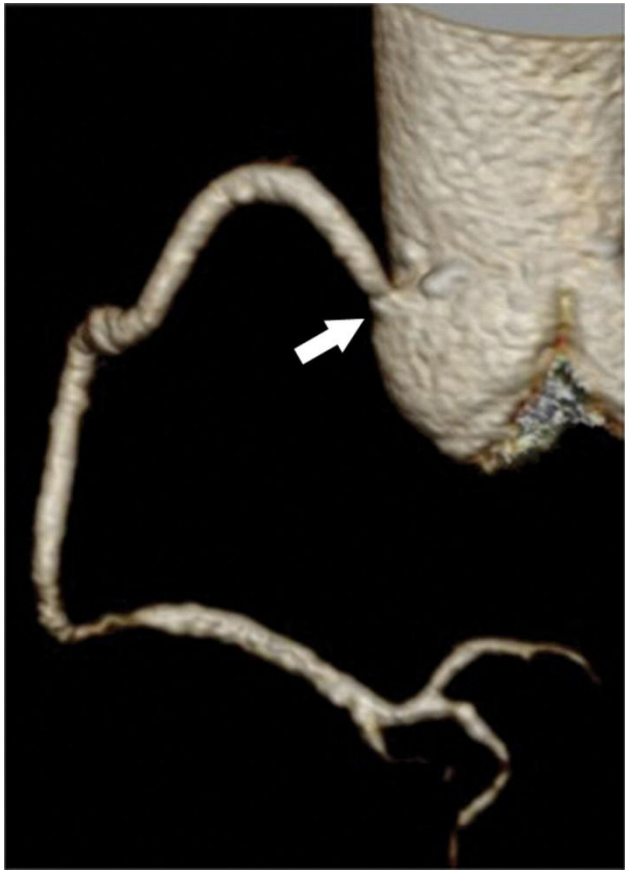
doi: 10.1111/j.1365-2796.2007.01788.x

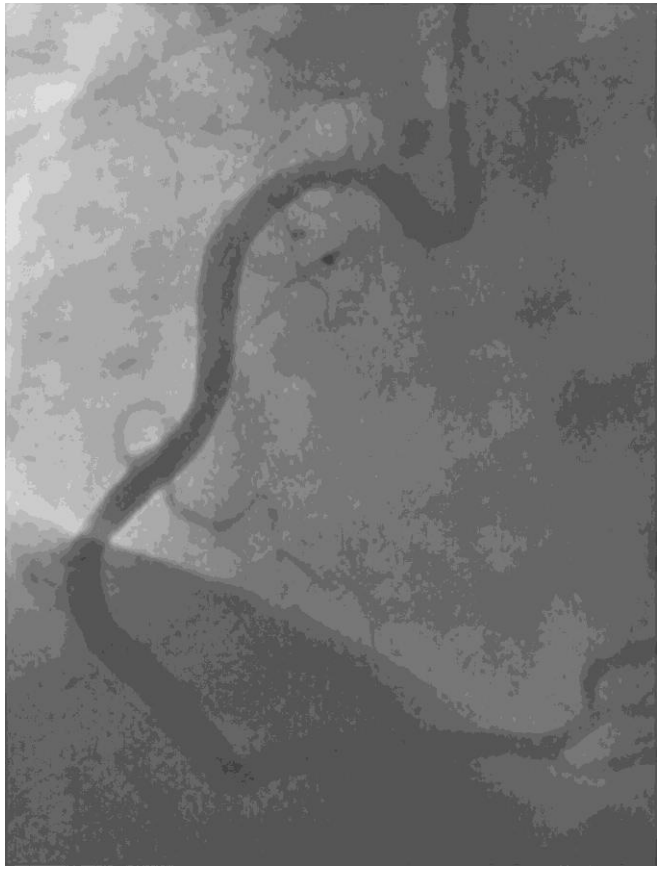
Myocardial infarction with normal coronary arteries: a conundrum with multiple aetiologies and variable prognosis: an update

I. Kardasz & R. De Caterina

From the Institute of Cardiology and Center of Excellence on Aging, 'G. d'Annunzio' University – Chieti, Chieti, and CNR Institute of Clinical Physiology, Pisa, Italy

Coronary CT scan

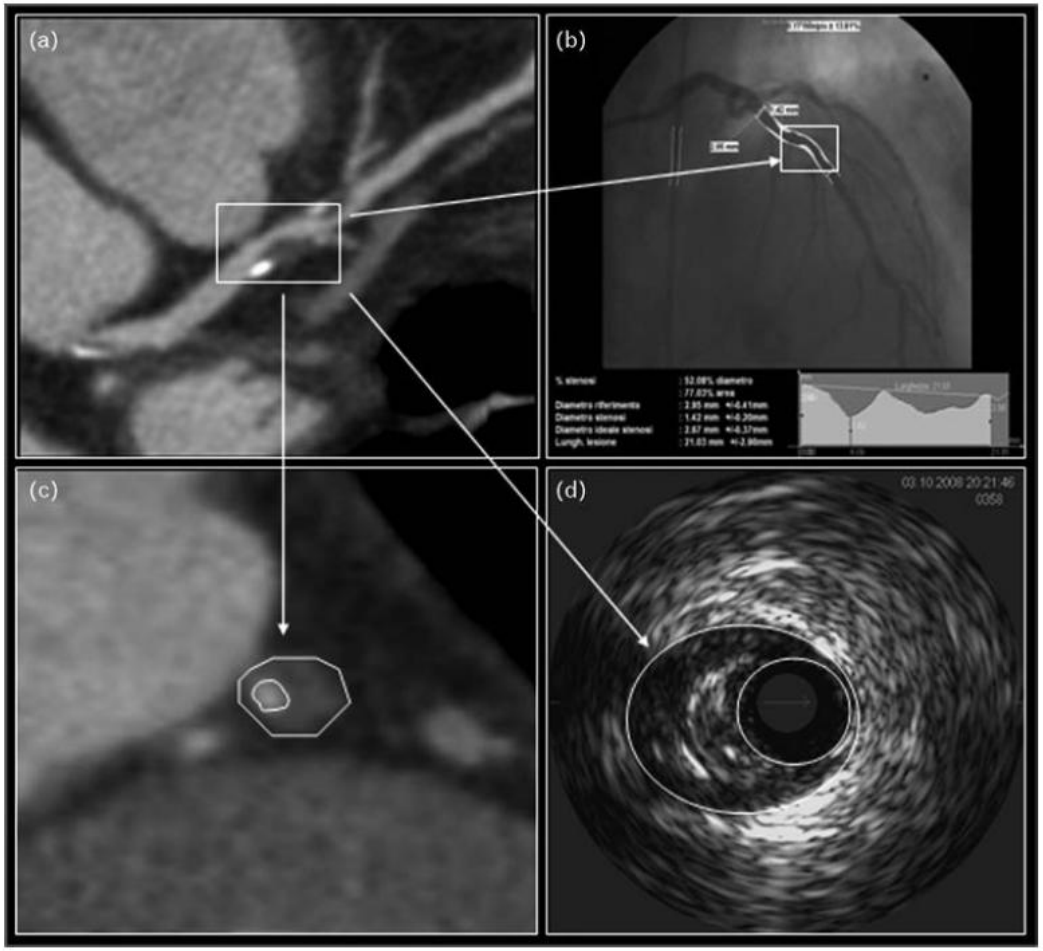




CT angiogram displayed as 3D volume rendering from RAO perspective show significant ostial stenosis (arrow) of the right coronary artery due to calcified plaque. This lesion had not been appreciated on prior coronary angiogram in straight left anterior oblique projection because the tip of the catheter was advanced beyond the stenosis prior to contrast medium injection.

Bastarrika G et al. Radiology 2009;253:317-338

Imaging multimodale



Assessment of coronary stenosis, plaque burden and remodeling by multidetector computed tomography in patients referred for suspected coronary artery disease

Pedrazzini GB, D'Angeli,I, Vassalli G, Faletra FF, Klersy C, Pasotti E, Corbacelli C, Moccetti T, Auricchio A. ***Journal Cardiovasc Med*** **2011; 12(2):122-130.**

Representative example of lesion analysis in a 57-year-old man with suspected coronary artery disease. [(a),(c)] Multidetector computed tomography [MDCT (long and short axis)] showing an eccentric, mixed plaque [lumen area stenosis (LAS) = 75%] of the proximal left anterior descending coronary artery (LAD) with positive remodeling (remodeling index = 1.3). (b) Corresponding quantitative coronary angiography (QCA) analysis showing a nonsignificant stenosis. (d) Intravascular ultrasound (IVUS) image showing an eccentric, moderately calcified lesion with stenosis severity (LAS = 78%) similar to that measured by MDCT.

Patogenesi multifattoriale

Concealed atherosclerosis

Coronary vasospasm

AMI with normal coronary arteries

Thrombosis and hypercoagulability

Embolisation

Inflammation

Review | Journal of INTERNAL MEDICINE

doi: 10.1111/j.1365-2796.2007.01788.x

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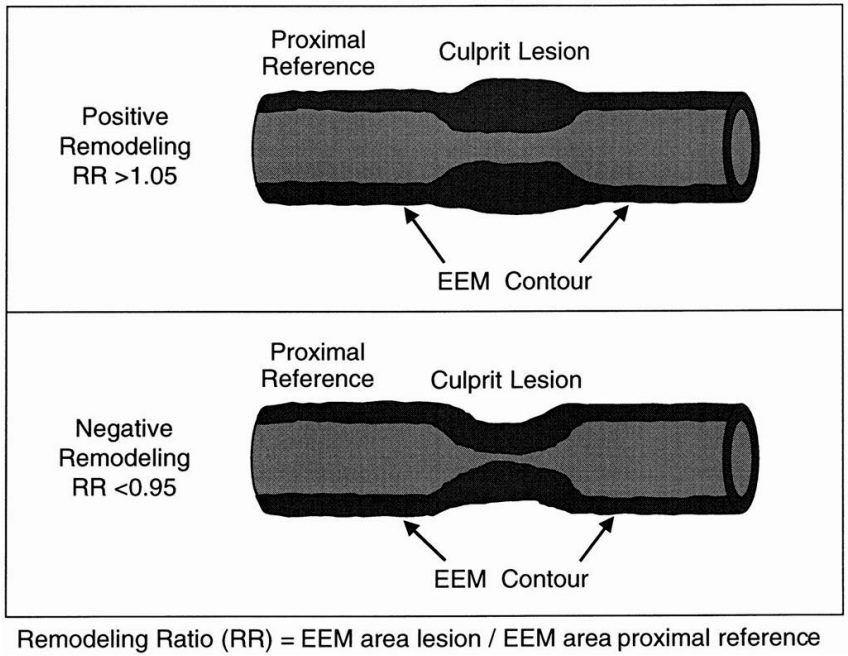
Aterosclerosi subclinica

- **> IMA origina da ateromi che provocano < 50% stenosi.**
- **Il diametro del lume dipende sia dalle dimensioni della placca che dalla sua espansione all'esterno (remodelling positivo)**

