OSPEDALE NIGUARDA CA' GRANDA
"DE GASPERIS" CARDIO CENTER

UNIVERSITÀ DEGLI STUDI DI MILANO BICOCCA

IX CONGRESSO NAZIONALE ECOCARDIOCHIRURGIA

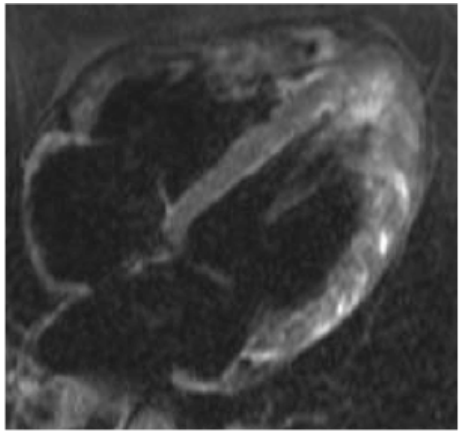
MALATTIE DEL MIOCARDIO E DEL PERICARDIO

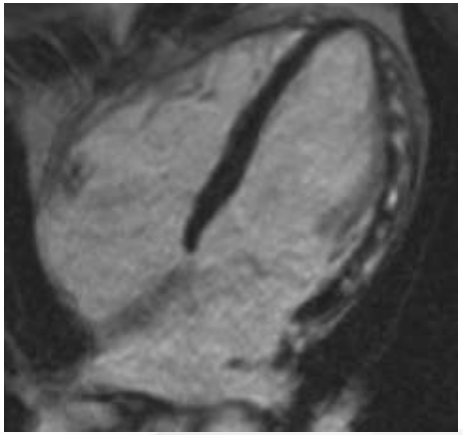
Miocarditi: quando l'imaging non invasivo è sufficiente?

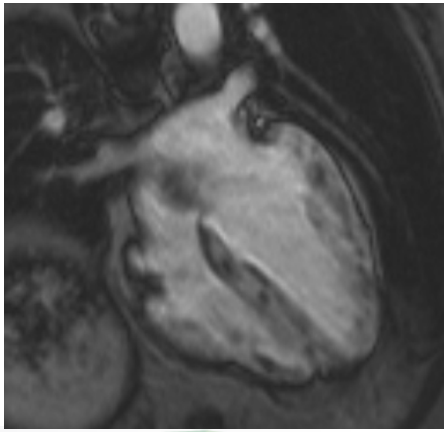
Patrizia Pedrotti

Laboratorio di RM Cardiaca - Cardiologia 4 - ASST Grande Ospedale Metropolitano Niguarda – Milano

Milano, 27-29 Marzo 2017

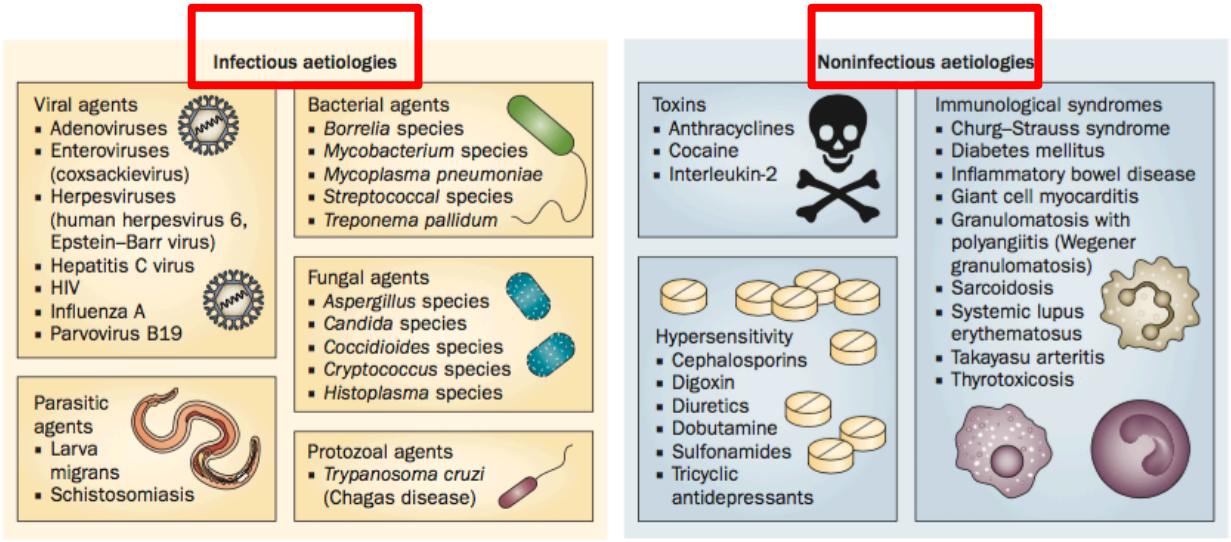






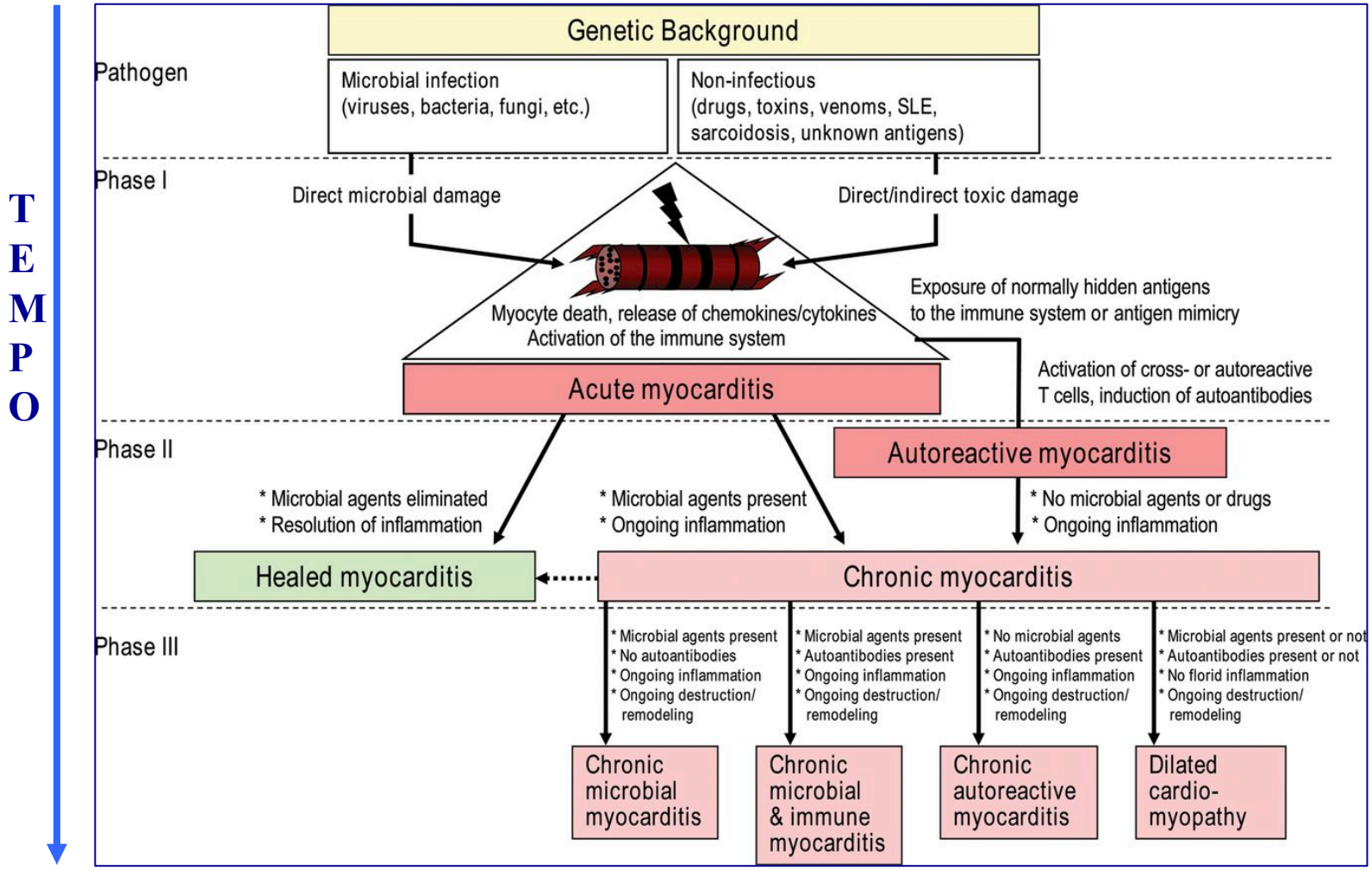
Miocardite: definizione ed eziologia

Malattia infiammatoria del miocardio diagnosticata utilizzando criteri istologici ed immunoistochimici stabiliti (WHO/ISFC)



