PŘÍNOS MAGNETICKÉ REZONANCE

u nemocných s myokarditidou ve světle nových ESC doporučení z roku 2025

Pleva Martin

Nemocnice Podlesí, a.s., Třinec

Vítkovická nemocnice, a.s., Ostrava

Výroční sjezd ČKS Brno 11. 5. 2026

ESC European Society of Cardiology
European Heart Journal (2025) **46**, 3952–4041
https://doi.org/10.1093/eurheartj/ehaf192

2025 ESC Guideli
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Endorsed by the Associa
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for Cardio-Thoracic Surg

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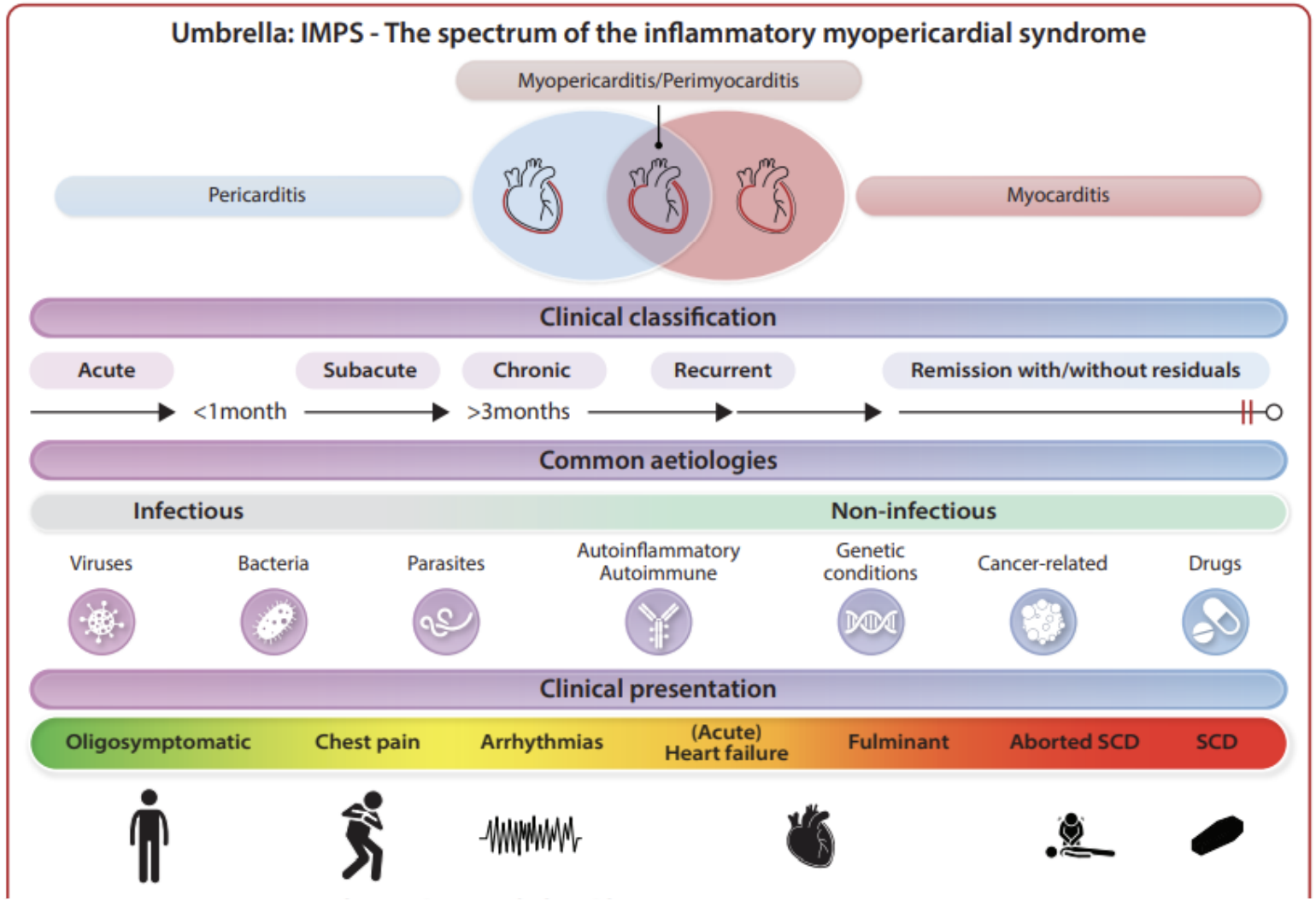
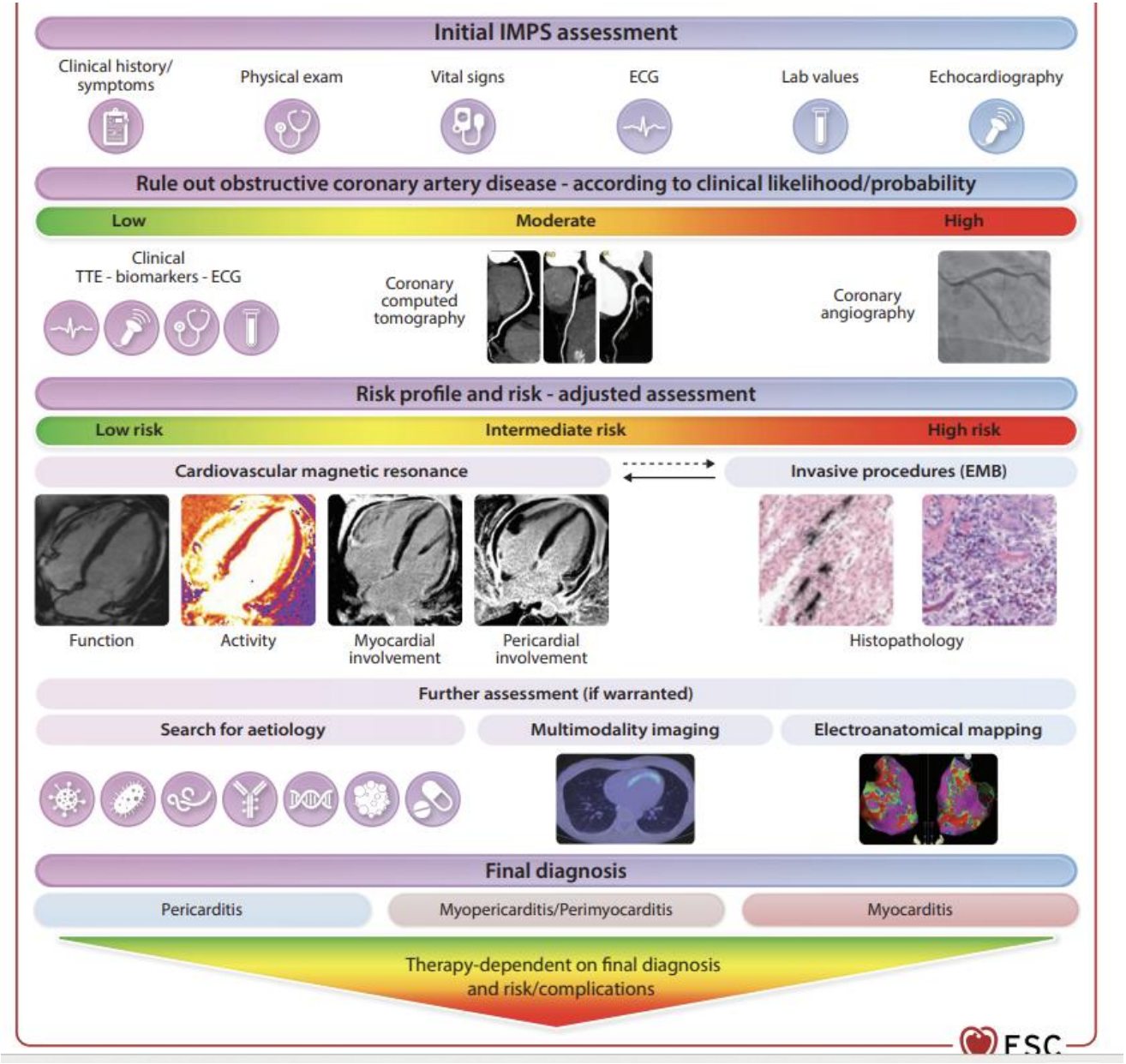
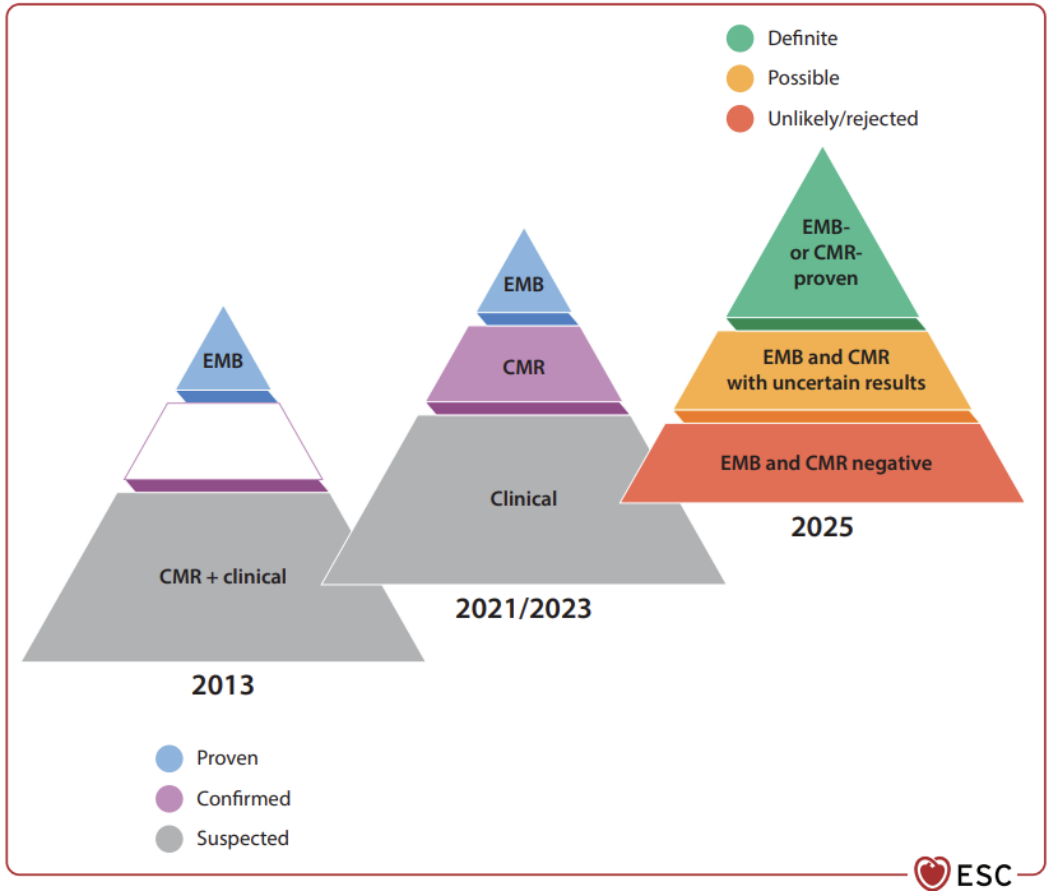






Schulz-Menger, J. et al. 2025 ESC Guidelines for the management of myocarditis and pericarditis. *European Heart Journal* (2025) 46, 3952–4041.