American Heart Association
Learn and Live

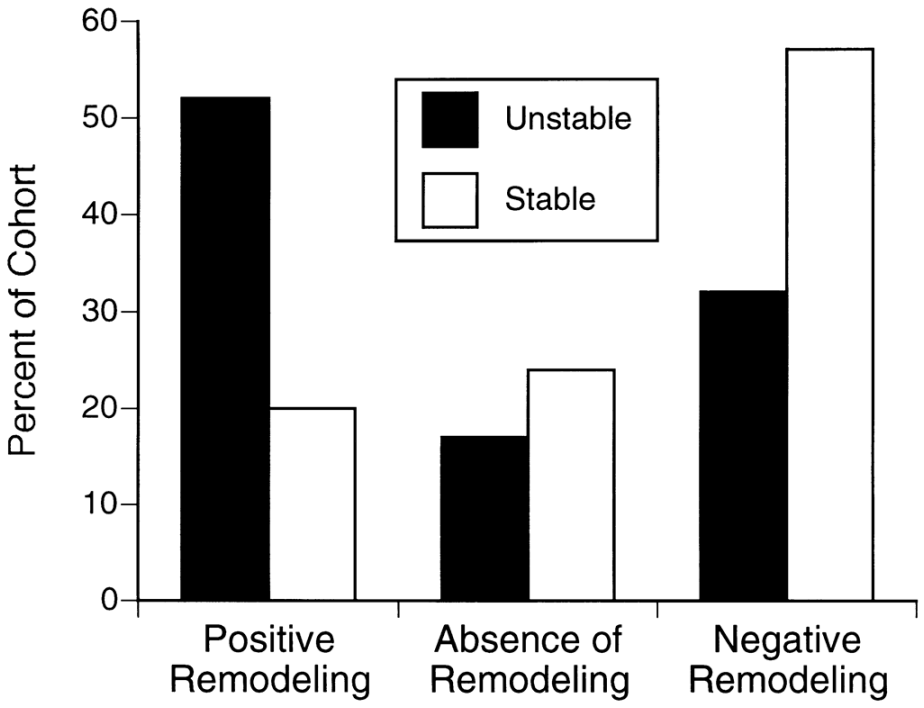


Remodeling Ratio (RR) = EEM area lesion / EEM area proximal reference

Schoenhagen P et al. Circulation 2000;101:598-603

Aterosclerosi subclinica

Frequency of positive and negative remodeling in stable and unstable angina groups.



Schoenhagen P et al. Circulation 2000;101:598-603

Conclusions—Positive remodeling and larger plaque areas were associated with unstable clinical presentation, whereas negative remodeling was more common in patients with stable clinical presentation. This association between the extent of remodeling and clinical presentation may reflect a greater tendency of plaques with positive remodeling to cause unstable coronary syndromes.

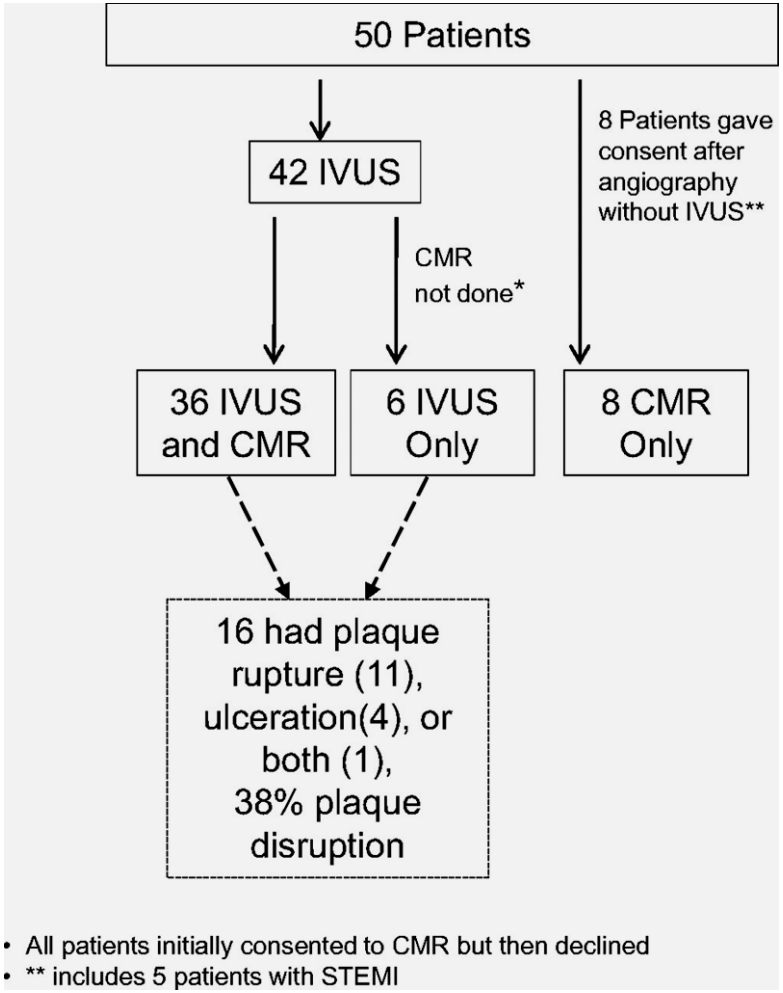
American Heart Association
Learn and Live

Mechanisms of Myocardial Infarction in Women Without Angiographically Obstructive Coronary Artery Disease

Harmony R. Reynolds, Monvadi B. Srichai, Sohah N. Iqbal, James N. Slater, G.B. John Mancini, Frederick Feit, Ivan Pena-Sing, Leon Axel, Michael J. Attubato, Leonid Yatskar, Rebecca T. Kalhorn, David A. Wood, Iryna V. Lobach and Judith S. Hochman

Circulation 2011, 124:1414-1425: originally published online September 6, 2011

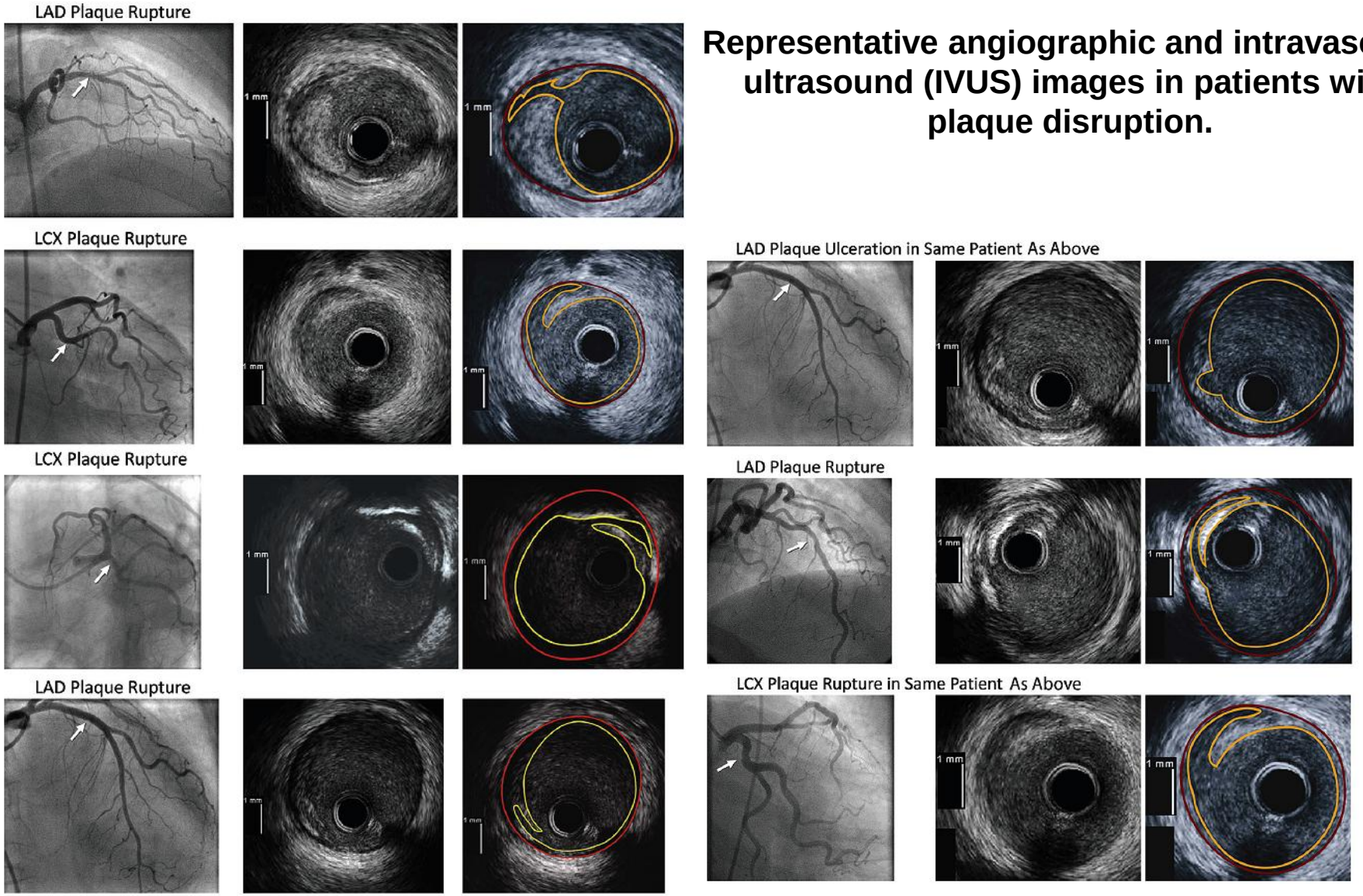
American Heart Association
Learn and Live



Patient flow and proportion with plaque disruption.

