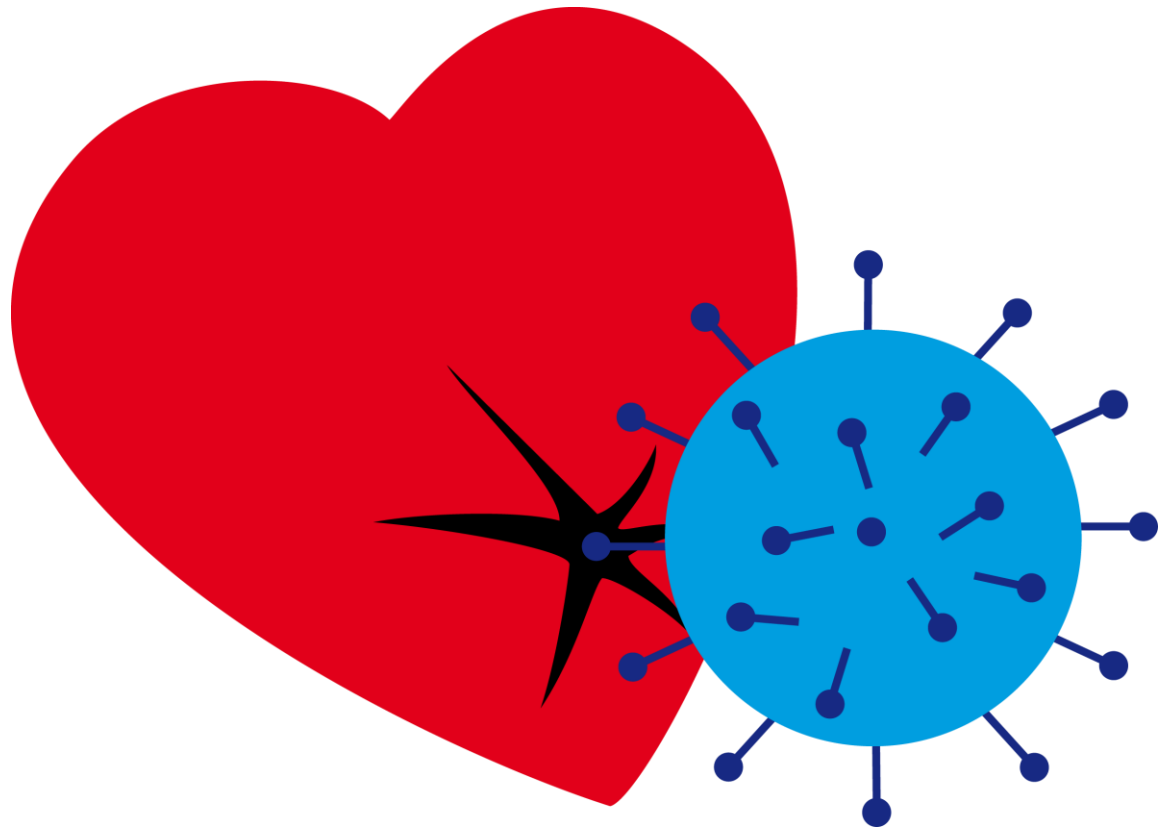


„Herz, Virus und Immunsystem“

Gemeinsame Fortbildungsveranstaltung des Instituts für Cardiomyopathien Heidelberg
und des Kardiologen-Qualitätszirkels Heidelberg-Mannheim



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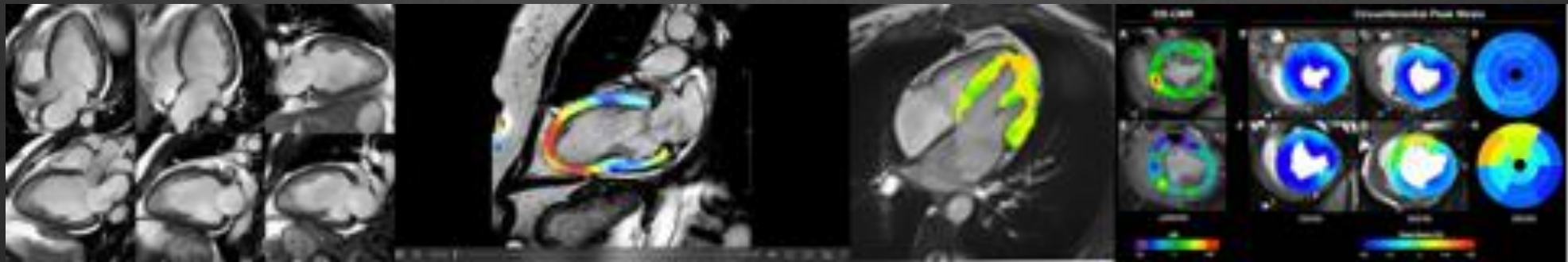
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Haben Sie Lust bekommen, selbst einmal zu stöbern und die Inhalte zu entdecken? Dann melden Sie sich gleich an unter www.zusammen-gesund.de/Anmeldung

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Myokarditis in der MRT – braucht es eine Biopsie?

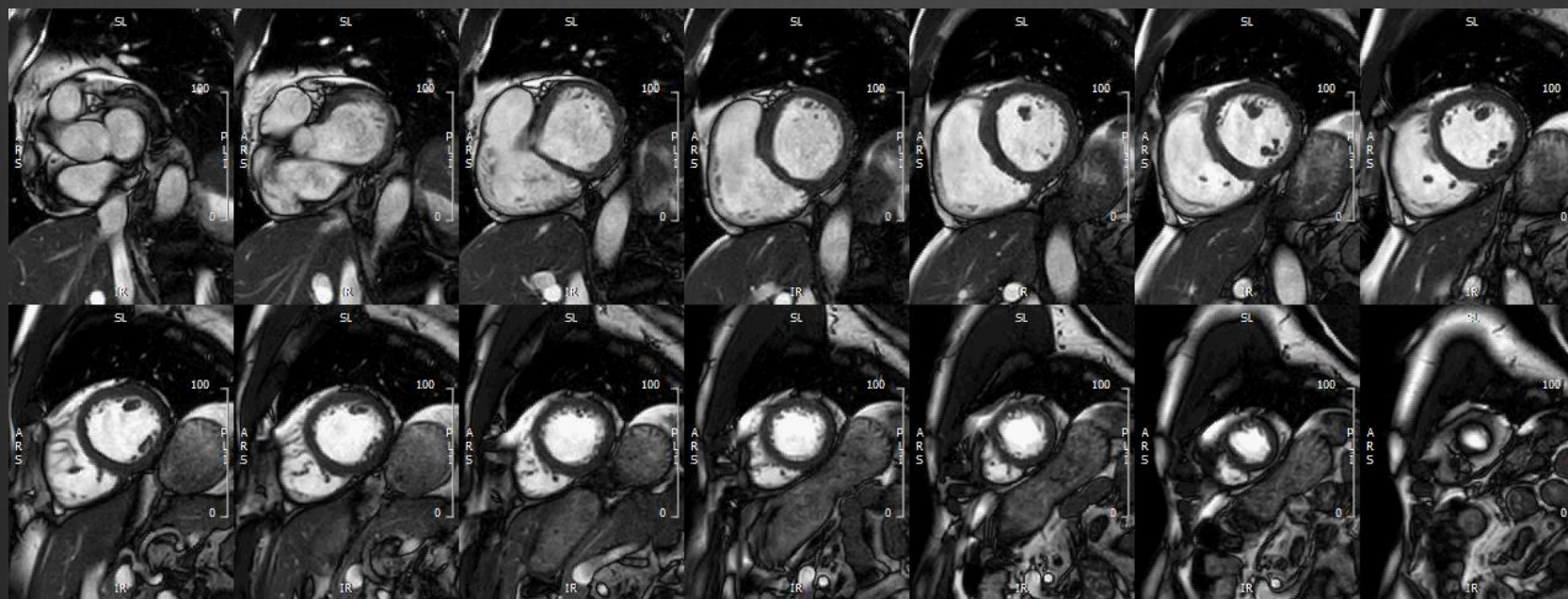
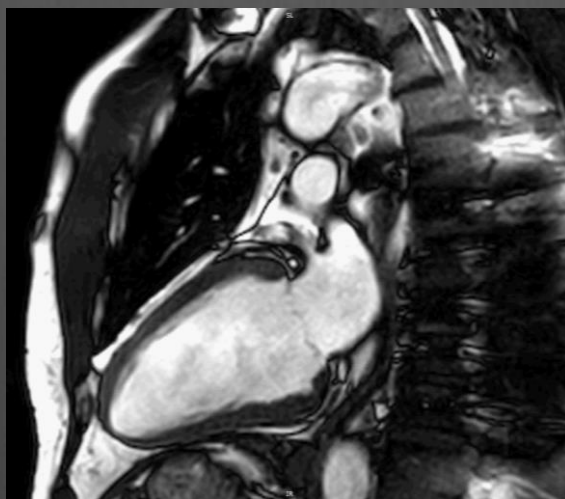
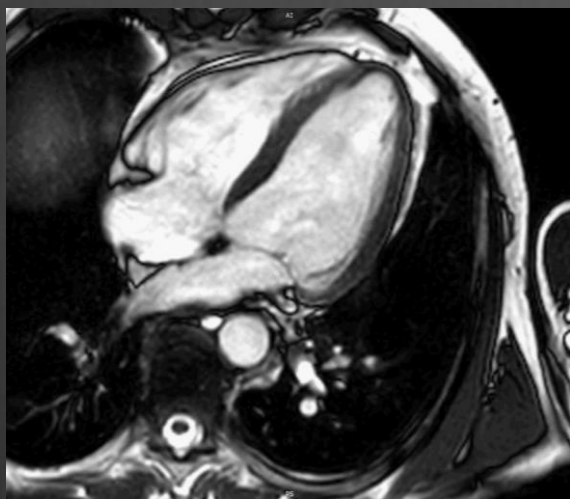