Diagnostika

EMB jako zlatý standard

- histologie a imunohistochemie – posouzení zánětlivé infiltrace myokardu (počet T lymfocytů > 7/mm²)
- PCR – přítomnost infekčního agens

CMR jako „zlatý neinvazivní“ standard

- přítomnost zánětlivých změn bez možnosti určení příčiny

Diagnostika myokarditidy

IMPS	
If diagnostic criteria for myocarditis and/or pericarditis are fulfilled[a]	
	Myocarditis
Definite	Clinical presentation[b] and CMR- or EMB-proven
Possible	Clinical presentation[b] with at least 1 additional criterion CMR- or EMB-uncertain or not available
Unlikely/rejected	Only clinical presentation[b] without additional criteria
Additional criteria beyond clinical presentations[b]	
	Myocarditis
Clinical[b]	Non-specific findings
ECG[c]	ST-T changes
Biomarkers	Troponin elevation
Imaging[d]	Abnormal strain, wall motion, reduced EF Myocardial oedema and/or LGE (CMR findings)

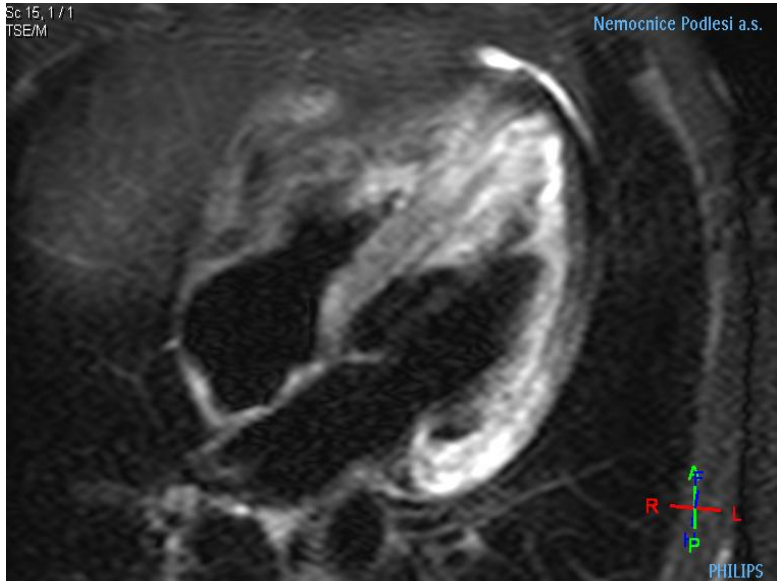
Recommendations	Class[a]	Level[b]
Myocarditis		
CMR is recommended in patients with suspected myocarditis to reach a clinical diagnosis and to determine the cause of acute myocardial injury, including assessment of oedema, ischaemia, and necrosis/fibrosis/scarring.[115,164,169–183]	**I**	**B**

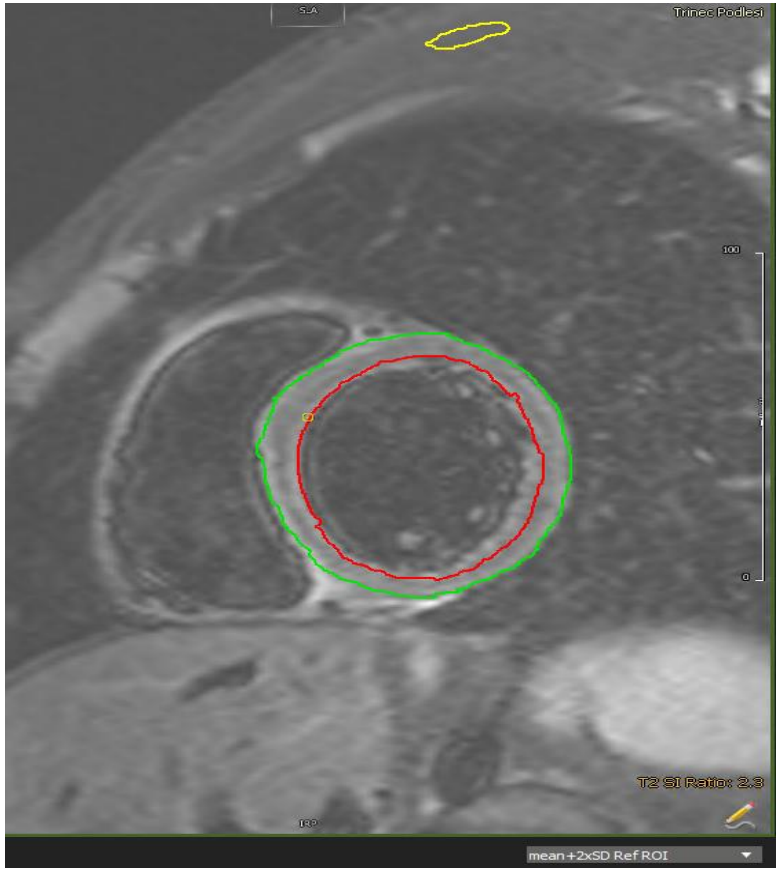
Schulz-Menger, J. et al. 2025 ESC Guidelines for the management of myocarditis and pericarditis. *European Heart Journal* (2025) 46, 3952–4041.

MR diagnostika

Průkaz edému (T2W obrazy):

- fokální
- difuzní

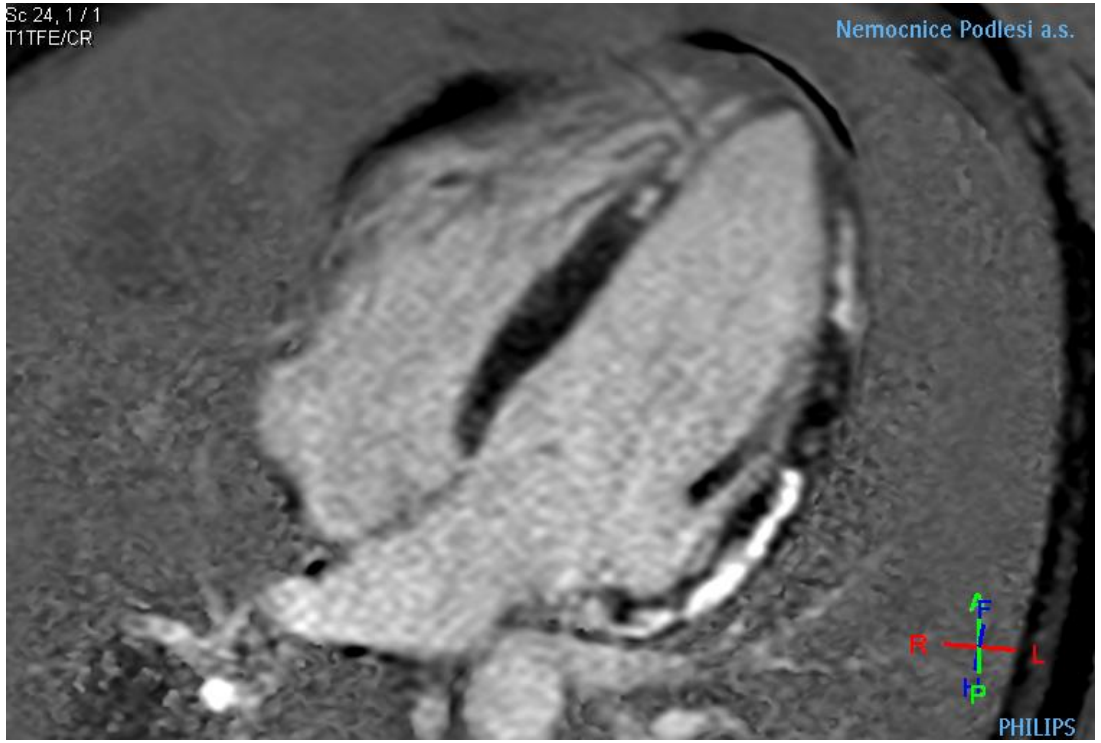


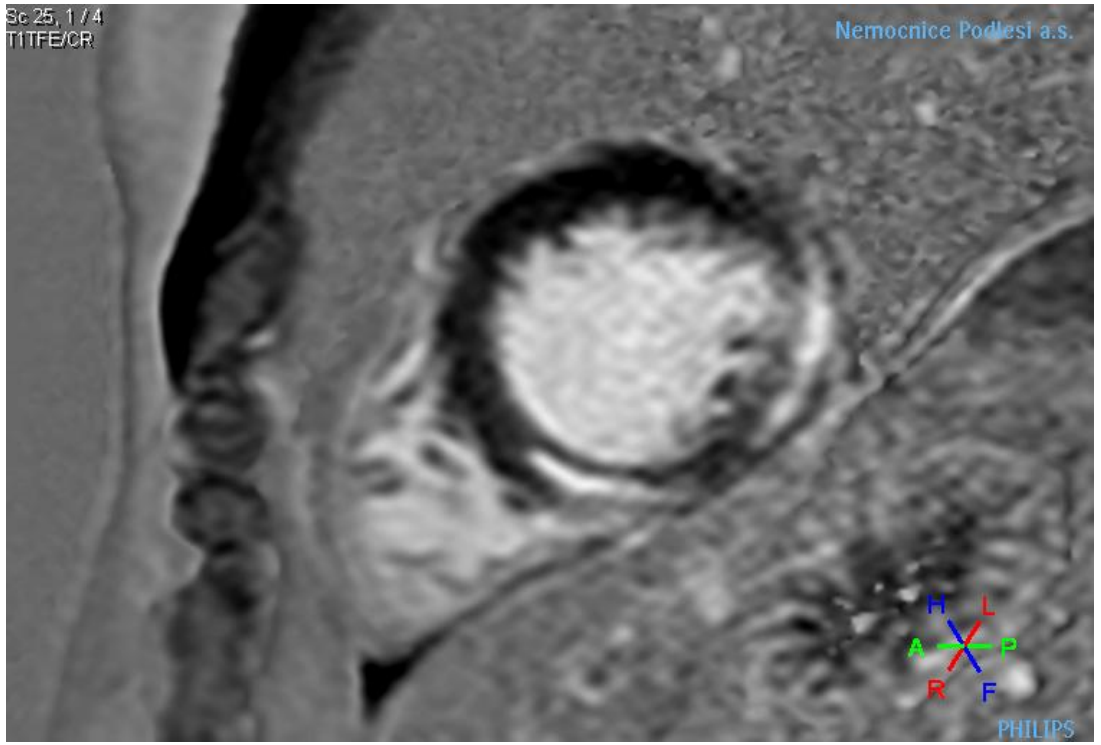


Edema ratio (SI myokardu/SI kosterního svalu) ≥ 2,0

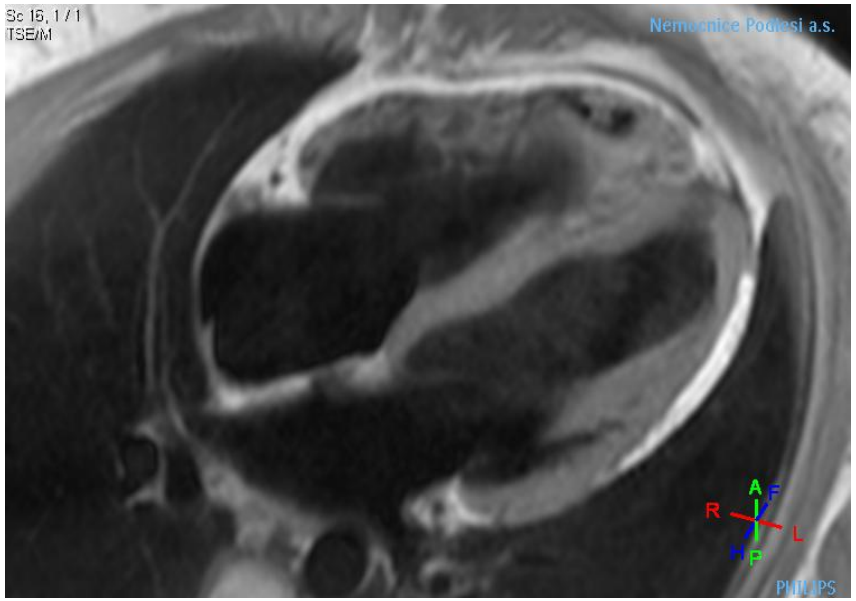
MR diagnostika

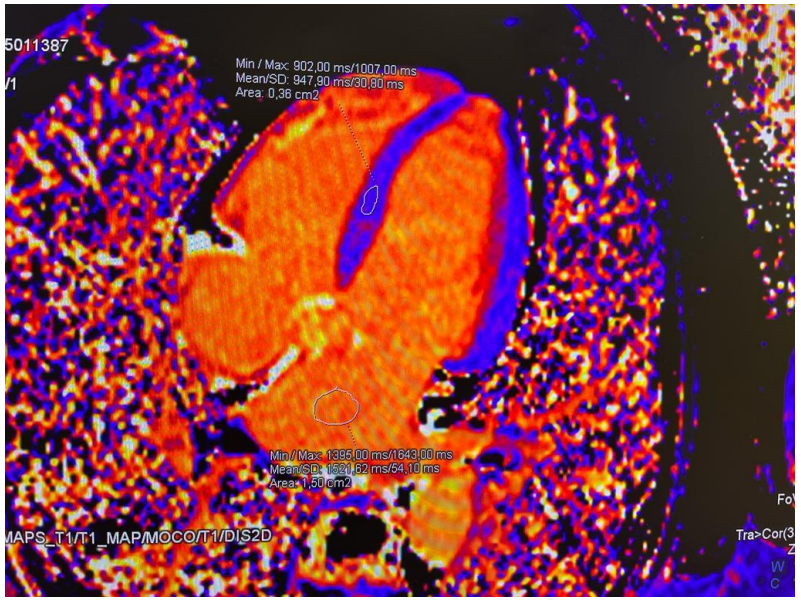
Late gadolinium enhancement neischemické etiologie