A substantial proportion of patients with myocardial infarction have no angiographically obstructive (50% diameter stenosis) coronary artery disease including 7% to 32% of women and 6% to 12% of men

Aterosclerosi subclinica

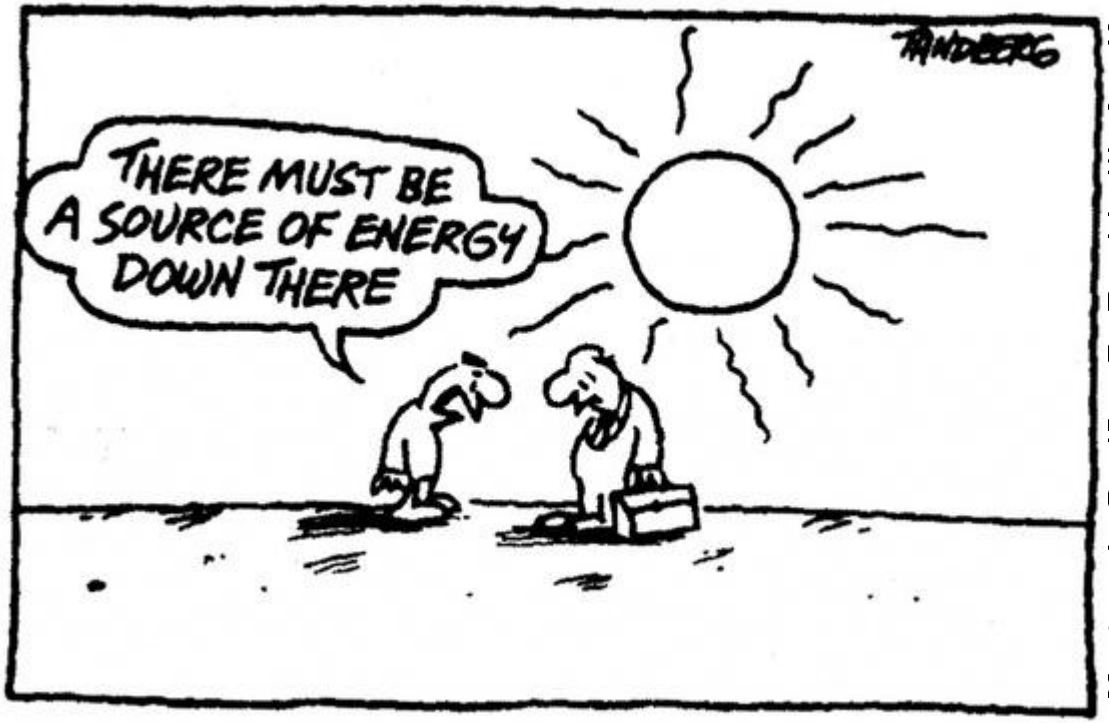


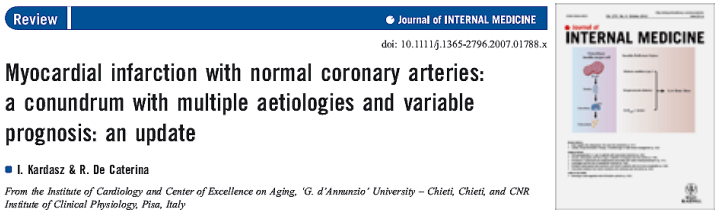
Representative angiographic and intravascular ultrasound (IVUS) images in patients with plaque disruption.

Reynolds H R et al. Circulation 2011;124:1414-1425

Aterosclerosi subclinica

- As most acute plaque complications occur on angiographically ‘minor’ stenoses, w s, or also on angiographic ard growth of some plaque al technique to evaluate the o acute plaque complication y accepted that coronary ang on.
- All studies o eries have used coronary an all ‘normality’. Due to a wi e likely that a substantial n ary thrombosis (with rapid erimposed on nonangiographically visible (concealed) or ‘minor’ coronary plaques.

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doi: 10.1111/j.1365-2796.2007.01788.x

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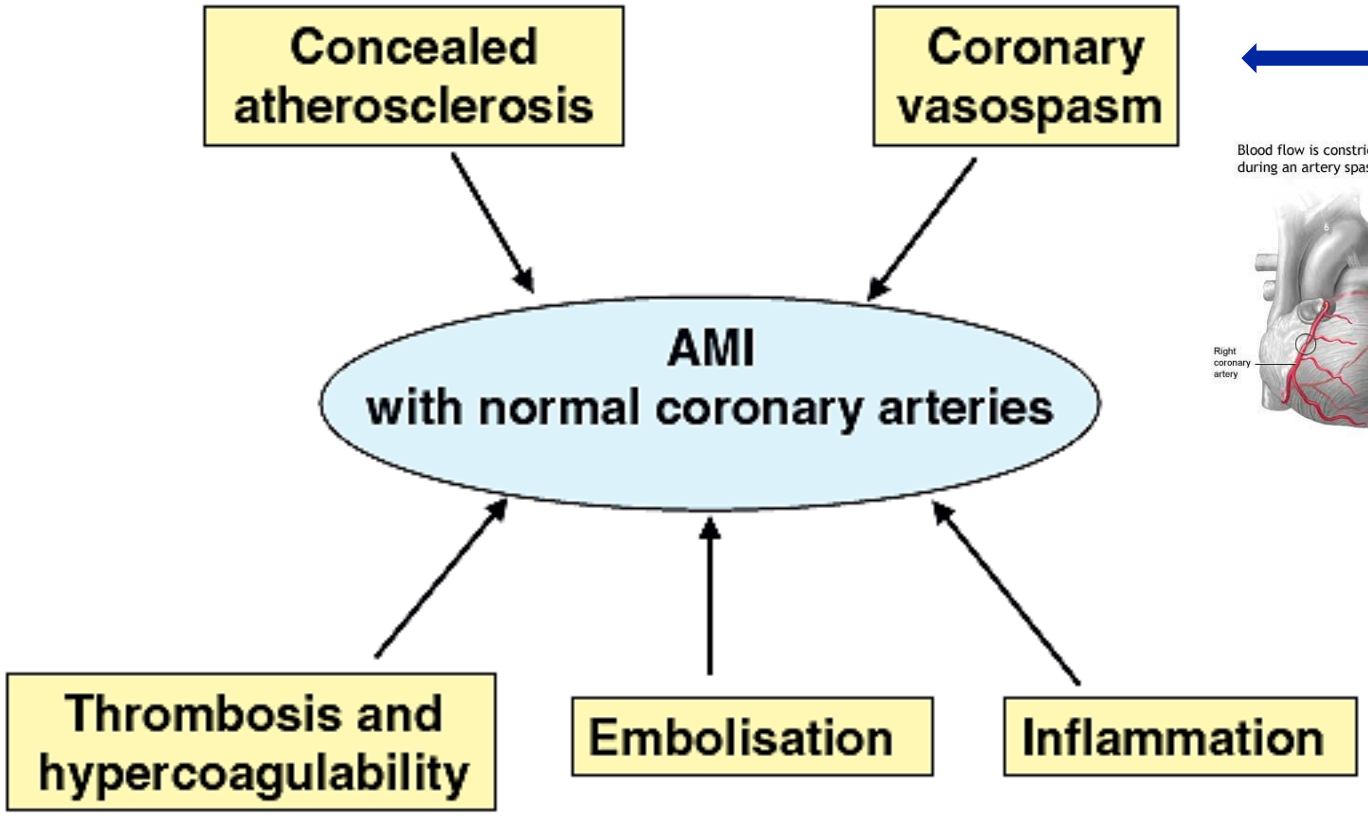
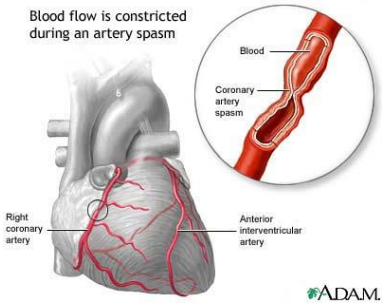
Patogenesi multifattoriale





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Vasospasmo coronario

Medical Progress

Cardiovascular Complications of Cocaine Use

Richard A. Lange, M.D., and L. David Hillis, M.D.

N Engl J Med, Vol. 345, No. 5 · August 2, 2001

The New England Journal of Medicine

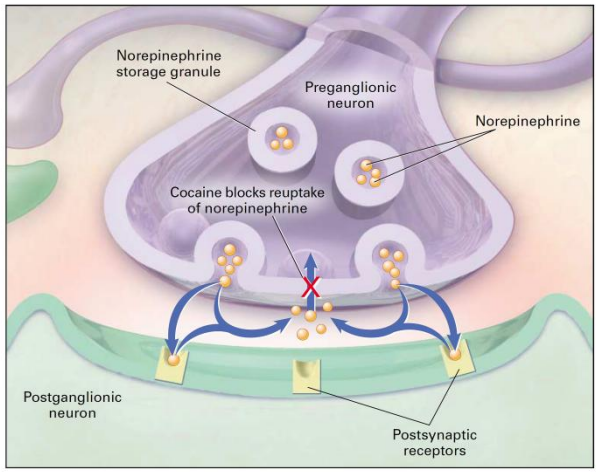


Figure 1. The Mechanism by Which Cocaine Alters Sympathetic Tone.
Cocaine blocks the reuptake of norepinephrine by the preganglionic neuron (red X), resulting in excess amounts of this neurotransmitter at receptor sites on the postganglionic neuron.

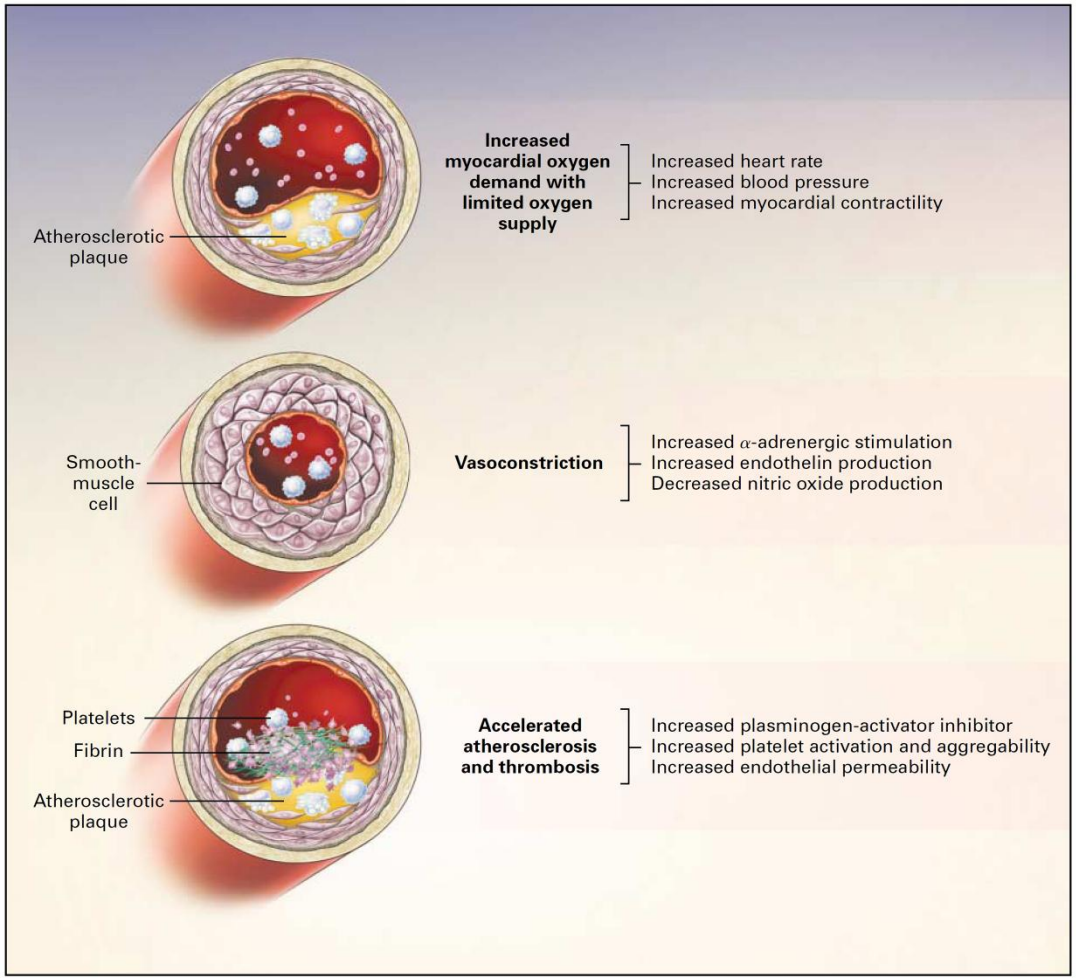
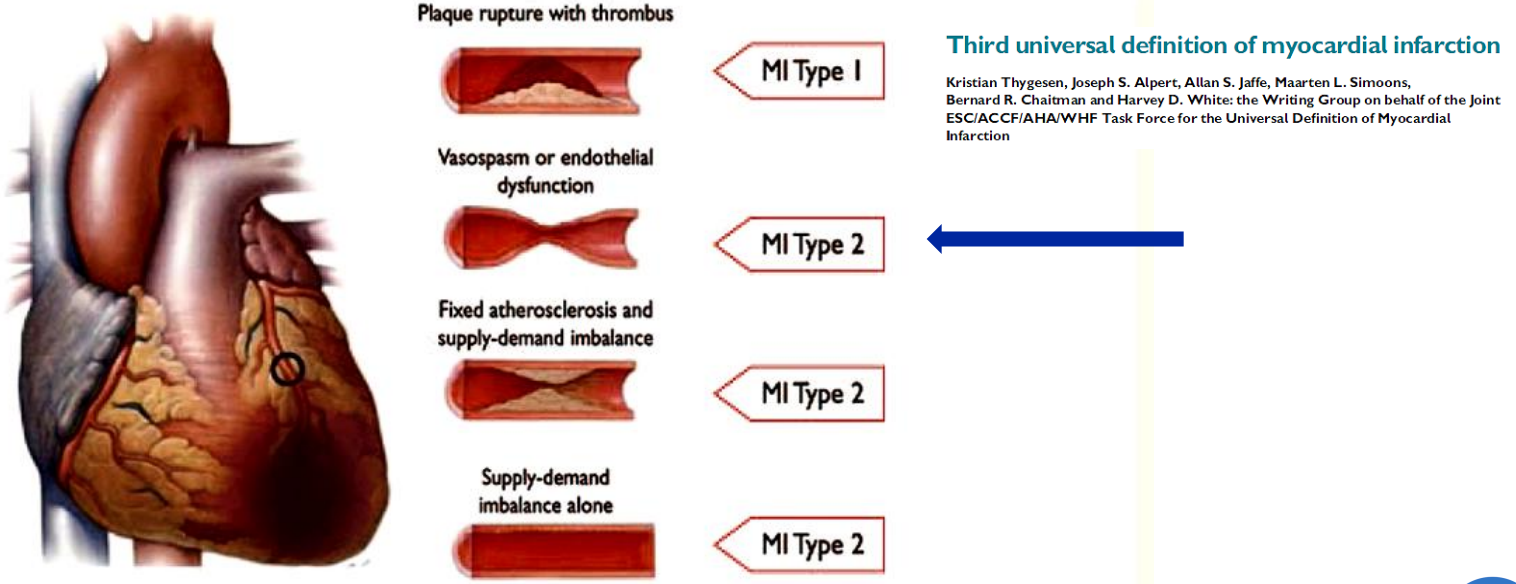


