

7 de maig 2012

Sessió dels dilluns – Societat Catalana de Cardiologia

Què aporten les tècniques d'imatge pel diagnòstic de miocarditis?



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Hospital de Sant Pau  
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*Editorial*

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## How can myocarditis be diagnosed and should it be treated?

Myocarditis remains an enigma. On one hand it is a diagnosis which is suspected clinically when sudden cardiac failure or arrhythmias or both follow a febrile 'flu-like

nificant clinical improvement occurred in those with histologically confirmed myocarditis, whether or not they had been treated with immunosuppression.

# Diagnòstic de miocarditis

Sospita clínica + dades compatibles de les tècniques diagnòstiques

# Tècniques diagnòstiques disponibles

No invasives

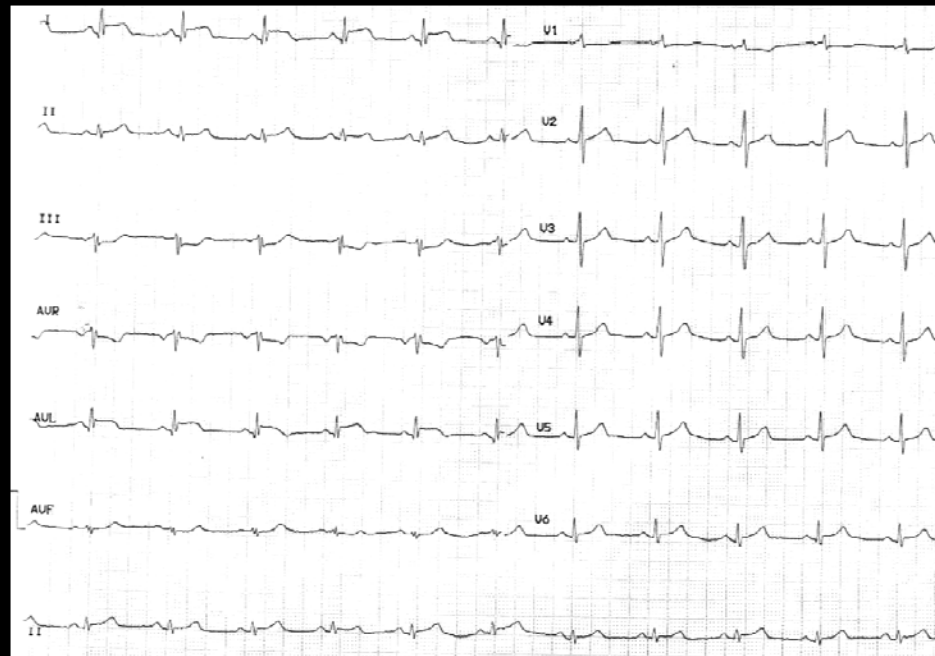
## ECG

Canvis inespecífics: trastorns de repolarització (ST/T)

Aritmies

Ones Q (Pseudoinfant) i trastorns de conducció (mal pronòstic)

Baixa sensibilitat/especificitat



# Tècniques diagnòstiques disponibles

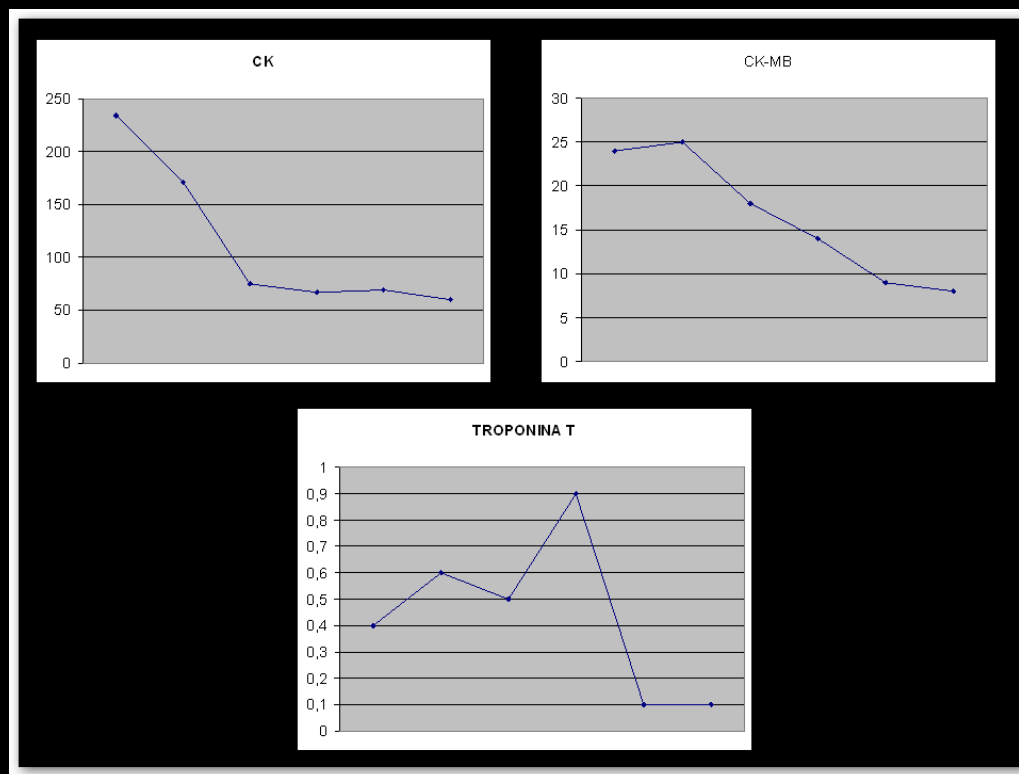
No invasives

## Marcadors sèrics

↑CK i troponines en relació amb el grau d'agressió inflamatoria  
Poc sens/esp

Títols serològics  
d'anticossos virus-  
específics (IgM)

Mètode massa lent per tenir  
implicacions terapèutiques



# Tècniques diagnòstiques disponibles

No invasives

## Ecocardiografia

No és una tècnica diagnòstica de miocarditis.  
Poc específica

Anomalies de la contractilitat segmentària  
Miocardiopatia dilatada (5% a 10% de casos)

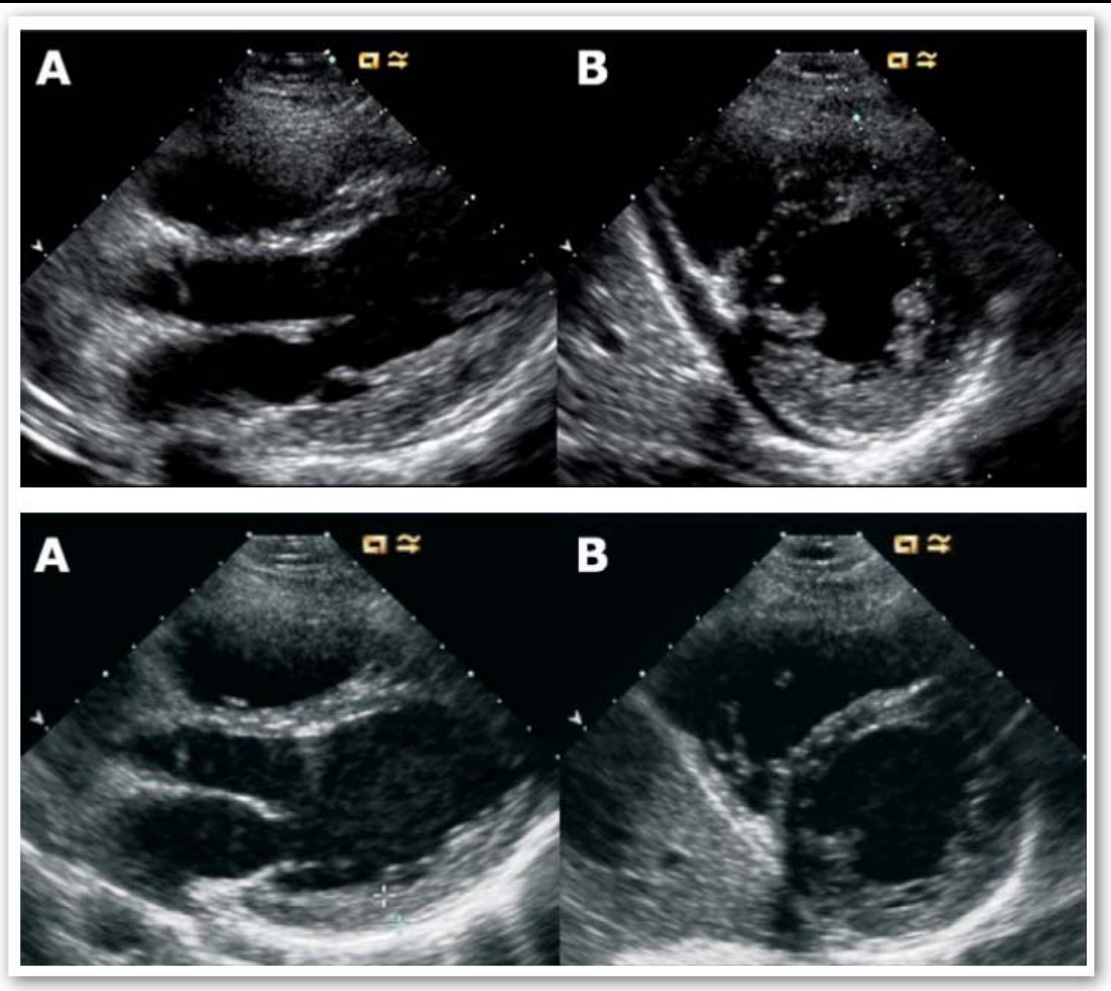
Pinamonti B et al. Echocardiographic findings in myocarditis  
AmJCardiol 1988;62:285

This study analyzes morphologic and functional alterations detected by M-mode and 2-dimensional echocardiography in 41 patients with histologically proven myocarditis and different clinical presentations: congestive heart failure (63%), atrioventricular block (17%), chest pain (15%) and supraventricular arrhythmias (5%). Left ventricular dysfunction was common (69%), particularly in patients with congestive heart failure (88%), often without or with minor cavity dilatation. Patients with atrioventricular block or chest pain had usually preserved ventricular function. Right ventricular dysfunction was present in 23%. Additional findings included asynergic ventricular areas (64%), left ventricular "hypertrophy" sometimes reversible (20%), hyperrefractile myocardial areas (23%), ventricular thrombi (15%) and "restrictive" ventricular filling (7%). It is concluded that echocardiographic features of myocarditis are polymorphous and nonspecific. The echocardiographic pattern can simulate alternatively dilated, hypertrophic, restrictive or "right" ventricular cardiomyopathy, as well as coronary artery disease. In an appropriate clinical context, echocardiography can be helpful in the diagnosis of myocarditis and in the selection of patients for endomyocardial biopsy.

# Engrosamiento miocárdico transitorio de la pared posterior en paciente con miopericarditis aguda

Adolfo Fontenla Cerezuela, Rodrigo Teijeiro Mestre,  
María Luaces Méndez y José M. Serrano Antolín  
Servicio de Cardiología. Hospital Universitario de Fuenlabrada.  
Fuenlabrada. Madrid. España.

Rev Esp Cardiol. 2010;63(4):488-502



5 dies



# Tècniques diagnòstiques disponibles

No invasives

## Cardiologia nuclear

Gali-67 i indi-111

Elevada sensibilitat però baixa especificitat. No s'utilitzen.