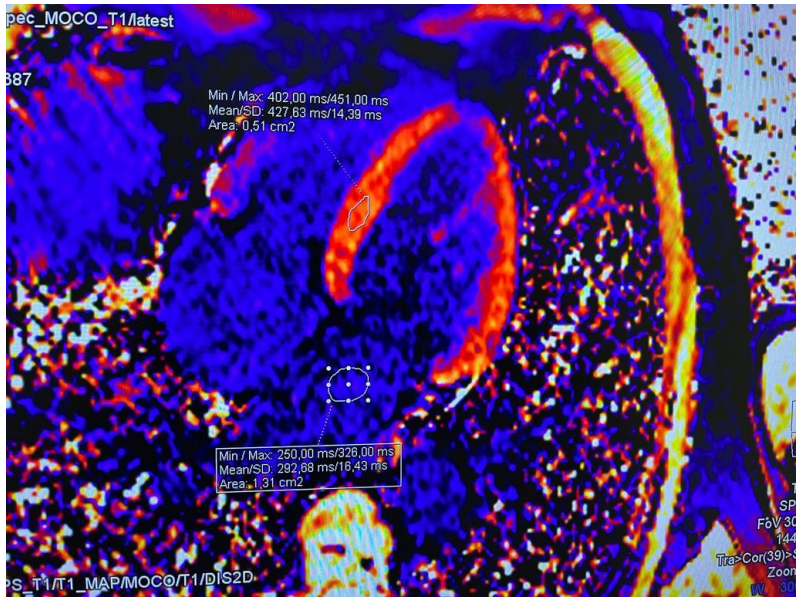




T1 mapping a ECV







T1 mapping

Předkontrastně:

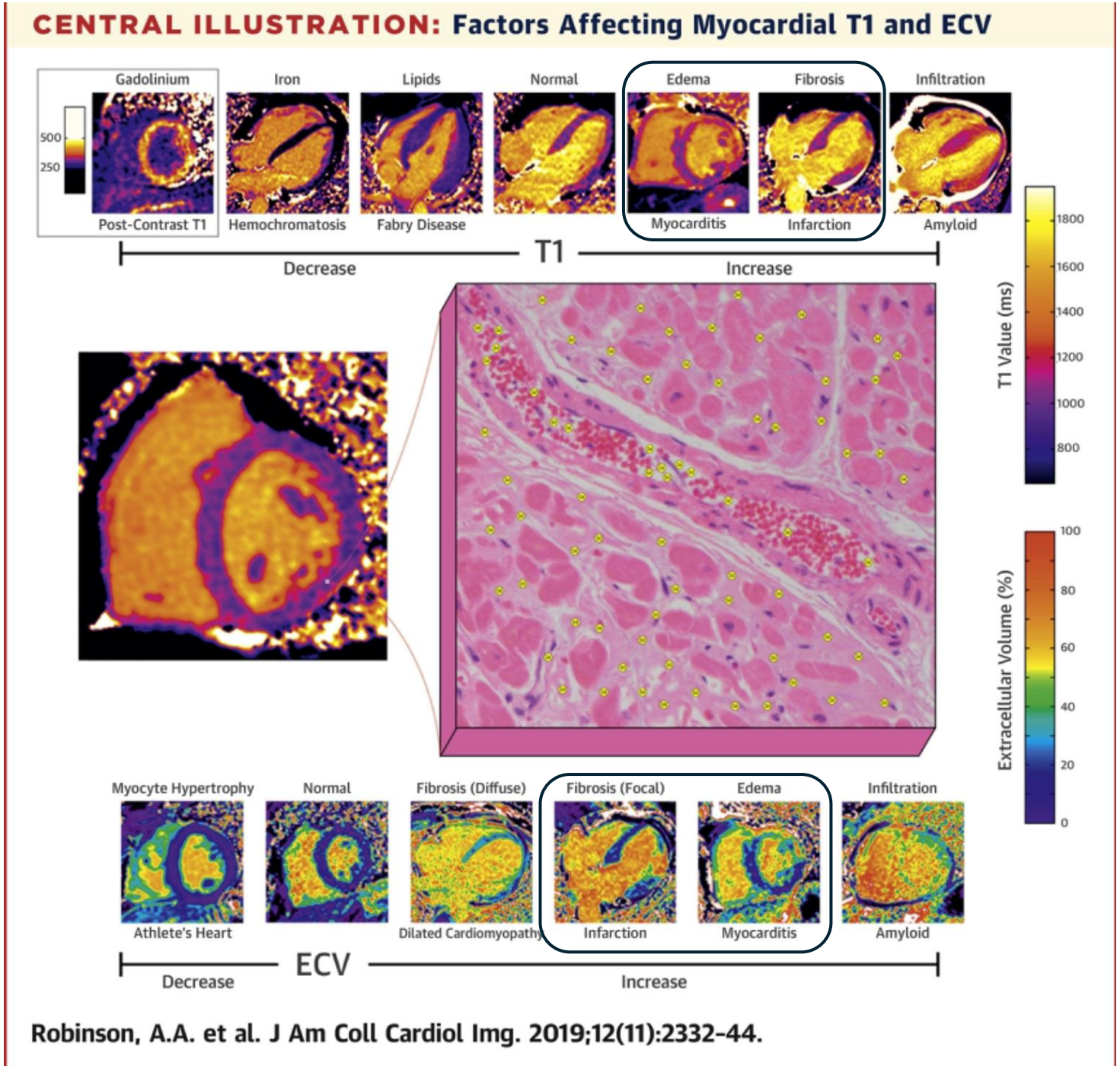
- přesné stanovení T1 relaxačního času myokardu
- **norm. hodnoty: cca 950-1000 ms** (pro přístroje o síle 1,5 Tesla)
- zvýšení: edém myokardu, přítomnost fibrózy či infiltrace amyloidem
- snížení: Fabryho choroba, sideróza

Postkontrastně:

- podíl extracelulárního objemu k celkovému objemu myokardu LK
- **norm. ECV: cca 0,25 ± 0,02** (1,5 Tesla)
- přítomnost fibrózy (fokální, difuzní) či amyloidu (ale i interstic. edému)
- nutnost znát aktuální hodnotu **hematokritu**

a. $\lambda = \Delta R1_{myocardium} / \Delta R1_{blood}$ where $R1 = 1/T1$ measured before and twenty minutes after GBCA administration.
b. $ECV = \lambda(1 - \text{hematocrit})$.

T1 mapping



Robinson, A.A. et al. J Am Coll Cardiol Img. 2019;12(11):2332-44.

T2 mapping

Contents lists available at ScienceDirect
Diagnostic and Interventional Imaging
journal homepage: www.elsevier.com/locate/diii

Original article

Normal variations of myocardial T1, T2 and T2* values at 1.5 T cardiac MRI in sex-matched healthy volunteers

Farah Cadour [a,b], Jérôme Caudron [c], André Gillibert [d], Sébastien Normant [e], Jean-Nicolas Dacher [b,f,*]

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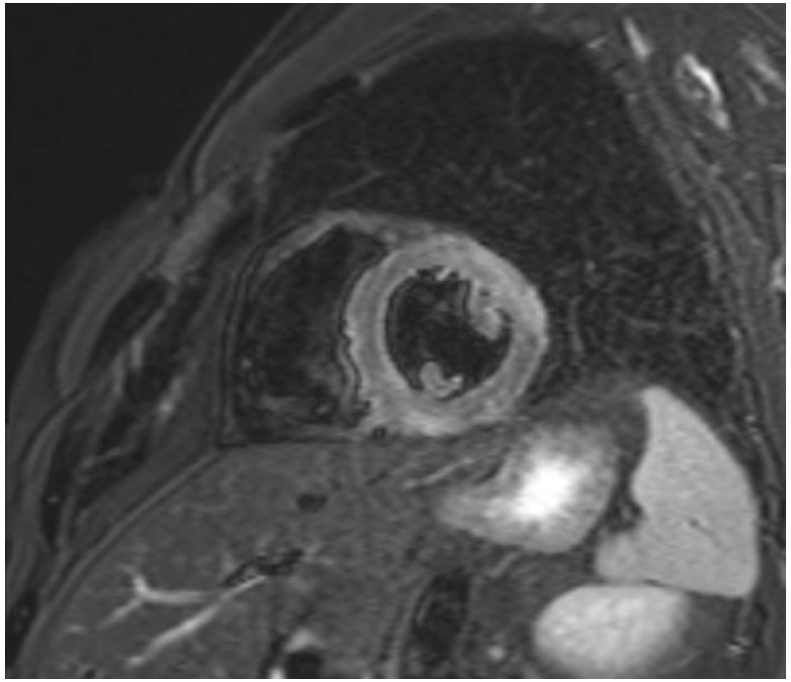
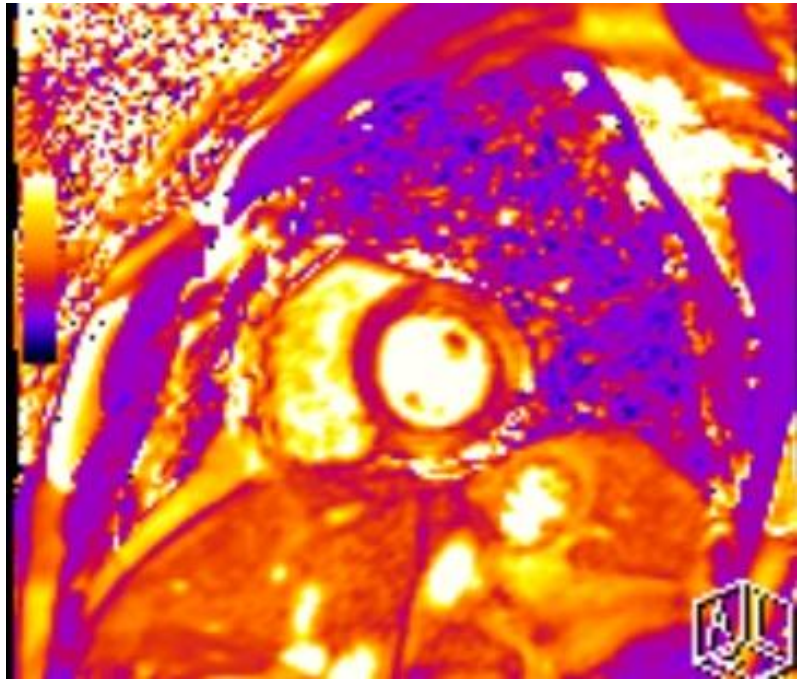
norma: ≤ 50ms „šedá zóna“: 50-60ms edém: ≥ 60ms Ženy: 52.8 ± 2.4 [SD] ms Muži: 51.8 ± 2.2 [SD] ms