Figure 2. Mechanisms by Which Cocaine May Induce Myocardial Ischemia or Infarction.
Cocaine may cause increases in the determinants of myocardial oxygen demand when there is a limited oxygen supply (top), intense vasoconstriction of the coronary arteries (middle), or induce accelerated atherosclerosis and thrombosis (bottom).

Vasospasmo coronarico

- Intossicazione acuta di etanolo
- Sospensione di Ca-antagonisti
- ATS coronarica “minima” diffusa
- Fumo di sigaretta
- Disfunzione endoteliale

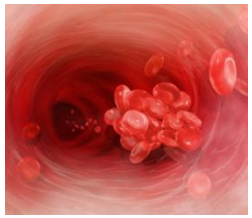


Third universal definition of myocardial infarction

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

Figure 2 Differentiation between myocardial infarction (MI) types 1 and 2 according to the condition of the coronary arteries.

Patogenesi multifattoriale



Concealed atherosclerosis

Coronary vasospasm

AMI with normal coronary arteries

Thrombosis and hypercoagulability

Embolisation

Inflammation

Review | Journal of INTERNAL MEDICINE

doi: 10.1111/j.1365-2796.2007.01788.x

Myocardial infarction with normal coronary arteries: a conundrum with multiple aetiologies and variable prognosis: an update

I. Kardasz & R. De Caterina

From the Institute of Cardiology and Center of Excellence on Aging, 'G. d'Annunzio' University – Chieti, Chieti, and CNR Institute of Clinical Physiology, Pisa, Italy

Trombosi ed ipercoagulabilità

- La formazione in situ di un trombo può occludere l'arteria causando l'IMA; la successiva lisi spontanea può spiegare la normalità angiografica del vaso.
- Le patologie ematologiche che causano ipercoagulabilità, il trattamento ormonale (contraccettivo o sostitutivo), la disfunzione endoteliale, il fumo, l'eccesso di Lp(a) e di PAI-1 possono tutti causare trombosi coronarica

Trombosi ed ipercoagulabilità

- **Estrogeni**: attivatori piastrinici. In ♀ con IMA a coronarie normali osservata > prevalenza di terapia estrogenica o gravidanza vs controlli.
- **Fumo**: riduce tPA e rilascio di NO dalle piastrine
- **Aumentati livelli di LP(a):** riducono la vasodilatazione endotelino-dipendente e l'attività fibrinolitica; stimolano la produzione di PAI-1 (il più potente inibitore della fibrinolisi)

Trombosi ed ipercoagulabilità

Health Services and Outcomes Research

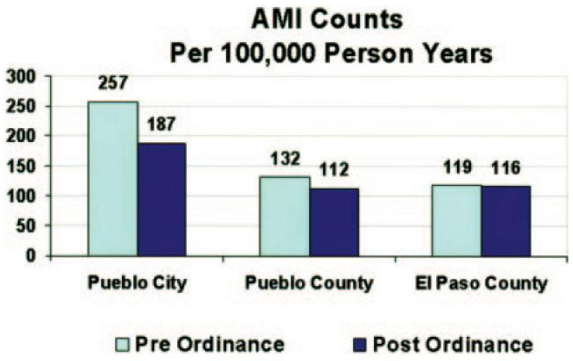
Reduction in the Incidence of Acute Myocardial Infarction Associated With a Citywide Smoking Ordinance

Carl Bartecchi, MD; Robert N. Alsever, MD; Christine Nevin-Woods, DO, MPH; William M. Thomas, PhD; Raymond O. Estacio, MD; Becki Bucher Bartelson, PhD; Mori J. Krantz, MD

Background—Secondhand smoke exposure increases the risk of acute myocardial infarction (AMI). One study (Helena, Mont) examined the issue and found a decrease in AMI associated with a smoke-free ordinance. We sought to determine the impact of a smoke-free ordinance on AMI admission rates in another geographically isolated community (Pueblo, Colo).

Methods and Results—We assessed AMI hospitalizations in Pueblo during a 3-year period, 1.5 years before and 1.5 years after implementation of a smoke-free ordinance. We compared the AMI hospitalization rates among individuals residing within city limits, the area where the ordinance applied, versus those outside city limits. We also compared AMI rates during this time period with another geographically isolated but proximal community, El Paso County, Colo, that did not have an ordinance. A total of 855 patients were hospitalized with a diagnosis of primary AMI in Pueblo between January 1, 2002, and December 31, 2004. A reduction in AMI hospitalizations was observed in the period after the ordinance among Pueblo city limit residents (relative risk [RR]=0.73, 95% confidence interval [CI] 0.63 to 0.85). No significant changes in AMI rates were observed among residents outside city limits (RR=0.85, 95% CI 0.63 to 1.16) or in El Paso County during the same period (RR=0.97, 95% CI 0.89 to 1.06). The reduction in AMI rate within Pueblo differed significantly from changes in the external control group (El Paso County) even after adjustment for seasonal trends ($P<0.001$).

Conclusions—A public ordinance reducing exposure to secondhand smoke was associated with a decrease in AMI hospitalizations in Pueblo, Colo, which supports previous data from a smaller study. **(*Circulation*. 2006;114:1490-1496.)**



American Heart Association
Learn and Live

Trombosi ed ipercoagulabilità

Preventive Cardiology

Effect of the Italian Smoking Ban on Population Rates of Acute Coronary Events

Giulia Cesaroni, MSc; Francesco Forastiere, MD, PhD; Nera Agabiti, MD; Pasquale Valente, MD; Piergiorgio Zuccaro, PhD; Carlo A. Perucci, MD

Background—Several countries in the world have not yet prohibited smoking in public places. Few studies have been conducted on the effects of smoking bans on cardiac health. We evaluated changes in the frequency of acute coronary events in Rome, Italy, after the introduction of legislation that banned smoking in all indoor public places in January 2005.

Methods and Results—We analyzed acute coronary events (out-of-hospital deaths and hospital admissions) between 2000 and 2005 in city residents 35 to 84 years of age. We computed annual standardized rates and estimated rate ratios by comparing the data from prelegislation (2000–2004) and postlegislation (2005) periods. We took into account several time-related potential confounders, including particulate matter (PM_{10}) air pollution, temperature, influenza epidemics, time trends, and total hospitalization rates. The reduction in acute coronary events was statistically significant in 35- to 64-year-olds (11.2%, 95% CI 6.9% to 15.3%) and in 65- to 74-year-olds (7.9%, 95% CI 3.4% to 12.2%) after the smoking ban. No evidence was found of an effect among the very elderly. The reduction tended to be greater in men and among lower socioeconomic groups.