# Tècniques diagnòstiques disponibles

## Invasiva

### Biopsia endomiocàrdica

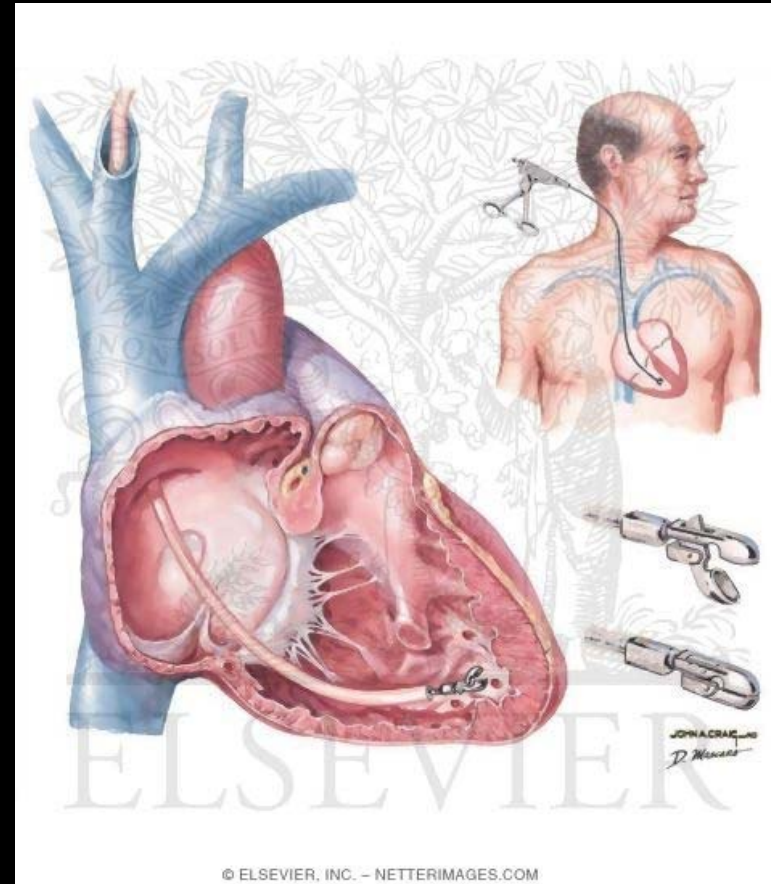
Indicació limitada a pocs pacients amb sospita

0,4% de complicacions

Mostres limitades al VD

Només un 10% són positives

**Baixa sensibilitat diagnòstica**



# Tècniques diagnòstiques disponibles

Invasiva

Cateterisme cardíac

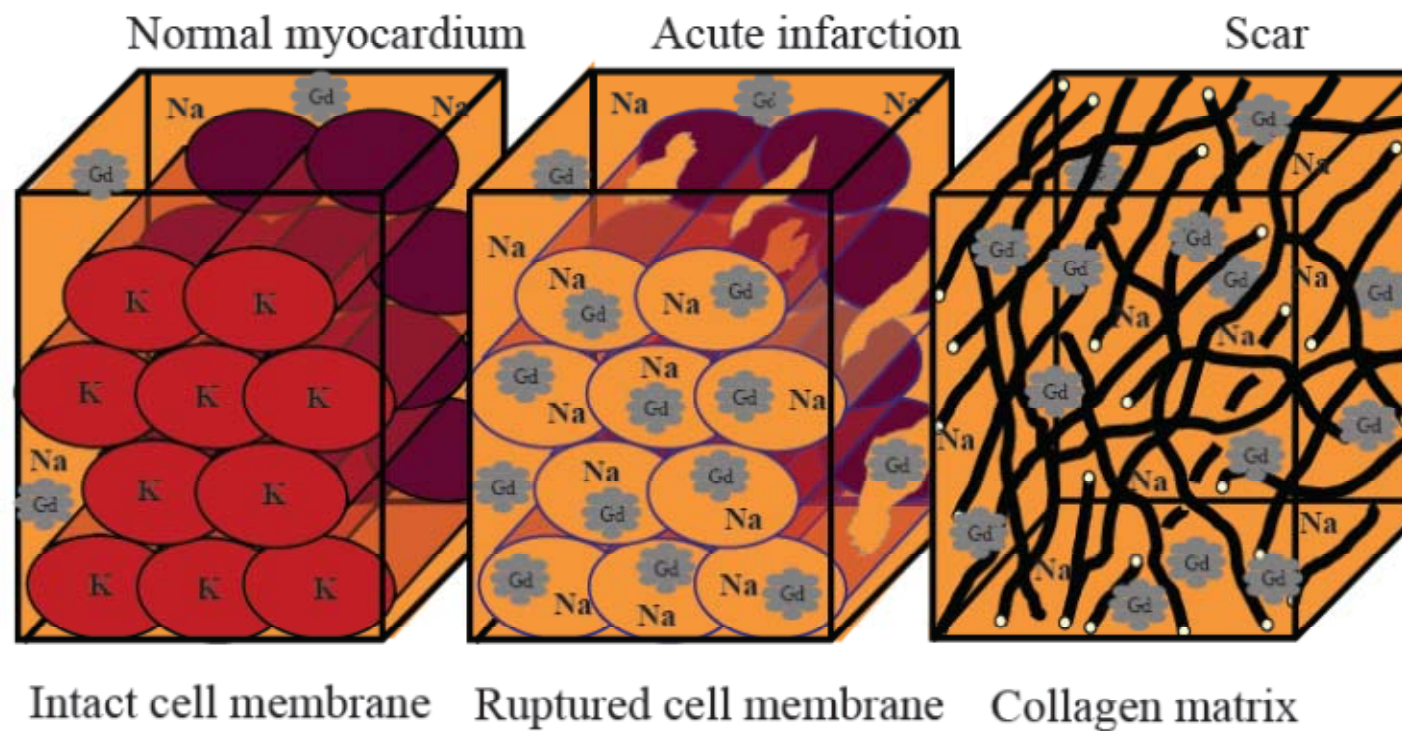
Sospita diagnòstica en els casos amb clínica i ECG compatible amb SCA però amb coronàries “normals” per cateterisme



Delayed enhancement cardiovascular magnetic resonance assessment of non-ischaemic cardiomyopathies

Heiko Mahrholdt<sup>1\*</sup>, Anja Wagner<sup>2</sup>, Robert M. Judd<sup>2</sup>, Udo Sechtem<sup>1</sup>, and Raymond J. Kim<sup>2†</sup>

European Heart Journal (2005) 26, 1461–1474

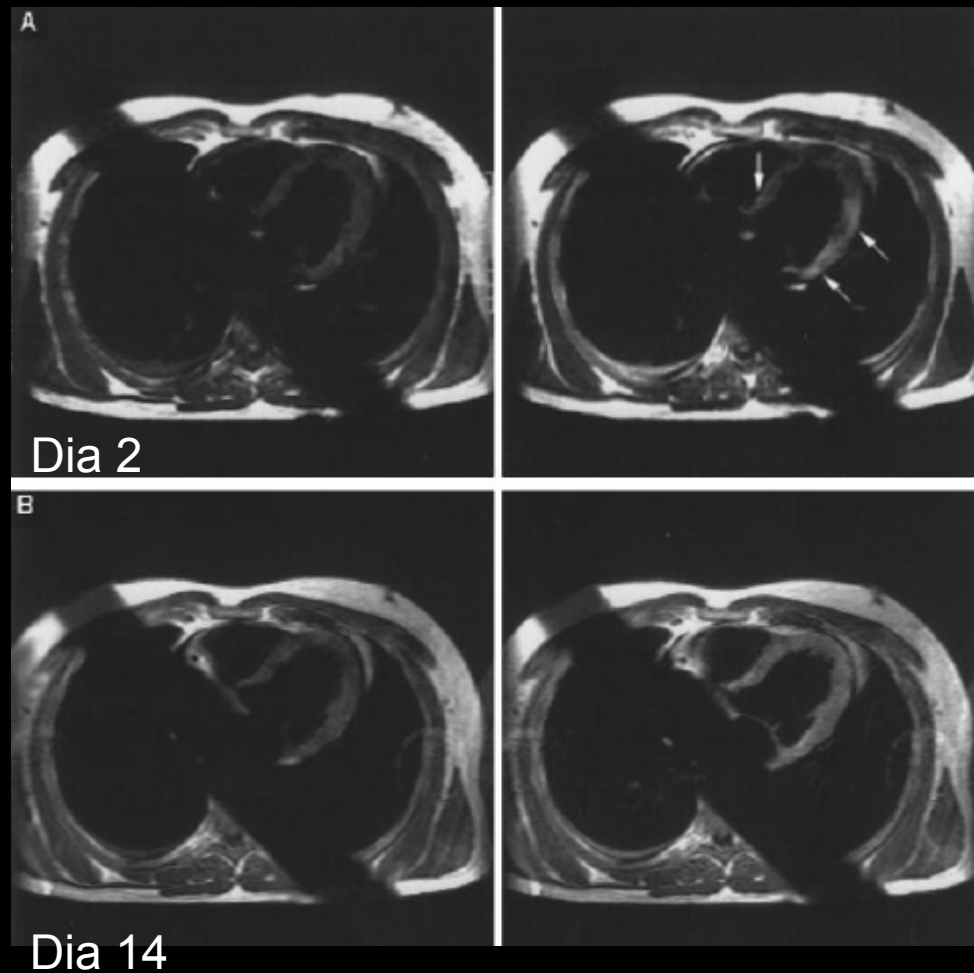
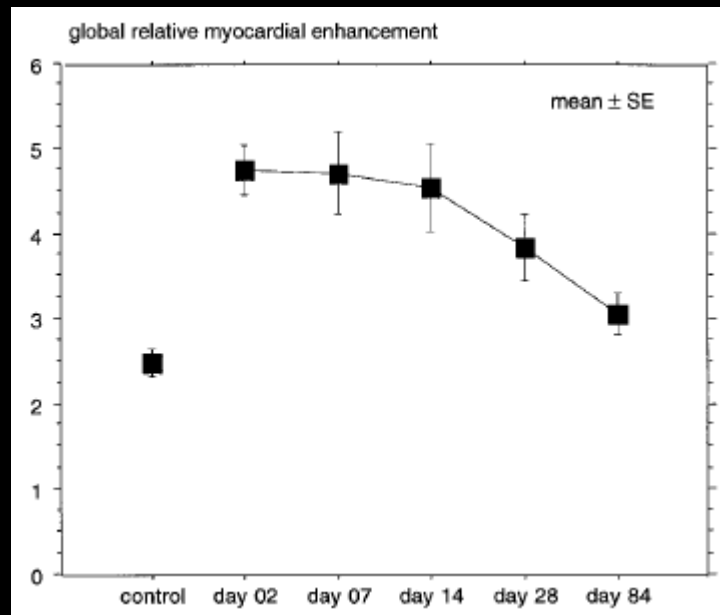


El Gd-DTPA queda retenido en las zonas de fibrosis, pero también en las zonas de inflamación o edema, donde aumenta el volumen extravascular y se retrasa su eliminación.

# Contrast Media-Enhanced Magnetic Resonance Imaging Visualizes Myocardial Changes in the Course of Viral Myocarditis

Matthias G. Friedrich, MD; Oliver Strohm, MD; Jeanette Schulz-Menger, MD; Heinz Marciniak, MD; Friedrich C. Luft, MD; Rainer Dietz, MD

*Circulation.* 1998;97:1802-1809

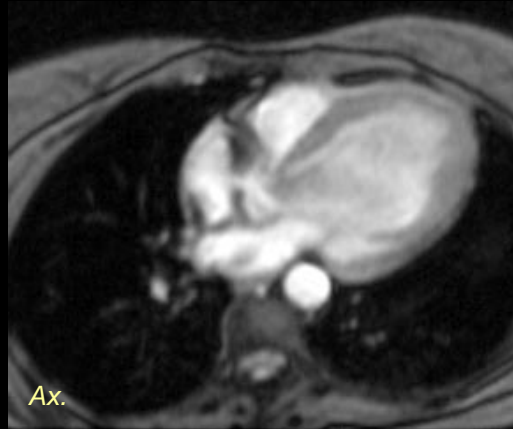




# MYOCARDITIS: CONTRAST STUDIES

## MYOCARDITIS

## NORMAL



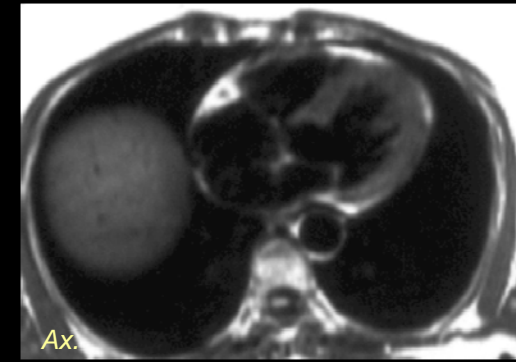
Ax.  
Diast

GRE



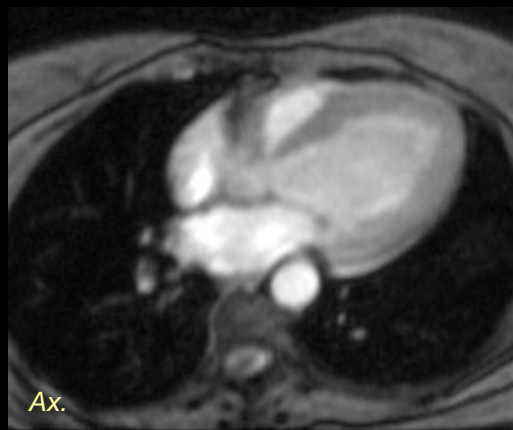
Ax.  
Basal

SE T1w



Ax.  
Basal

SE T1w



Ax.  
Syst



Ax.  
Gad (10 min)

SI ratio Myoc/Skel: 4



Ax.  
Gad (10 min)