Aretz HD, Human Pathology 1987 (Dallas criteria); Maisch B, Herz 2000 (Marburg Classification); Pollack A, Nature Rev Cardiol 2015; Sinagra G, Mayo Clin Proc 2016

Miocardite: patogenesi



Caforio A., Eur Heart J 2013

Miocardite acuta: presentazione clinica

Presentazione clinica

- SCA-like
- SHOCK
- ARITMIE (MI)
- CMD - HF

Diagnosi

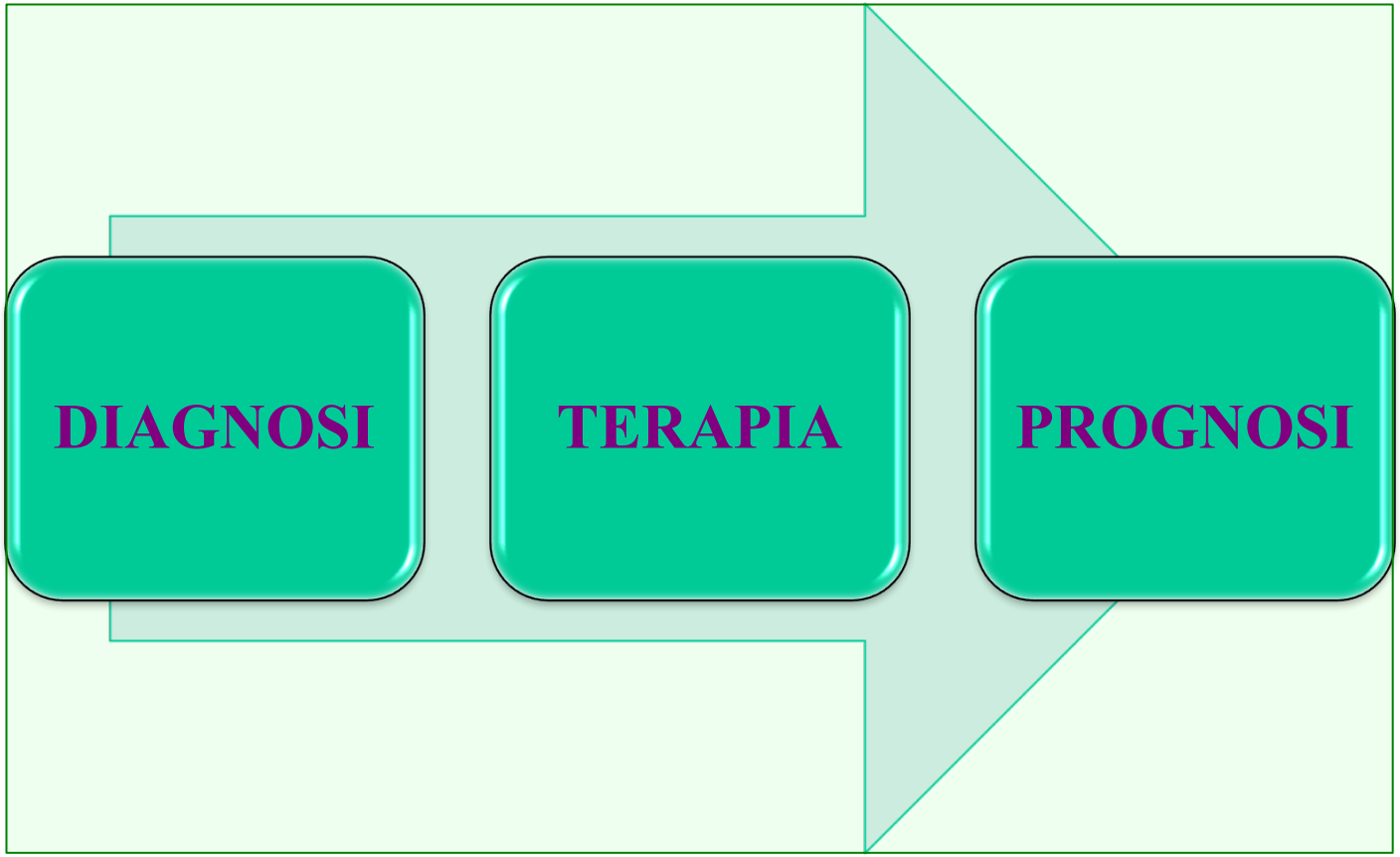
- -ECG
  -LAB
  -ECO
- -RM
  -TC/PET
  -BEM
  -CORO
- -Indicazione
  -Accessibilità
  -Fattibilità

BIOPSIA ENDOMIOCARDICA (BEM)

- SCC severo di recente insorgenza, non responsivo alla tp; aritmie minacciose (LG ACC/AHA)
- Sempre a tutti, indipendentemente dalla modalità e severità di presentazione clinica (Position statement WG Malattie miocardio e pericardio ESC)

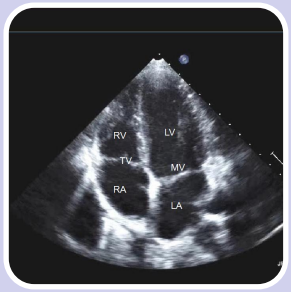
Cooper LT, Circulation 2007; Caforio A, Eur Heart J 2013

Miocardite acuta: importanza della diagnosi

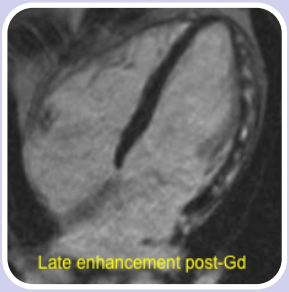


Miocardite gigantocellulare, eosinofila, sarcoidosi hanno terapia specifica e prognosi peggiore rispetto alle forme virali

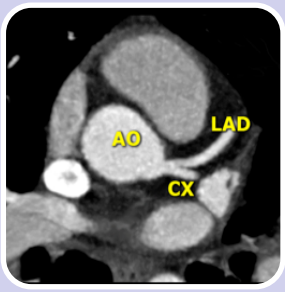
IMAGING NELLE MIOCARDITI



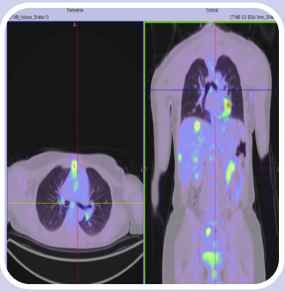
Morfologia
Funzione
Valvole
Fase acuta (bed-side)
Follow-up



Morfologia
Funzione
Edema
LGE
Fase acuta (appena possibile)
Follow-up



Coronarie (dd SCA-miocardite)
Reperti collaterali (patologia sistemica associata)



Patologia sistemica associata (sarcoidosi)

ESEMPIO CLINICO 1 – ESORDIO CON DOLORE TORACICO

-S.M., uomo, 41 aa, fumatore, fam. per CAD

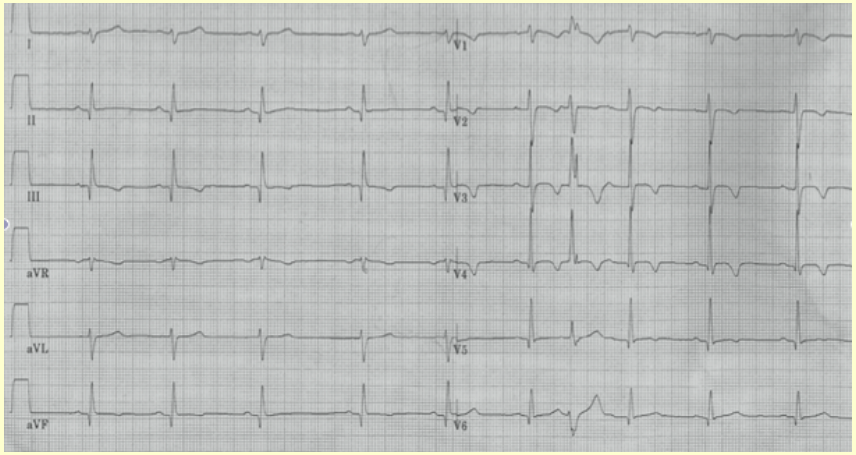
-Insorgenza di dolore toracico, circa una settimana dopo infezione prime vie aeree