T2W STIR TSE



T2 mapping



Simson’s rule

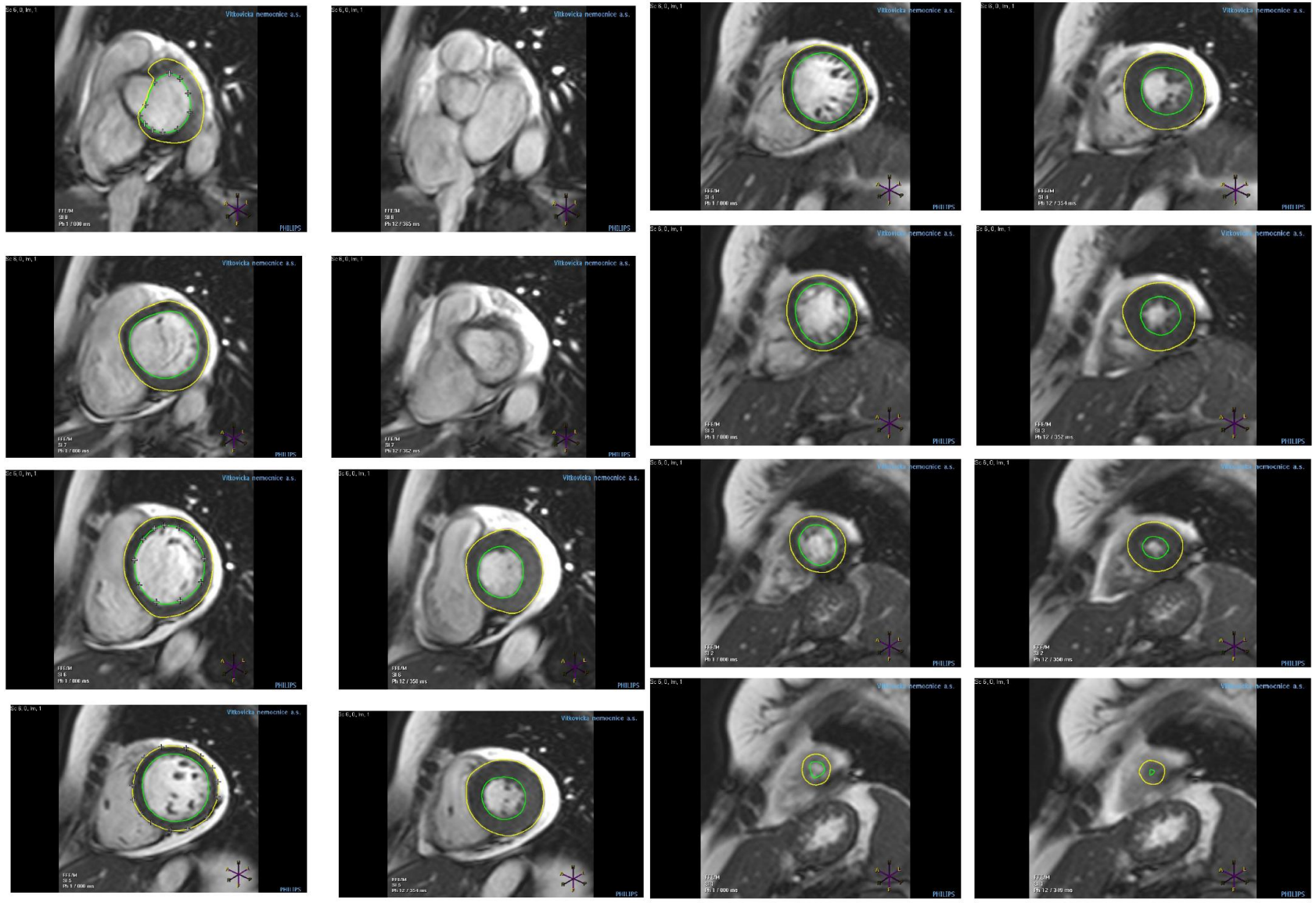
EDV/EDVI

ESV/ESVI

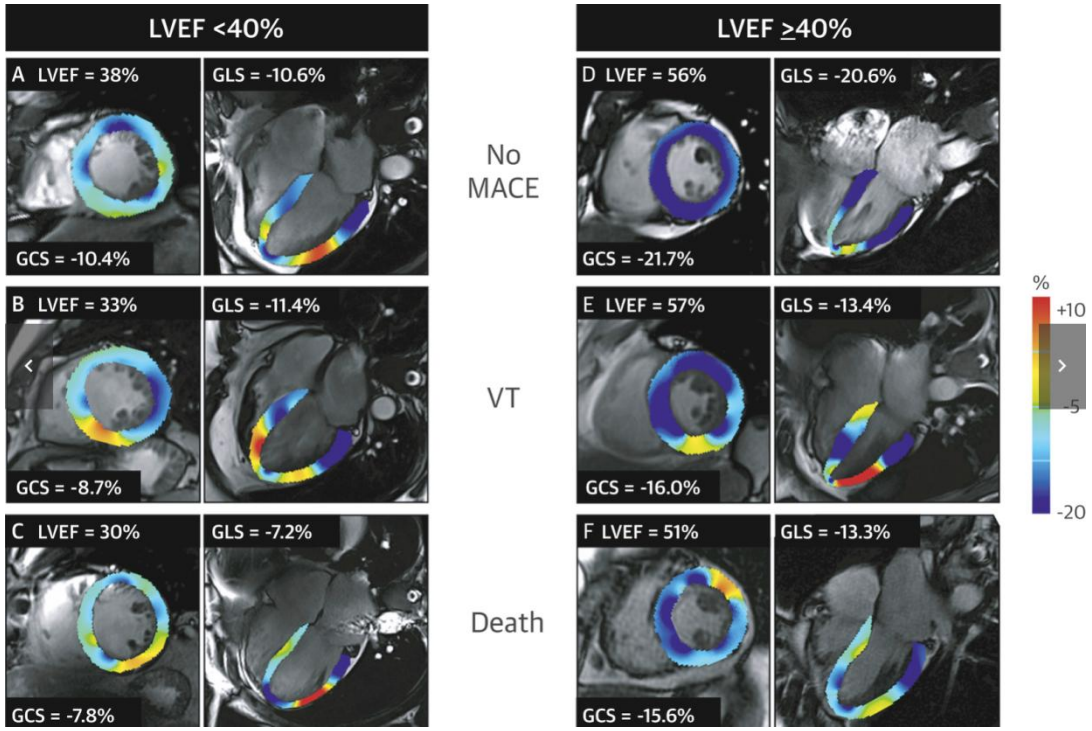
EF LK

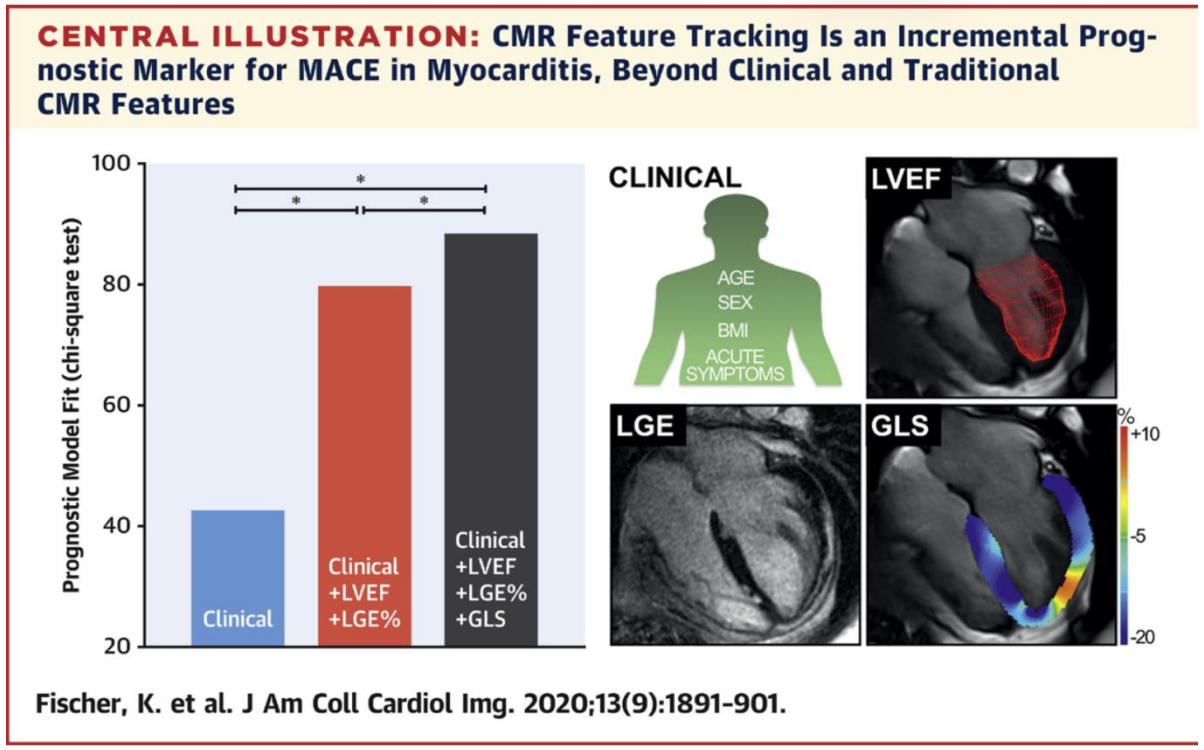
SV

LVM



Feature tracking





MRI – „Lake Louise Criteria“

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*

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").

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VOL. 72, NO. 24, 2018

THE PRESENT AND FUTURE

JACC STATE-OF-THE-ART REVIEW

Cardiovascular Magnetic Resonance in Nonischemic Myocardial Inflammation

Expert Recommendations

Vanessa M. Ferreira, MD, DPHIL,[a] Jeanette Schulz-Menger, MD,[b] Godtfred Holmvang, MD,[c] Christopher M. Kramer, MD,[d] Iacopo Carbone, MD,[e] Udo Sechtem, MD,[f] Ingrid Kindermann, MD,[g] Matthias Gutberlet, MD,[h] Leslie T. Cooper, MD,[i] Peter Liu, MD,[j] Matthias G. Friedrich, MD[k,l,m]

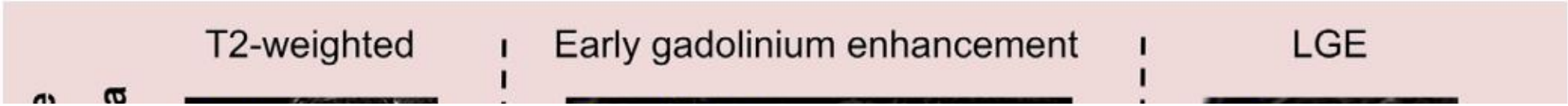
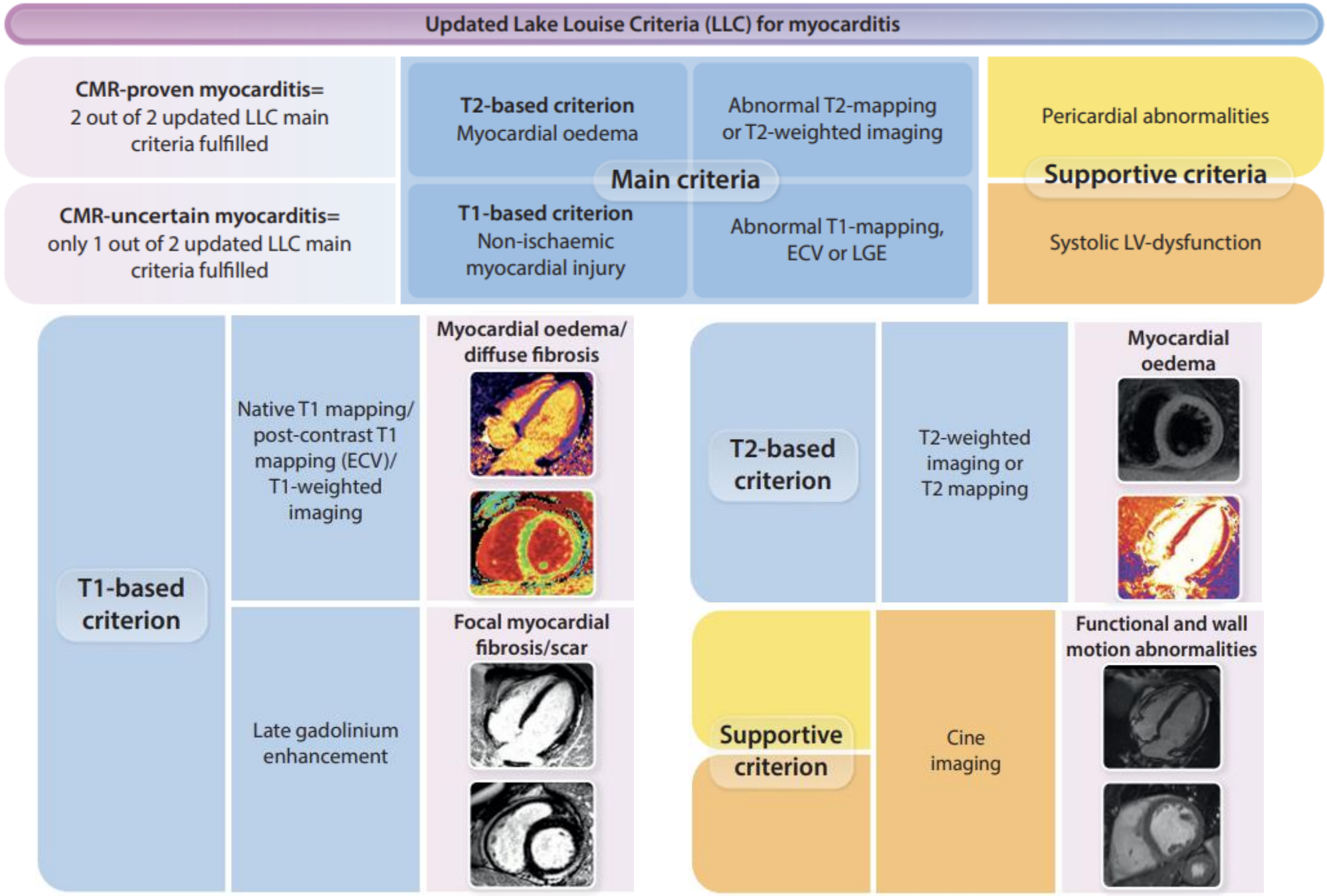