SI ratio Myoc/Skel: 2.5

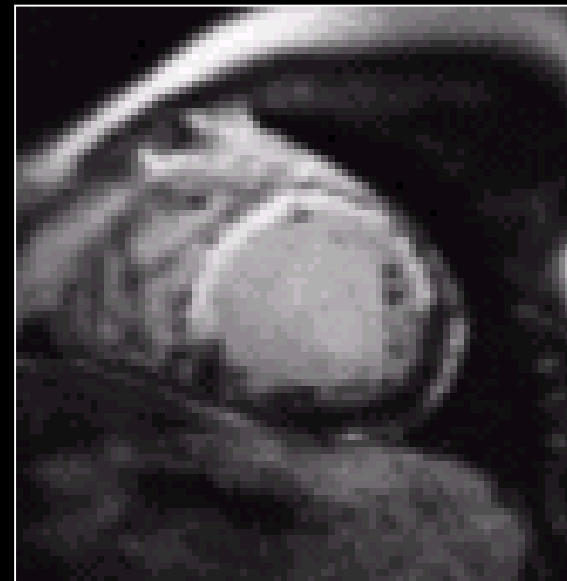
*Friedrich. Circulation 1998*



# APLICACIONES DE LA CARDIO-RM EN CARDIOPATIA ISQUEMICA

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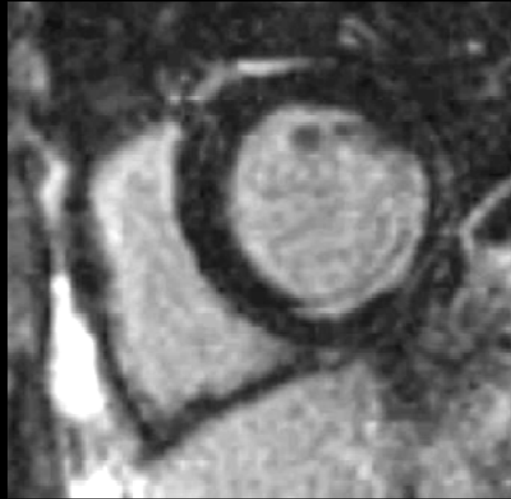
## Detección de necrosis miocárdica



Any 2000: Introducció de les seqüències IR optimitzades per destacar el senyal intens del gadolini



## Dx diferencial de la disfunción VI: patrones de RT



Necrosis subendocárdica



Miocarditis



Fibrosis focal en MH



Amiloidosis<sup>1</sup>

<sup>1</sup> Maceira et al. *Circulation* 2005;111:186

# Cardiovascular Magnetic Resonance Assessment of Human Myocarditis

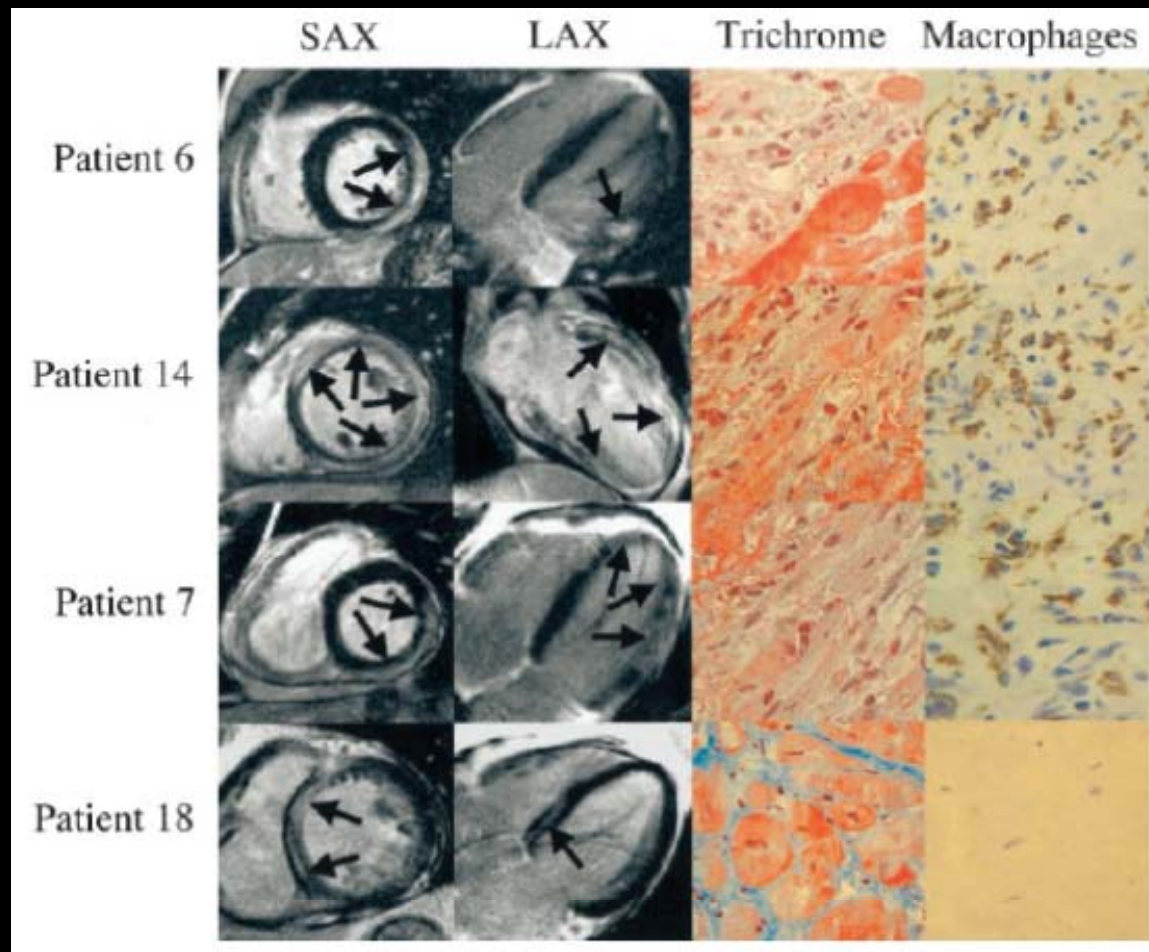
## A Comparison to Histology and Molecular Pathology

Heiko Mahrholdt, MD; Christine Goedecke, MD; Anja Wagner, MD; Gabriel Meinhardt, MD; Anasthasios Athanasiadis, MD; Holger Vogelsberg, MD; Peter Fritz, MD; Karin Klingel, MD; Reinhard Kandolf, MD; Udo Sechtem, MD

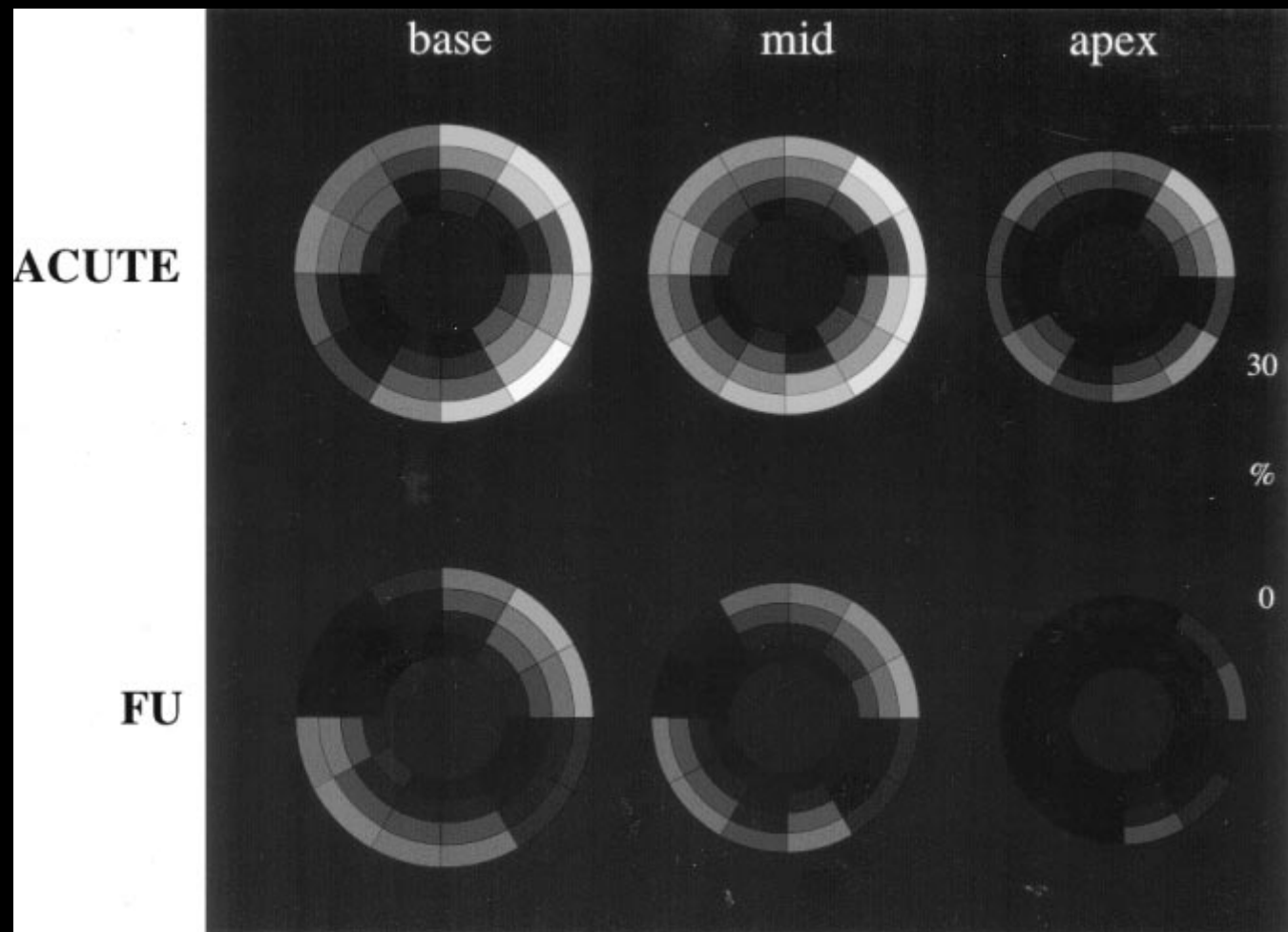
*Circulation.* 2004;109:1250.

### Distribution of Myocarditis

We observed a peculiar distribution pattern of myocarditic lesions: they occurred predominantly in the lateral free wall and originated from the epicardial quartile of the ventricular wall (Figure 4). Contrast enhancement was never seen to originate from the subendocardium, which is typical for myocardial infarction.<sup>12</sup> The finding of the lateral wall as the preferred location of inflammatory lesions has been shown previously in postmortem evaluations.<sup>4,15,18,24,29</sup> Shirani et al<sup>15</sup> demonstrated in a necropsy study of myocarditis patients who died suddenly that the predominant location of myocardial lesions was the subepicardial region of the lateral free wall. In contrast, a relatively low density of inflammatory cells was found in the RV half of the septum, which is the usual location of EMB. The present study demonstrates the same pattern of myocardial lesions in vivo.



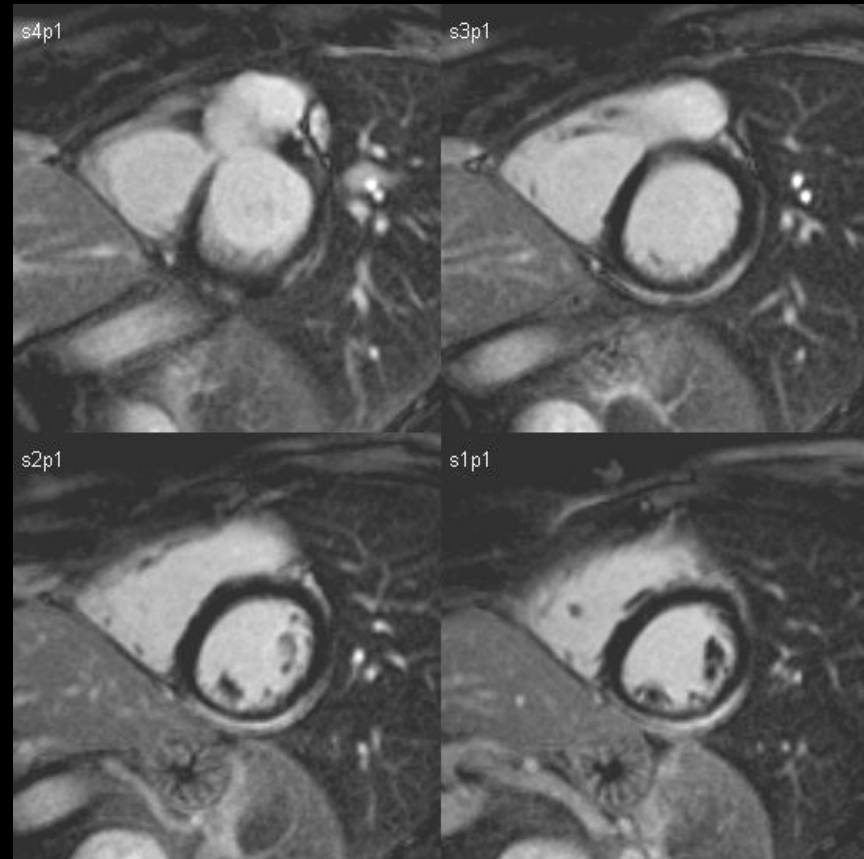
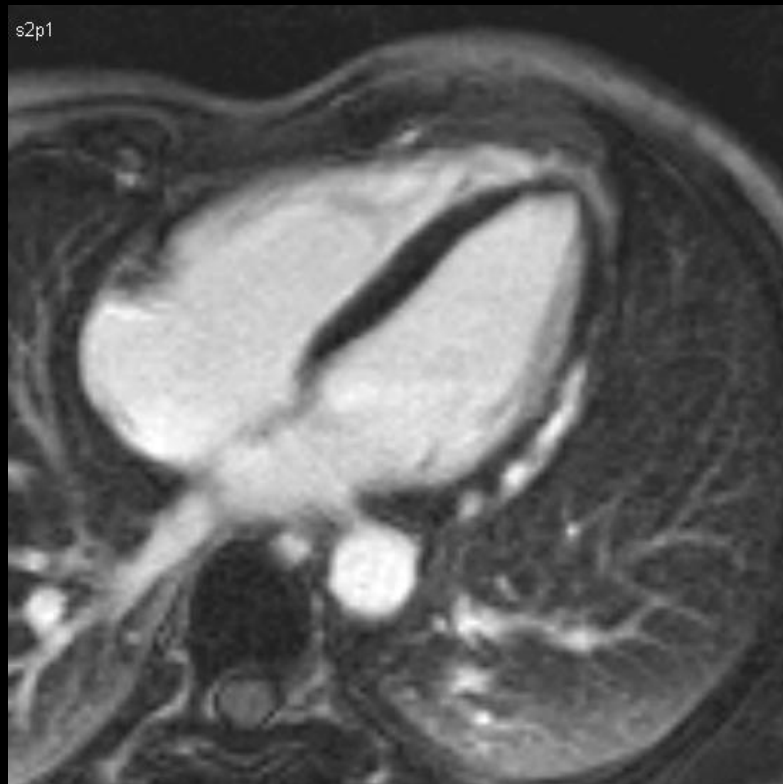
**Figure 3.** Results of CMR and histopathology of typical patients in whom biopsies were obtained from area of contrast enhancement. Top 3 panels show cases (patients 6, 7, and 14) of active myocarditis with myocyte damage and infiltration of macrophages; bottom panel shows a patient (patient 18) without active myocarditis who was diagnosed with HCM. SAX indicates short axis; LAX, long axis.