-ECG: alterazioni diffuse della RV

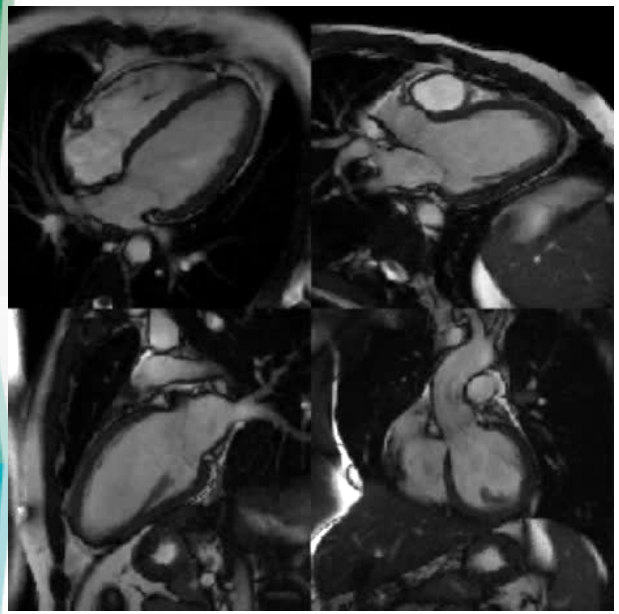
-Eco: cinesi ed FE normali, non versamento pericardico

-Aumento TnHs, gb e PCR

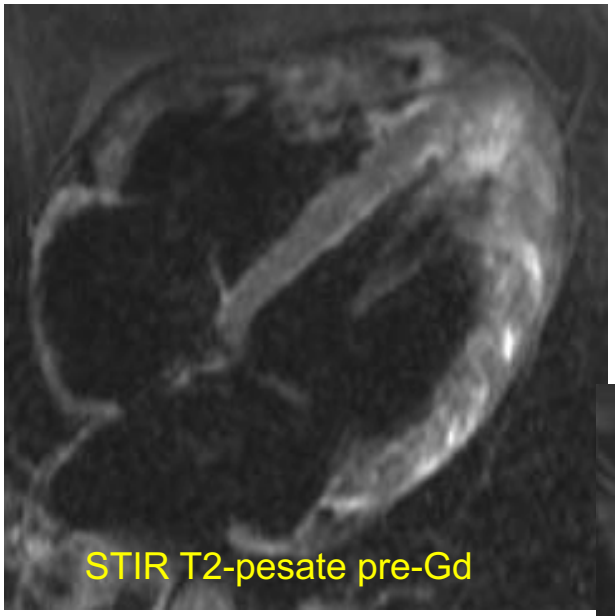
-Coronarie normali **(coroTC)**



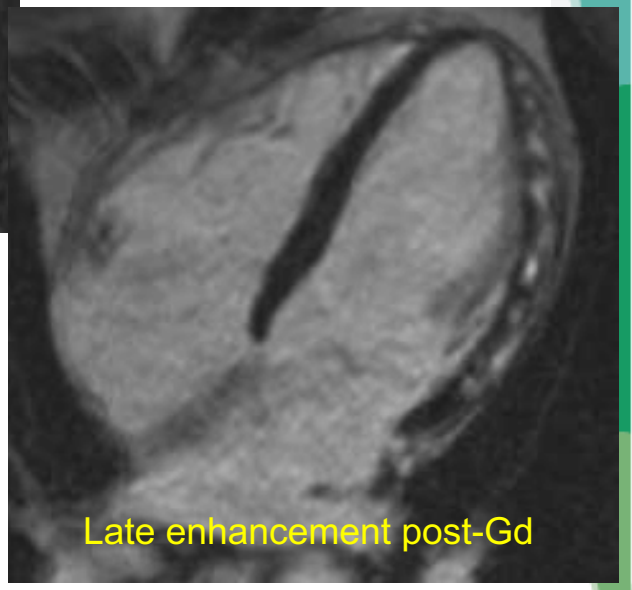
RM CARDIACA



1) Cinesi



2) Edema



3)Necrosi/edema

Cardiovascular Magnetic Resonance in Myocarditis: A JACC White Paper, Friedrich MG JACC 2009

Cardiovascular Magnetic Resonance in Myocarditis: A JACC White Paper

Matthias G. Friedrich, MD,* Udo Sechtem, MD,‡ Jeanette Schulz-Menger, MD,§ Godtfred Holmvang, MD,|| Pauline Alakija, MD,† Leslie T. Cooper, MD,¶ James A. White, MD,# Hassan Abdel-Aty, MD,§ Matthias Gutberlet, MD,** Sanjay Prasad, MD,†† Anthony Aletras, PHD,‡‡ Jean-Pierre Laissy, MD,§§ Ian Paterson, MD,||| Neil G. Filipchuk, MD,* Andreas Kumar, MD,* Matthias Pauschinger, MD,¶¶ Peter Liu, MD,## for the *International Consensus Group on Cardiovascular Magnetic Resonance in Myocarditis*

Published Controlled Studies on Cardiovascular Magnetic Resonance in Myocarditis

	Validation	No. of Patients	No. of Control Patients
Friedrich et al., *Circulation* 1998 (9)	Clinical	19	18
Laissy et al., *Chest* 2002 (11)	Clinical	20	7
Rieker et al., *Rofo* 2002 (36)	Clinical	11	10
Laissy et al., *Radiology* 2005 (37)*	Clinical	24	31
Abdel-Aty et al., *J Am Coll Cardiol* 2005 (13)	Clinical	25	22
Mahrholdt et al., *Circulation* 2006 (40)	Histology	87	26
Gutberlet et al., *Radiology* 2008 (34)†	Histology	48	35
Yilmaz et al., *Heart* 2008 (43)†	Histology	55	30
Total		289	179

*Compared with patients with acute myocardial infarction. †Compared with patients with clinical evidence but lack of immunohistologic evidence for chronic myocarditis.

JACC 2009

Criteri diagnostici di RMN cardiaca per miocardite proposti (Lake Louise Consensus Criteria; JACC White Paper 2009)

Reperti CMR indicativi di miocardite in presenza di almeno 2 dei seguenti criteri:

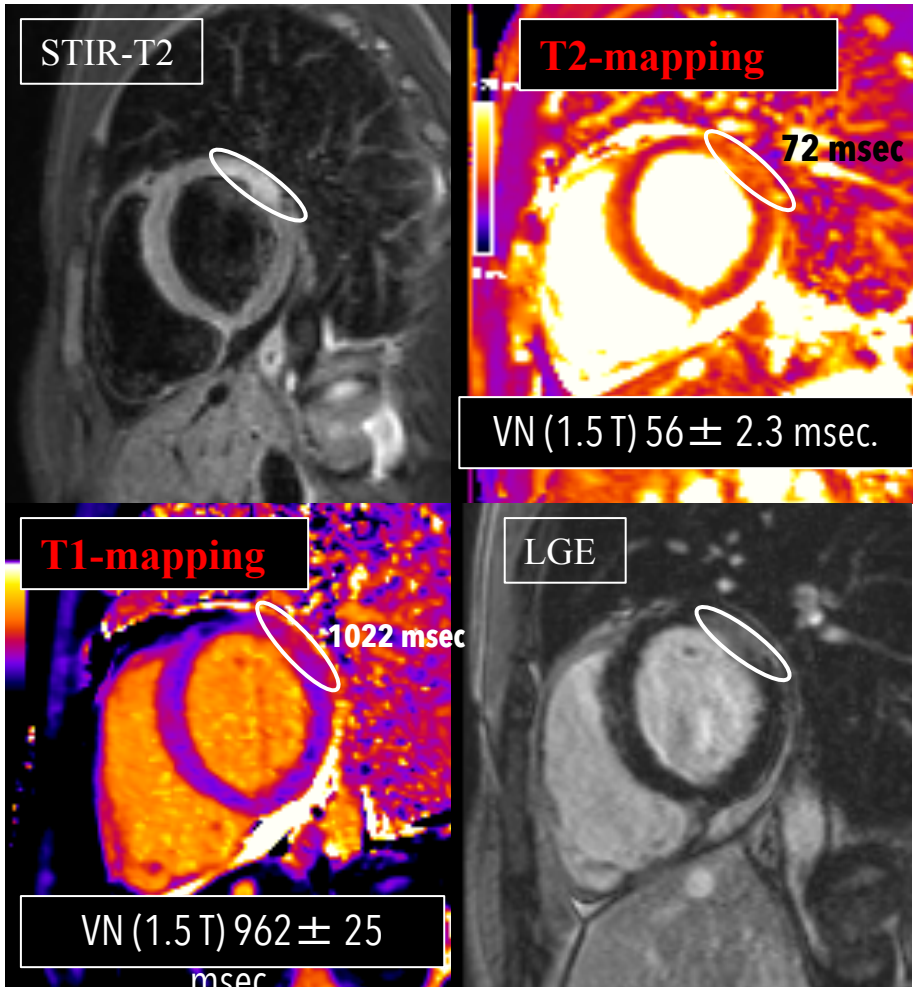
-Aumento intensità del segnale miocardico, regionale o globale, alle immagini T2-pesate