Conclusions—We found a statistically significant reduction in acute coronary events in the adult population after the smoking ban. The size of the effect was consistent with the pollution reduction observed in indoor public places and with the known health effects of passive smoking. The results affirm that public interventions that prohibit smoking can have enormous public health implications. (***Circulation*. 2008;117:1183-1188.**)

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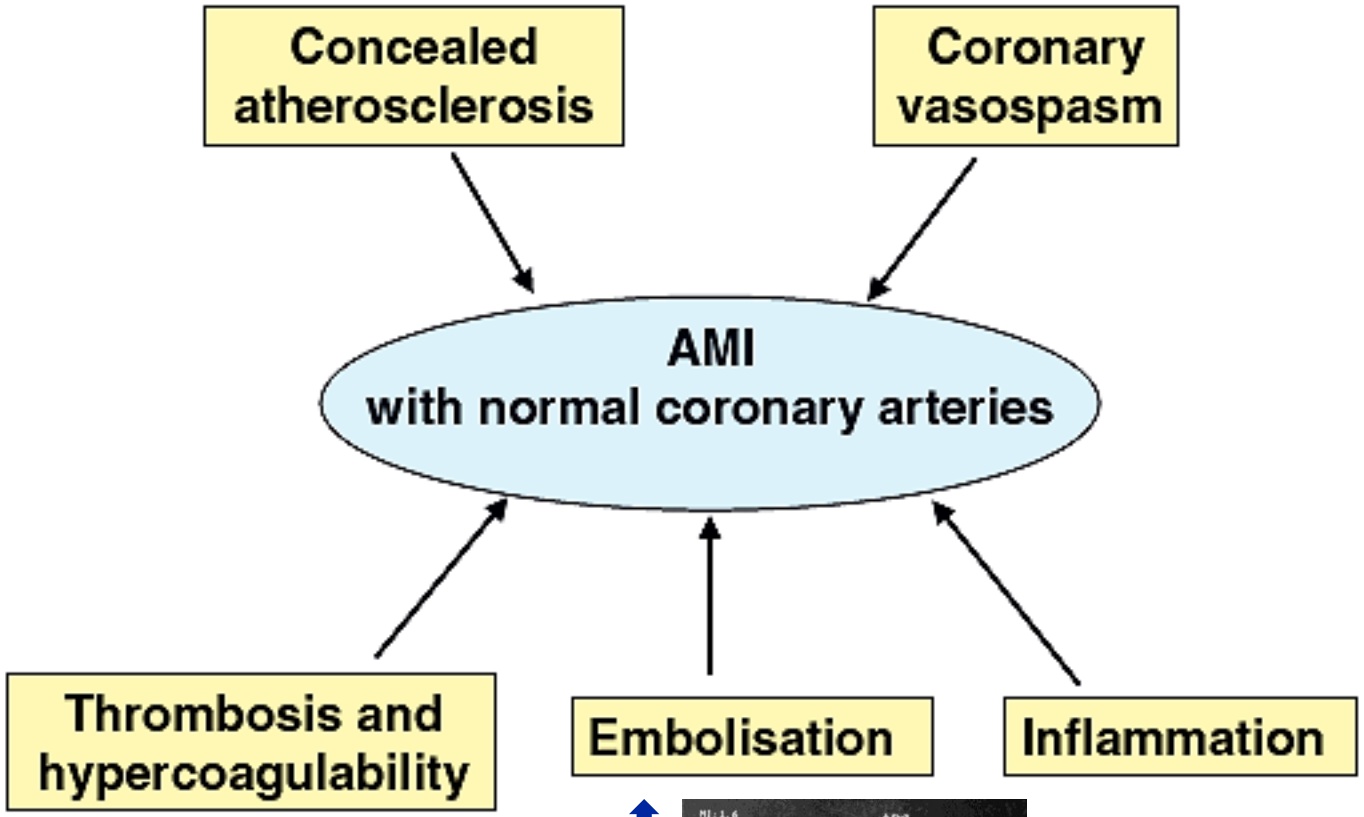
Patogenesi multifattoriale



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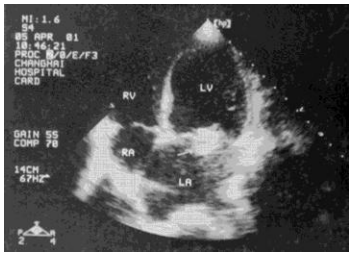


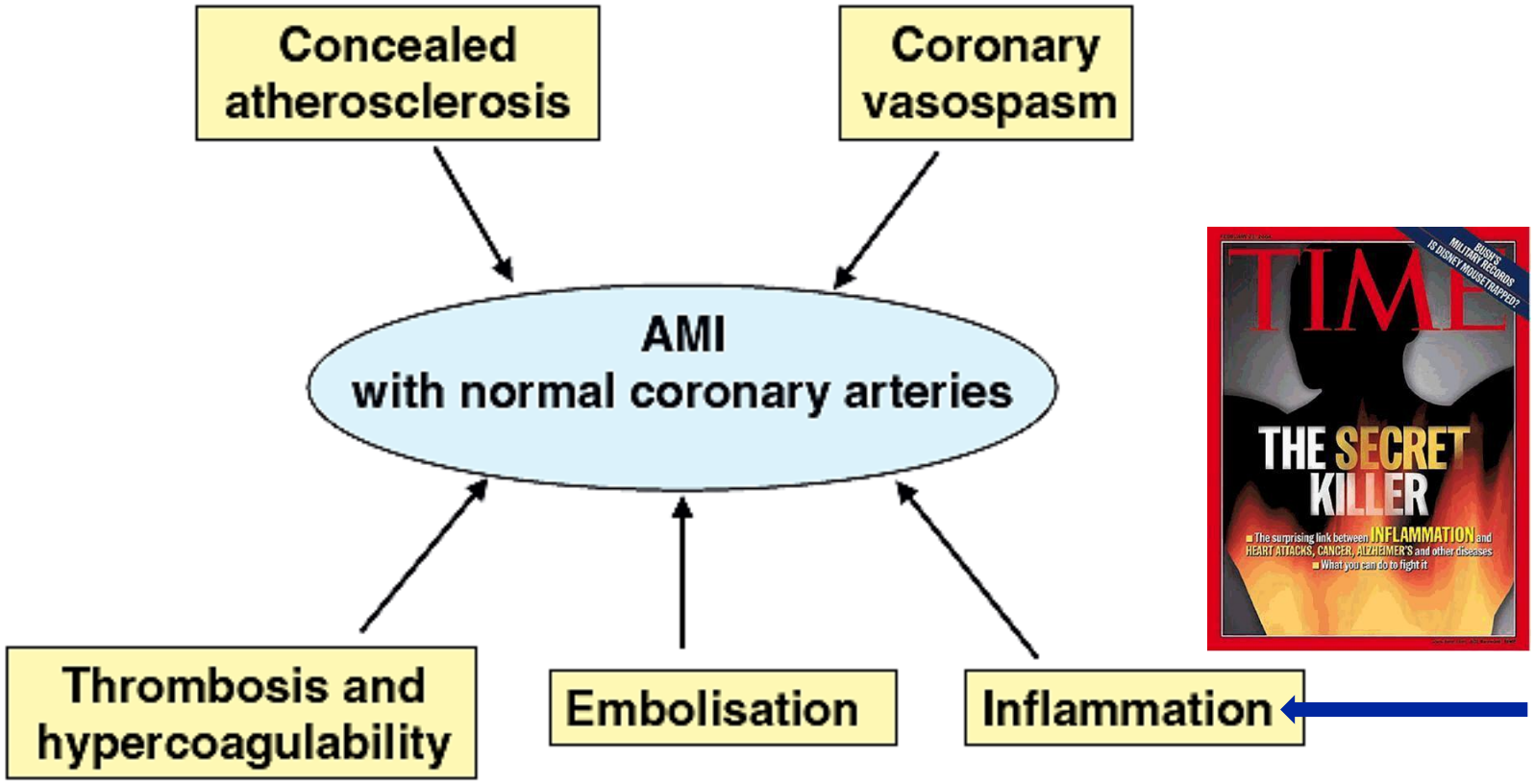
JThorac Cardiovasc Surg 2009;137:749-751

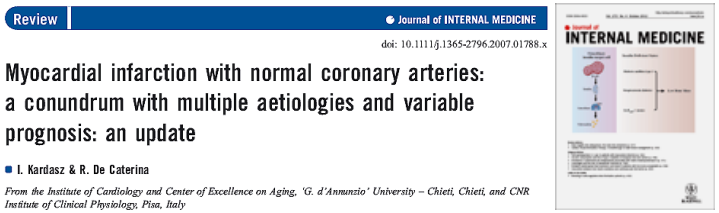
Embolismo

- Un embolo può occludere una coronaria e dare IMA
- Sede preferenziale dell'IMA embolico: IVA
- Sino al 13% IMA in casistiche autoptiche degli anni '70
- SOE possibili: valvole native o protesi, mixoma AS, endocardite, trombosi murale, durante CCH (passaggio di aria nel circolo coronarico, migrazione di frammenti di calcio).
- Non dimostrata associazione con PFO

Anche se teoricamente possibile, l'IMA embolico probabilmente spiega una parte modesta degli IMA a coronarie indenni

Patogenesi multifattoriale





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Infiammazione

- La PCR, specie se valutata con metodica ultrasensibile, è un predittore di eventi CV
- Il pazienti con IMA a coronarie normali sembrerebbero avere una > prevalenza di infezioni febbrili nelle 2 settimane precedenti

Conclusion: **High migraine score and prior febrile infection together with a lower cardiovascular risk profile are compatible with an inflammatory and a vasomotor component in the pathophysiology of the acute coronary event in MINC patients. The prognosis for these patients is excellent.**

Characteristics and Prognosis of Myocardial Infarction in Patients With Normal Coronary Arteries*

Peter Ammann, MD; Sabine Marschall, MD; Martin Kraus, MD; Lucius Schmid, MD; Walter Angehrn, MD; Reto Krapf, MD; and Hans Rickli, MD

(CHEST 2000; 117:333–338)

Infiammazione

Table 2—*Baseline Clinical Characteristics of MINC and CAD Patients

Characteristics	MINC	CAD	p Value
Gender, No.			
Female	6	6	ns
Male	15	15	ns
Ejection fraction, %	60 ± 13	61 ± 11	ns
BMI, kg/m^2	24.3 ± 3.2	27.3 ± 4.1	0.05
Infarct anterior	15 (71)	15 (71)	ns
Angina prior to infarction	1 (5)	7 (33)	0.05
Atypical angina prior to infarction	4 (19)	2 (10)	ns
History of arterial hypertension	2 (10)	8 (40)	0.05
History of hypercholesterolemia	9 (43)	18 (86)	0.01
Family history of CAD	6 (29)	6 (29)	ns
Diabetes mellitus	0 (0)	3 (14)	ns
Smoker	16 (76)	14 (67)	ns
Febrile infection prior to infarction	6 (29)	0 (0)	0.05
Migraine score	7.1 ± 6.3	2.2 ± 4.1	0.01
Migraine score ≥ 7	10 (48)	2 (10)	0.01
Raynaud score	1.7 ± 2.9	0.5 ± 1.4	ns
Raynaud score ≥ 5	5 (24)	1 (5)	ns
Cholesterol, mmol/L	5.6 ± 1.0	6.1 ± 1.3	ns
Triglyceride, mmol/L	1.3 ± 0.5	3.0 ± 2.4	0.005
HDL-cholesterol, mmol/L	1.3 ± 0.3	1.0 ± 0.3	0.005
Cholesterol/HDL ratio	4.4 ± 1.0	6.5 ± 2.3	0.005
Apolipoprotein A1, g/L	1.52 ± 0.34	1.33 ± 0.22	0.08
Apolipoprotein B, g/L	1.03 ± 0.24	1.24 ± 0.31	0.05
Lipoprotein (a), mg/L	271 ± 389	292 ± 463	ns

*Values are presented as mean ± SEM or as No. (percent of total), unless otherwise indicated; p values ≤ 0.05 are considered statistically significant; ns = not significant.