Johannes Riffel

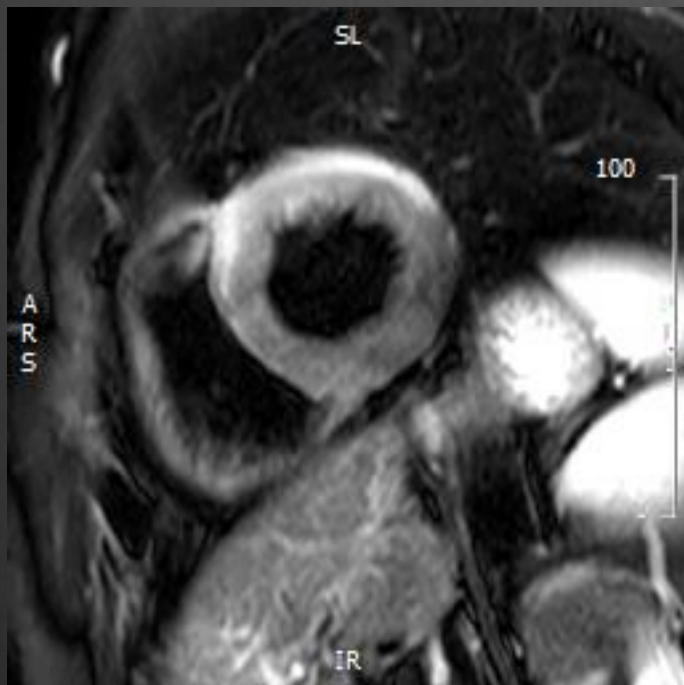
MYOCARDITIS - CASE 1

- 35 y, male patient
- Recurrent Angina
- ECG: normal, hsTroponinT 540 pg/ml, elevated CRP, normal Leucocytes
- Cath-Lab: CAD excluded

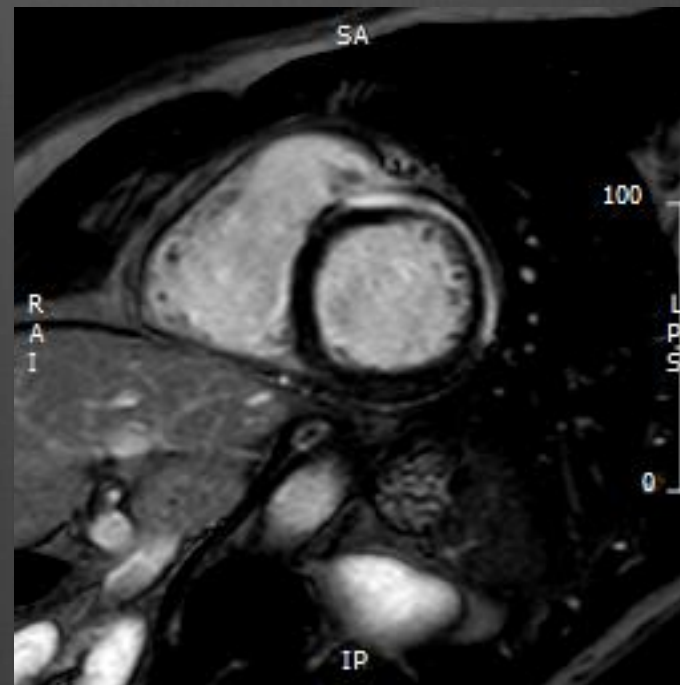
MYOCARDITIS - CASE 1



MYOCARDITIS - CASE 1



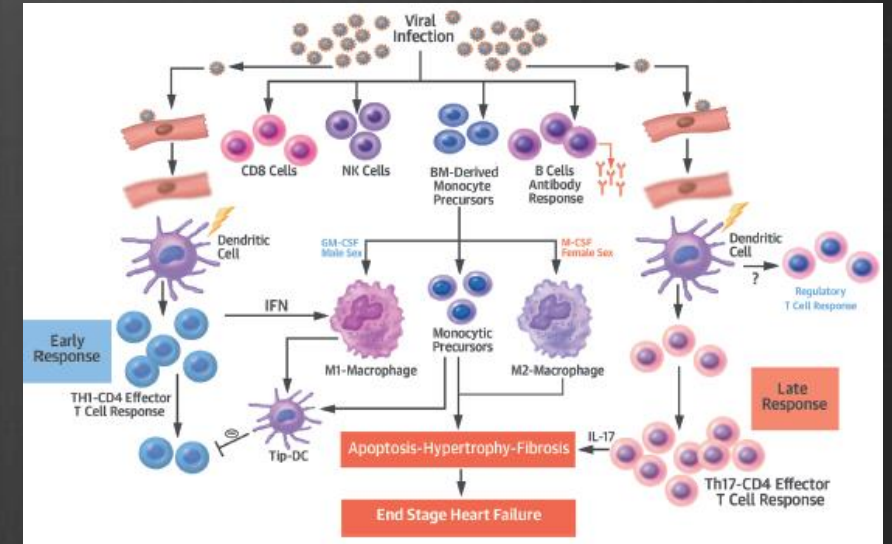
edema



LGE

Causes of myocarditis/inflammatory cardiomyopathy

- Infectious myocarditis
 - Viral, bacterial, fungal, parasitic ...
- Immune-mediated
 - Autoantigens (Sarcoidosis, Lupus, Churg-Strauss...)
 - Allergens (Drugs, Vaccine...)
 - Alloantigens (HTX)
- Toxic myocarditis
 - Drugs, Heavy metals, Radiation ...



MYOCARDITIS - DIAGNOSIS

Table 4 Diagnostic criteria for clinically suspected myocarditis

Clinical presentations^a

Acute chest pain, pericarditic, or pseudo-ischaemic

New-onset (days up to 3 months) or worsening of: dyspnoea at rest or exercise, and/or fatigue, with or without left and/or right heart failure signs and/or aborted sudden cardiac death

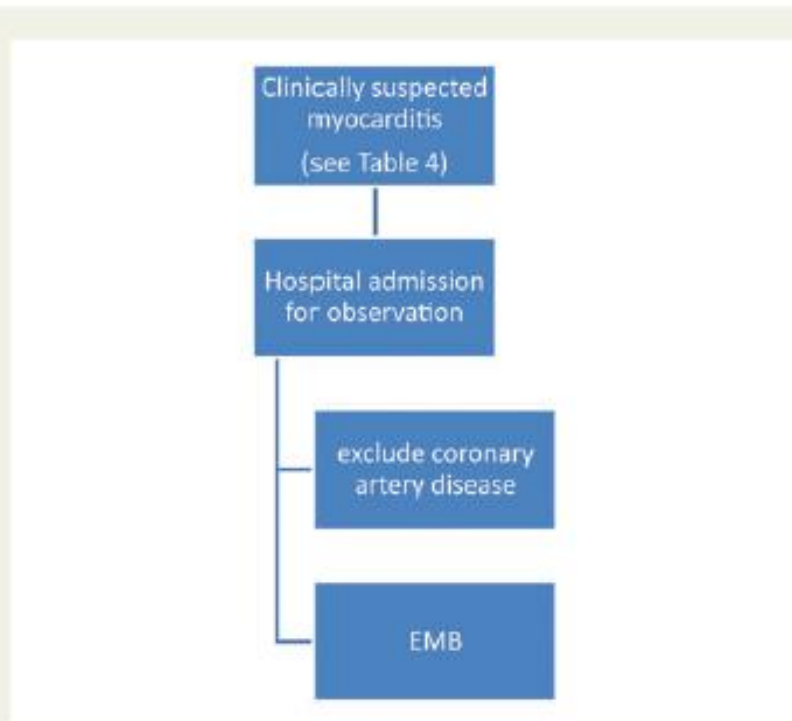


Figure 3 The flow chart shows the proposed diagnostic approach for patients with clinically suspected myocarditis according to Table 4.

Exercise, and/or fatigue, with or without left and/or right heart failure signs and/or aborted sudden cardiac death

of the following: I to III degree atrioventricular block, or bundle branch block, ST/T wave depression (or ST/T wave elevation), sinus arrest, ventricular tachycardia or fibrillation and asystole, atrial fibrillation, prolonged QTc interval (or QTc interval > 440 ms), abnormal Q waves, low voltage, frequent premature beats, or frequent premature beats

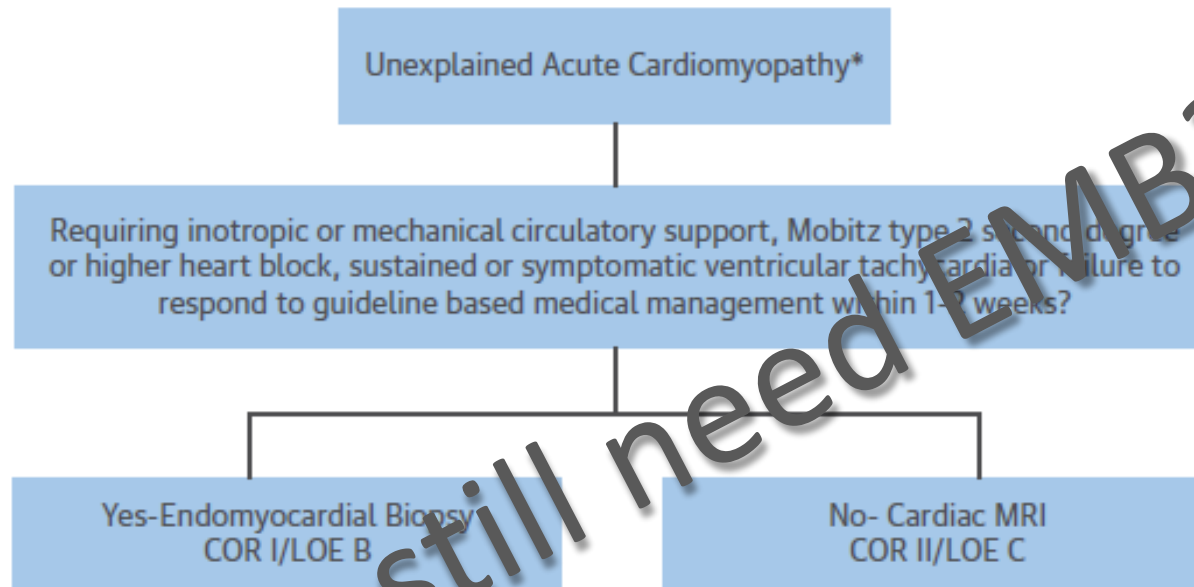
ECG or/CMR)

Abnormality (including incidental finding in apparently asymptomatic subjects): regional wall motion abnormality without ventricular dilatation, with or without increased wall thickness, with or without late gadolinium enhancement

Diagnosis of myocarditis is based on the presence of two or more of the following criteria from different categories, in the absence of: (1) angiographically detectable coronary artery disease; (2) non-cardiac causes that could explain the syndrome (e.g. valve disease, congenital heart disease, congenital or acquired long QT syndrome, aortic dissection, etc.).