-Aumento del rapporto tra enhancement precoce globale del miocardio e muscolare dopo gd (early enhancement)

-Almeno una lesione focale con pattern non ischemico tardivamente dopo gd (late enhancement, LGE)

N. di criteri	Sensibilità (%)	Specificità (%)	Accuratezza (%)	VPP (%)	VPN (%)
1 su 3	88	48	70	68	76
2 su 3	67	91	78	91	69

Caratterizzazione tissutale con mapping parametrico T1 e T2



- Quantificazione (espressa in msec.) del segnale miocardico T1 e T2
- Miocardio nativo (non necessario mdc)
- Vantaggio nella valutazione di processi patologici diffusi

- Standardizzazione dei protocolli di esecuzione
- Sequenze vendor specifiche
- Parametri di normalità di laboratorio
- Implementazione crescente

Ferreira V, JCMR 2014; Thavendiranathan P, Circulation Cardiovasc Imaging 2011

The role of cardiovascular magnetic resonance in patients presenting with chest pain, raised troponin, and unobstructed coronary arteries. Assomul, Eur Heart J 2007

-60 pazienti dolore toracico

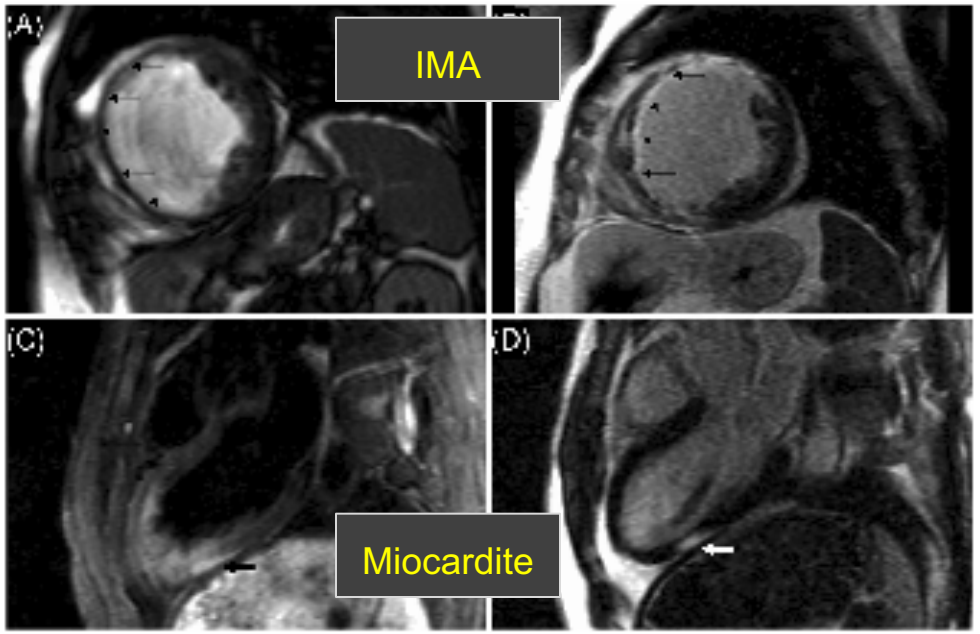
-40% sopraST all'esordio

-Coronarie normali

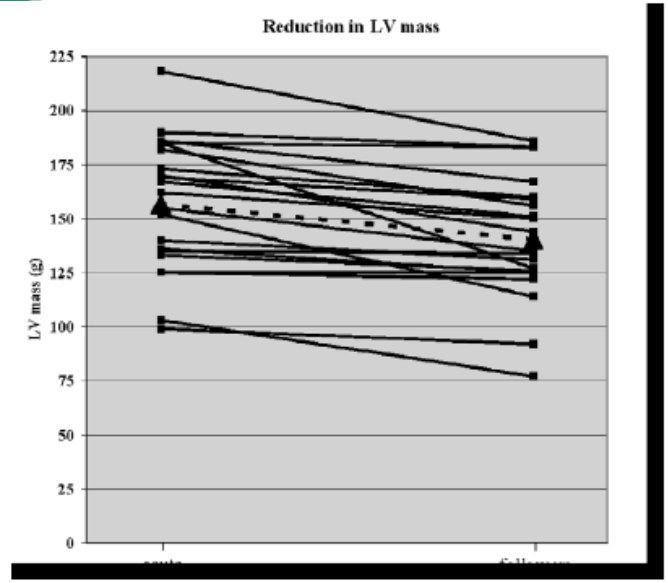
-RMC entro 3 mesi da sintomi

-Reperti RMC

- 50% Miocardite
- 11.6% IMA
- 3.4% Takotsubo/DCM
- 35% Normale



Valutazione dell'edema al follow-up – Massa cardiaca



Relazione tra edema miocardico e massa miocardica (JCMR 2008)

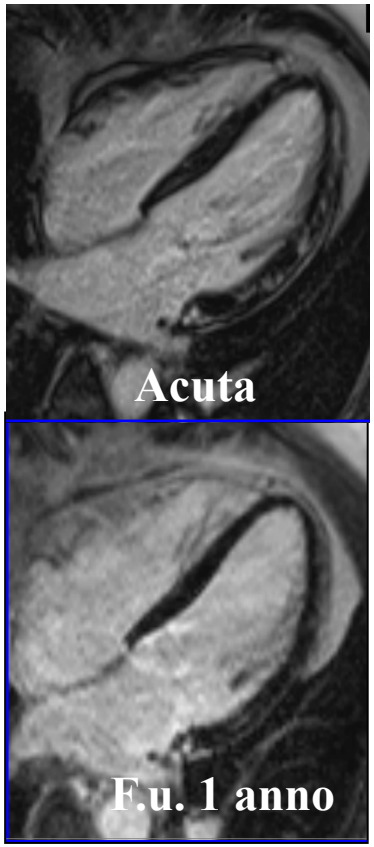
RMC è il gold standard per la misurazione dei volumi ed FE biventricolari e della massa (Lancet 1985, Radiology 1990, 2005; JCMR 2003)