Table 3: Diagnostic Performance of Different Cardiac MRI Parameters for Diagnosis of Acute Myocarditis

Variable	Cutoff Value	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
Qualitative or semiquantitative parameter						
T2 signal intensity ratio	≥1.9	35 (22.1, 50.5)	88.5 (71.0, 86.0)	82.4 (59.0, 93.8)	46.9 (33.7, 60.6)	56.1 (44.1, 67.4)
Early gadolinium enhancement ratio	≥1.95	66.7 (50.3, 79.8)	57.7 (38.9, 74.5)	68.6 (52.0, 81.4)	55.6 (37.3, 72.4)	62.9 (50.5, 73.8)
Late gadolinium enhancement		77.5 (62.5, 87.7)	100.0 (87.1, 100.0)	100.0 (89.0, 100.0)	74.3 (57.9, 85.8)	86.4 (76.1, 92.7)
Quantitative parameter						
T1 native (msec)	≥1000	77.5 (62.5, 87.7)	96.2 (81.1, 99.3)	96.9 (84.3, 99.4)	73.5 (56.9, 85.4)	84.8 (74.3, 91.6)
Extracellular volume fraction (%)	≥28.8	45 (30.7, 60.2)	84.0 (65.3, 93.6)	81.8 (61.5, 92.7)	48.8 (34.6, 63.2)	60.0 (47.9, 71.0)
T2 (msec)	≥55.9	79.5 (64.5, 89.2)	92.3 (75.9, 97.9)	93.9 (80.4, 98.3)	75.0 (57.9, 86.7)	84.6 (73.9, 91.4)
Lake Louise criteria						
Original Lake Louise criteria		72.5 (57.2, 83.9)	96.2 (81.1, 99.3)	96.7 (83.3, 99.4)	73.5 (56.9, 85.4)	81.8 (70.9, 89.3)
2018 Lake Louise criteria		87.5 (73.9, 94.5)	96.2 (81.1, 99.3)	97.2 (85.8, 99.5)	83.3 (66.4, 92.7)	90.9 (81.6, 95.8)

(2 out of 2)

Luetkens, JA et al. Comparison of Original and 2018 Lake Louise Criteria for Diagnosis of Acute Myocarditis: Results of a Validation Cohort. *Radiology: Cardiothoracic Imaging* 2019; 1(3):e190010



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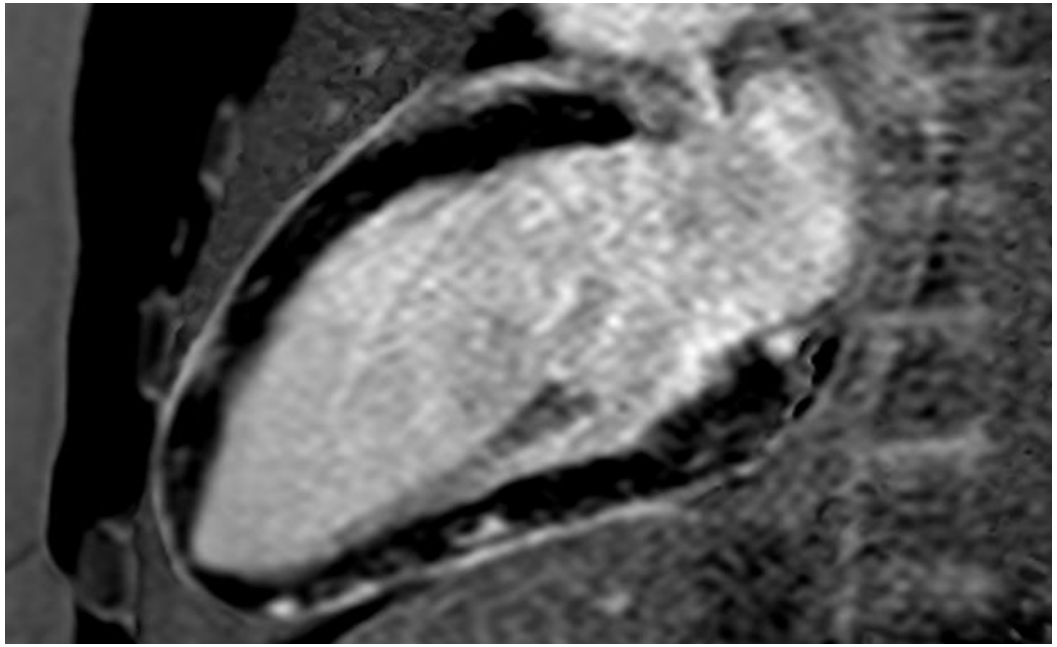
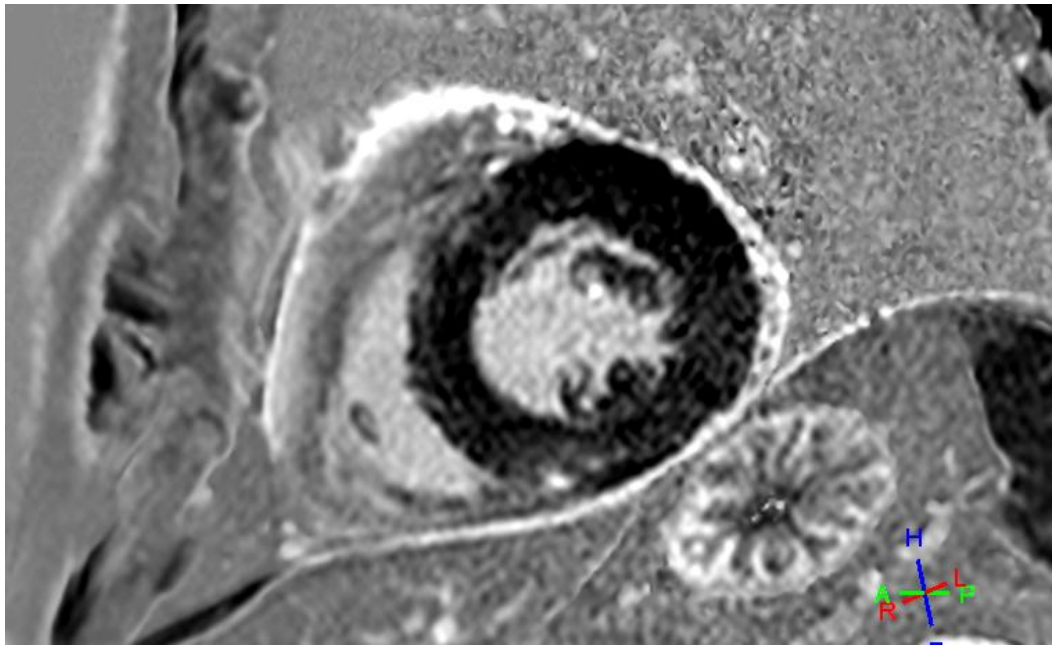
MRI

Unikátní metoda pro stanovení:

- perimyokarditidy
- myoperikarditidy

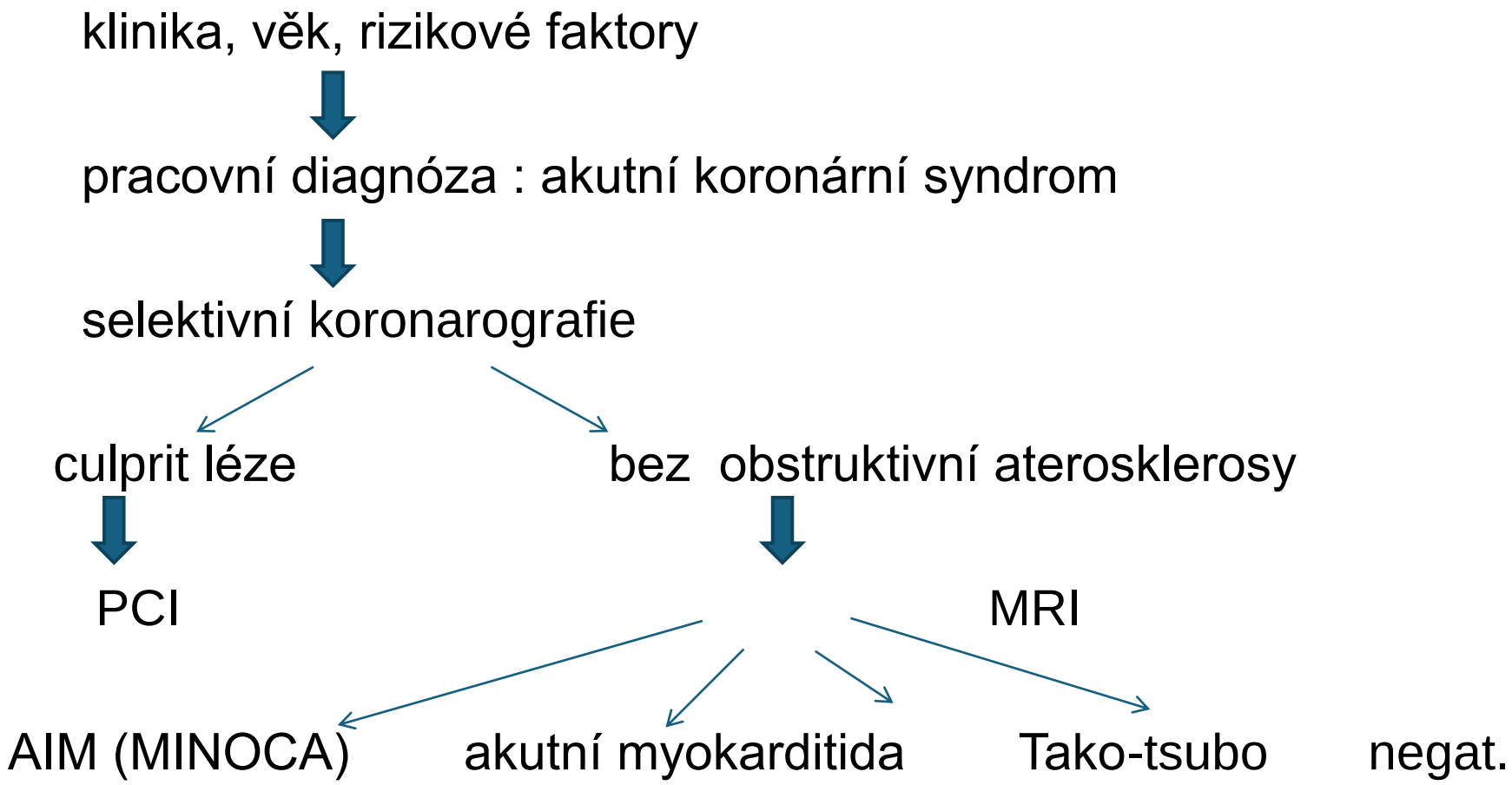




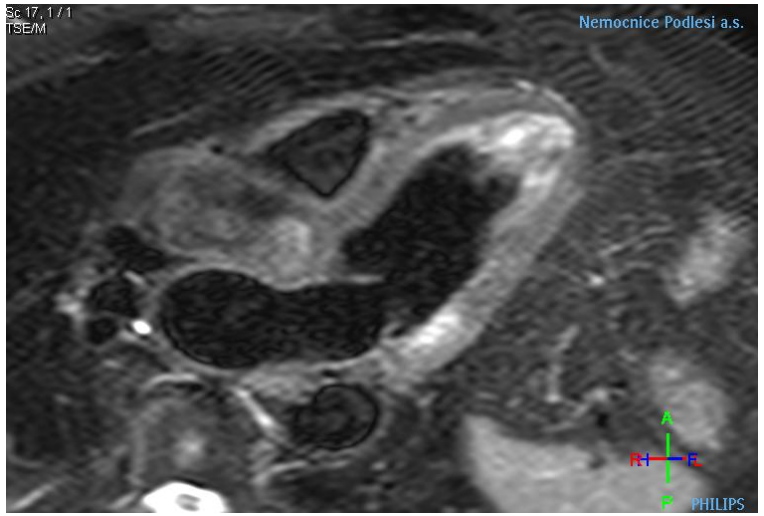
Klinické formy

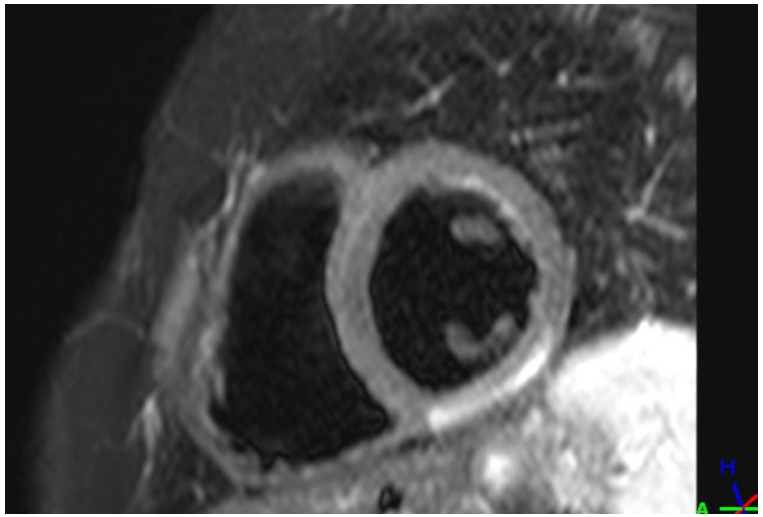
- subklinická forma (asymptomatický průběh)
- **„AKS – like“ průběh – bolest na hrudi s pozitivitou troponinu (± ekg změny)**
- **nově vzniklé srdeční selhání**
- život ohrožující arytmie/kardiogenní šok

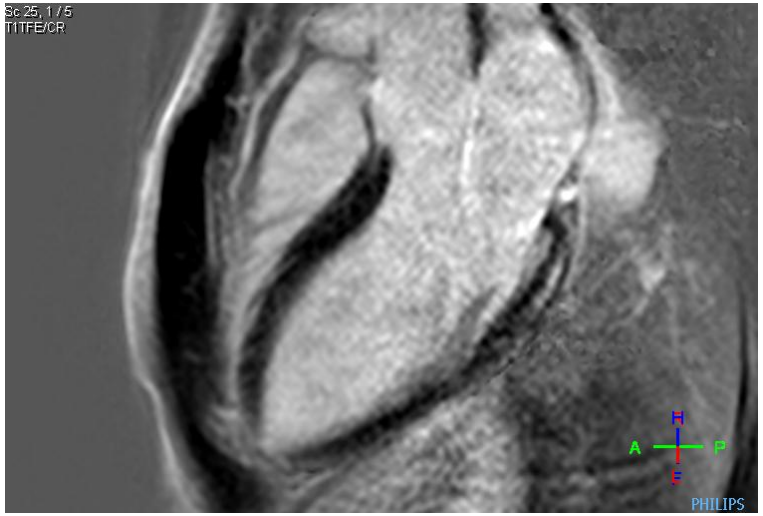
Dif. dg. bolesti na hrudi + dynamiky troponinu



AIM x akutní myokarditis







MINOCA

- 136 pacientů
  - bolest na hrudi
  - elevace Tn
  - EKG změny
  - negativní koronarogram

RESEARCH ARTICLE Open Access

The unique value of cardiovascular magnetic resonance in patients with suspected acute coronary syndrome and culprit-free coronary angiograms

Roman Panovský[1,2*], Júlia Borová[3], Martin Pleva[3], Věra Feitová[1,4], Petr Novotný[1,2], Vladimír Kincl[1,2], Tomáš Holeček[1,4], Jaroslav Meluzín[1,2], Ondřej Sochor[1,2] and Radka Štěpánová[5]

- Myokarditis 38 %
- Perimyokarditis 18 %
- AIM 18 %
- Takotsubo syndrom 15 %
- Nejasná dg. 6 %

Význam CMR pro stanovení dg

- 57 % – zásadní
- 35 % – potvrzení suspekce
- 8 % – bez významu

Stratifikace rizika

ESC European Society of Cardiology European Heart Journal (2025) 46, 3952–4041 https://doi.org/10.1093/eurheartj/ehaf192 ESC GUIDELINES

2025 ESC Guidelines for the management of myocarditis and pericarditis

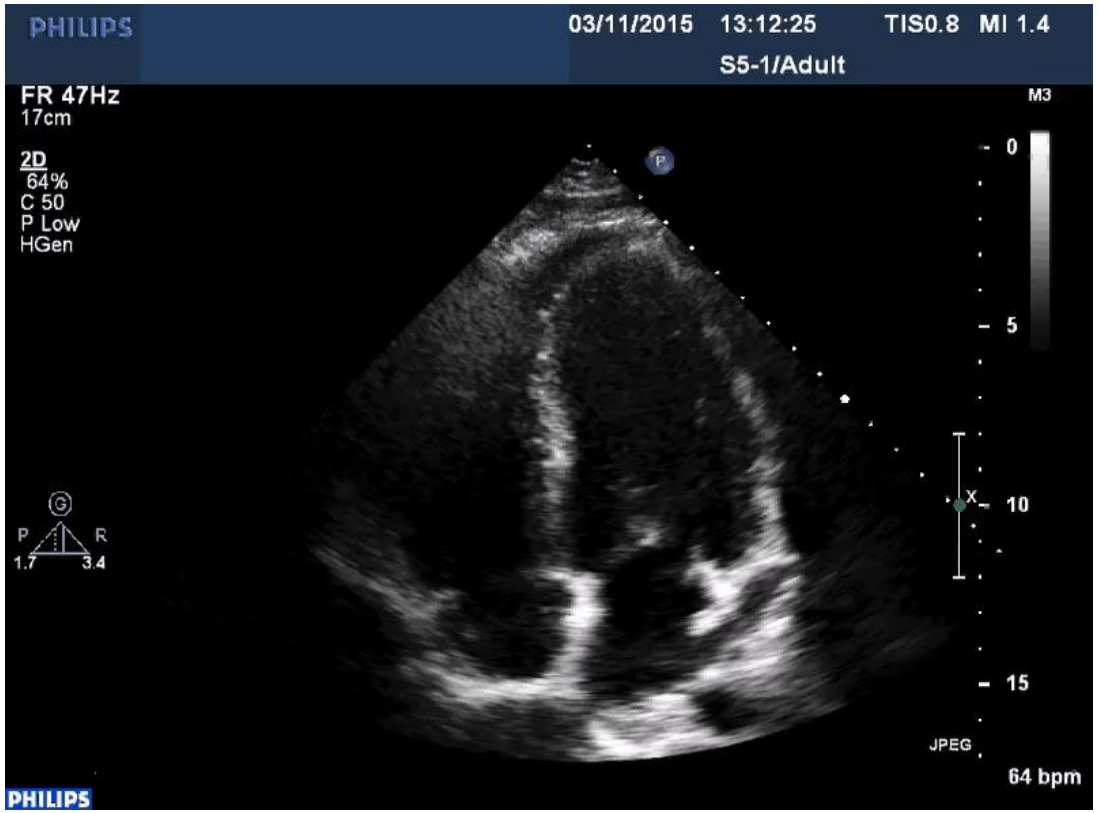
Developed by the task for ce for the management of myocarditis and pericarditis of the European Society of Cardiology (ESC)

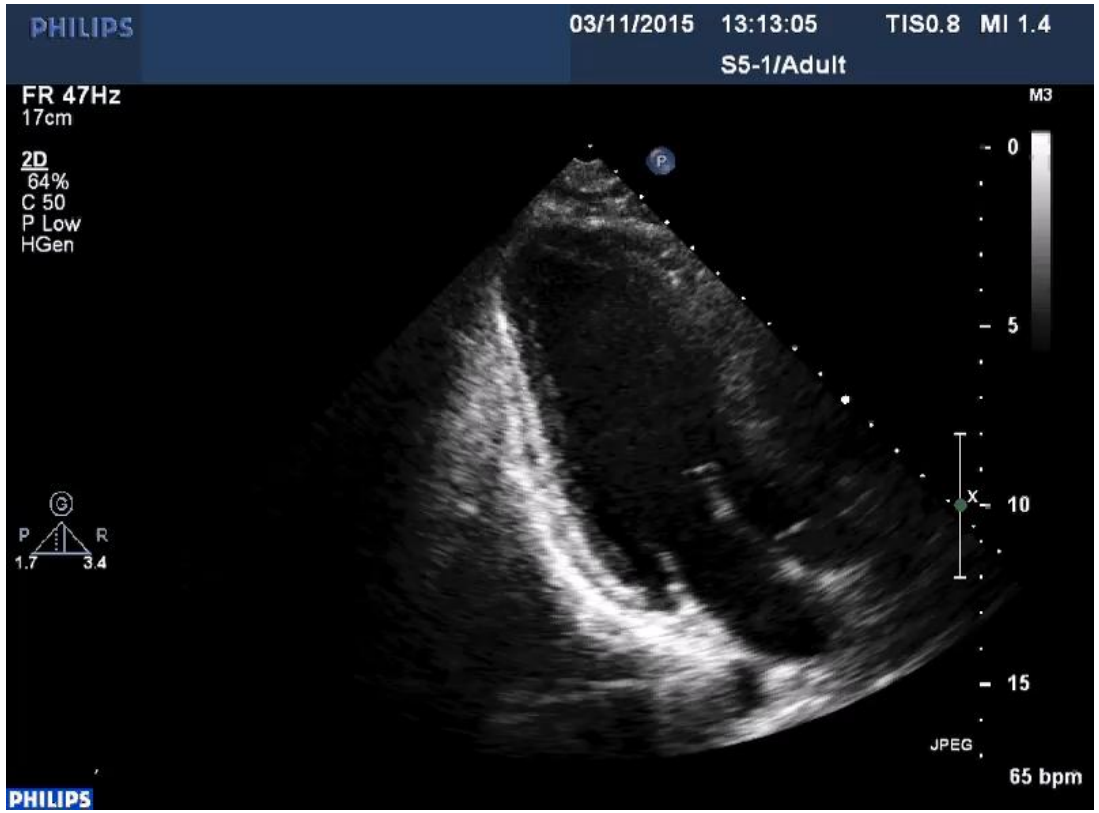
Endorsed by the Association for European Paediatric and Congenital Cardiology (AEPC) and the European Association for Cardio-Thoracic Surgery (EACTS)

Authors/Task Force Members: Jeanette Schulz-Menger [1-*], (Chairperson) (Germany), Valentino Collini [‡], (Task Force Co-ordinator) (Italy), Jan Gröschel [‡], (Task Force Co-ordinator) (Germany), Yehuda Adler (Israel), Antonio Brucato (Italy), Vanessa Christian (United Kingdom), Vanessa M. Ferreira (United Kingdom), Estelle Gandjbakhch (France), Bettina Heidecker (Germany), Mathieu Kerneis (France), Allan L. Klein (United States of America), Karin Klingel (Germany), George Lazaros (Greece), Roberto Lorusso (Netherlands), Elena G. Nesukay (Ukraine), Kazem Rahimi (United Kingdom), Arsen D. Ristić (Serbia), Marcin Rucinski (Poland), Leyla Elif Sade (United States of America), Hannah Schaubroeck (Belgium), Anne Grete Semb (Norway), Gianfranco Sinagra (Italy), Jens Jakob Thune (Denmark), Massimo Imazio [1-*], (Chairperson) (Italy), and the ESC Scientific Document Group