(CHEST 2000; 117:333–338)

A proposito di infiammazione…

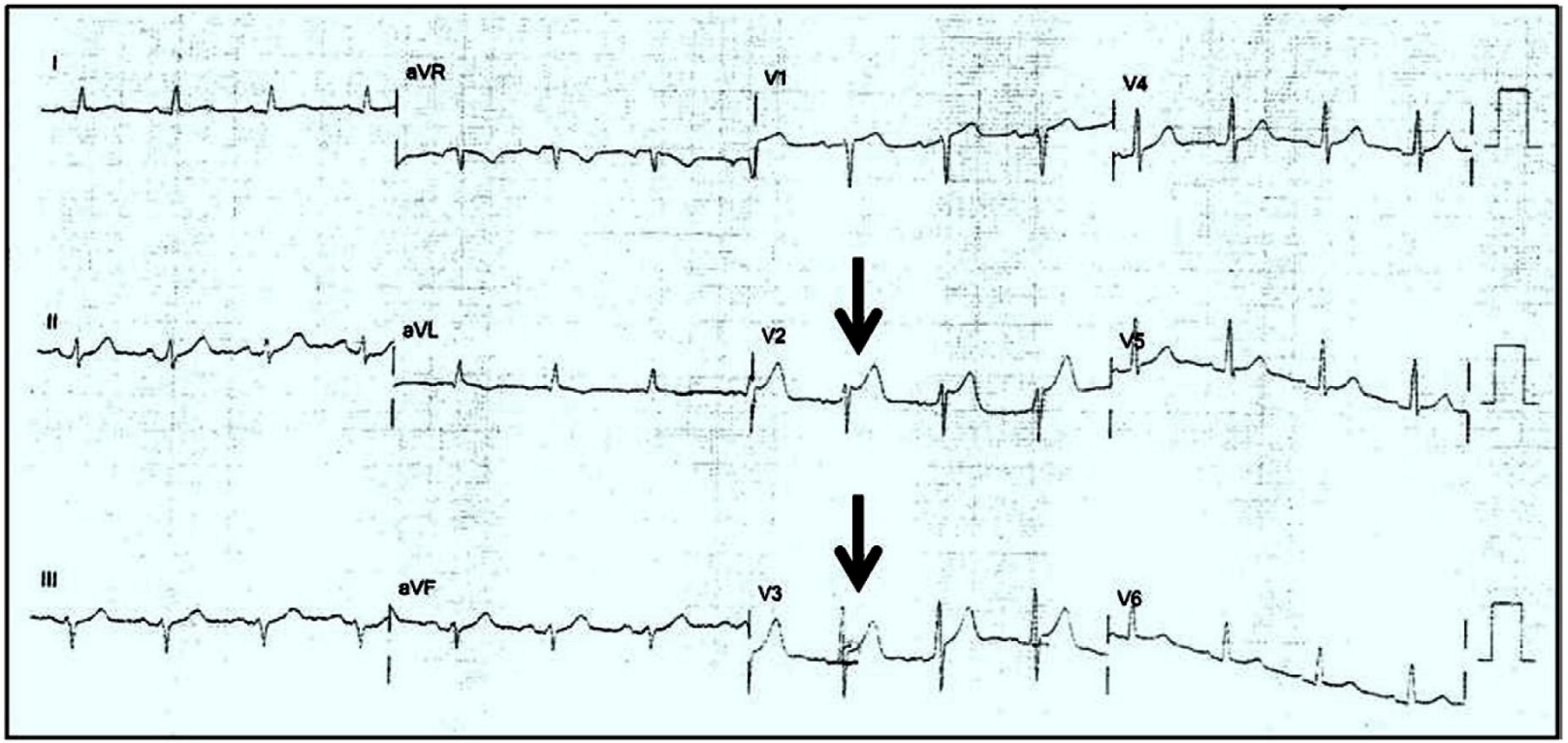


Fig. 3 Myocarditis—a 57-year-old man presented with chest pain, hypotension, and pulmonary edema. The ST-segment elevation (large arrow) in the anterior leads resulted in rapid transfer to the catheterization laboratory where no significant coronary lesions were noted; an elevated pulmonary wedge pressure confirmed myocarditis. The serum troponin was elevated.

Clinical factors suggesting a diagnosis of myocarditis in individuals with ST-segment and T-wave abnormalities include a younger patient age (younger than 40 years), complaint of recent viral illness, slowly evolving ECG changes involving more than one vascular distribution, and diffuse—rather than focal—wall motion abnormalities on echocardiogram

A proposito di infiammazione…

STATE-OF-THE-ART PAPER

Update on Myocarditis

Ingrid Kindermann, MD,* Christine Barth,* Felix Mahfoud, MD,* Christian Ukena, MD,* Matthias Lenski, MD,* Ali Yilmaz, MD,† Karin Klingel, MD,‡ Reinhard Kandolf, MD,‡ Udo Sechtem, MD,† Leslie T. Cooper, MD,§ Michael Böhm, MD*

Homburg/Saar, Stuttgart, and Tübingen, Germany; and Rochester, Minnesota

(J Am Coll Cardiol 2012;59:779–92)

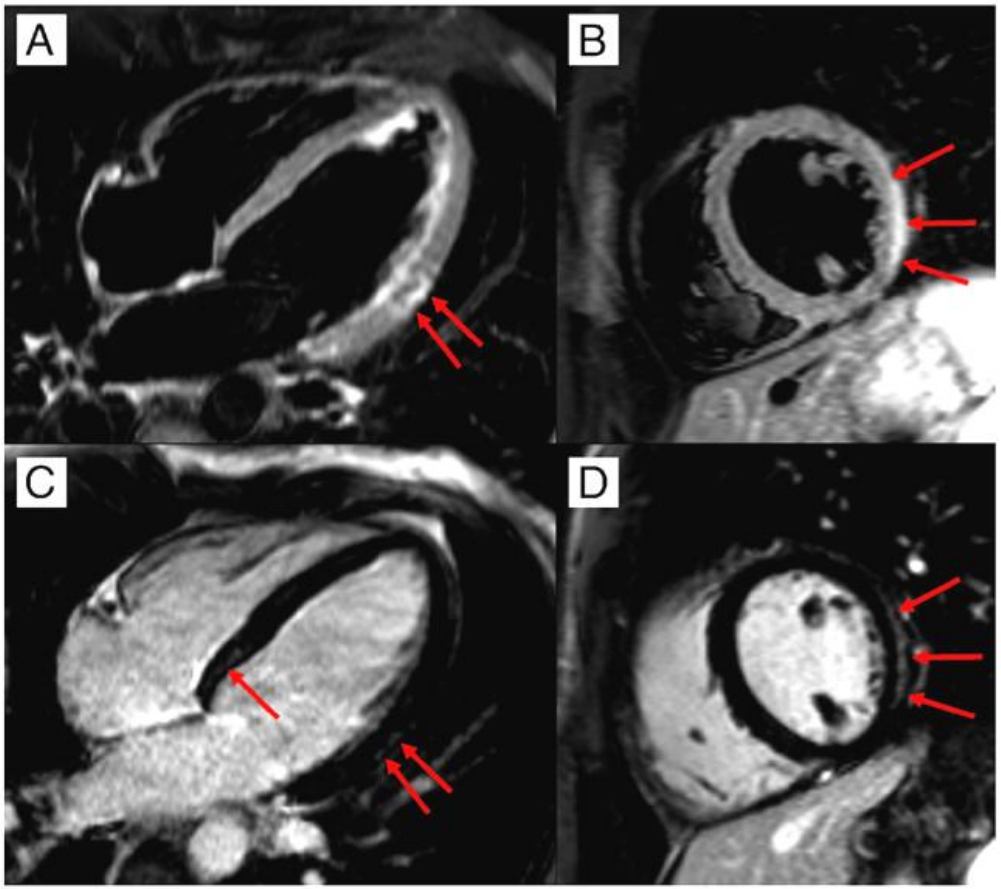


Figure 3 **MRI Findings in Patients With Myocarditis**

Cardiac magnetic resonance imaging (MRI) images of a young patient presenting with acute chest pain syndrome due to acute myocarditis. **(A)** Long-axis and **(B)** short-axis T2-weighted edema images demonstrating focal myocardial edema in the subepicardium of the left midventricular lateral wall **(red arrows)**. Corresponding **(C)** long-axis and **(D)** short-axis T1-weighted late gadolinium enhancement images demonstrate presence of typical late gadolinium enhancement in the subepicardium of the left midventricular lateral wall and the basal septum **(red arrows)**.

Miocardite ≠ IMA

Table 2
Studies of Myocardial Infarction with Normal Coronary Arteries using magnetic resonance imaging (MRI).

Patients, no	Age, mean	Myocarditis	Myocardial necrosis	Normal	Reference
23	54	1 (4%)	7 (30%)	15 (65%)	[7]
60	44	30 (50%)	7 (12%)	21 (35%)[a]	[8]
80	48	51 (63%)	12 (15%)	17 (21%)	[9]
49	45	14 (29%)	None	5 (10%)[b]	[3]

[a] Two patients were diagnosed with cardiomyopathy.
[b] The remaining patients were classified as pericarditis, stress cardiomyopathy, dilated cardiomyopathy or non-diagnostic using an integrated approach using clinical findings, ECG, biomarkers and MRI.

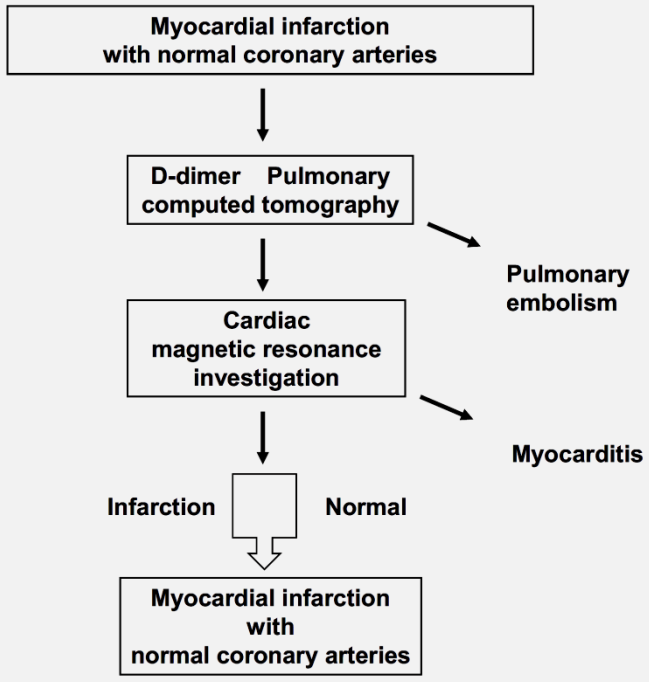
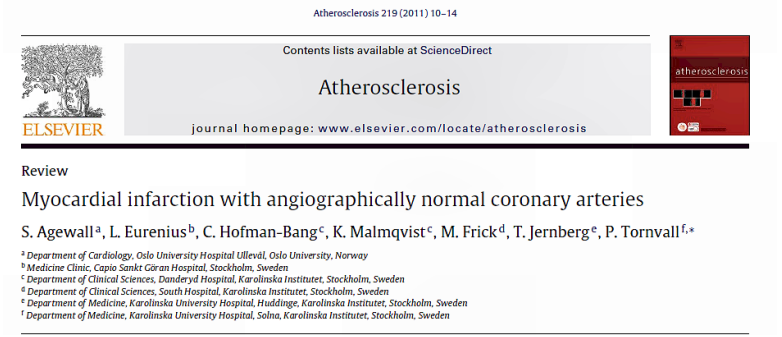


Fig. 1. Diagnostic algorithm for investigation of patients with myocardial infarction that have angiographic normal coronary arteries.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Review