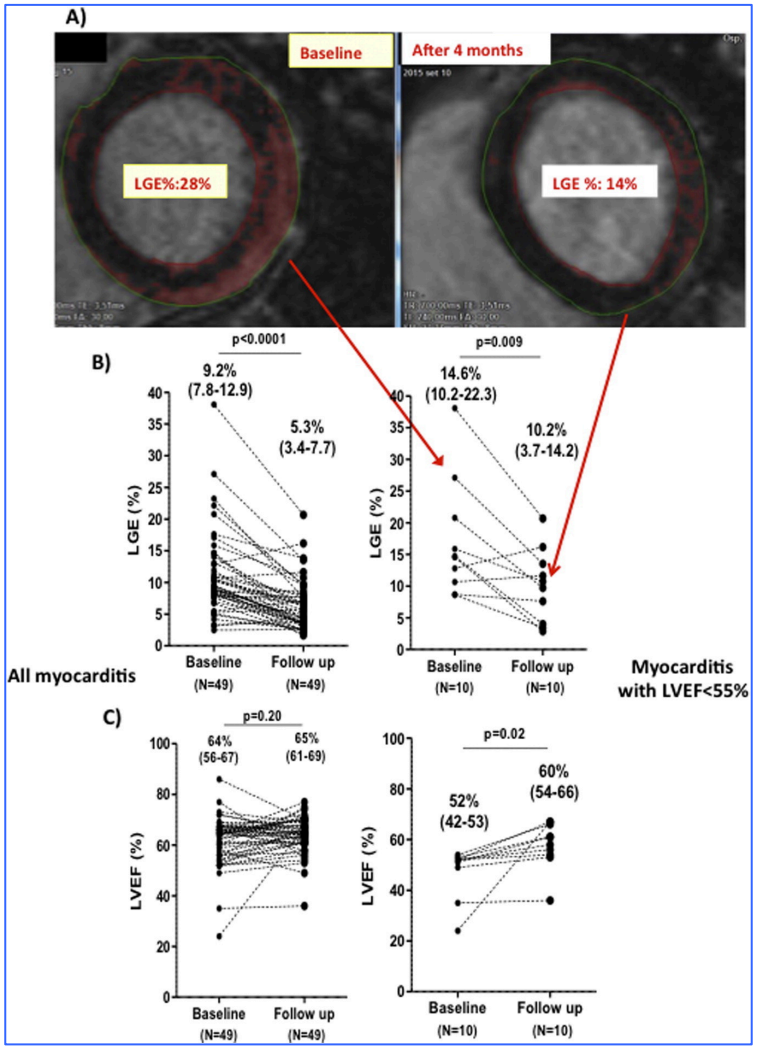
Table 3: CMR results in acute myocarditis and at follw-up

Variable	*Acute*	*Follow-up*	*Difference between means*	*P-value acute vs. follow-up*
LV mass (g)	156.66 ± 30.56	140.33 ± 28.30	-16.33	<0.0001
LV mass/height (g/cm)	0.90 ± 0.15	0.80 ± 0.12	-0.10	0.0001
LVEDV (ml)	158.10 ± 40.01	153.57 ± 37.50	-4.52	0.395
LVEDV/height (ml/cm)	0.89 ± 0.19	0.85 ± 0.19	-0.04	0.2859
Ejection fraction (%)	59.95 ± 6.39	64.14 ± 5.26	4.19	0.015
T2 ratio	2.41 ± 0.39	1.68 ± 0.29	-0.72	<0.0001

Follow-up – FE e late enhancement

-Decorso clinico non complicato, FE conservata
-RMC tipica per miocardite
-No tp specifica
-Imaging sufficiente





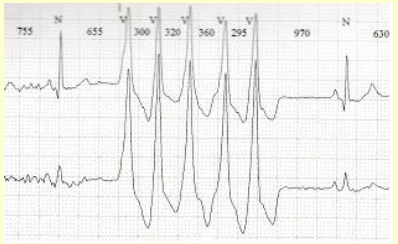
Ammirati E, IJC 2016

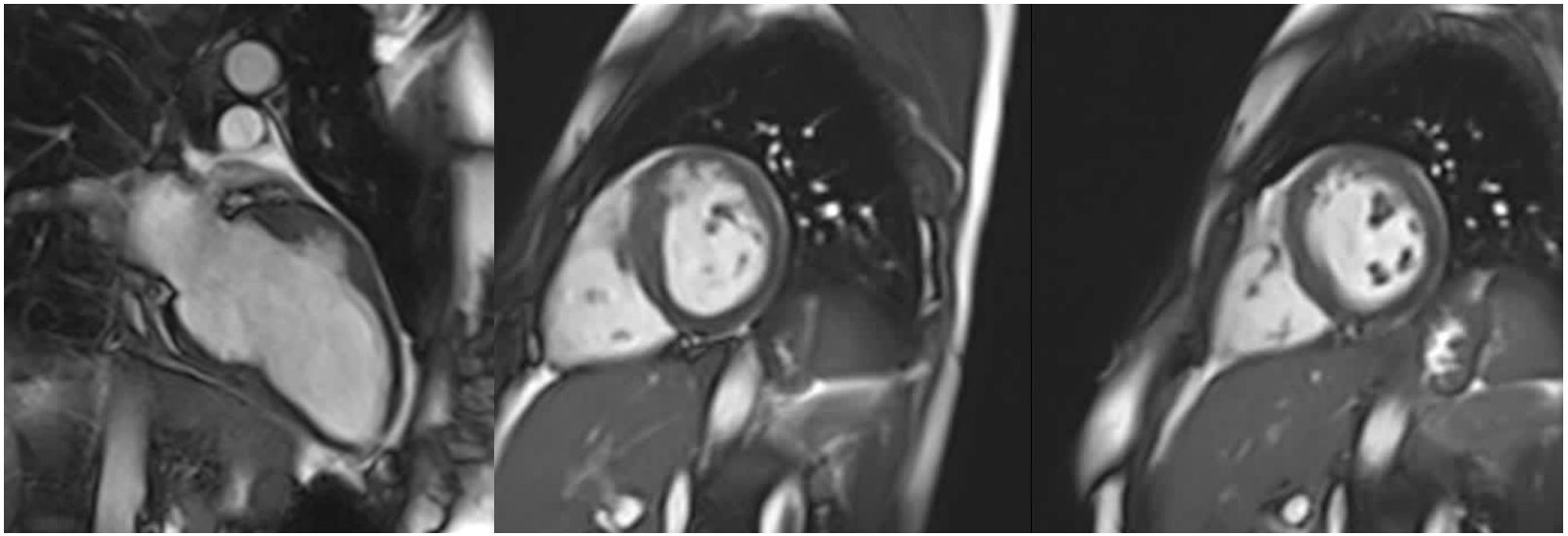
ESEMPIO CLINICO 3 – ESORDIO ARITMICO

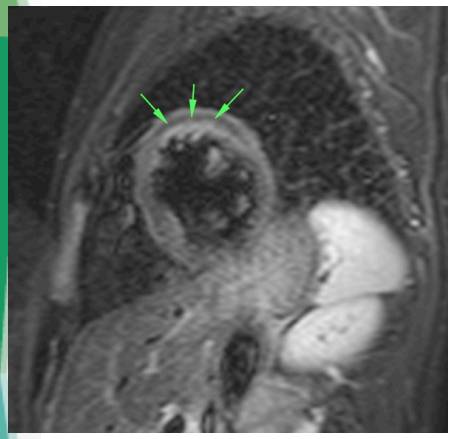
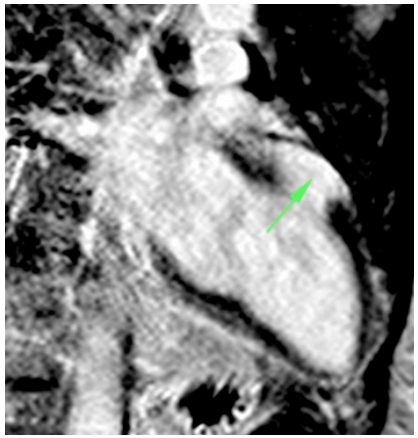
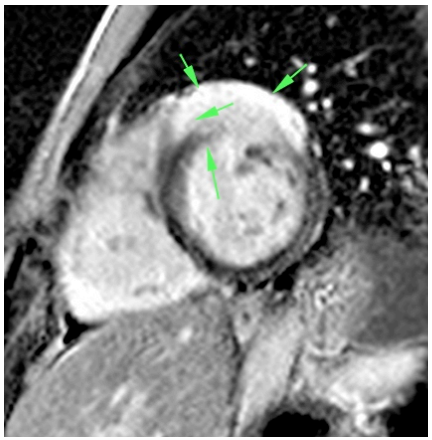
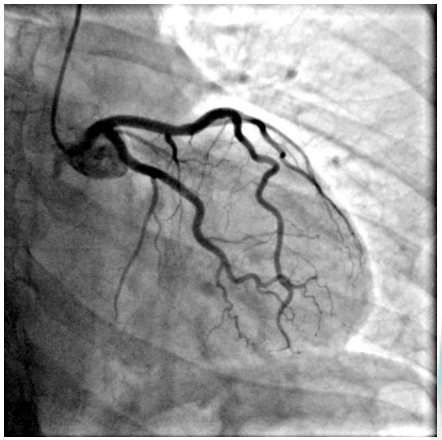
- Donna, 39 aa
- Anamnesi –va per eventi rilevanti; no fattori di rischio