MYOCARDITIS - DIAGNOSIS

FIGURE 4 Algorithm for the Evaluation of Suspected Myocarditis

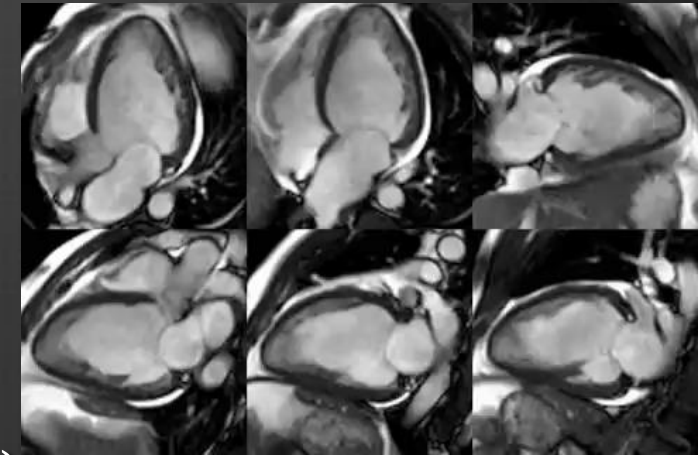
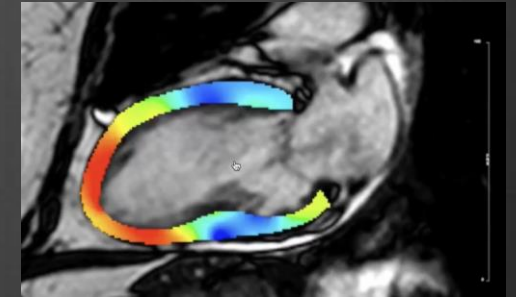


Endomyocardial biopsy (EMB) should be performed in those patients with clinically suspected unexplained acute myocarditis who require inotropic or mechanical circulatory support, Mobitz type 2 second degree or higher heart block, sustained or symptomatic ventricular tachycardia or failure to respond to guideline-directed medical management within 1 to 2 weeks. In other clinical scenarios of clinically suspected acute myocarditis, EMB may be helpful, but CMR may be considered as an initial diagnostic test to identify inflammation. Reprinted with permission from Bozkurt et al. (176). *Usually a dilated cardiomyopathy. Fulminant myocarditis may have normal end diastolic diameter with mildly thickened walls. Exclude ischemic, hemodynamic (valvular, hypertensive), metabolic, and toxic causes of cardiomyopathy as indicated clinically. CMR = cardiac magnetic resonance; COR = Class of recommendation; LOE = Level of Evidence; MRI = magnetic resonance imaging.

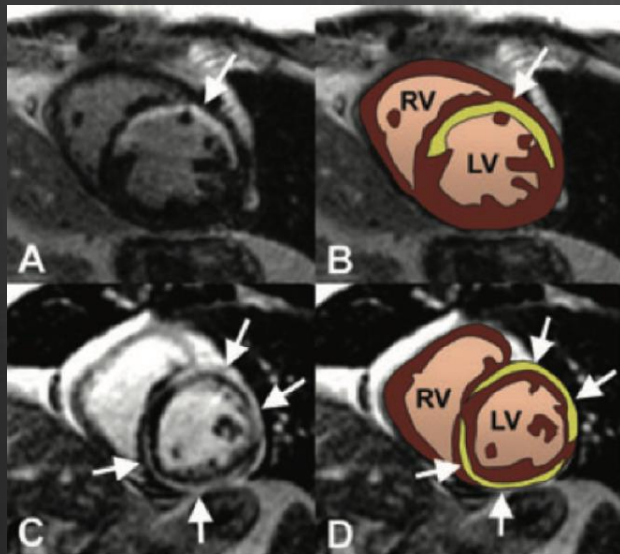
DO we still need EMB?

Unique Contributions of CMR in acute Myocarditis

- Gold standard for the quantitative assessment of cardiac morphology, volume and function
- Tissue characterization
 - Edema (acute, potentially reversible injury)
 - Necrosis, scar (irreversible injury)
 - Infiltration/storage (abnormal tissue components)