Myocardial infarction with angiographically normal coronary arteries

S. Agewall[a], L. Eurenius[b], C. Hofman-Bang[c], K. Malmqvist[c], M. Frick[d], T. Jernberg[e], P. Tornvall[f,*]

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[b] Medicine Clinic, Capio Sankt Göran Hospital, Stockholm, Sweden
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[e] Department of Medicine, Karolinska University Hospital, Huddinge, Karolinska Institutet, Stockholm, Sweden
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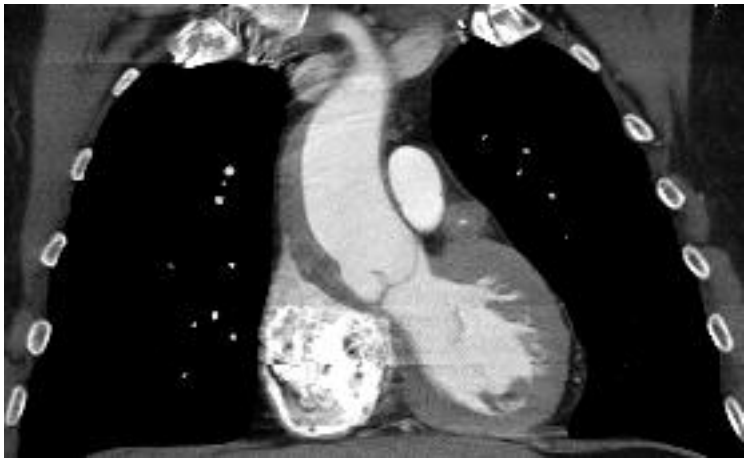
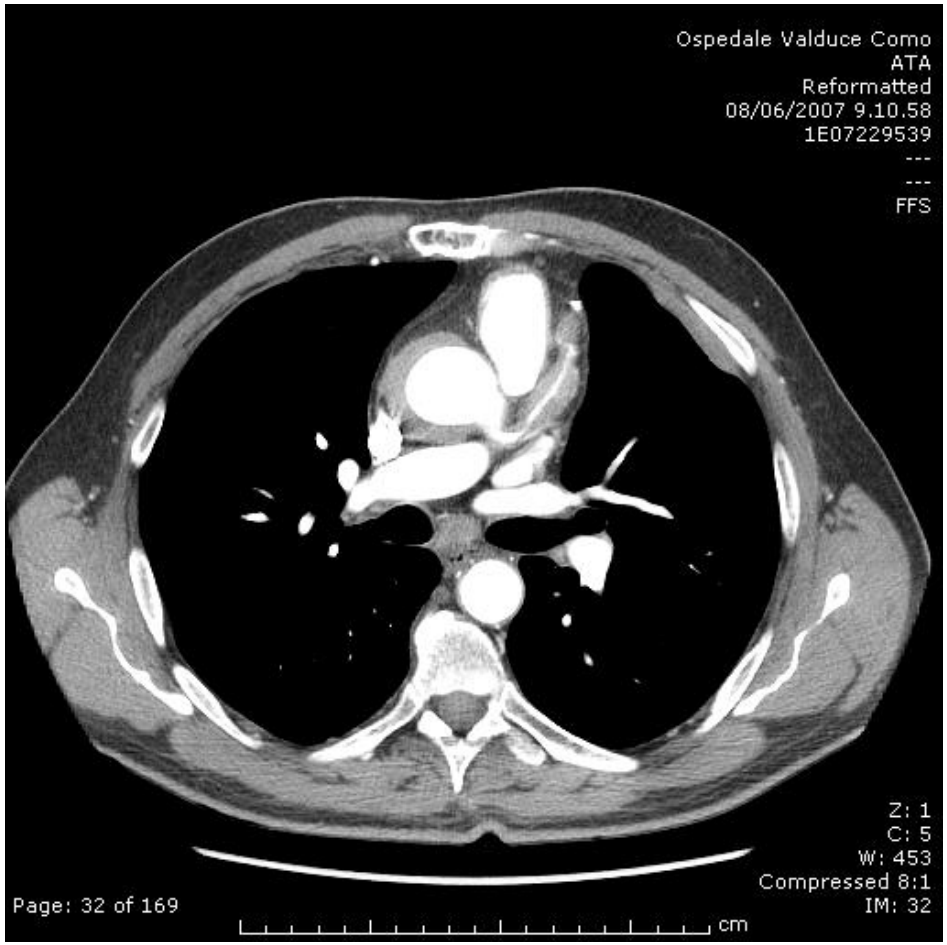
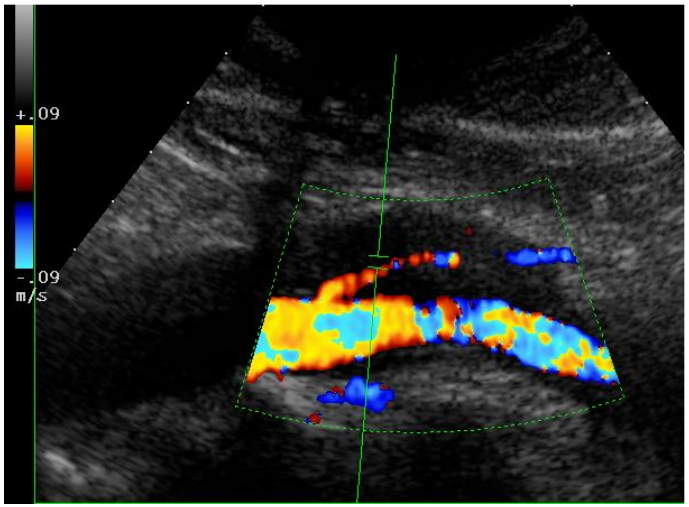
A proposito di infiammazione…

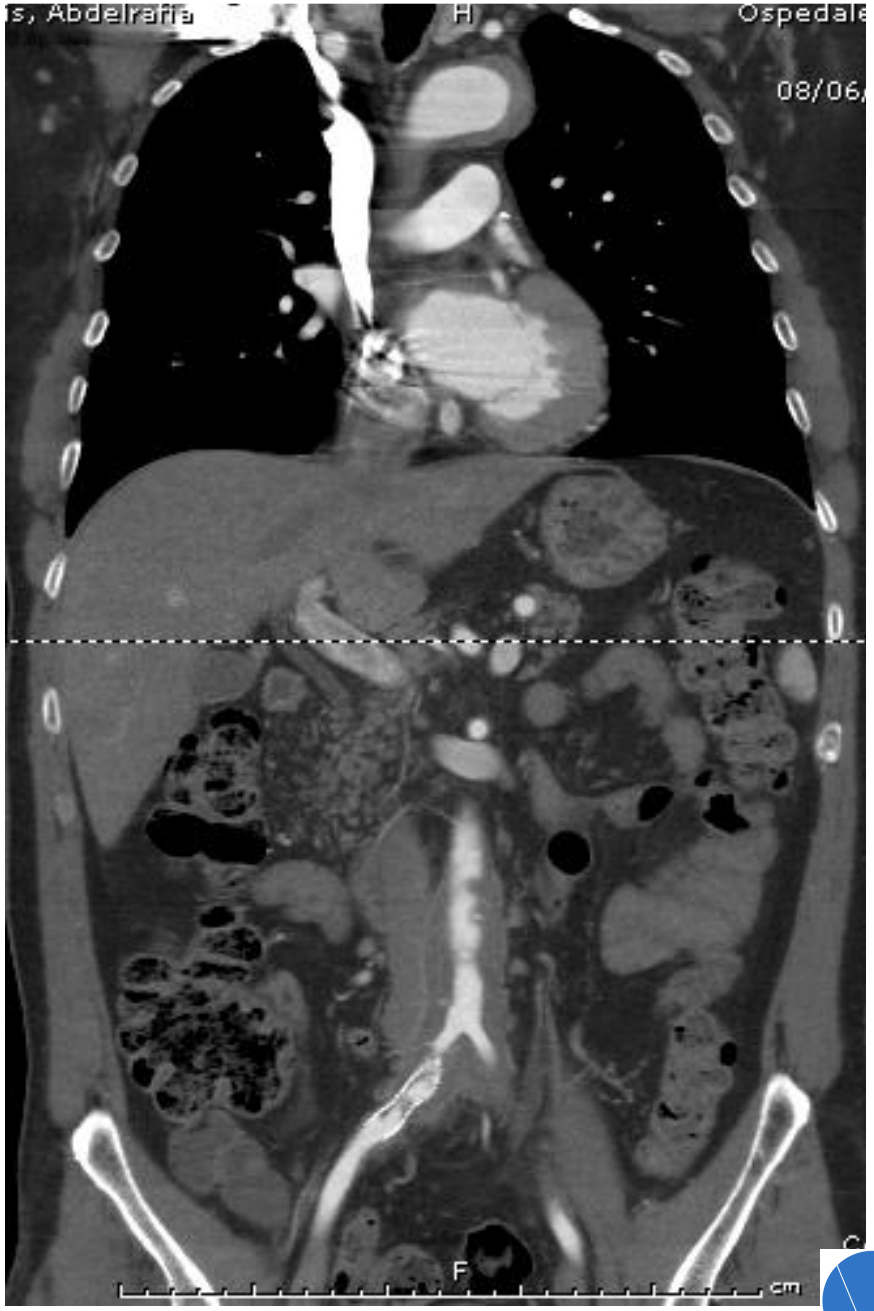




♂ n. 1948. IMA inferiore nel **1999** con rilievo di coronaropatia trivasale → BPAC nel **2000** (AMIs su IVA, safena su PL. PTA su iliaca dx (**2003**) e sin (**2007**). **2007** coro: occlusione IVA media, occlusione MO1 e PL, stenosi critiche di CD e CX → PTCA + DES su Dx media e PL, BMS su Cx media. **2007**: persistono angina pectoris e caludicatio