Palpitazioni; ECG Holter: BEV frequenti, TVNS

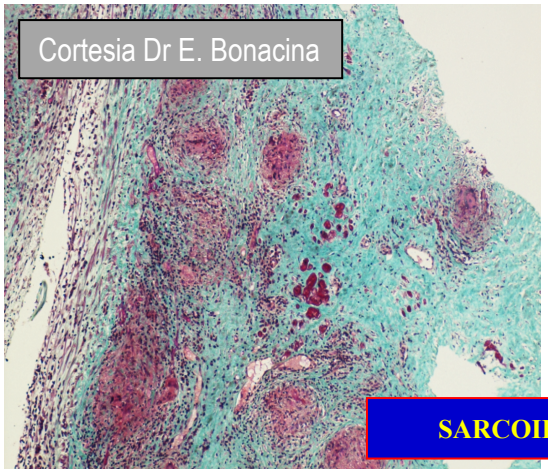
Eco: normale (? pitfall parete anteriore basale VSx)

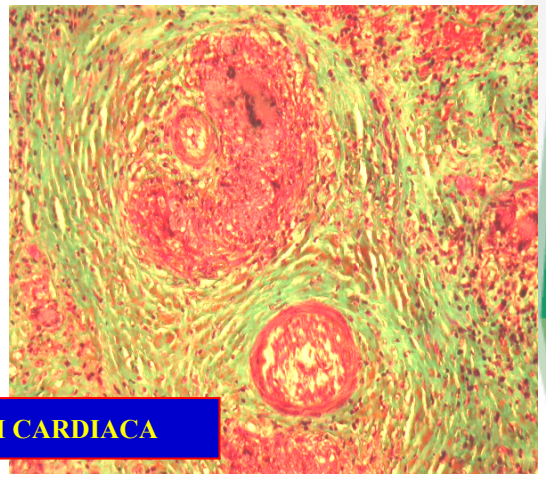




- AIV minacciose persistenti
- Intervento CCH
- Aneurisma rimosso e sostituito con patch pericardico

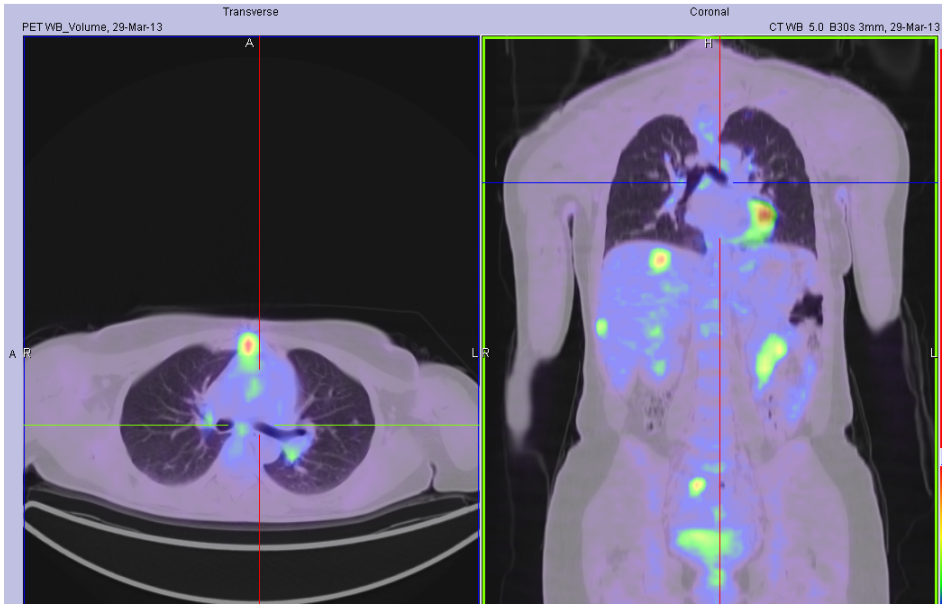




SARCOIDOSI CARDIACA

TAC/ PET

-Decorso complicato (AIV minacciose)
-Necessità di imaging avanzato complesso
-Reperto istologico in contesto di procedura terapeutica
-Terapia specifica
-La presenza di aneurisma non ischemico è "campanello d'allarme" (sarcoidosi, m. gigantocellulare)

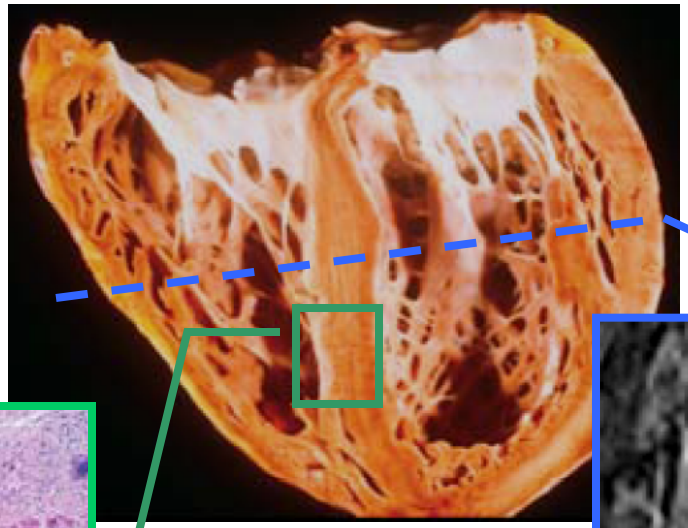


-Successiva diagnosi di sarcoidosi sistemica con TAC/PET
-Iniziata terapia steroidea
-Asintomatica, non recidive aritmiche

P. Pedrotti, IJC 2015;
Kandolin R, Circulation HH 2013

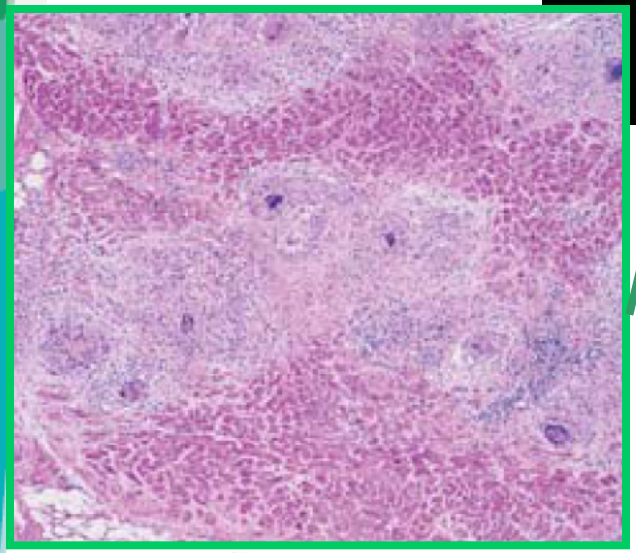
Youssef G, J Nucl Med 2012; Sobic-Saranovic D, Sem Nucl Med 2013

L.T. Cooper – "Myocarditis, from bench to bedside" – Humana Press, 2003.



SARCOIDOSI CARDIACA)

EMB

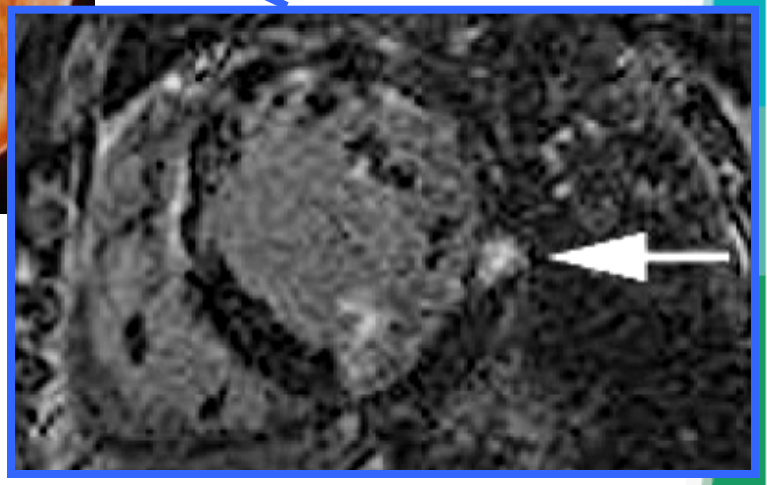


Sens.