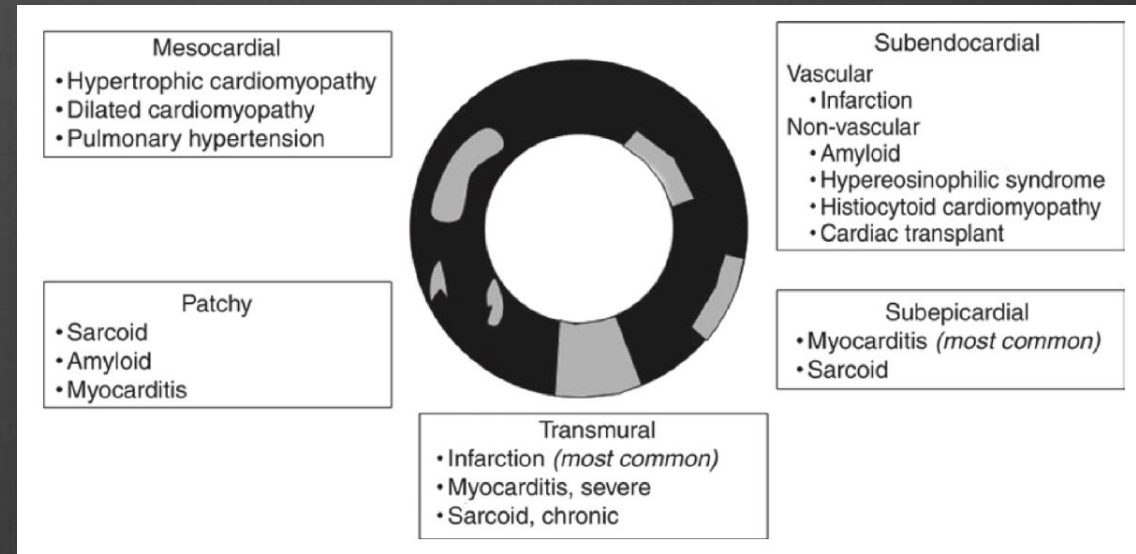


Appearance of irreversible myocardial injury



Sanz. Ann N Y Acad Sci 2012

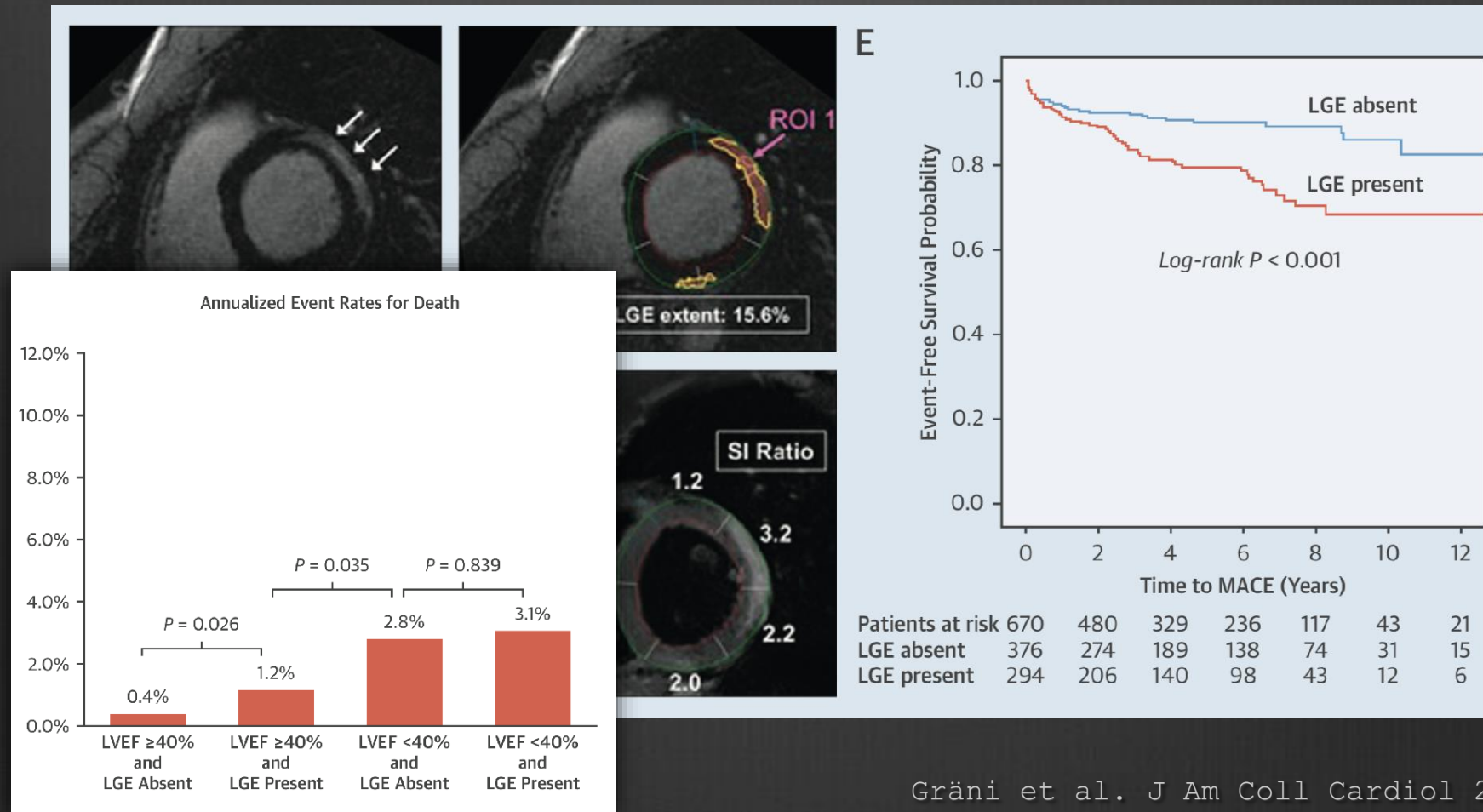
Ischemic vs non-ischemic



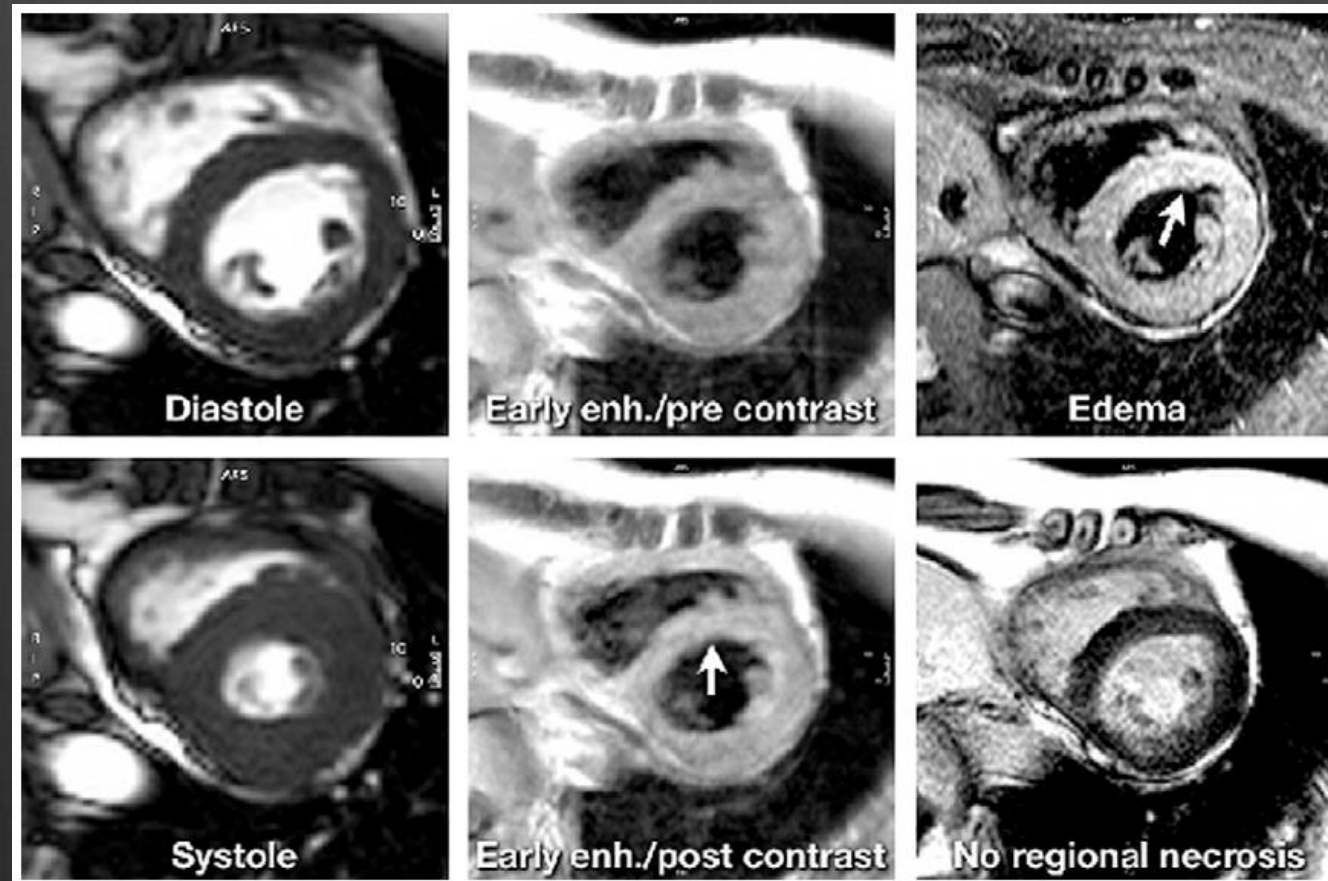
Cummings et al. Radiographics 2009

Non-ischemic etiology

CMR in myocarditis: Prognostic value of scars

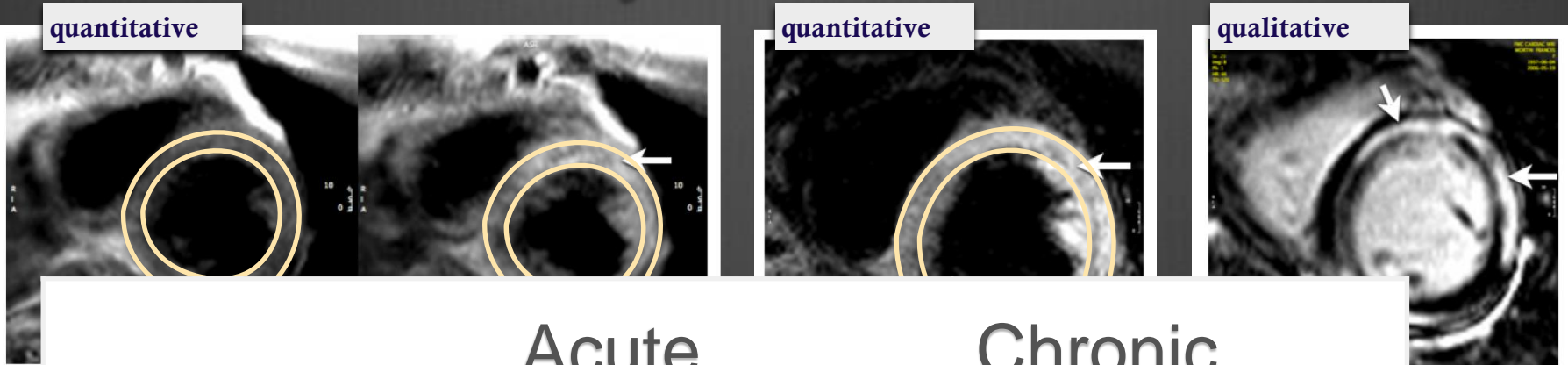


Lack of LGE in less severe acute myocarditis



2009: lake louise criteria for CMR in acute myocarditis

	Acute	Chronic
Sensitivity	81%	63%
Specificity	71%	40%
Accuracy	79%	52%

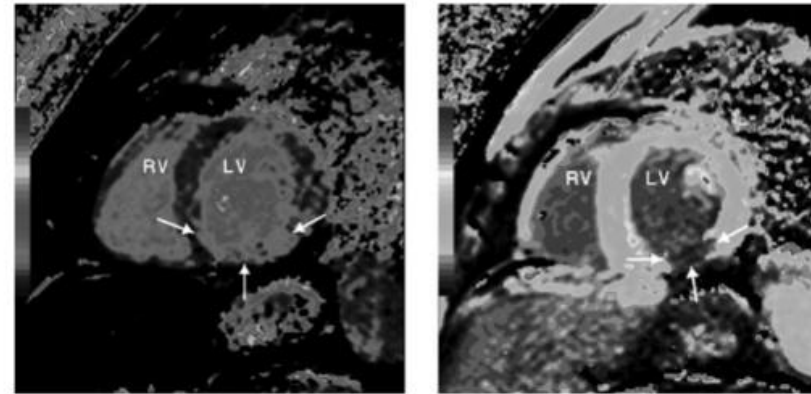
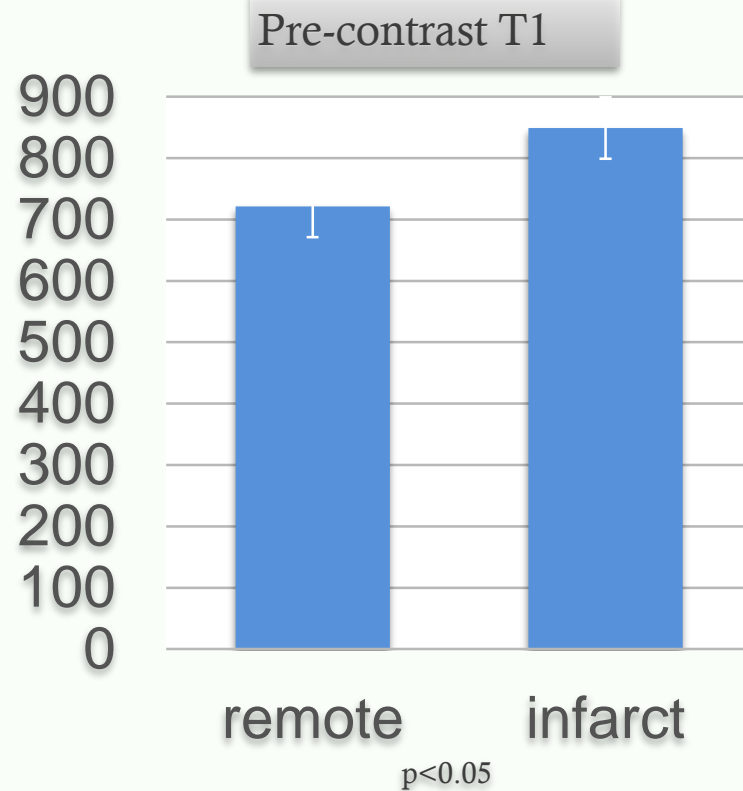