A proposito di infiammazione…





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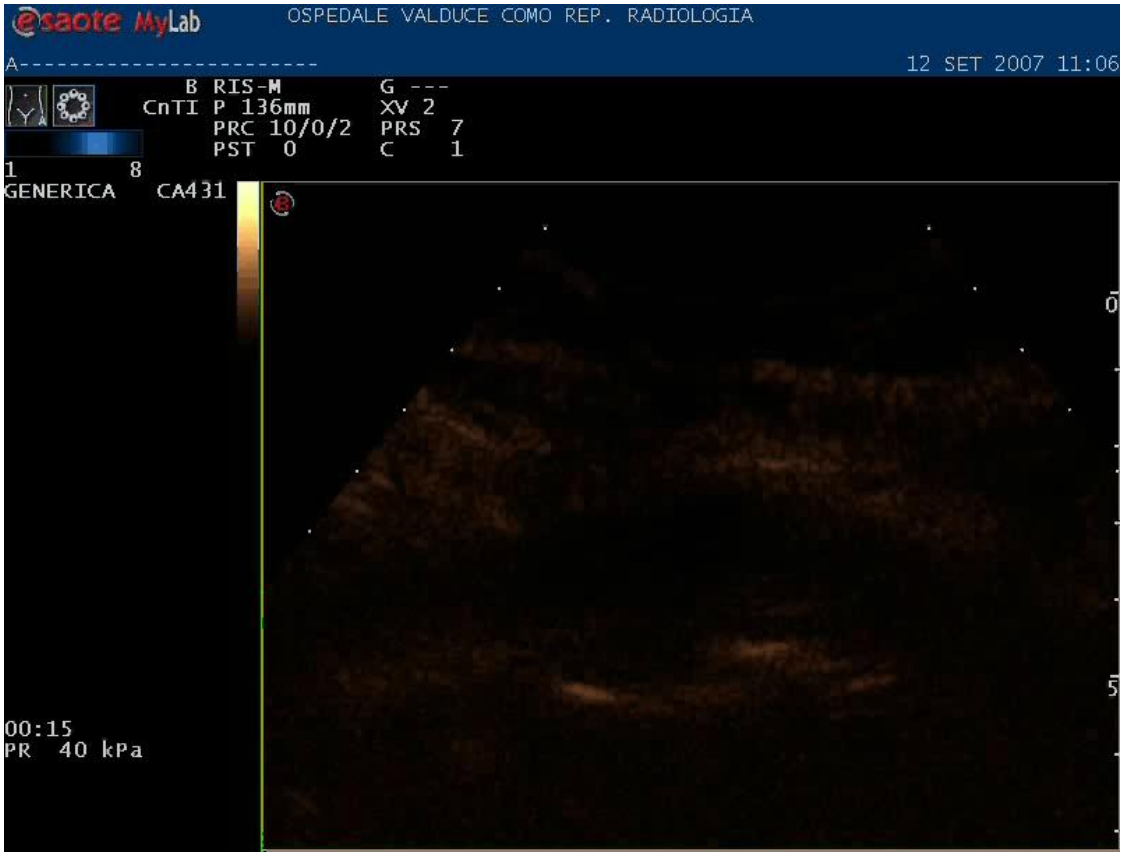

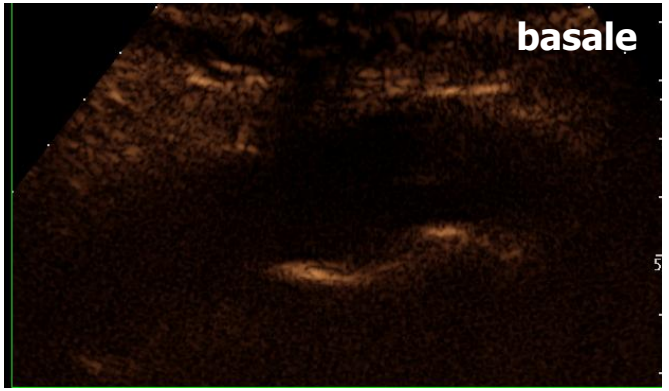

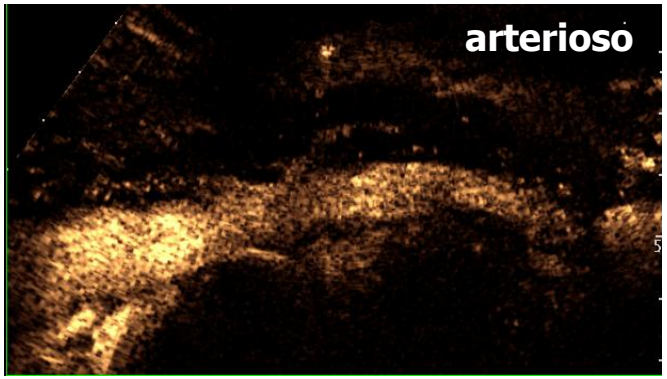

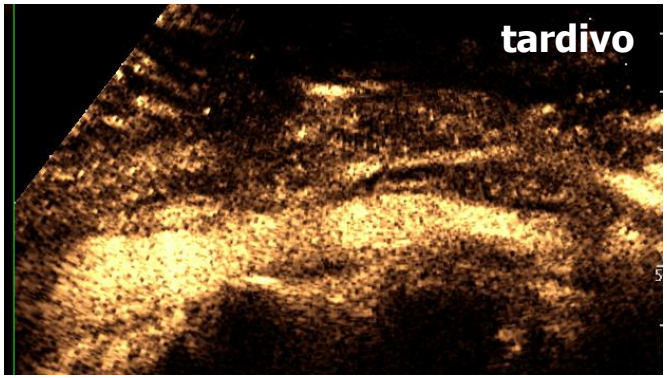

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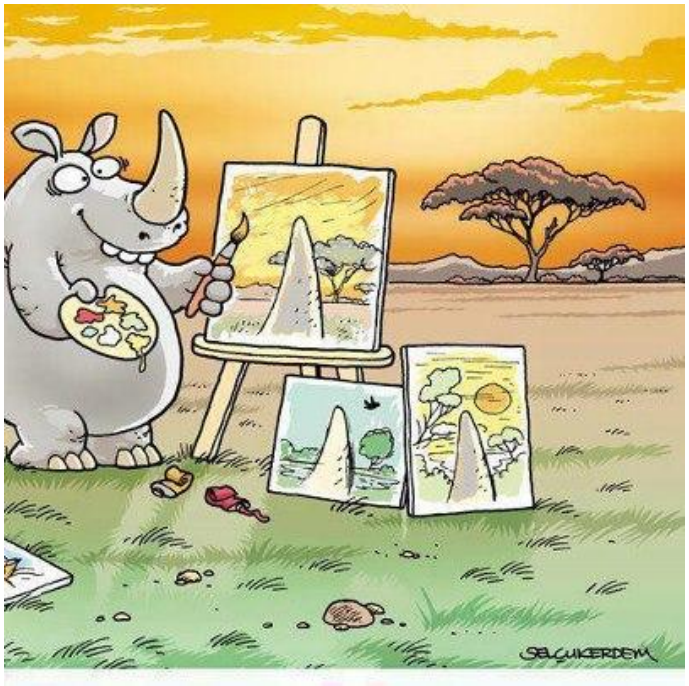
Arterite di Takayasu

Tabella IV - Classificazione angiografica dell'arterite di Takayasu secondo la Conferenza di Tokyo (1994).

Tipo	*Interessamento vasale*
Tipo I	Diramazioni dell'arco aortico
Tipo IIa	Aorta ascendente, arco aortico e sue diramazioni
Tipo IIb	Aorta ascendente, arco aortico e sue diramazioni, aorta discendente toracica
Tipo III	Aorta discendente toracica, aorta addominale, e/o arterie renali
Tipo IV	Aorta addominale e/o arterie renali
Tipo V	Combinazione delle caratteristiche del tipo IIb e IV

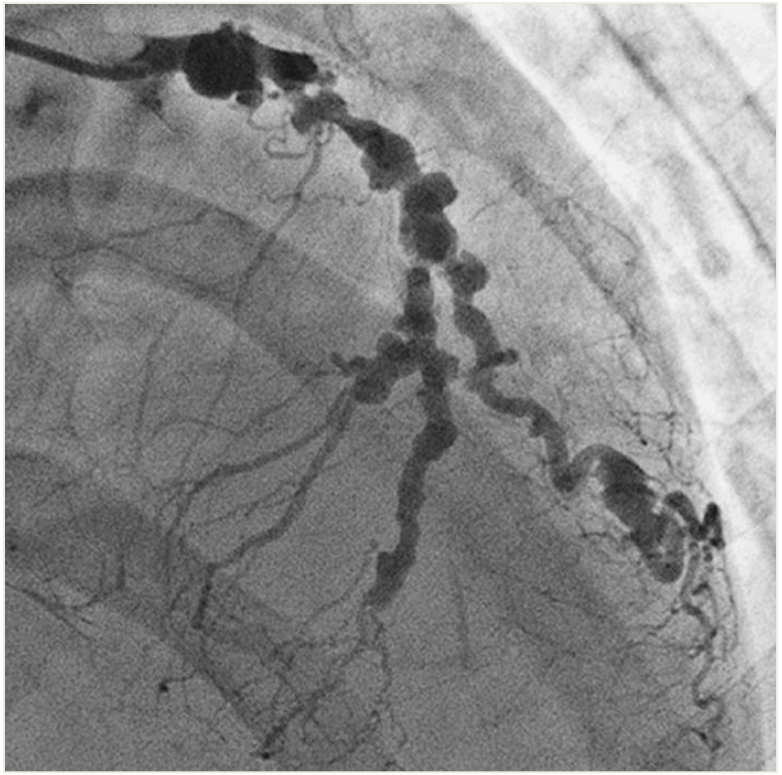
Interessamento delle arterie coronarie: C (+); interessamento delle arterie polmonari: P (+).



A proposito di infiammazione…

Polyarteritis nodosa

These findings on coronary angiography are most consistent with severe generalized coronary arteritis. This 25-year-old woman had been given a diagnosis of polyarteritis nodosa 3 years earlier and was receiving prednisolone maintenance therapy when she presented with cardiac arrest. Although severe cardiac involvement in polyarteritis nodosa is unusual, it can result in myocardial infarction and confers a poorer prognosis. Despite treatment, the patient died a few months later.



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Patogenesi multifattoriale

Mechanisms involved in AMI with normal coronary arteries: features

Concealed atherosclerosis

- Most AMI derive from atheromas causing <50% diameter stenosis
- External remodeling is more common at sites of 'culprit' lesions
- 'Minor' stenoses are more abundant than severe stenoses
- Coronary angiography is not a good predictor of instabilization
- Alternative techniques:
  - IVUS
  - optical coherence tomography
  - multislice computerized tomography
  - magnetic resonance imaging

  } plaque morphology

  thermography
  elastography } plaque function

Coronary vasospasm

- Cocaine abuse
- Ethanol intoxication
- Withdrawal of calcium channel blockers
- Minimal, but diffuse, coronary atherosclerosis
- Angiotensin II type-1 receptor gene polymorphism
- Cigarette smoking
- Endothelial dysfunction

Thrombosis and hypercoagulability

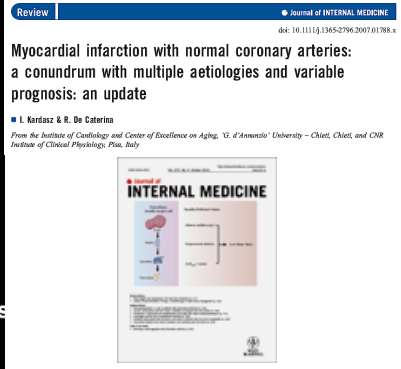
- Enhanced factor VII coagulation activity
- Factor V Leiden
- Protein C deficiency
- G20210A mutation in the prothrombin gene
- Hyperhomocysteinemia
- Estrogens
- Endothelial dysfunction
- Cigarette smoking
- High levels of lipoprotein(a) and PAI-1

Embolization

theoretically possible, but minute percentage of cases:
native valvular heart disease, prosthetic valve disease,
left atrial mixoma, endocarditis and mural thrombosis

Inflammation

Patients with normal coronary arteries had
significantly more frequent febrile infections,
mainly of the upper airways, within 2 weeks prior to AMI, but
conclusive evidence regarding the actual mechanism linking
inflammation to the occurrence of AMI is lacking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Grazie per la vostra attenzione