20 - 30%

L.T. Cooper et al. – JACC, 2007

CMR



58 Pts with pulmonary sarcoidosis

Sens. **100%**

Acc **83%**

Doughan AR – Heart, 2006
Smedema JP JACC 2005

Limite BEM nelle patologie focali

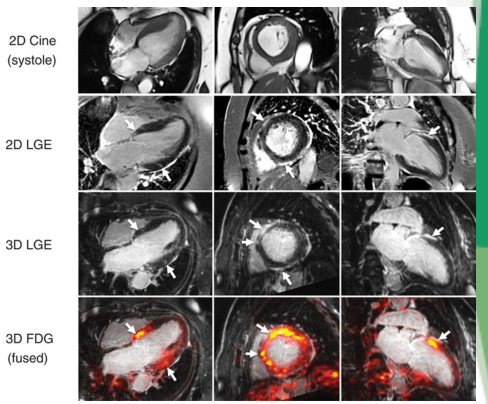
SARCOIDOSI CARDIACA - DIAGNOSI

Table 1: The Japanese Ministry of Health and Welfare 1993 Guidelines for the Diagnosis of Cardiac Sarcoidosis.[20]

1. Histologic diagnosis group
Cardiac sarcoid is *confirmed* then endomyocardial biopsy demonstrates epithelioid granulomas without caseating necrosis.
2. Clinical diagnosis group: In patients with a histologic diagnosis of extracardiac sarcoidosis, cardiac sarcoidosis is *suspected* when:
"a" and at least one of criteria "b" to "e" is present, and other etiologies such as hypertension and coronary artery disease have been excluded.
a. Bundle branch block, heart block of any degree, left-axis deviation, ventricular tachycardia, premature ventricular contractions, or pathological Q or ST-T change on resting or ambulatory electrocardiogram.
b. Abnormal wall motion, regional wall thinning, or dilation of the left ventricle.
c. Perfusion defect by thallium-201 or technetium-99m myocardial scintigraphy, or abnormal accumulation by gallium-67.
d. Abnormal intracardiac pressure, low cardiac output, or abnormal wall motion or depressed ejection fraction of the left ventricle on cardiac catheterization.
e. Interstitial fibrosis or more than moderate cellular infiltration over moderate grade on endomyocardial biopsy specimen, even if the findings are non-specific.

Ruolo crescente di metodiche di imaging avanzato:
-RMC
-PET-FDG
-TC/PET
-Integrazione di caratterizzazione tissutale (RMC) e dati metabolici (PET) (Heart Rhythm Society, 2014)

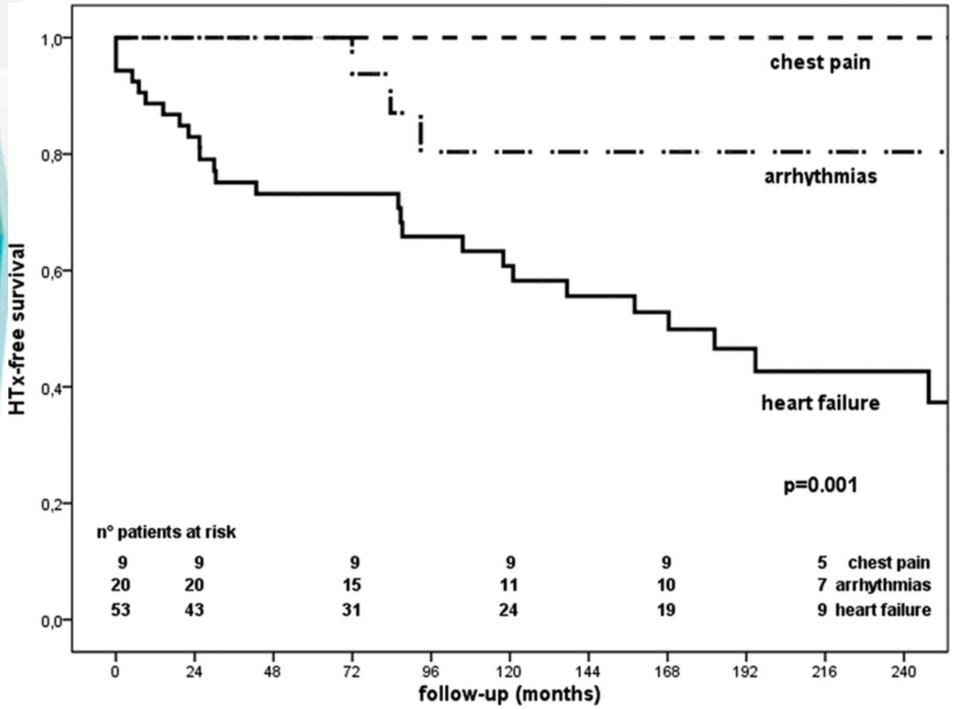
Imaging necessario



White J A, Circulation 2013

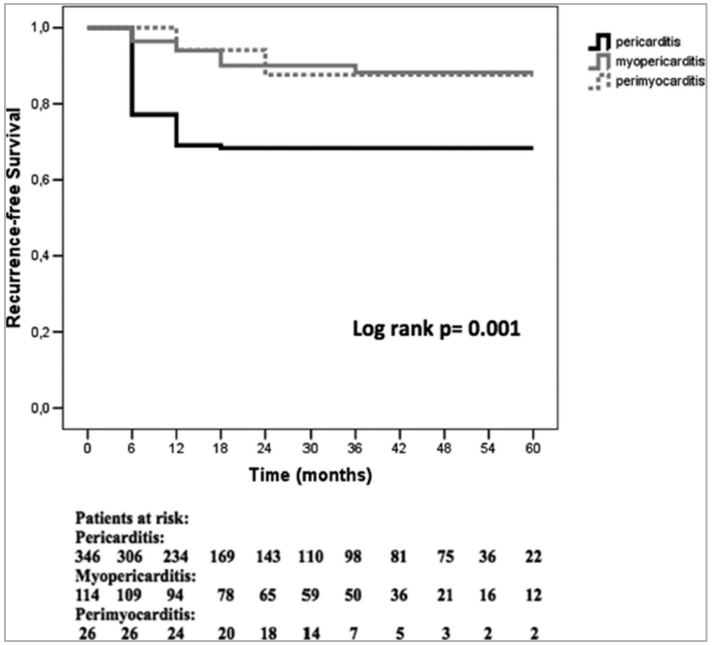
Prognosi in relazione alla modalità di presentazione clinica

Miocardite diagnosticata alla BEM



Anzini M, Circulation 2013

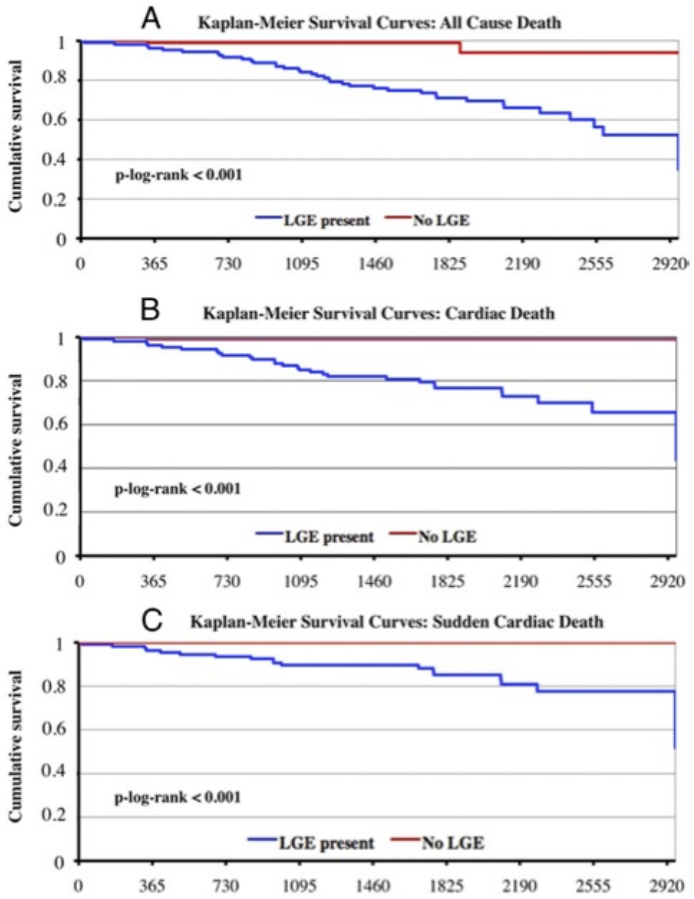
Miopericardite/perimiocardite – Studio multicentrico (diagnosi clinica/RMC)