*Circulation.* 2004;109:1250.

Home de 43 anys. Clínica compatible amb SCA. Coronariografia normal

## Miocarditis



Realçament tardà de Gd amb seqüència IR

# Pericarditis Aguda

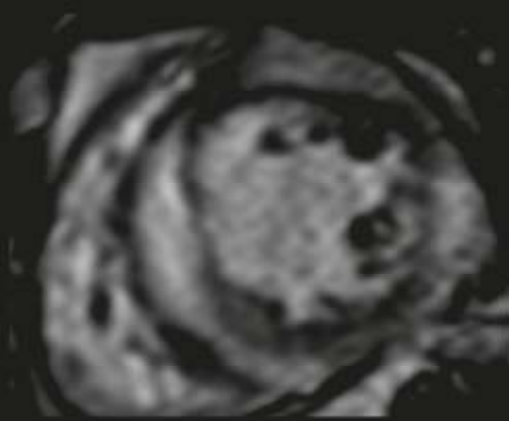


Serie IR Gadolinio

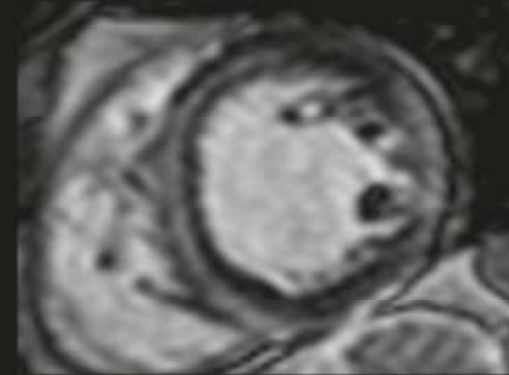
IR LE

**A**

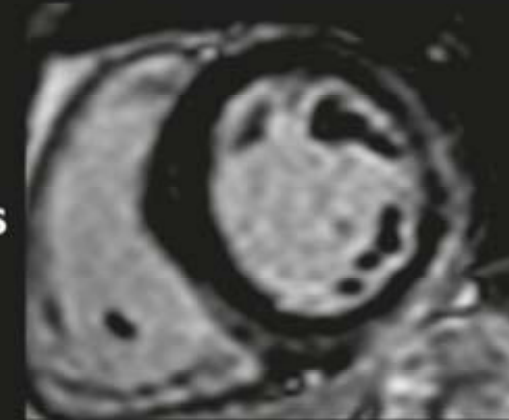
+1 day



+1 month

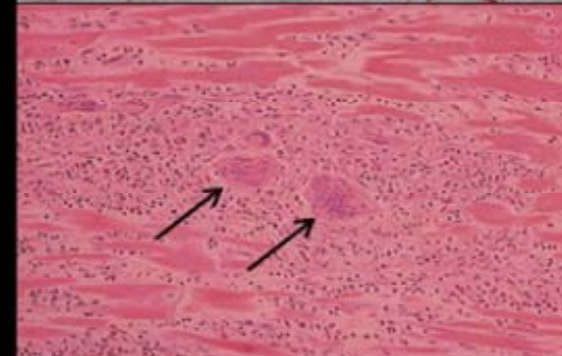
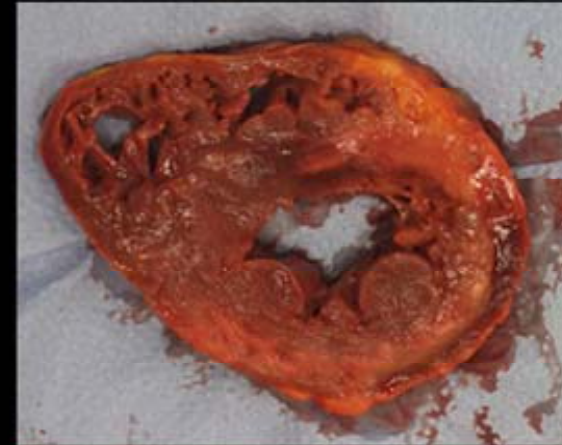