contrast
/scar

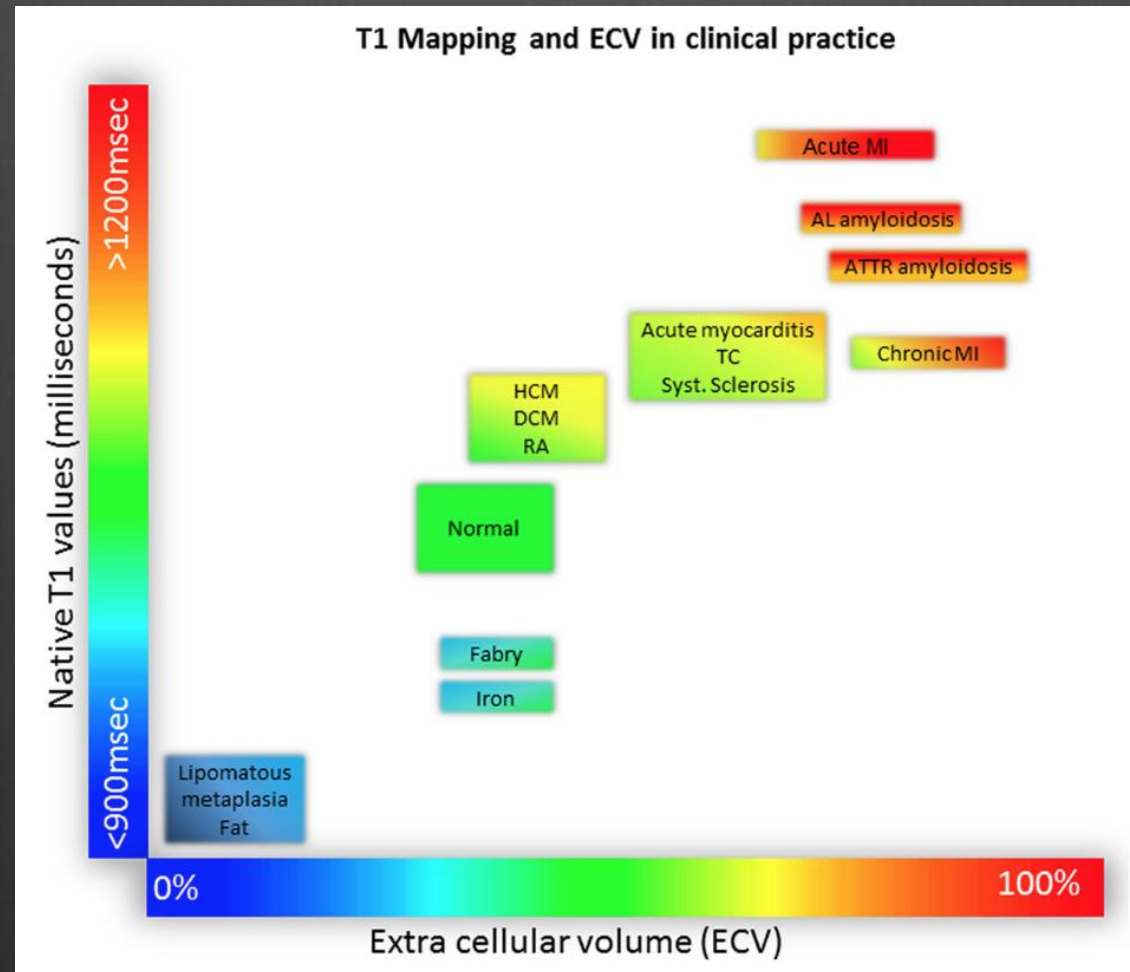
Myocardial mapping

T₁ Mapping in Patients with Acute Myocardial Infarction

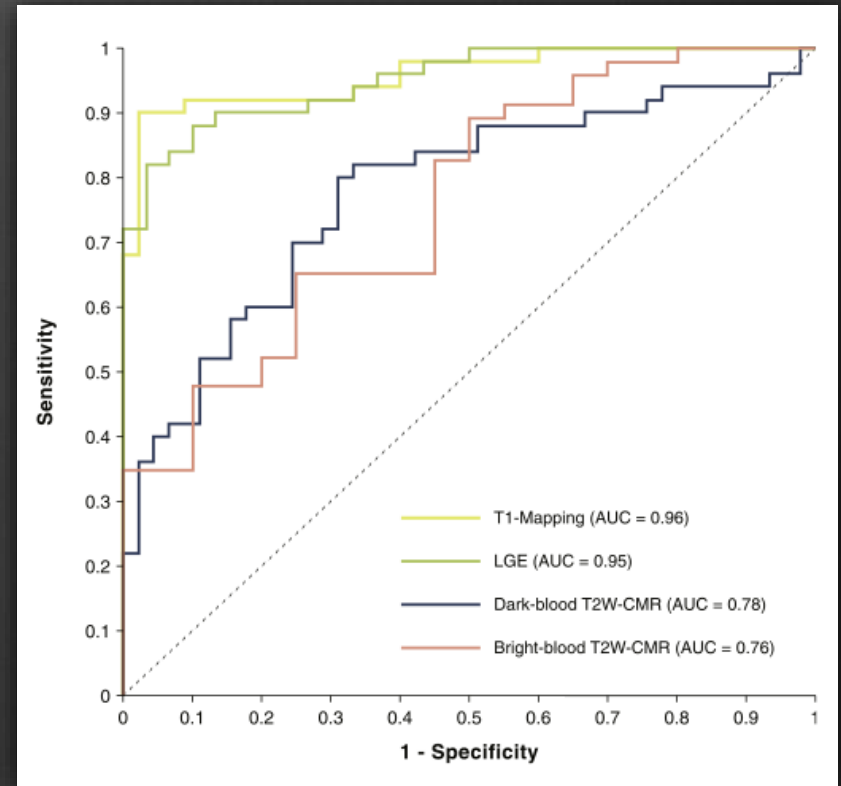
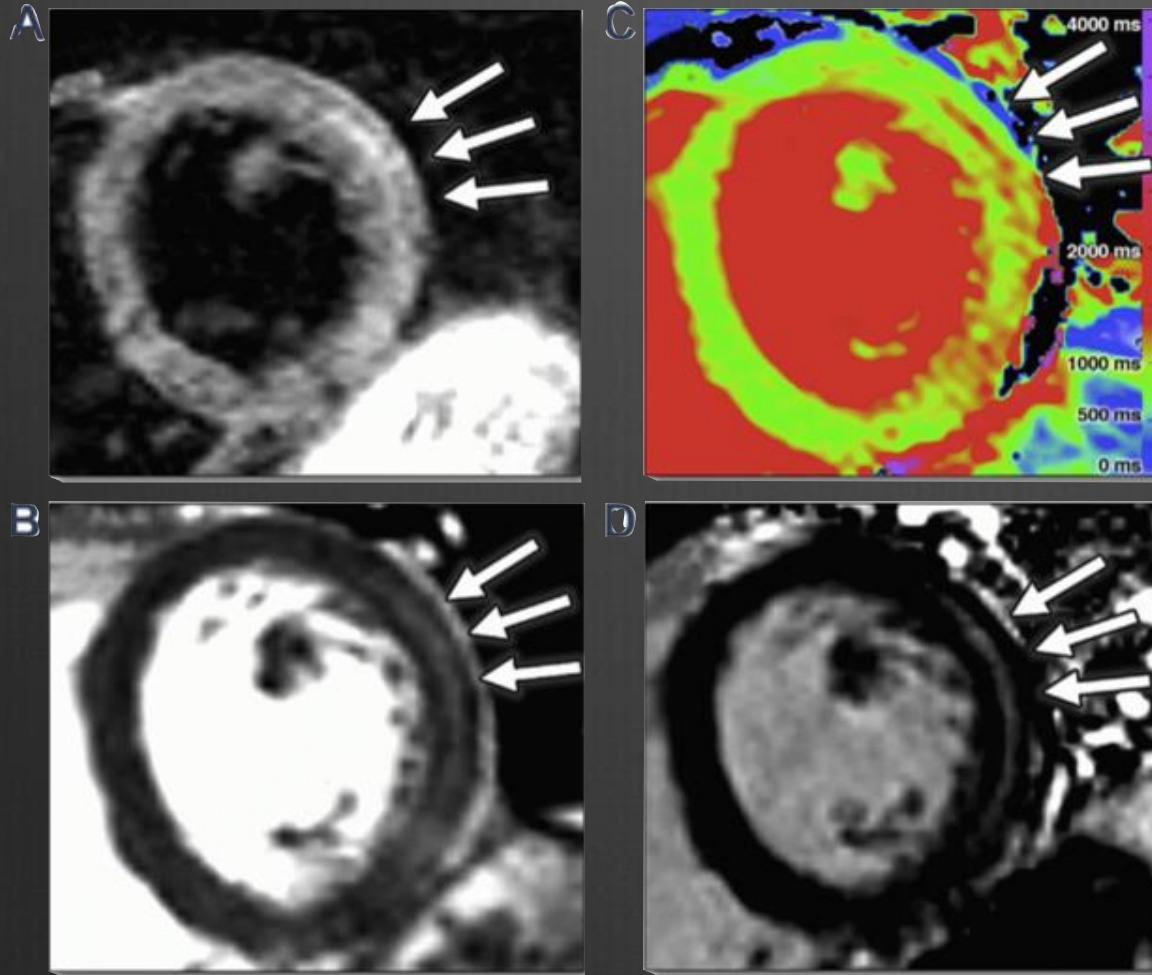
Daniel R. Messroghli,^{1,*} Thoralf Niendorf,² Jeanette Schulz-Menger,¹
Rainer Dietz,¹ and Matthias G. Friedrich¹