Imazio M, Circulation 2013

Prognosi in relazione alla modalità di presentazione clinica

RMC in miocardite diagnosticata alla BEM



Grun S, JACC 2012

Table 1 Baseline Patient Characteristics (All Patients With Clinical Follow-Up)

All patients with follow-up	203 (91.5)
Time to follow-up, days	1,685 (1,267–2,102)
Female	63 (31.0)
Age, yrs	52 (40–54)
BMI, kg/m^2	26.3 (24.0–29.1)
BSA, m^2	2.0 (1.8–2.1)
Primary clinical presentation	
Symptoms of ACS	74 (36.5)
Subacute new-onset HF	62 (30.5)
Reoccurring episodes of overt HF	18 (8.9)
Combination of palpitations, fatigue, dyspnea on exertion	49 (24.1)
Aborted SCD	0
Initial NYHA functional class	
I	48 (23.6)
II	64 (31.5)
III	71 (35.0)
IV	20 (9.9)
Virus type by endomyocardial biopsy	
PVB19	113 (55.7)
HHV6	49 (24.1)
PVB19/HHV6	35 (17.2)
EBV	2 (1.0)
PVB19/HHV6/EBV	1 (0.5)
PVB19/EBV	2 (1.0)
HHV6/EBV	1 (0.5)
Blood testing	
Troponin positive	46 (22.7)
BNP, pg/ml	190 (39–652)
NT-proBNP, pg/ml	1,938 (220–8822)
CMR imaging parameter	
LVEF, %	45 (31–60)
EF indexed, %/m^2	23.7 (15.9–31.2)
Event	
All-cause death	39 (19.2)
Cardiac death	29 (15.0)
SCD	18 (9.9)

STIR T2-pesate acquisite ma non riportate

Iter diagnostico nei pazienti con miocardite – Cardiologia Niguarda

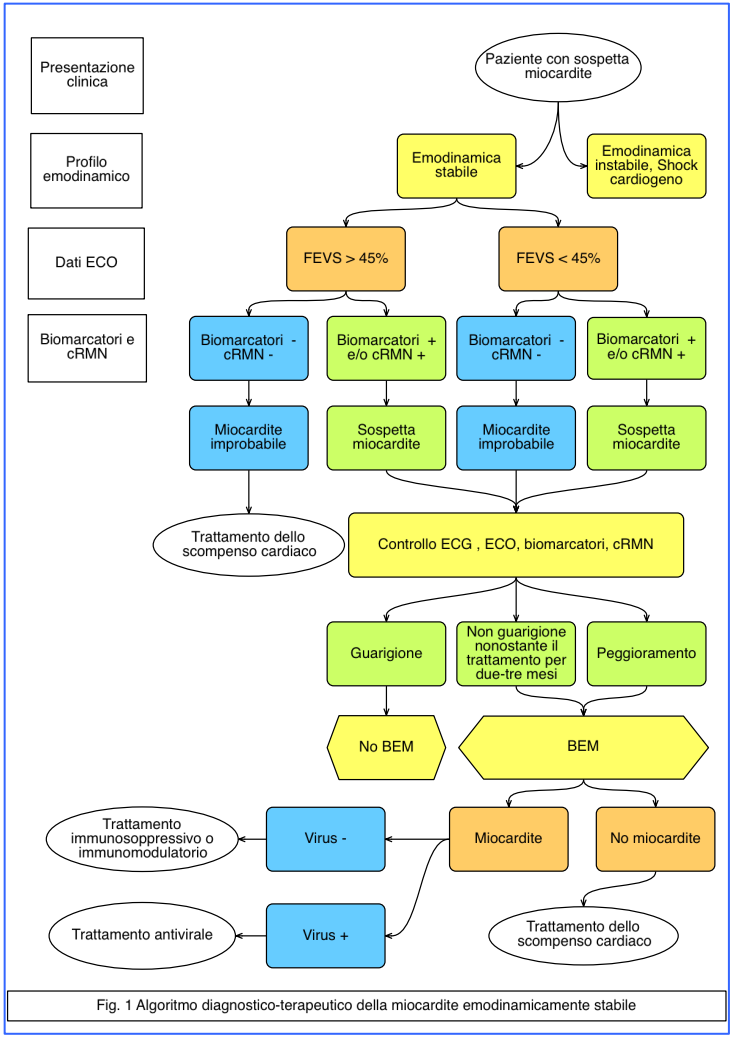


Fig. 1 Algoritmo diagnostico-terapeutico della miocardite emodinamicamente stabile

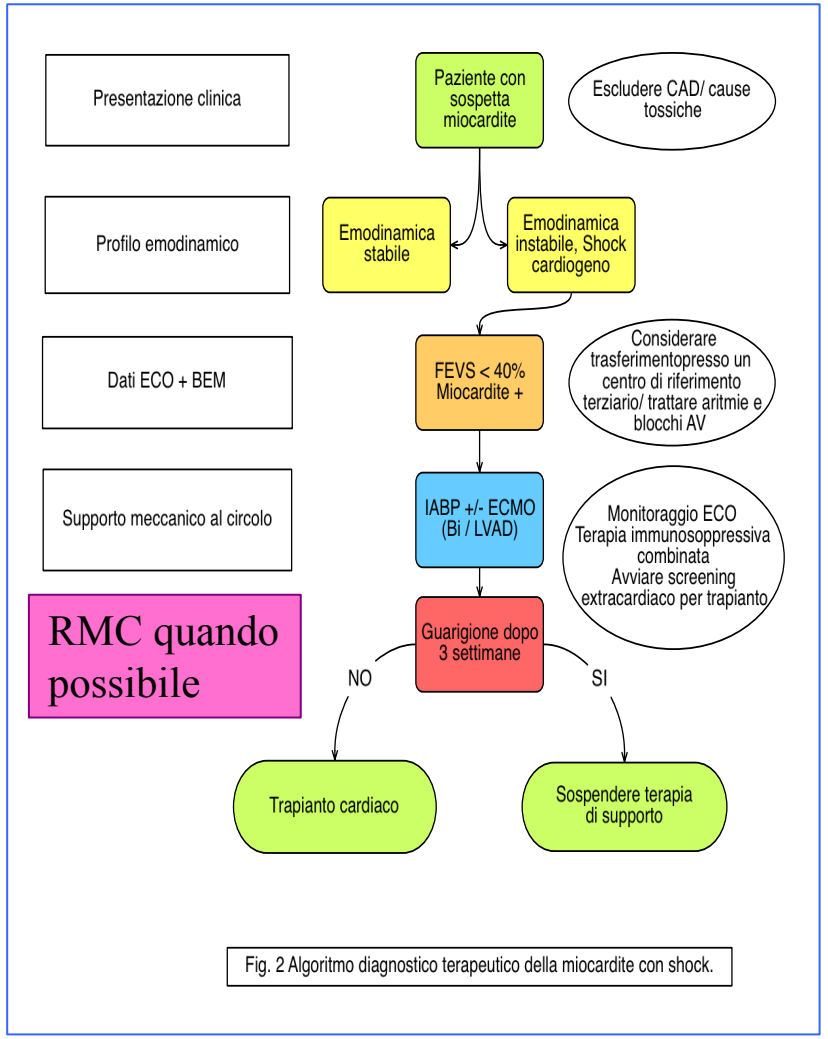


Fig. 2 Algoritmo diagnostico terapeutico della miocardite con shock.

Cortesia Dr E. Ammirati, H. Niguarda
Pollack A, Nature Rev Cardiol 2015

CONCLUSIONI

- Imaging esaustivo se decorso clinico non complicato ad evoluzione favorevole (pazienti a basso rischio)
- L'imaging avanzato con TC, TC/PET deve integrare l'iter diagnostico di forme con componente sistemica (es. sarcoidosi, Churg Strauss; coro TC per rule out CAD)
- L'imaging deve essere previsto anche nel follow-up, per monitorizzare la regressione/ripresa di flogosi miocardica e regressione/persistenza/entità LGE
- Ampia area grigia sul significato prognostico/decisioni terapeutiche nei pz con significativo LGE persistente ed FE conservata/lievemente ridotta
- Consensus su durata e modalità del follow-up