+5 months



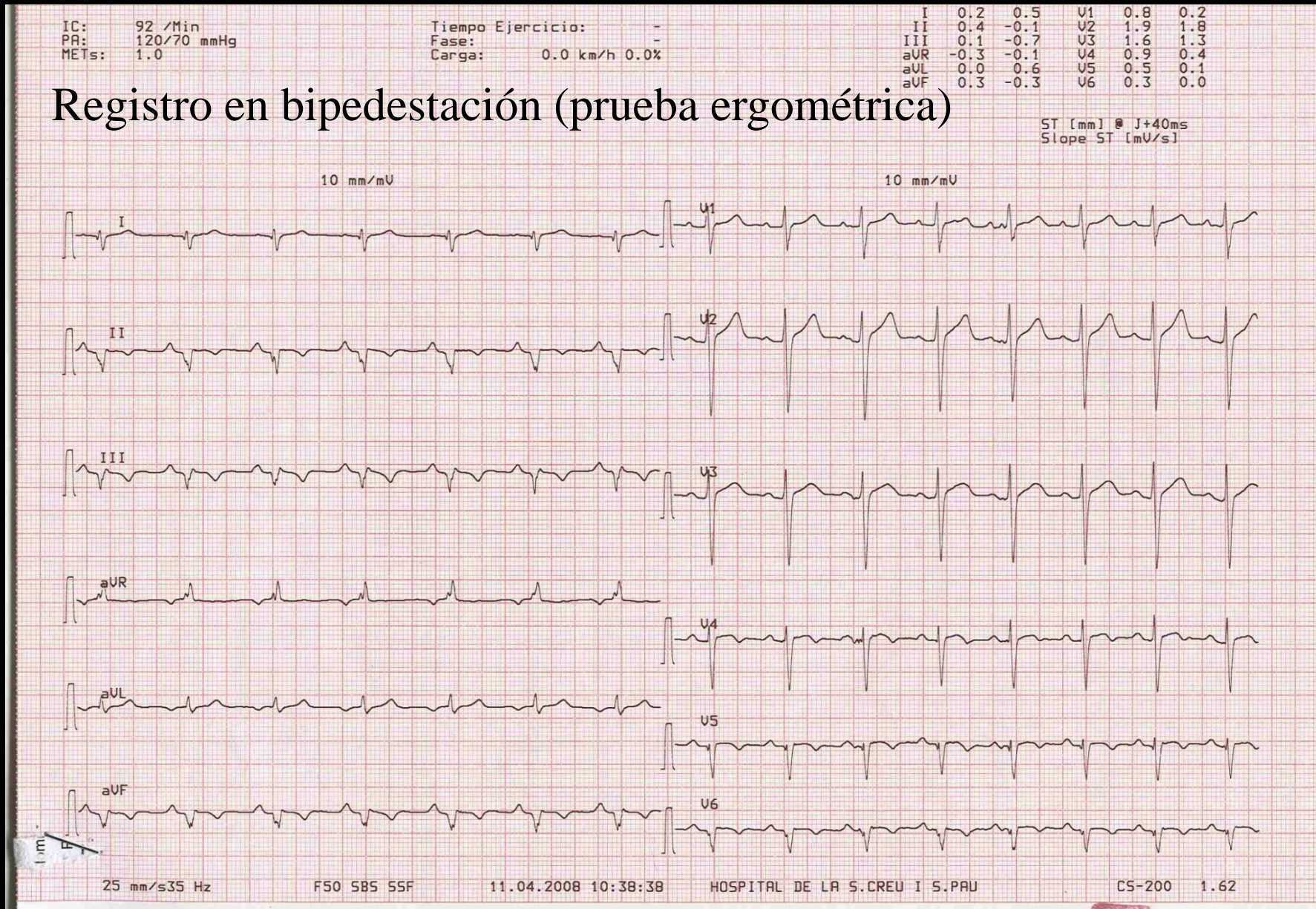
*Heart* 2011;**97**:1312–1318

**B**



Miocarditis de cèl.lules gegants

# Deportista amateur con antecedentes de pre-síncope jugando a fútbol



Se solicita ecocardiograma





# Deportista amateur con antecedentes de pre-síncope jugando a fútbol



CRM

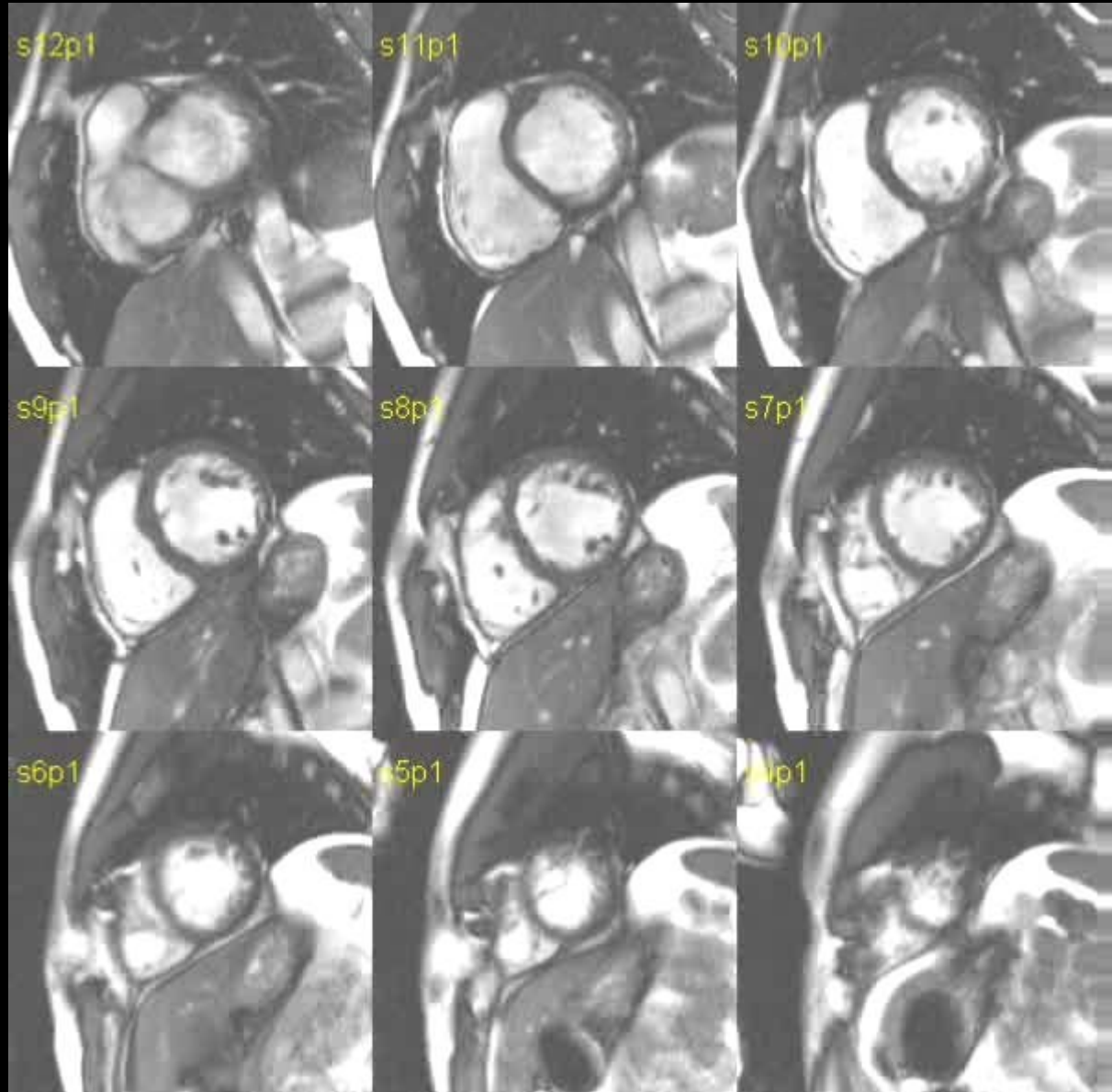
Hipoquinesia lateral



# Deportista amateur con antecedentes de pre-síncope jugando a fútbol



# Deportista amateur con antecedentes de pre-síncope jugando a fútbol



Cardiopatía isquémica: si/no



# Deportista amateur con antecedentes de pre-síncope jugando a fútbol



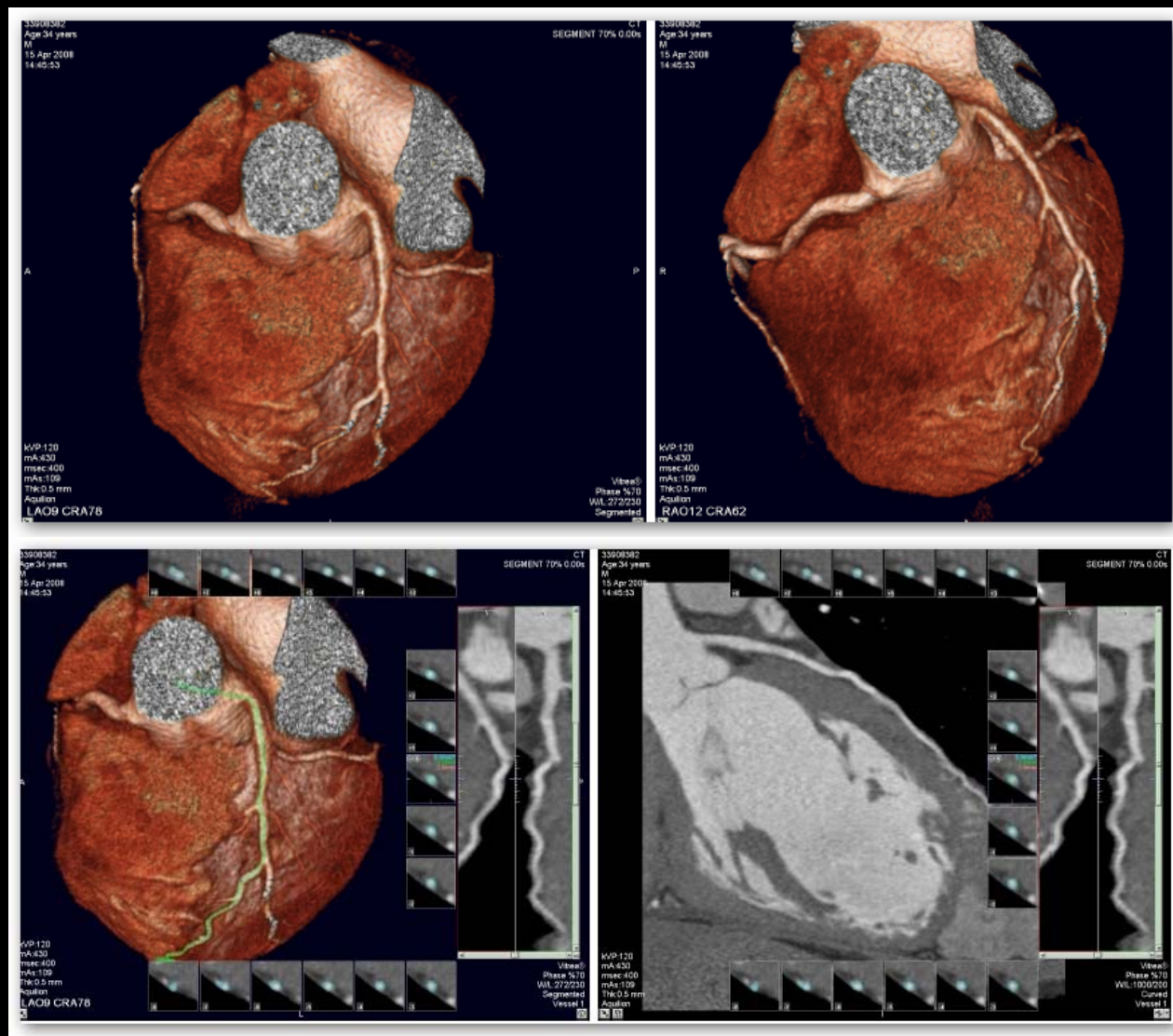
# Deportista amateur con antecedentes de pre-síncope jugando a fútbol



Miocarditis



# Deportista amateur con antecedentes de pre-síncope jugando a fútbol



TCMD coronario: ausencia de lesiones coronarias

Table 1 Cardiovascular causes of sudden death in young competitive athletes in the United States

---

Most common

Hypertrophic cardiomyopathy

Congenital coronary artery anomaly

Less common

Myocarditis

Aortic rupture (Marfan syndrome)

Mitral valve prolapse

Uncommon

Arrhythmogenic RV cardiomyopathy

Atherosclerotic coronary artery disease

Conduction system abnormalities

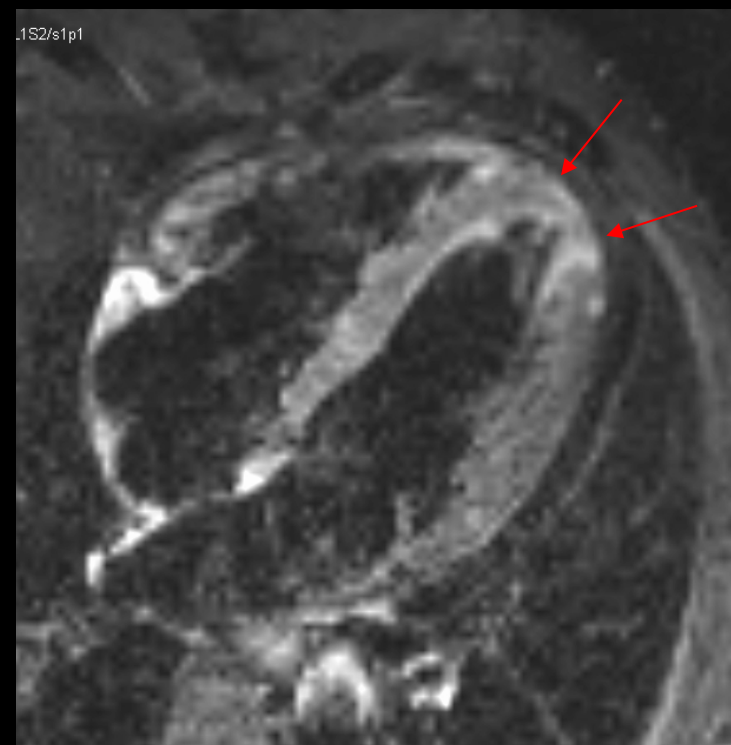
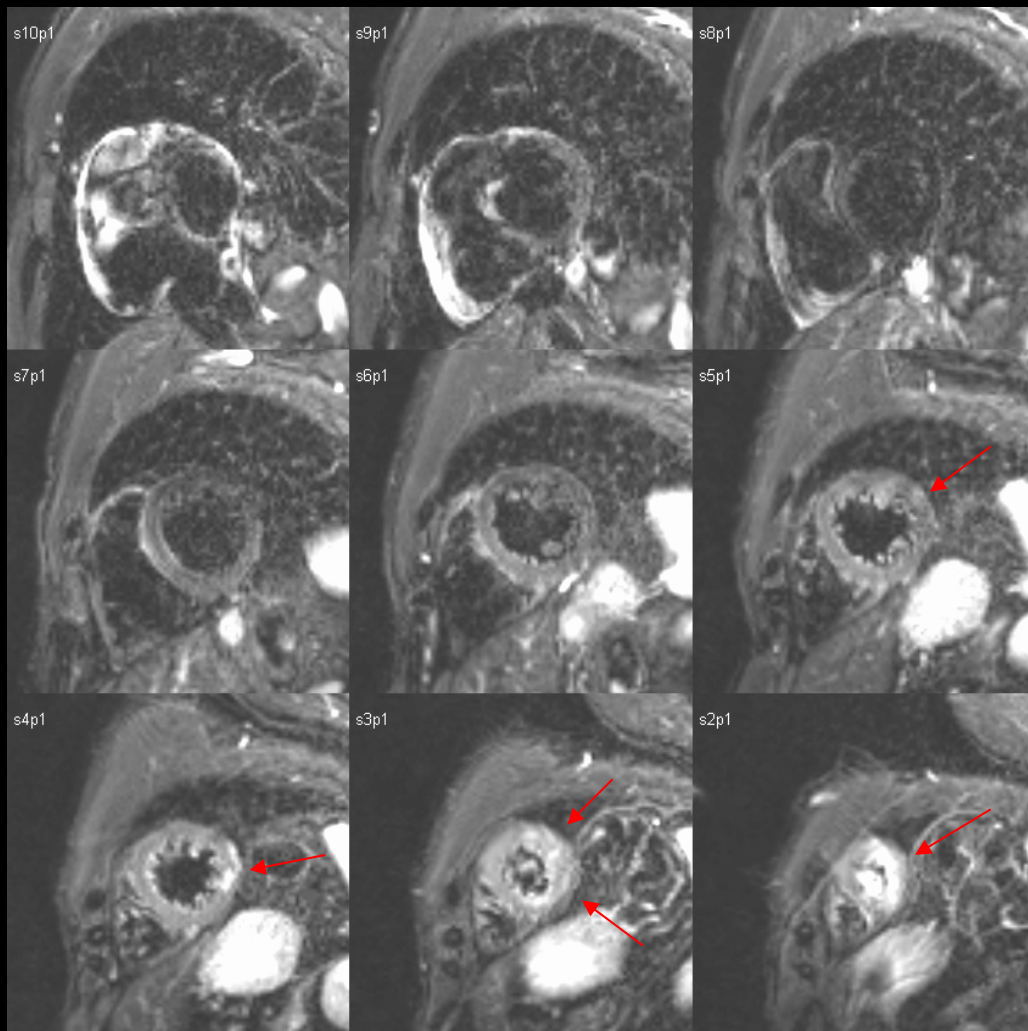
Aortic valve stenosis

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# Cas 1

Paciente con FRCV que ingresa por dolor torácico y elevación de marcadores enzimáticos (Trop. I: 11 y CK-MB: 1,2). Coronariografía sin lesiones. Ecocardiograma normal. Descartar miocarditis.