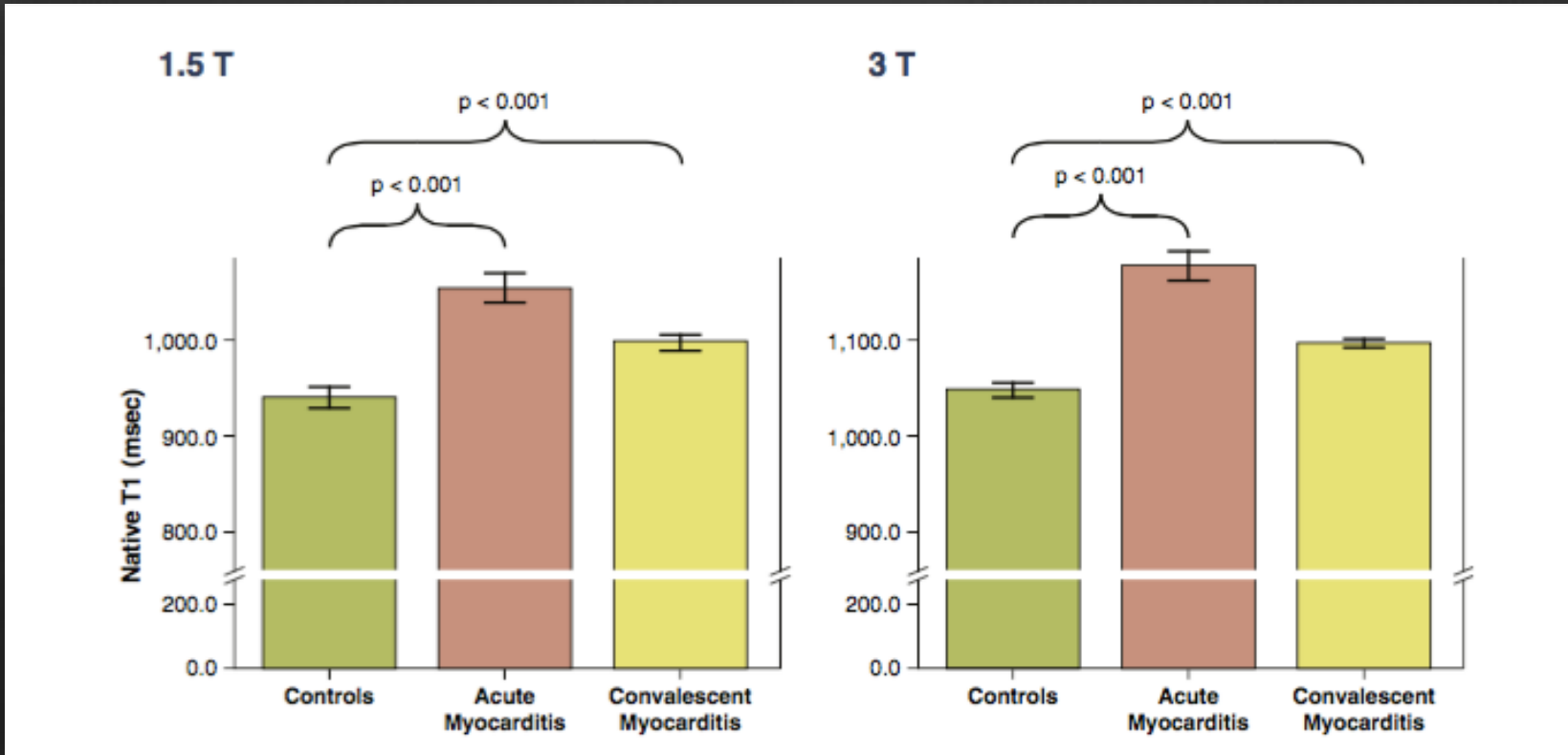
Myocardial mapping



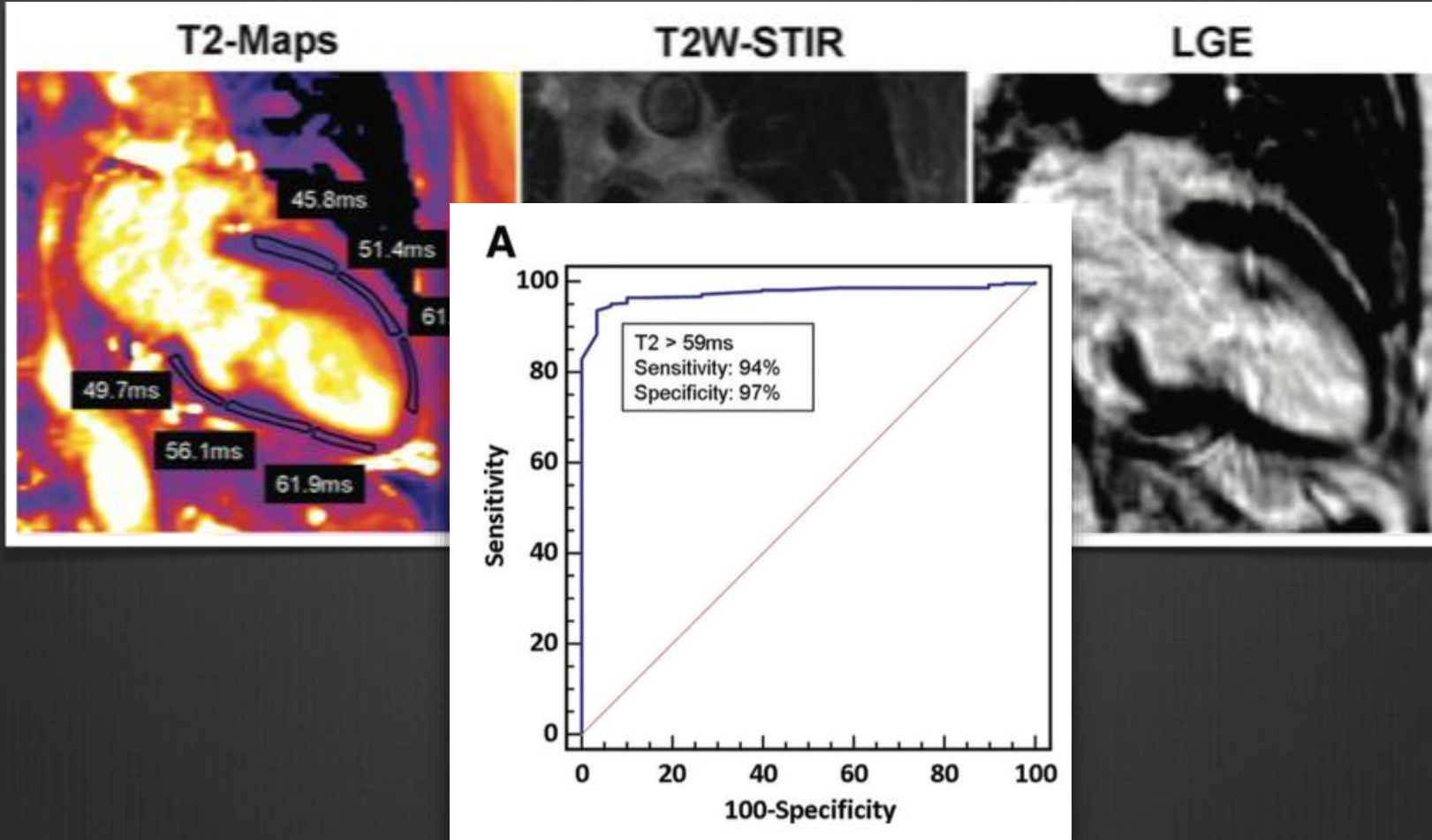
Myocardial mapping



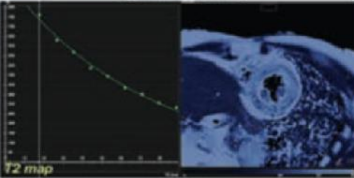
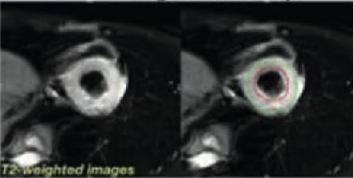
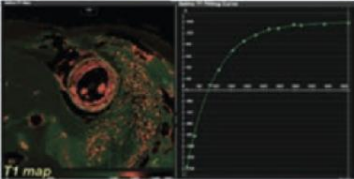
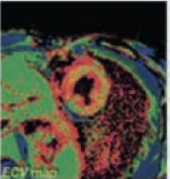
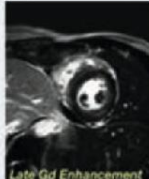
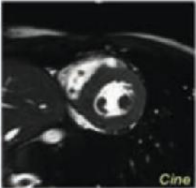
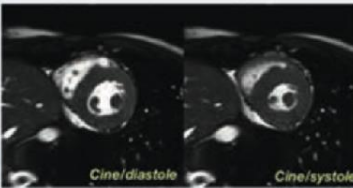
Native T1 in myocarditis



Native T2 in myocardial inflammation



2018 Update of lake louise criteria

	2018 Lake Louise Criteria	CMR Image Examples
Main Criteria	<p>Myocardial Edema (T2-mapping or T2W images)</p>	<p>Regional or global increase of native T2</p>  <p>or</p> <p>Regional or global increase of T2 signal intensity</p> 
	<p>Non-ischemic Myocardial Injury (Abnormal T1, ECV, or LGE)</p>	<p>Regional or global increase of native T1</p>  <p>or</p> <p>Regional or global increase of ECV</p>  <p>or</p> <p>Regional LGE signal increase</p> 
Supportive Criteria	<p>Pericarditis (Effusion in cine images or abnormal LGE, T2, or T1)</p>	<p>Pericardial effusion</p> 
	<p>Systolic LV Dysfunction (Regional or global wall motion abnormality)</p>	<p>Regional or global hypokinesis</p> 

Updated lake louise criteria

Radiology: Cardiothoracic Imaging

ORIGINAL RESEARCH

Comparison of Original and 2018 Lake Louise Criteria for Diagnosis of Acute Myocarditis: Results of a Validation Cohort

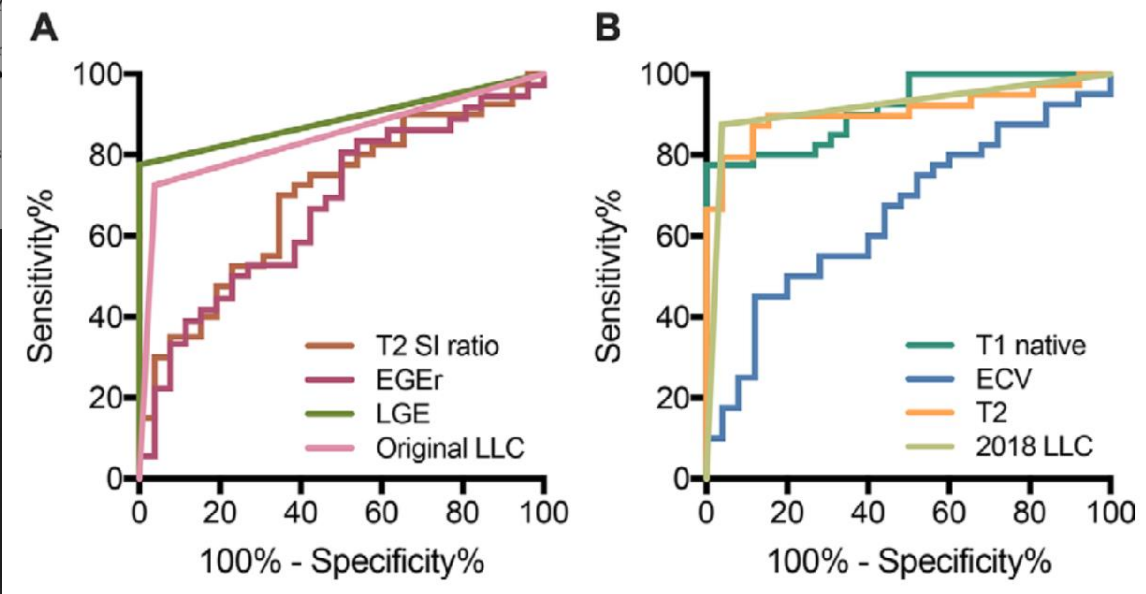
Julian A. Luetkens, MD • Anton Faron, MD • Alexander Isaak, MD • Darius Dabir, MD • Daniel Kuetting, MD • Andreas Feisst, MD • Frederic C. Schmeel, MD

From the Department of Radiology, University of Bonn, Siegen, Germany. Received March 14, 2019; revision received May 8; accepted May 14. Address correspondence to Julian A. Luetkens, MD, Department of Radiology, University of Bonn, Sigmund-Freud-Straße 25, 53105 Bonn, Germany; e-mail: julian.luetkens@ukb.uni-bonn.de

Conflicts of interest are listed at the end of this article.

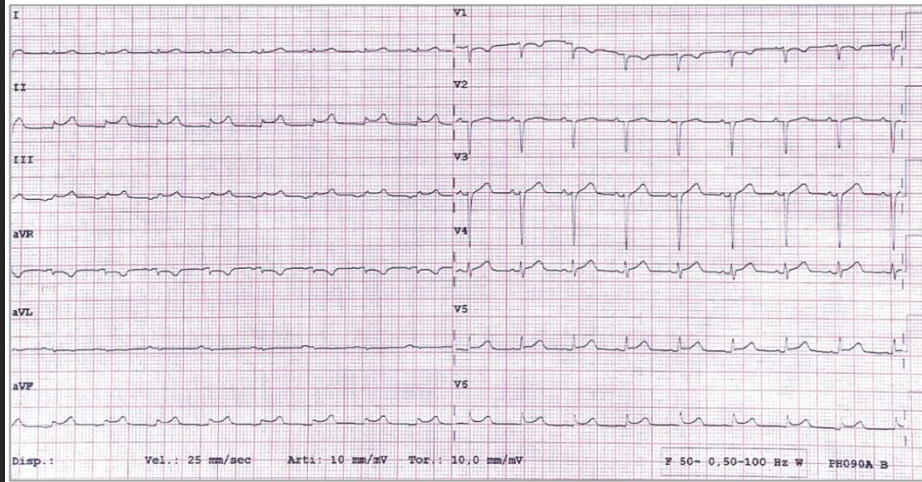
See also the commentary by Gutberlet and Lücke in this issue.