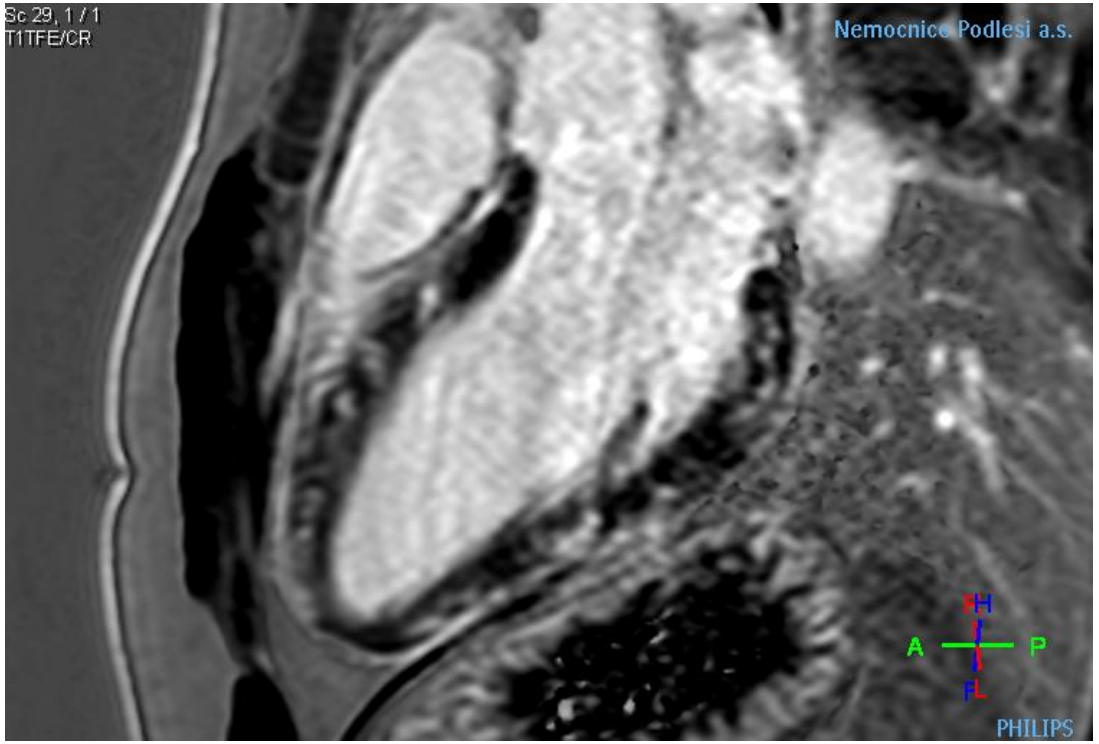
Risk	High risk	Intermediate risk	Low risk
Myocarditis	• Acute HF/cardiogenic shock • Dyspnoea NYHA III–IV refractory to medical therapy • Cardiac arrest/syncope[a] • Ventricular fibrillation/sustained ventricular tachycardia[a] • High-level AV block[a]	• New/progressive dyspnoea • Non-sustained ventricular arrhythmias • Persistent release or relapsing troponin	Stable symptoms or oligosymptomatic
	Imaging criteria:	**Imaging criteria:**	**Imaging criteria:**
	• Newly reduced LVEF (<40%)[a] • Extensive LGE on CMR[a]	• Newly mildly reduced LVEF (41%–49%) and/or WMA • Preserved LVEF (≥50%) and LGE ≥2 segments on CMR	• Preserved LVEF (≥50%) without LGE or limited LGE (<2 segments) on CMR

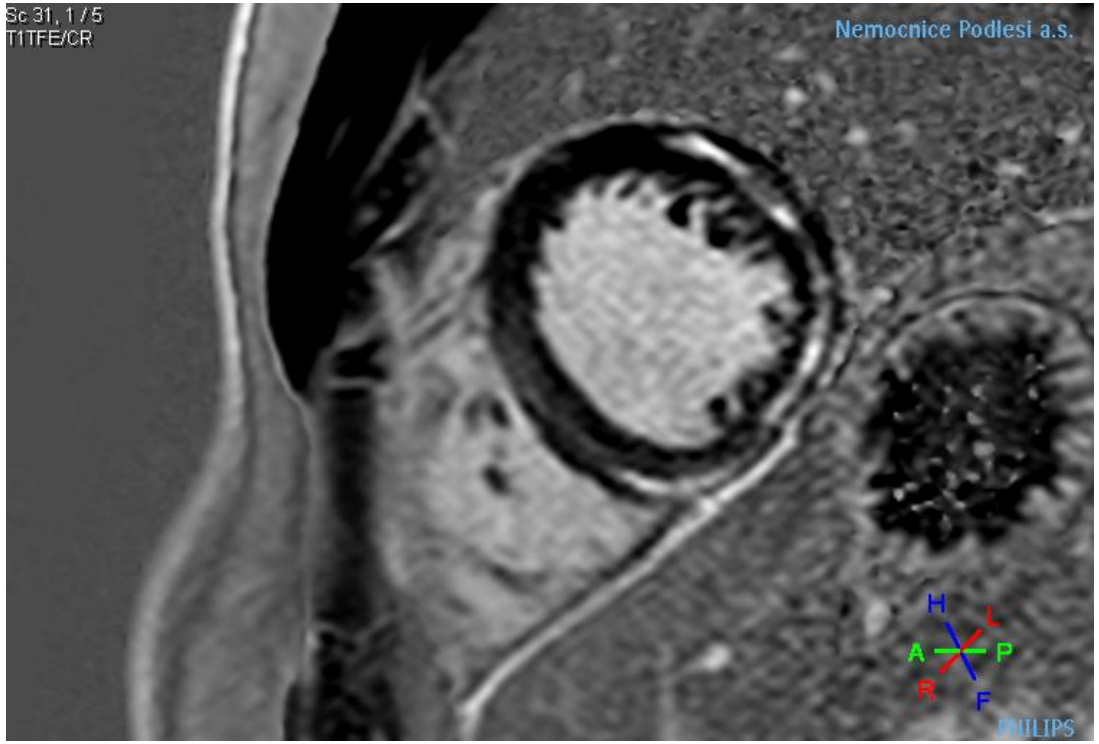
Myokarditida – ECHO





Myokarditida – LGE





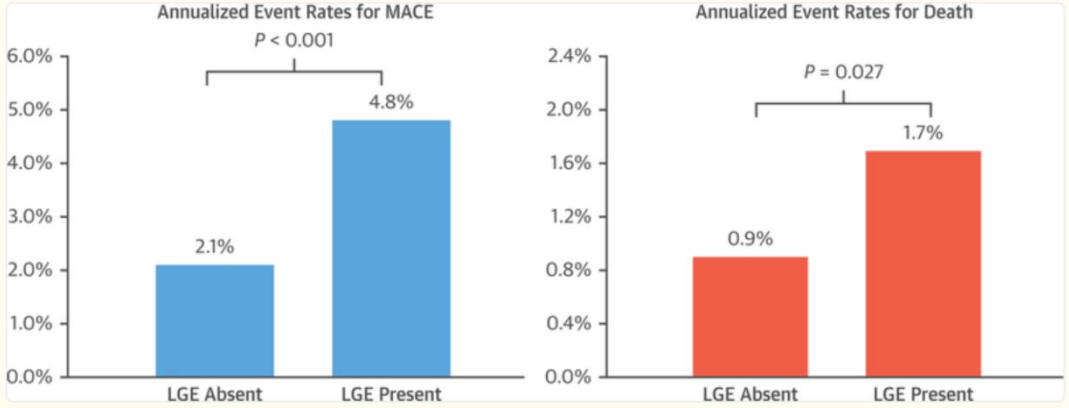
V diskrepanci s příznivým echo nálezem přítomny rozsáhlé signálové změny myokardu

LK

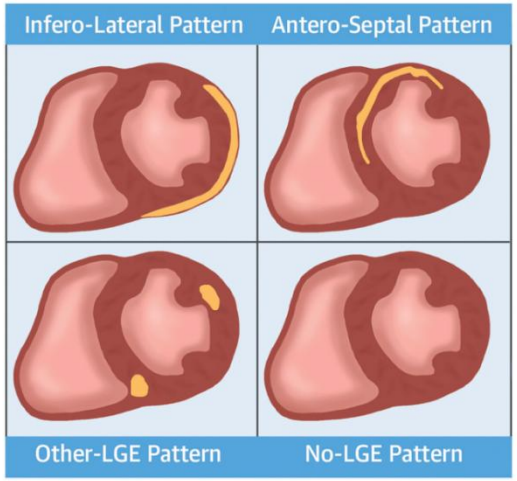
LGE a prognóza

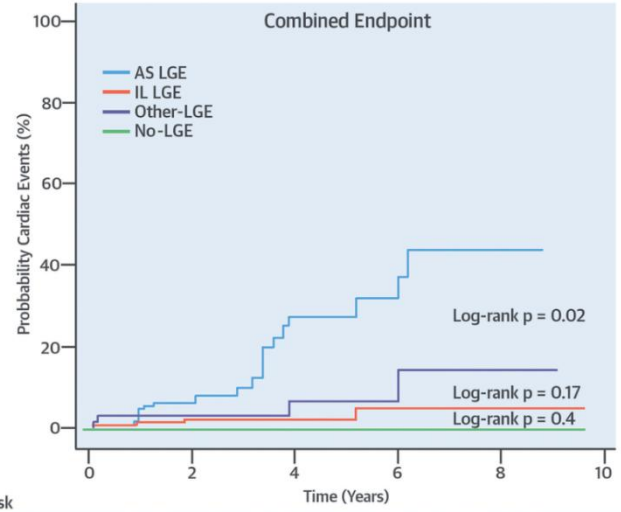
- přítomnost/rozsah LGE
- charakter LGE
  - v anteroseptu
  - ring-like LGE
- perzistence LGE či progrese

FIGURE 3. Annualized Event Rates Between LGE Presence and LGE Absence in Patients With Suspected Myocarditis.



CENTRAL ILLUSTRATION: Prognostic Role of Different LGE Patterns in Patients With AM and Preserved EF





At Risk

AS LGE	135	60	27	11	1	0
IL LGE	154	92	52	21	6	0
Other-LGE	59	44	24	11	6	0
No-LGE	26	19	7	1	1	0

Aquaro, G.D. et al. J Am Coll Cardiol. 2017;70(16):1977-87.

Current Cardiology Reports (2025) 27:11
https://doi.org/10.1007/s11886-024-02168-6

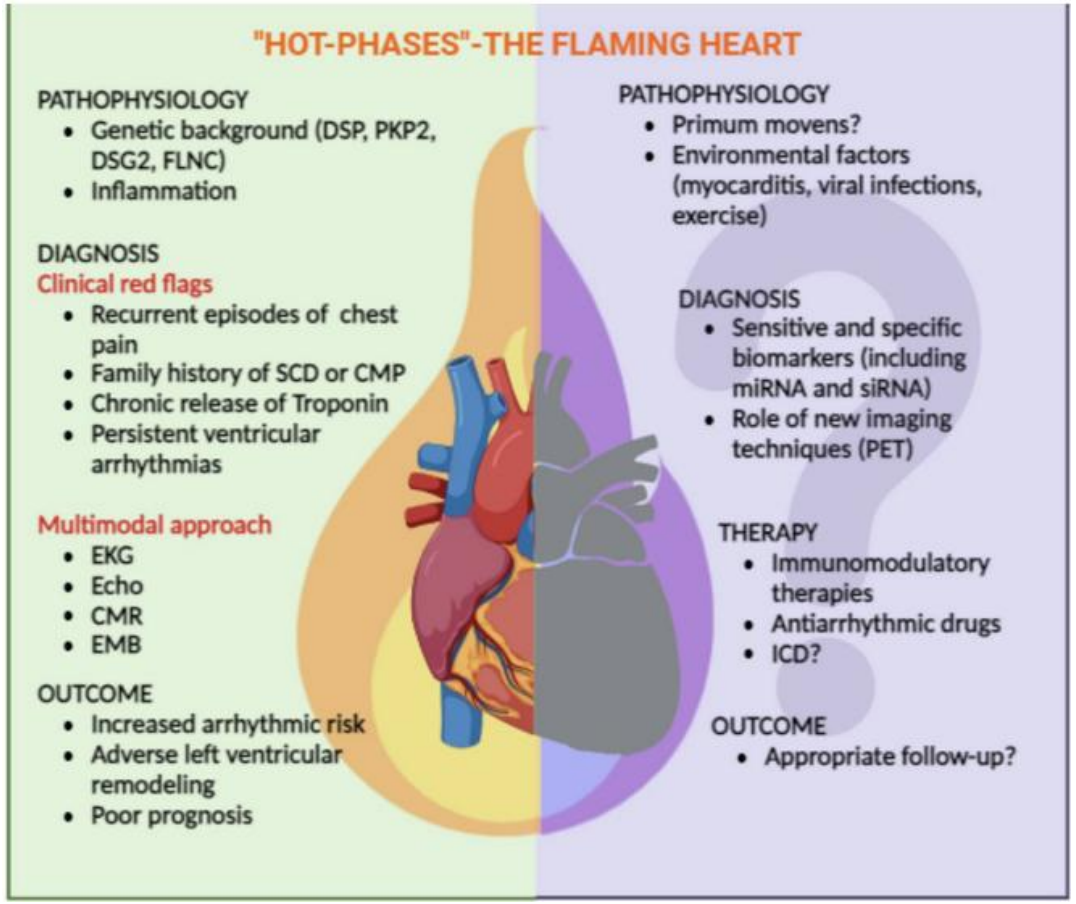
MYOCARDIAL DISEASE (A ABBATE AND M MERLO, SECTION EDITORS)