T2 STIR



Cas 1

L1S1/s5p1

L1S1/s4

L1S1/s3p

L1S1/s2p1

L1S1/s1p1

L1S2/s5p1

L1S2/s4p1

L1S2/s3p1

L1S2/s2p1

L1S2/s1p1

L1S3/s3p1

L1S3/s2p1

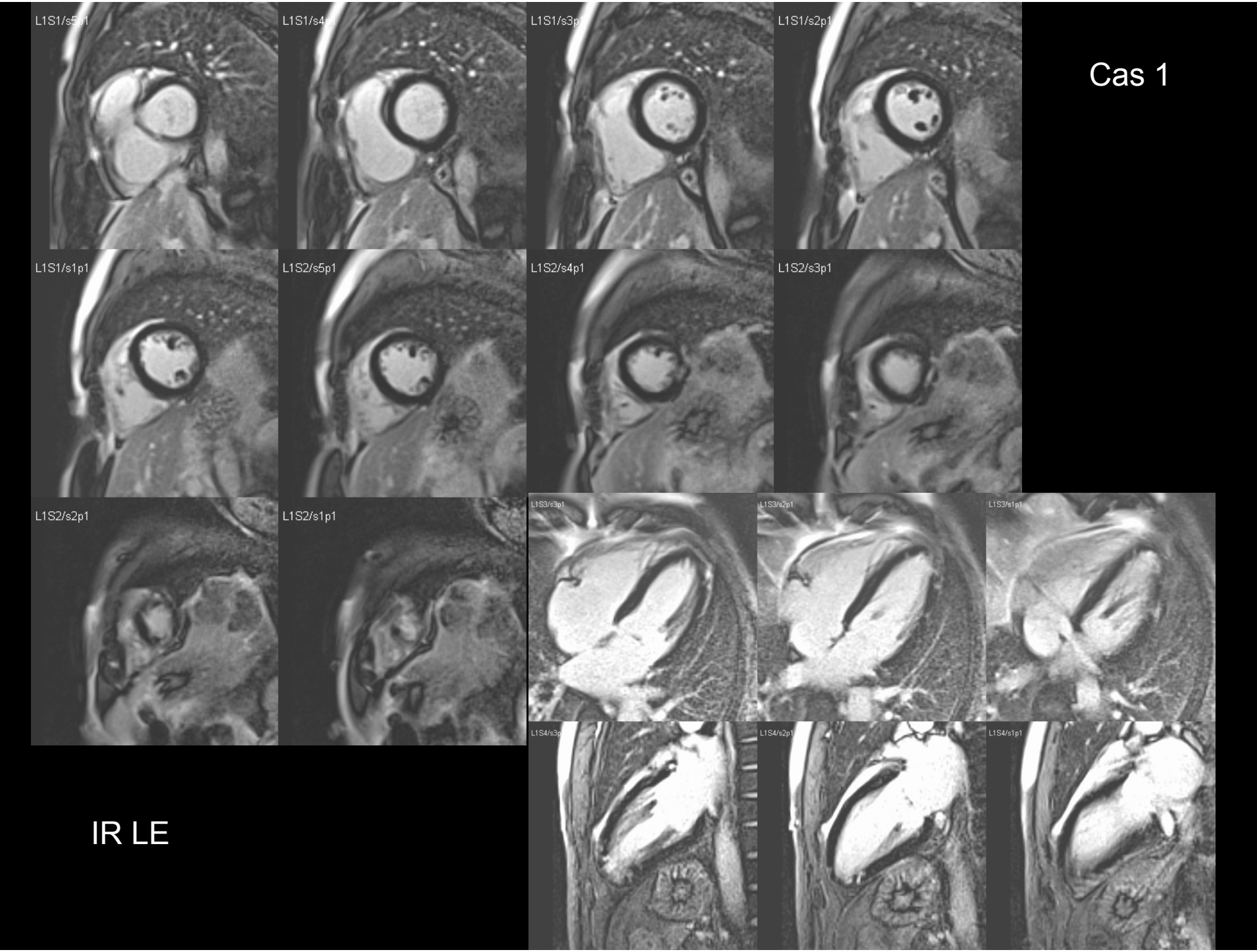
L1S3/s1p1

L1S4/s3p

L1S4/s2p1

L1S4/s1p1

IR LE



## Caso 4

Un paciente varón de 43 años acude al servicio de urgencias por un cuadro de dolor torácico opresivo con vegetatismo. El ECG muestra elevación del ST de 3 mm en cara inferior y lateral. Los marcadores bioquímicos fueron positivos (Tnl 20 ng/ml; CK 1000 UI/l). Se practicó coronariografía invasiva que no mostró lesiones, tras lo cual el paciente se remitió a nuestro centro para la realización de RM cardíaca con la sospecha clínica de miocarditis aguda.

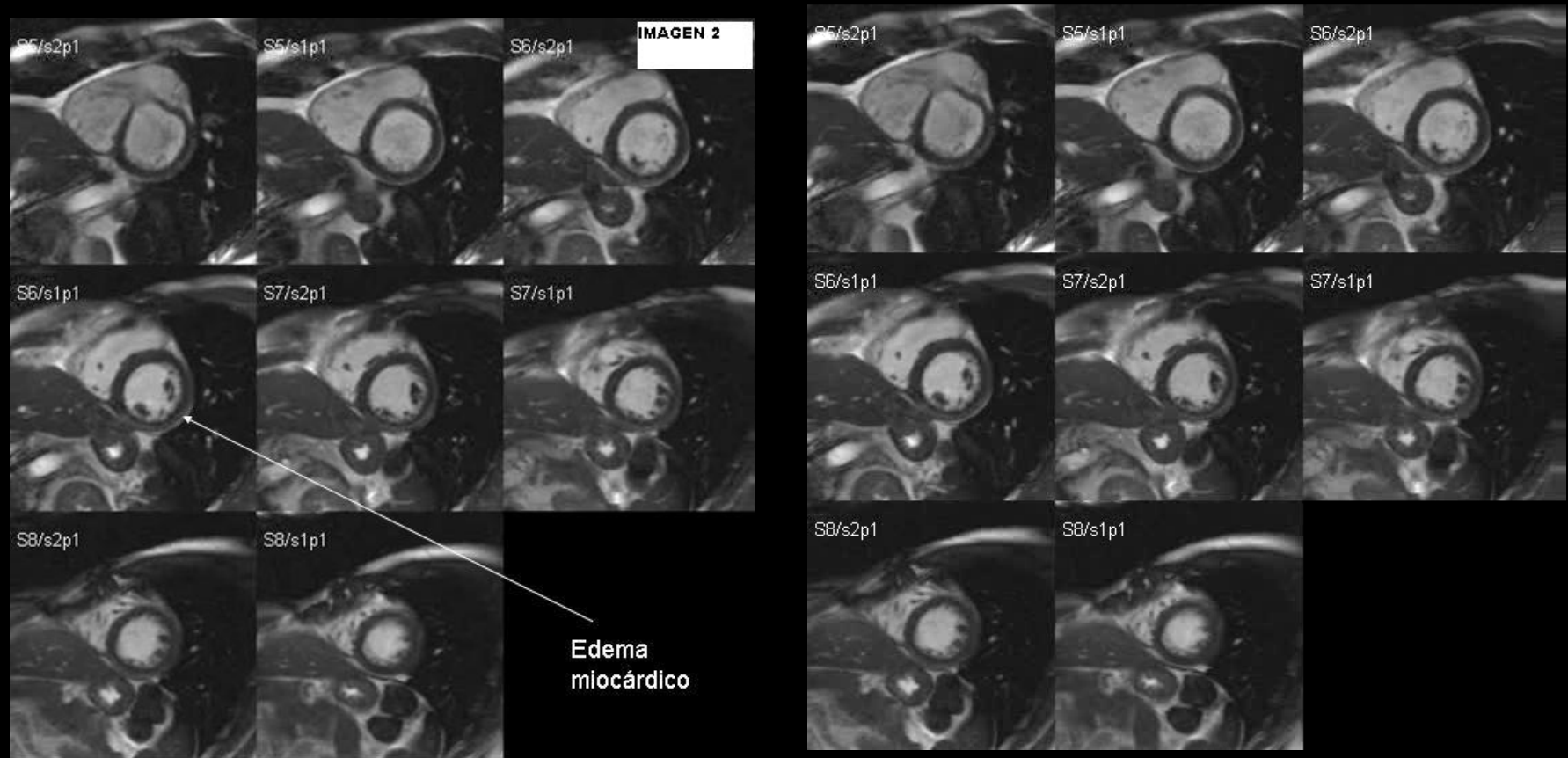


Cine MR True-FISP



IR LE

# Caso 4



Cine MR True-FISP

## Cas 2. Miocarditis aguda i estudi de seguiment

Paciente varón de 30 años, sin antecedentes patológicos de interés, derivado de Hospital bajo activación de código infarto.

Refiere cuadro de dolor centrotorácico precordial no irradiado de una semana de evolución, de características opresivas con sudoración, que no relaciona con los esfuerzos y de predominio nocturno. Refiere catarro de vías altas los días previos por lo que consultó a su ambulatorio que inició azitromicina y paracetamol.

El día 13 por la noche, presentó cuadro de dolor centrotorácico opresivo de reposo, que no se modifica ni con la movilidad ni con la respiración, que irradiaba a ambas extremidades superiores y se acompañaba de diaforesis profusa, por el que consultó a Urgencias de Hospital. A su llegada, hemodinámicamente estable, exploración física anodina, presentando en el ECG ritmo sinusal con supradesnivel cóncavo de hasta 2 mm en cara inferolateral y T picudas en cara anterior. Se activó código IAM, trasladándose a nuestro centro, previo tratamiento con antiagregación y anticoagulación.

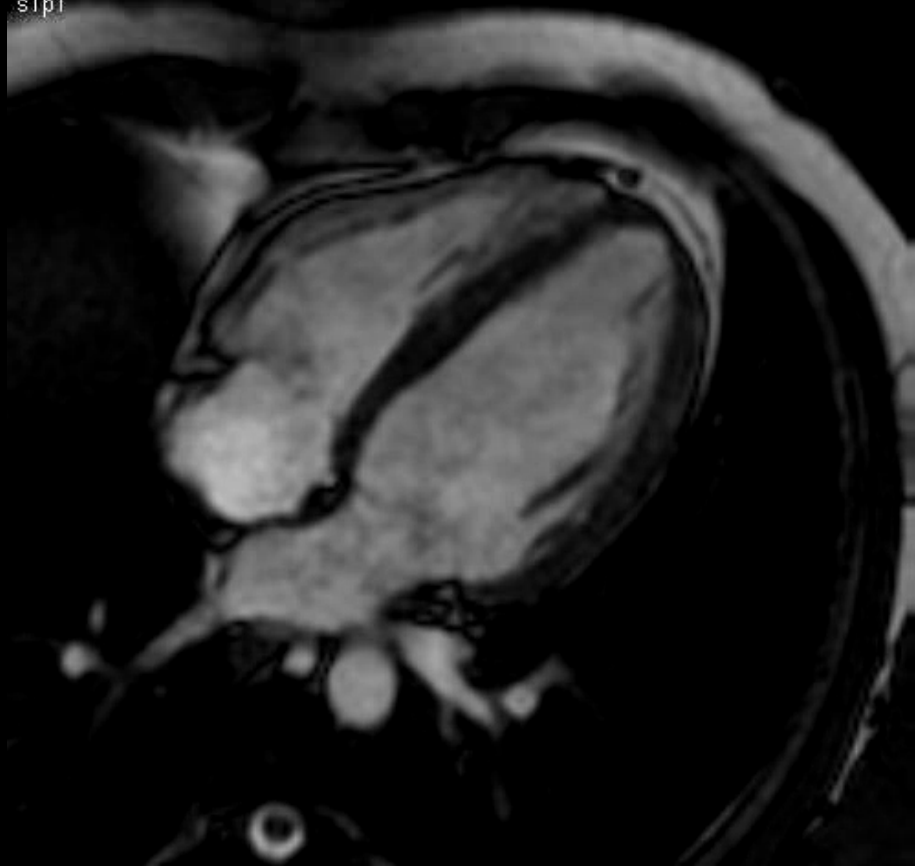
Llega sin dolor, estable. Se realiza coronariografía por acceso radial derecho, que muestra arterias coronarias sanas, ventriculografía, que muestra un VI no dilatado, con hipoquinesia difusa y FEVI estimada en un 48%.

Posteriormente ingresa en Semicríticos. Desde entonces evolución favorable, sin nuevos episodios de dolor. Curva de marcadores de lesión miocárdica: CK 150---217---160; TnT us 1930---2050---1300, con PCR de 163.

Se orienta como Miocarditis Aguda y se traslada a sala convencional de cardiología para tratamiento y control.