Radiology: Cardiothoracic Imaging 2019; 1(3):e190010 •

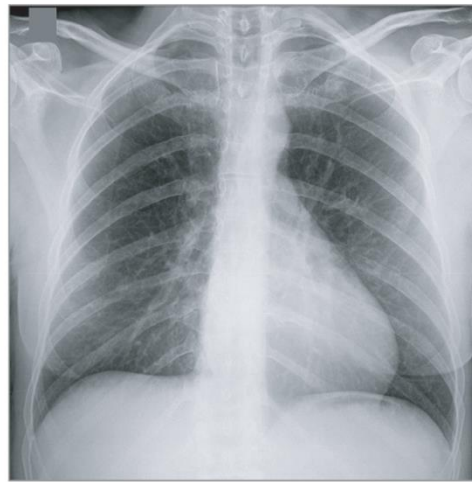


MYOCARDITIS IN COVID-19

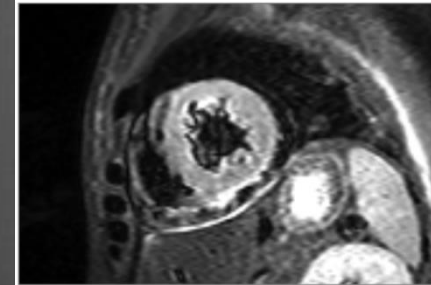
A Electrocardiography



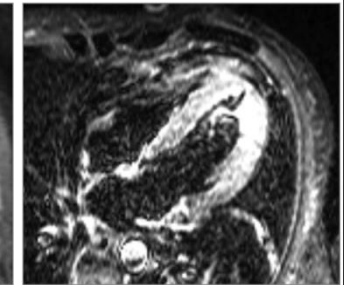
B Chest radiography



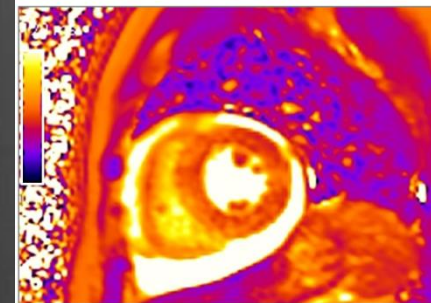
A STIR sequence in short-axis view



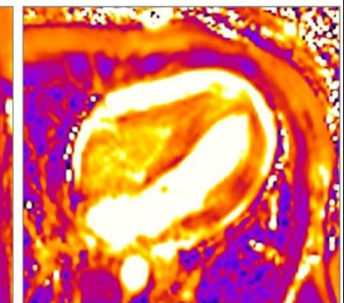
B STIR sequence in 4-chamber view



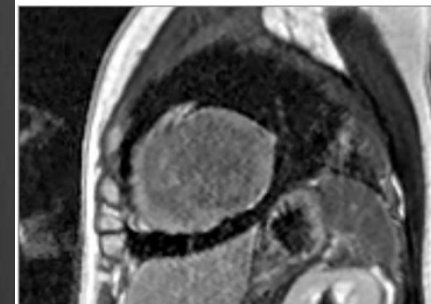
C T2-mapping sequence in short-axis view



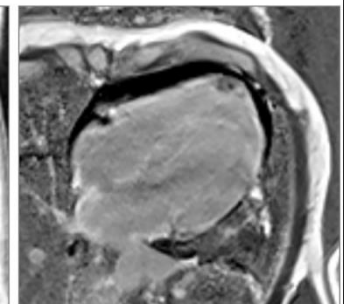
D T2-mapping sequence in 4-chamber view



E PSIR sequence in short-axis view



F PSIR sequence in 4-chamber view

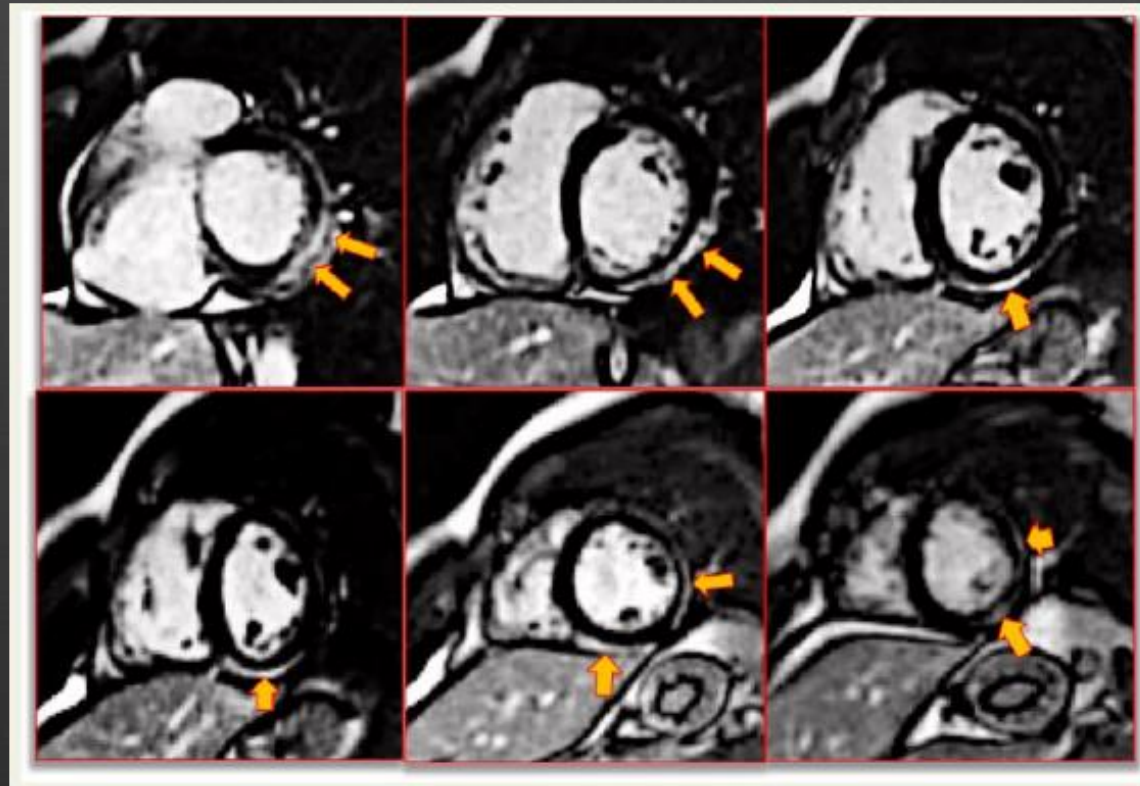


Myocarditis revealing COVID-19 infection in a young patient

Jean-François Paul*, Pierre Charles, Clémence Richaud, Christophe Caussin, and Christelle Diakov

Institut Mutualiste Montsouris, Paris, France

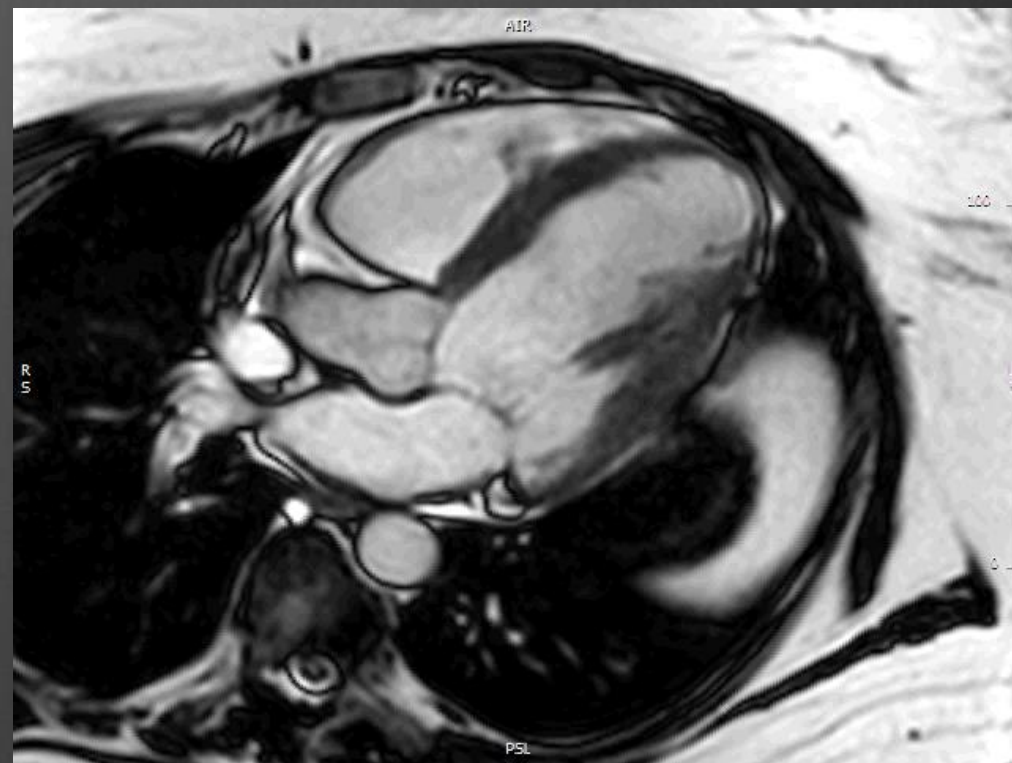
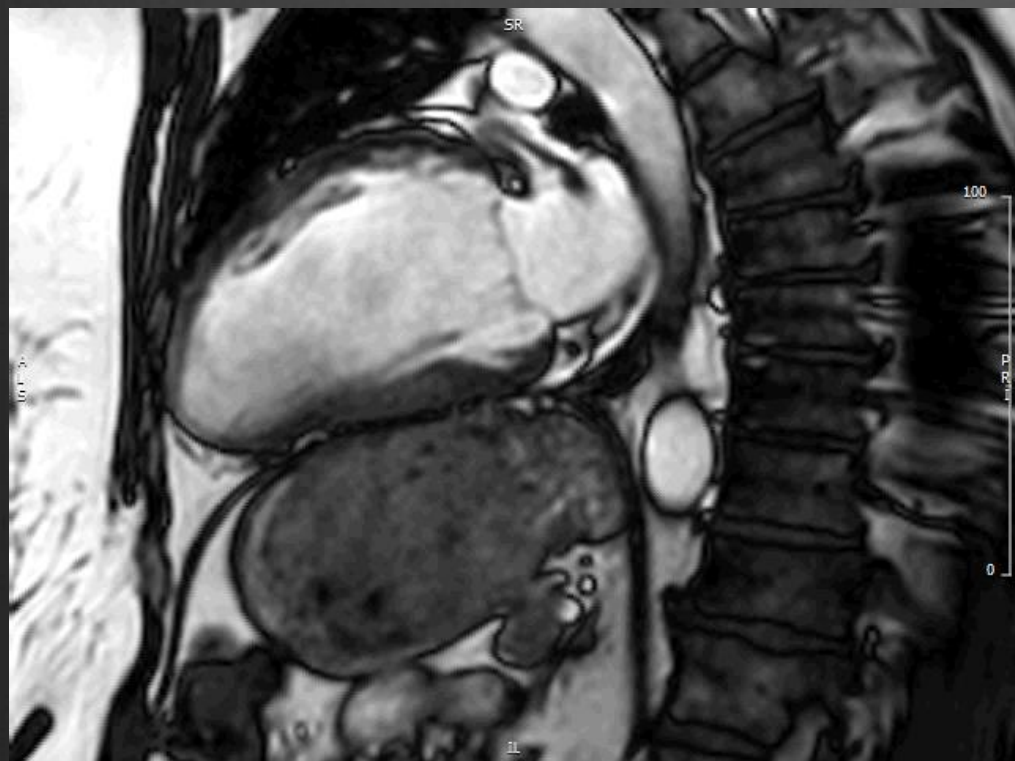
* Corresponding author. Institut Mutualiste Montsouris, 42 bd Jourdan, 75014 Paris, France. Tel: +33 1 56616057, Email: jean-francois.paul@imm.fr