## Cas 2. Miocarditis aguda i estudi de seguiment

s1p1



13-01-2011

s1p1

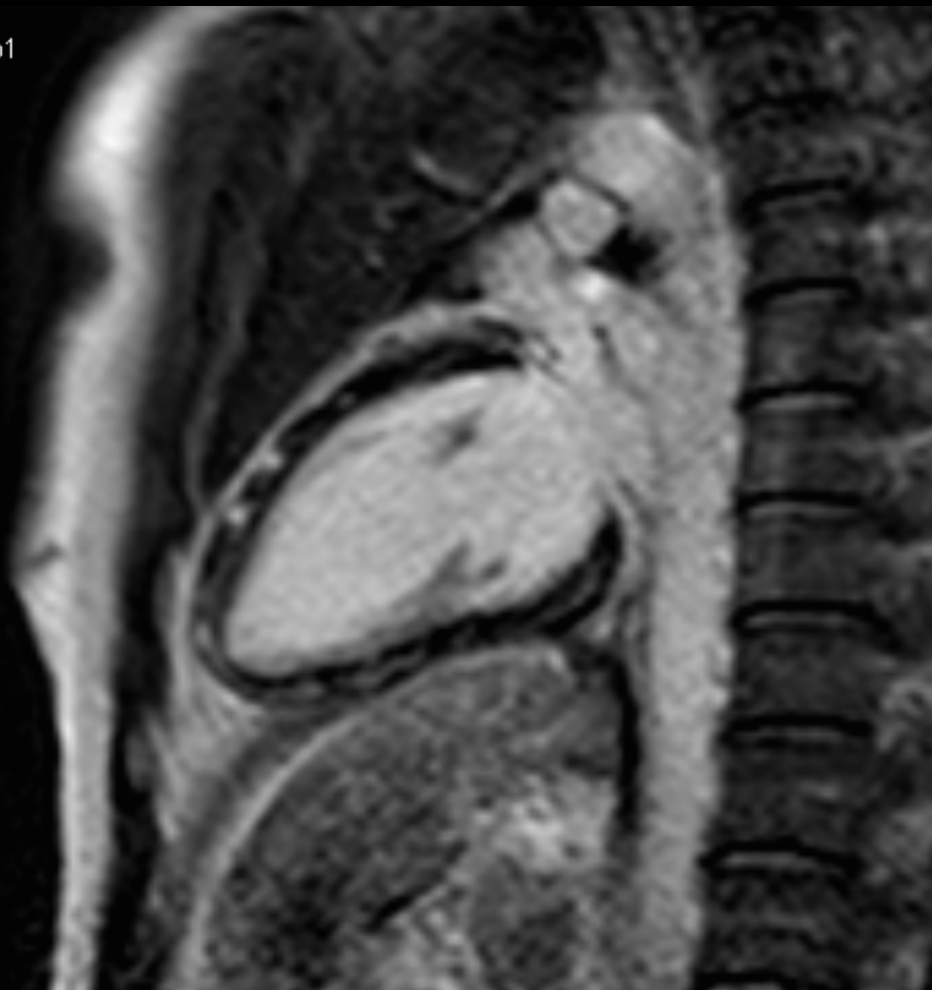


26-10-2011

Cine True-FISP

## Cas 2. Miocarditis aguda i estudi de seguiment

s5p1



13-01-2011

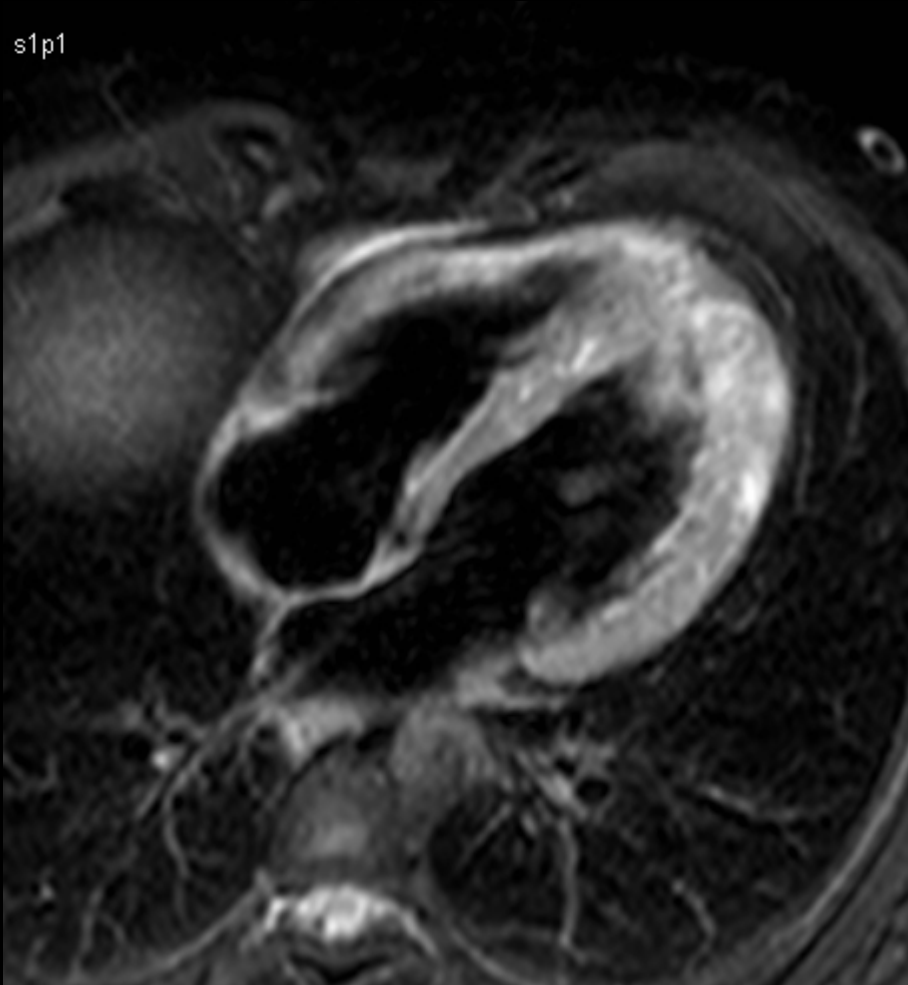
IR LE



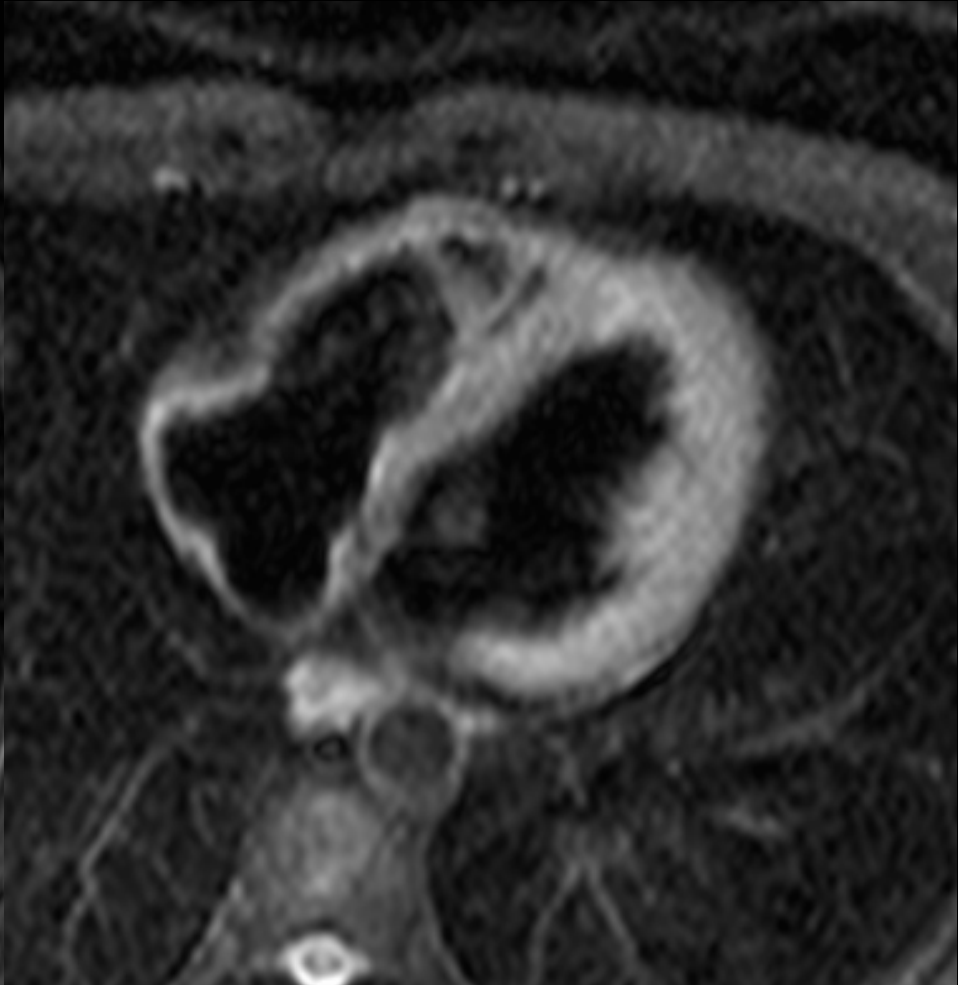
26-10-2011

Cas 2. Miocarditis aguda i estudi de seguiment

s1p1



13-01-2011

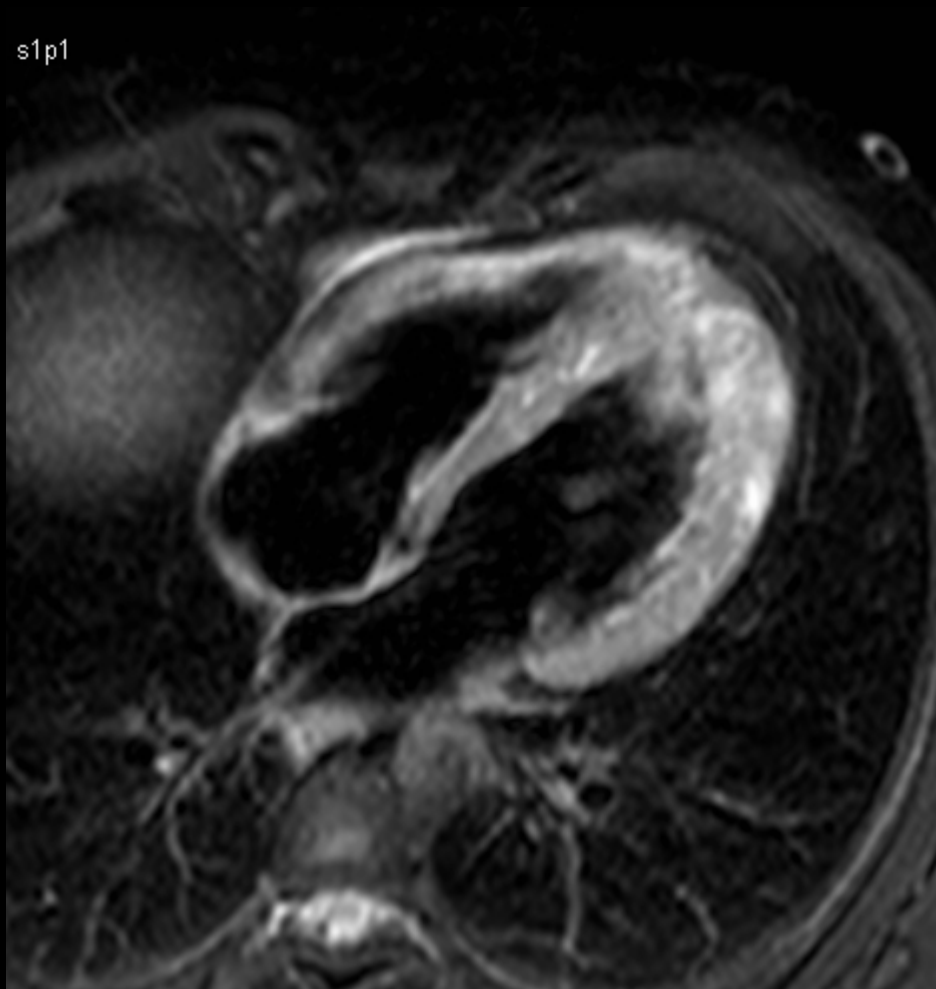


T2 STIR

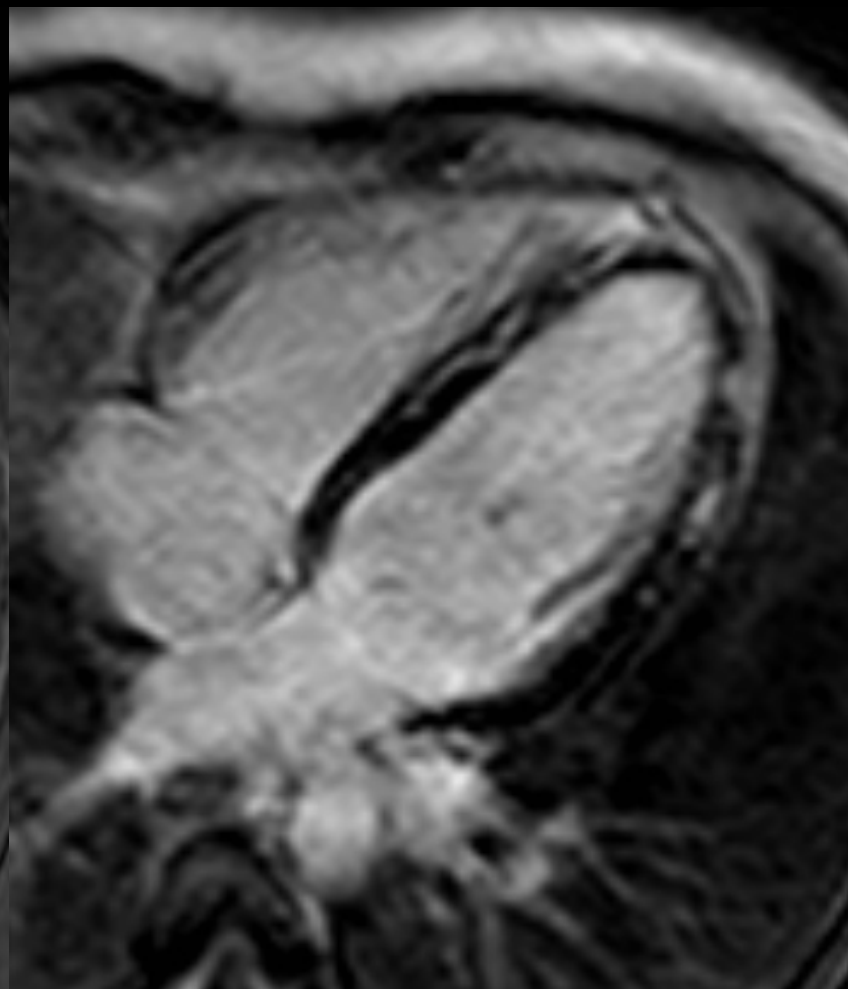
26-10-2011

## Cas 2. Miocarditis aguda i estudi de seguiment

s1p1



T2 STIR

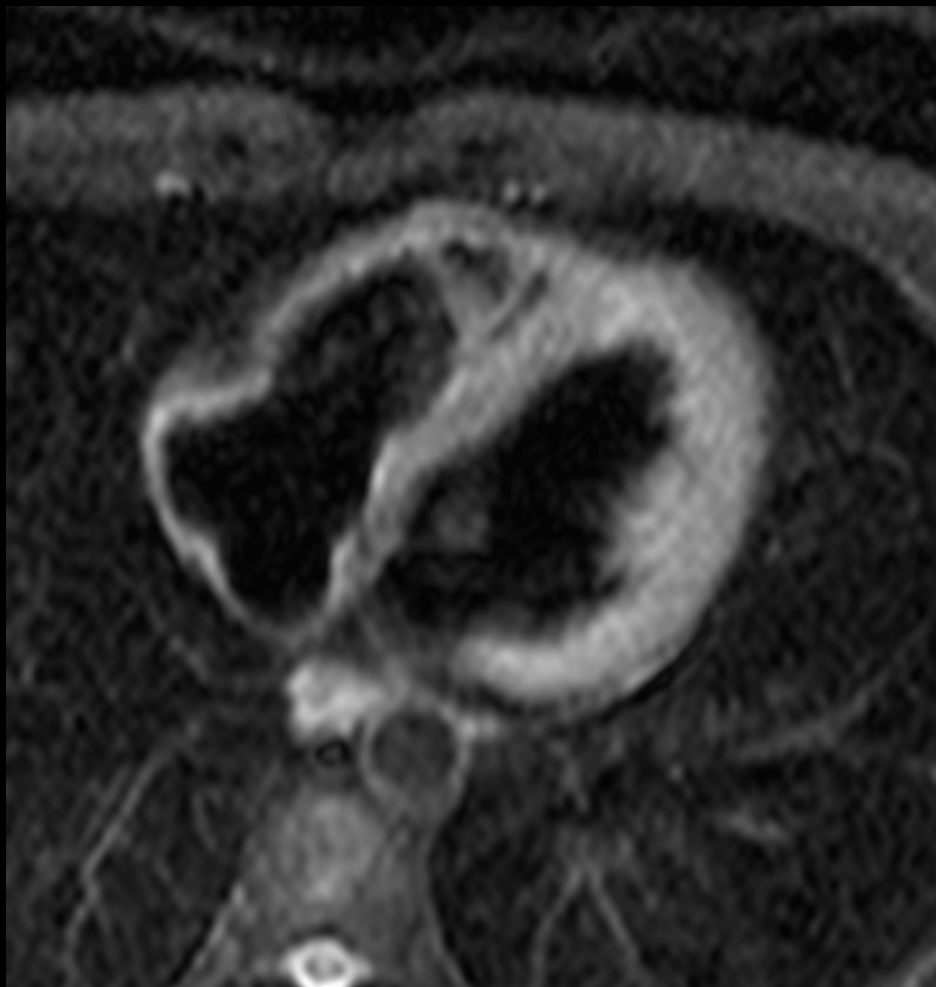


IR LE

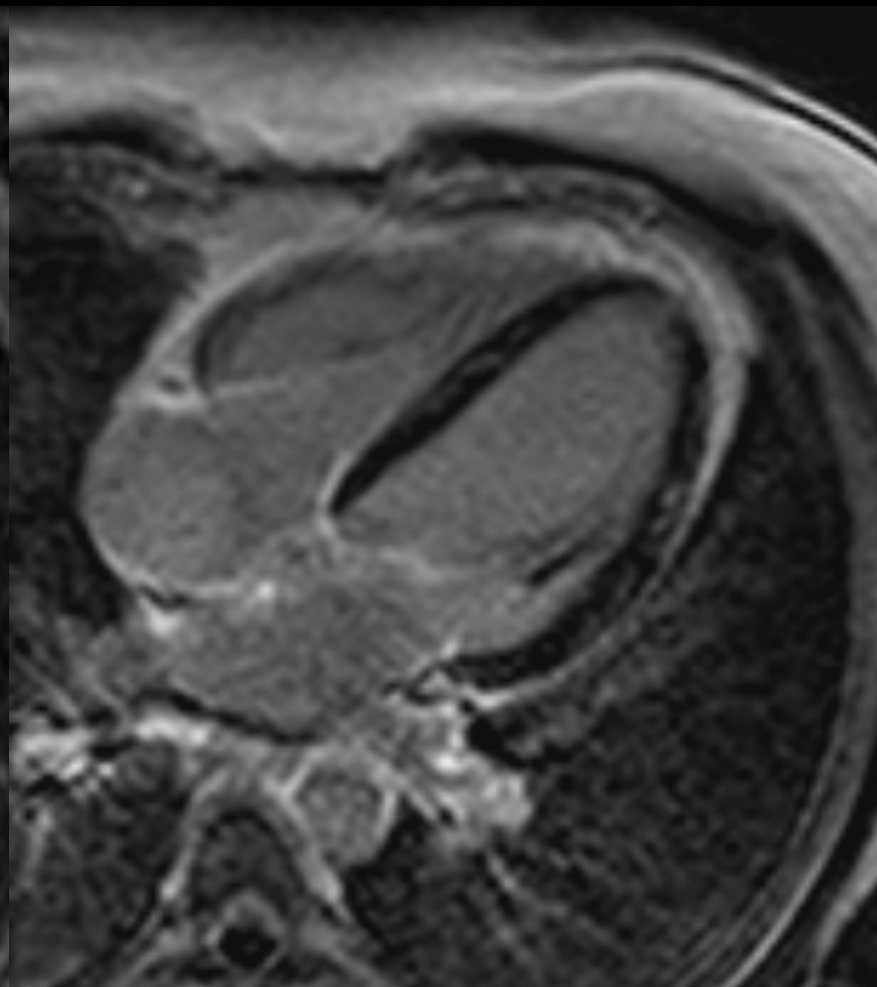
13-01-2011



Cas 2. Miocarditis aguda i estudi de seguiment



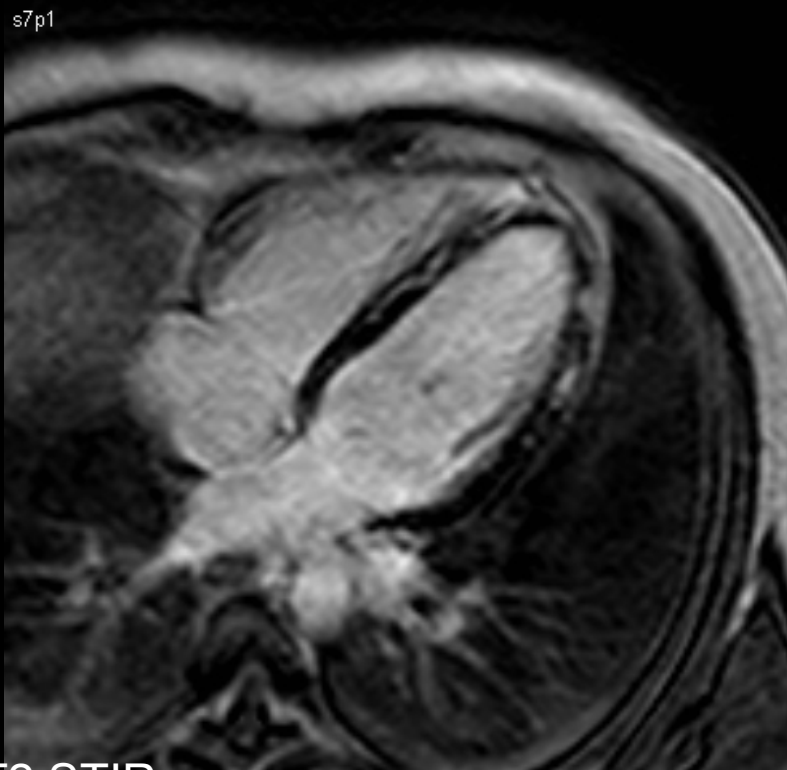
T2 STIR



IR LE

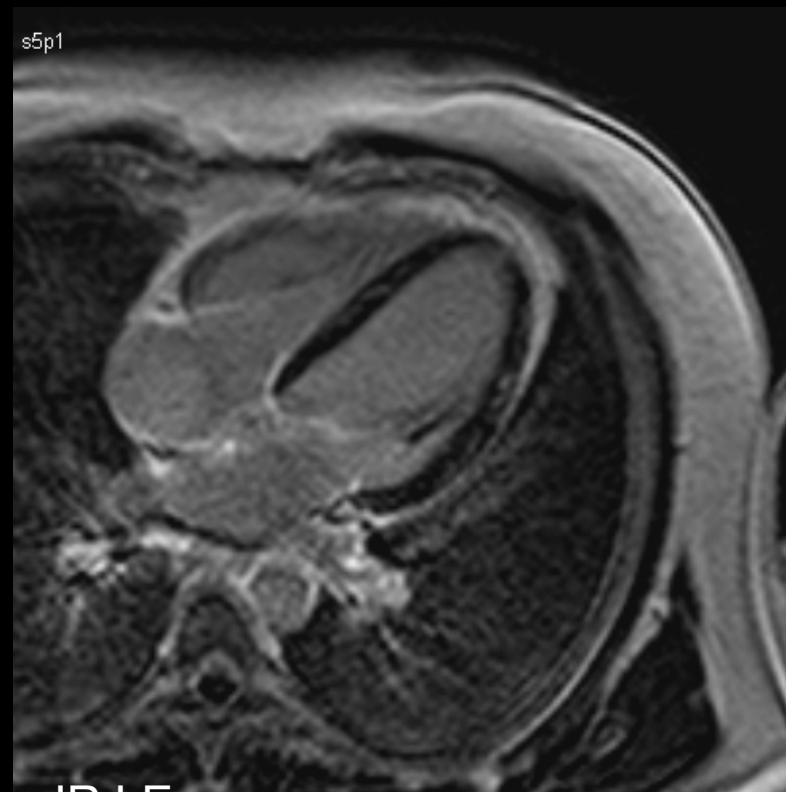
26-10-2011

## Cas 2. Miocarditis aguda i estudi de seguiment



T2 STIR

13-01-2011



IR LE

26-10-2011

# Cardiovascular Magnetic Resonance in Myocarditis: A JACC White Paper

Matthias G. Friedrich, MD,\* Udo Sechtem, MD,‡ Jeanette Schulz-Menger, MD,§

JACC Vol. 53, No. 17, 2009

April 28, 2009:1475–87

**Cardiovascular magnetic resonance (CMR)** has become the primary tool for noninvasive assessment of myocardial inflammation in patients with suspected myocarditis. The International Consensus Group on CMR Diagnosis of Myocarditis was founded in 2006 to achieve consensus among CMR experts and develop recommendations on the current state-of-the-art use of CMR for myocarditis. The recommendations include indications for CMR in patients with suspected myocarditis, CMR protocol standards, terminology for reporting CMR findings, and diagnostic CMR criteria for myocarditis (i.e., “Lake Louise Criteria”).

**Table 7**

## Proposed Diagnostic CMR Criteria (i.e., Lake Louise Consensus Criteria) for Myocarditis

In the setting of clinically suspected myocarditis,\* CMR findings are consistent with myocardial inflammation, if at least 2 of the following criteria are present:

Regional or global myocardial SI increase in T2-weighted images.†

Increased global myocardial early gadolinium enhancement ratio between myocardium and skeletal muscle in gadolinium-enhanced T1-weighted images.‡

There is at least 1 focal lesion with nonischemic regional distribution in inversion recovery-prepared gadolinium-enhanced T1-weighted images (“late gadolinium enhancement”).§

# Myocarditis

Sandeep Sagar, Peter P Liu, Leslie T Cooper Jr

Myocarditis is an underdiagnosed cause of acute heart failure, sudden death, and chronic dilated cardiomyopathy.

www.thelancet.com Published online December 19, 2011 DOI:10.1016/S0140-6736(11)60648-X

## Lake Louise Consensus Criteria

	Validation	Sensitivity (%)	Specificity (%)	Accuracy (%)	PPV (%)
T2 and LGE	Clinical histology	25	95	56	86
T2, LGE, or both	Clinical histology	60	66	62	79
Any 1 of 3	Clinical histology	88	48	70	68
Any 2 of 3	Clinical histology	67	91	78	91

PPV=positive predictive value. T2=T2-weighted MRI. LGE=late gadolinium enhancement. Adapted with permission from Friedrich and colleagues.<sup>79</sup>

**Table 2: Accuracy of several combinations of cardiac MRI tissue criteria for the diagnosis of myocarditis**

# Myocarditis

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**Table 2: Accuracy of several combinations of cardiac MRI tissue criteria for the diagnosis of myocarditis**

La presencia de gadolini + en pacient amb miocarditis (biopsia +) implica una mortalitat de causa cardíaca de superior al que no la té.  
JACC 2012;59:1604

## Cardio-RM: tècnica de primera elecció

Estudi de funció ventricular i caracterització del dany tisular

D.D. Entre miocarditis aguda (edema i hiperemia) i crònica

D.D. Amb IAM i altres miocardiopaties: Tako-Tsubo i miocardiopatia peripart que es caracteritzen per edema i hiperemia (canvis inflamatoris), però no hi ha gadolini (en particular al Tako-Tsubo)

Table 1

Indications for CMR in patients with suspected myocarditis

---

New or persisting symptoms suggestive of myocarditis

(ie, dyspnea, orthopnea, palpitations, effort intolerance, malaise, chest pain)

Evidence for recent/ongoing myocardial injury

(ie, ventricular dysfunction, new or persisting ECG abnormalities, elevated troponin)

Unknown etiology of symptoms

(ie, disease or previous myocarditis, absence of risk factors for coronary artery disease or age <35 years, symptoms unexplained by stenosis on coronary angiogram, recent negative ischemic stress test)

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Sospita  
clínica