CASE 2

- 45 y, female patient
- Resuscitation due to VF and NSTEMI
- CAD excluded, EMB: Hypertrophy (DD DCM), no Myocarditis, no Sarcoidosis

CASE 2

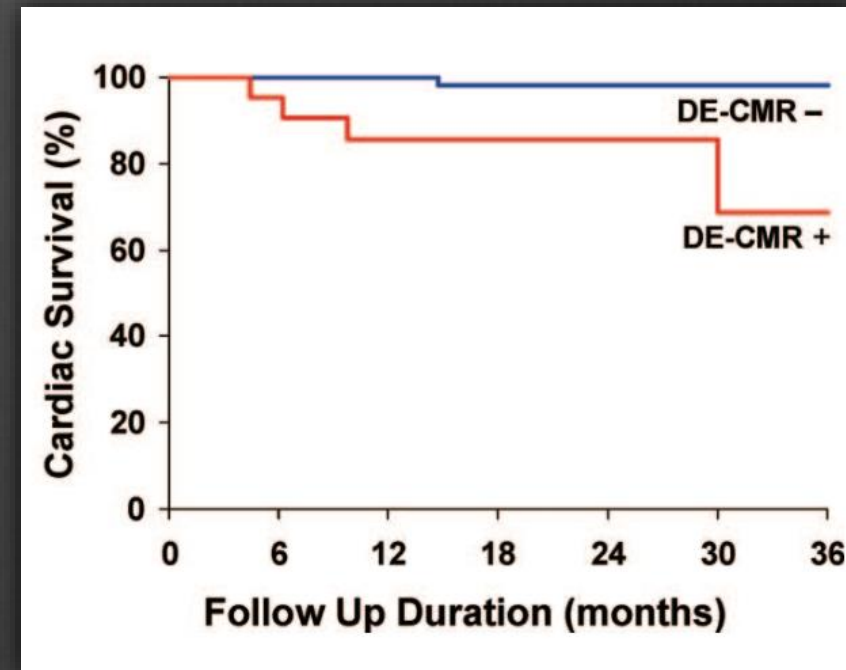
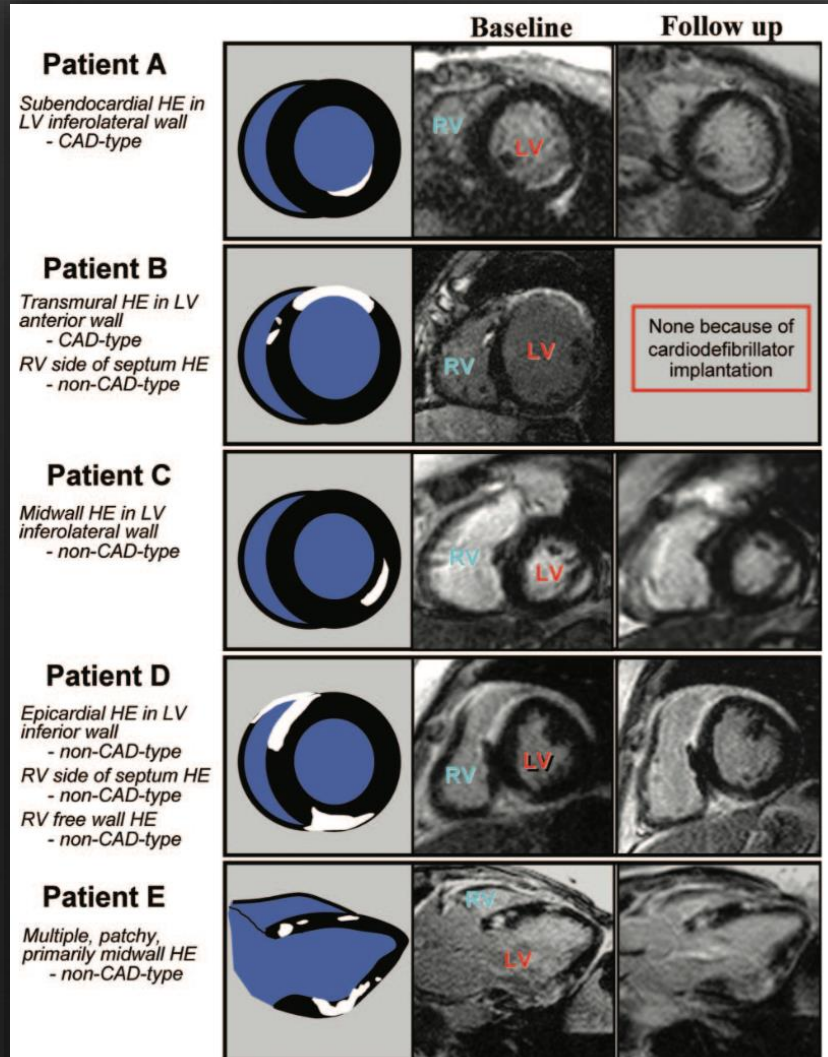


CASE 2

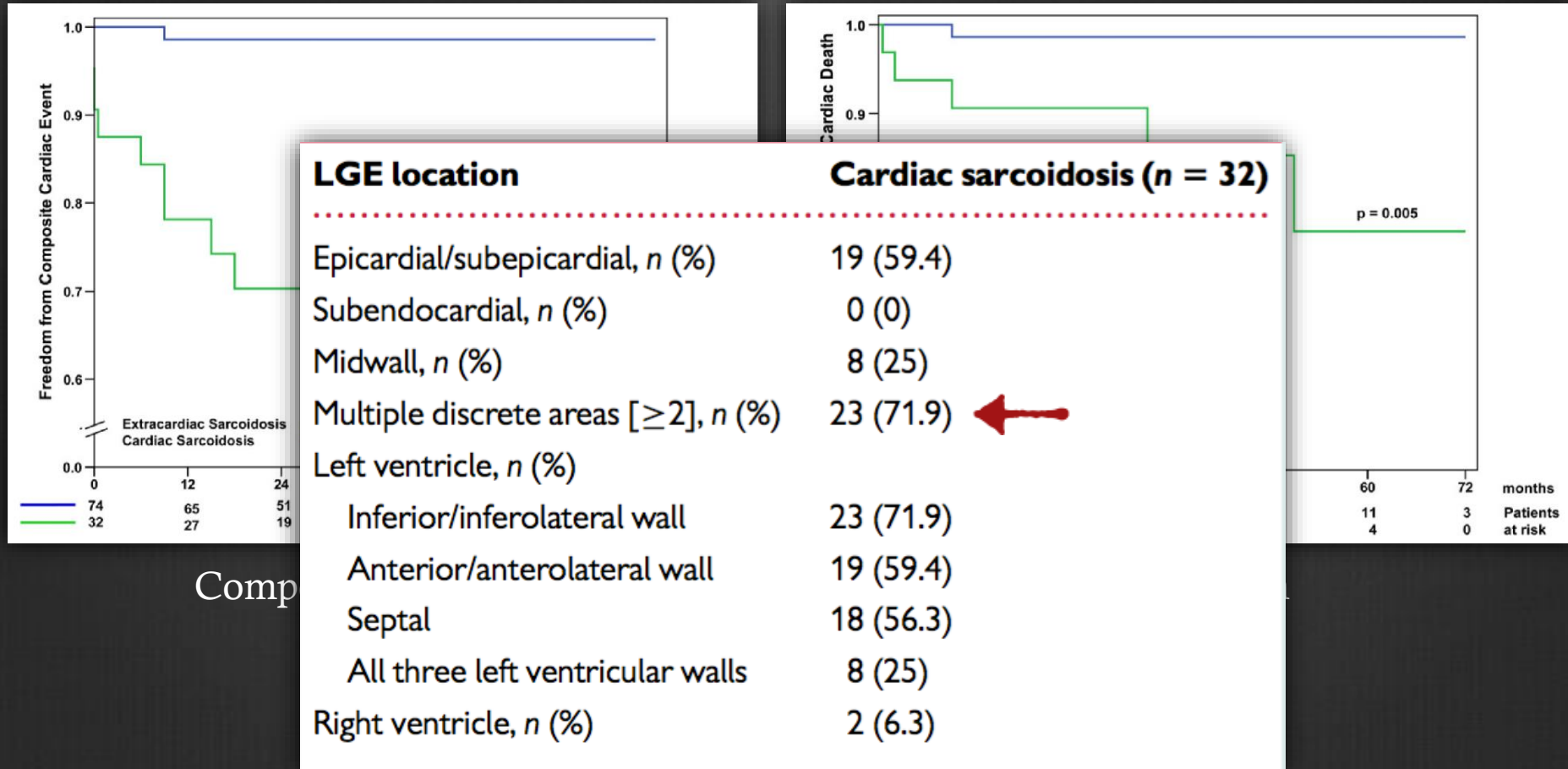


PET CT: Sarcoidosis, bilateral hilar lymphadenopathy

Patterns of Infiltration in Cardiac Sarcoidosis



Patterns of Infiltration in Cardiac Sarcoidosis



Comp

CONCLUSION

- CMR is gold standard for morphology and function
- Tissue characterization w/o contrast agent
 - Detection of Myocarditis (Lake Louise criteria)
 - Risk stratification
 - Differential diagnoses
- EMB may be helpful, but not in all cases necessary