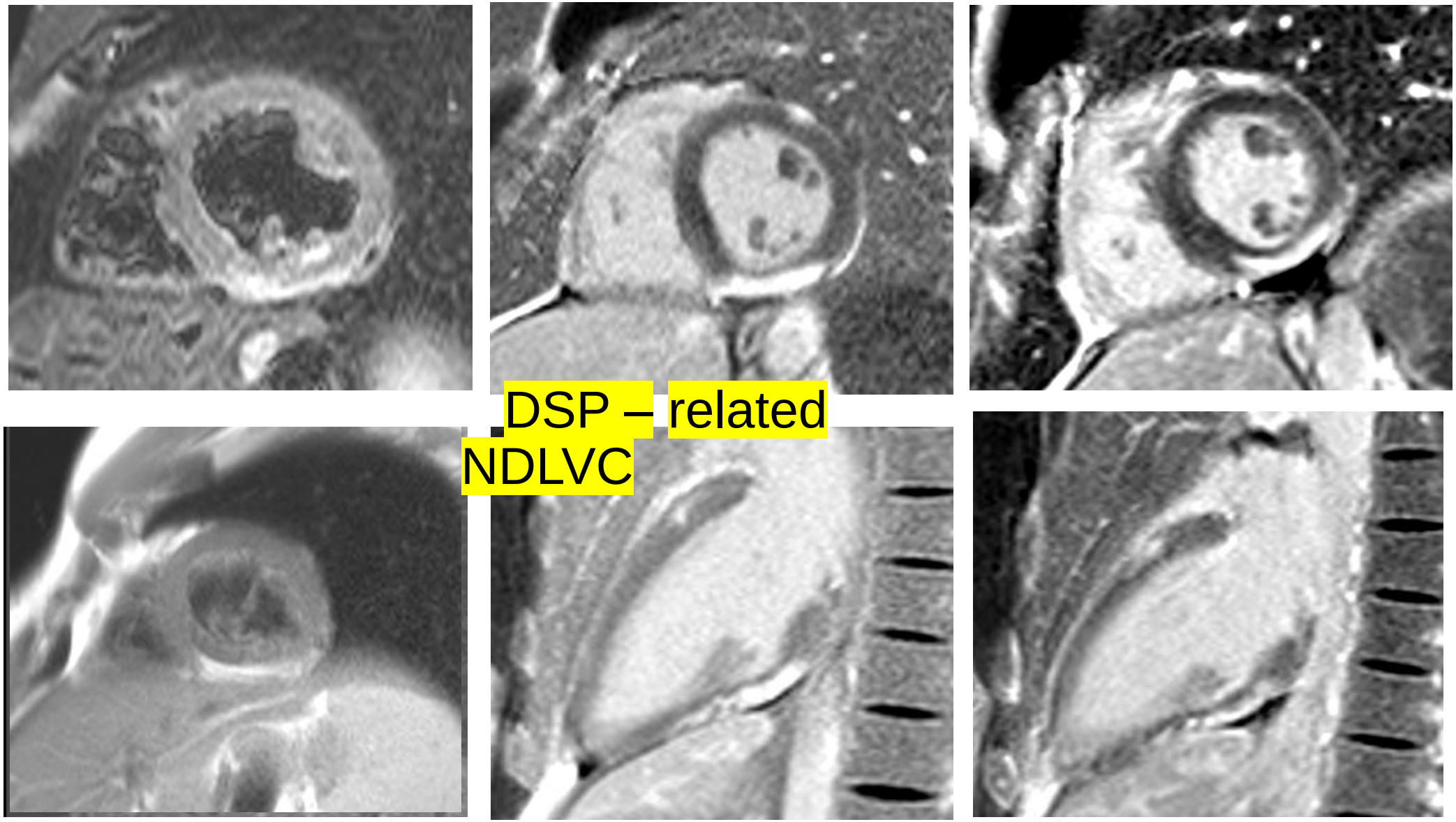
Hot Phases Cardiomyopathy: Pathophysiology, Diagnostic Challenges, and Emerging Therapies

Giulia Bassetto[1] · Federico Angriman[1] · Carola Pio Loco detto Gava[1] · Alessia Paldino[1] · Maria Perotto[1] · Luca Bordignon[1] · Marta Gigli[1] · Matteo Dal Ferro[1] · Laura Massa[1] · Alessandro Altinier[1] · Antonio De Luca[1] · Gianfranco Sinagra[1] · Marco Merlo[1]

Table 1 Clinical and instrumental "Red flags" of "Hot phases" cardiomyopathy

RED FLAGS	
Clinical History	• Recurrent episodes of chest pain • Family history of SCD or CMP • Chronic release of Troponin
EKG	• Low QRS voltages • Fragmented QRS • Inferolateral T-wave inversion • Persistent ventricular arrhythmias
Imaging	• Persistent LV dysfunction • Ring-like LGE pattern at CMR



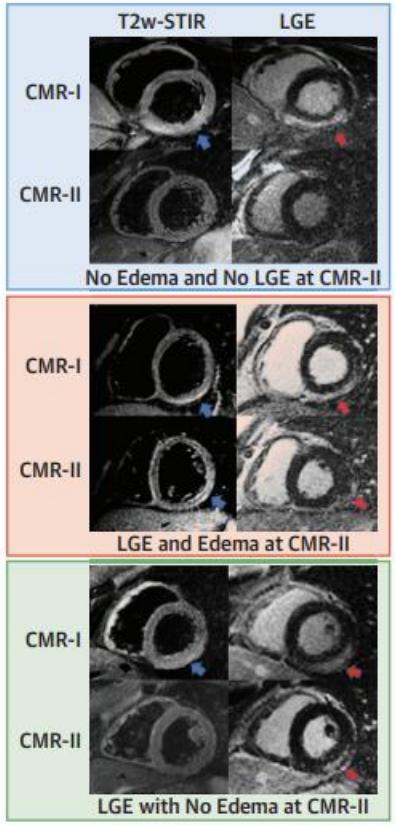


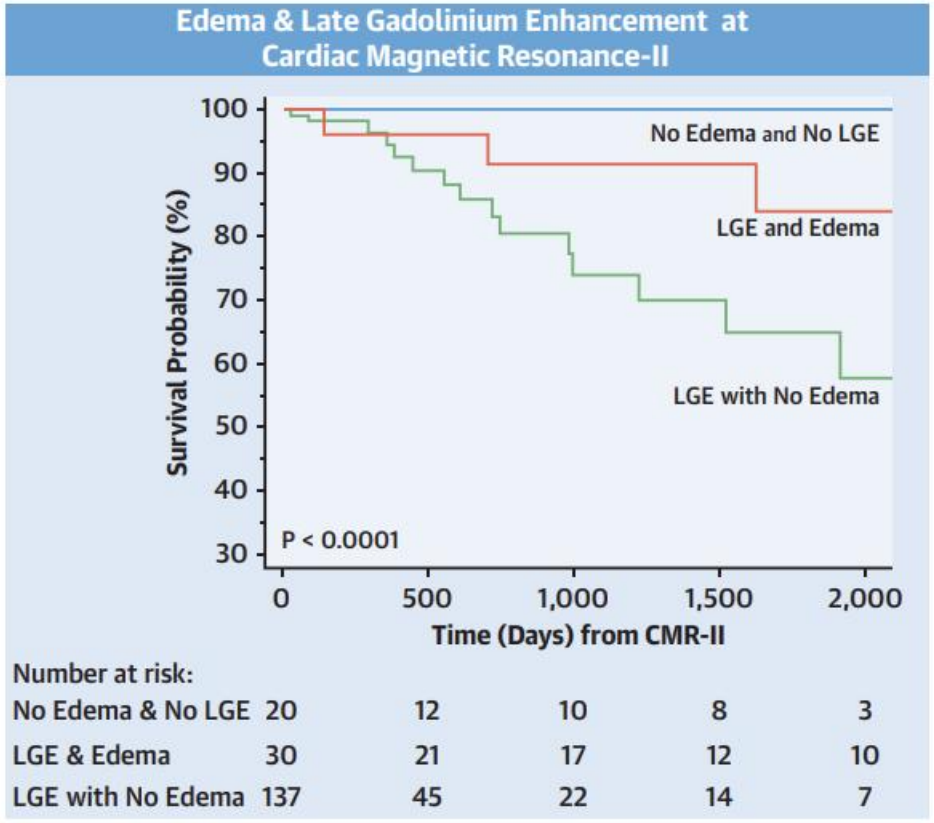
DSP – related NDLVC

33-letý muž, bolest na hrudi po viróze, elevace ST na spodní stěně, TnT 3484ng, SKG neg

po 6 měsících

CENTRAL ILLUSTRATION Prognostic Role of 6-Month Follow-Up CMR in Myocarditis





Aquaro, G.D. et al. J Am Coll Cardiol. 2019;74(20):2439-48.

CMR is recommended for follow-up at least within the first 6 months in patients with myocarditis to identify a healed or ongoing process, for risk stratification and personalized therapy, and to enable a return to exercise.[10,62,184–186]

I	C

Schulz-Menger, J. et al. 2025 ESC Guidelines for the management of myocarditis and pericarditis. *European Heart Journal* (2025) 46, 3952–4041.

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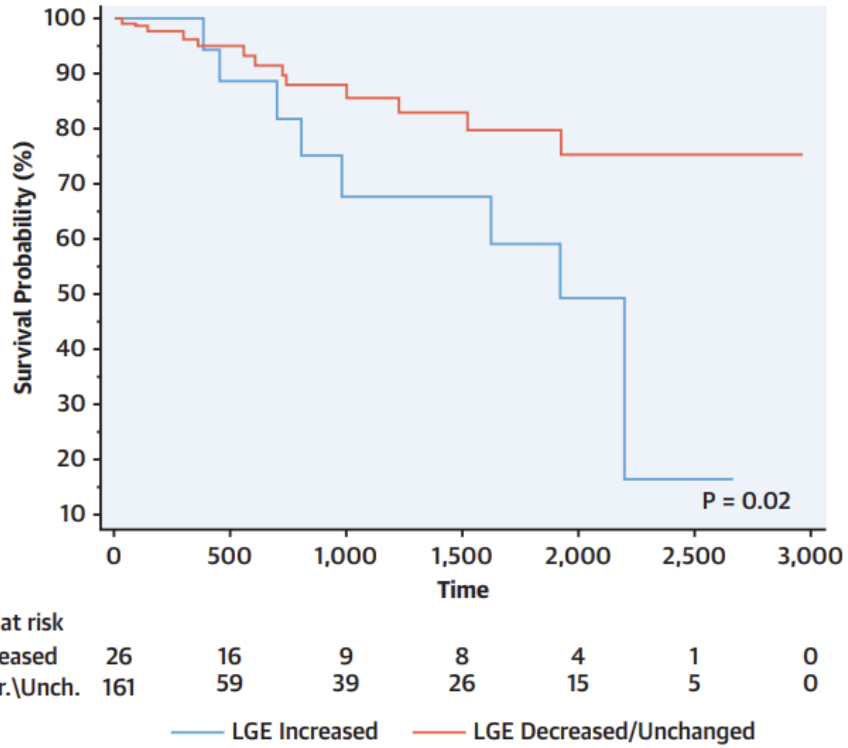
PUBLISHED BY ELSEVIER

ORIGINAL INVESTIGATIONS

Prognostic Value of Repeating Cardiac Magnetic Resonance in Patients With Acute Myocarditis

Giovanni Donato Aquaro, MD,[a] Yacob Ghebru Habtemicael, MD,[a] Giovanni Camastra, MD,[b] Lorenzo Monti, MD,[c] Santo Dellegrottaglie, MD,[d,e] Claudio Moro,[f] Chiara Lanzillo, MD,[g] Alessandra Scatteia, MD,[h] Mauro Di Roma, MD,[i] Gianluca Pontone, MD,[j] Martina Perazzolo Marra,[k] Andrea Barison, MD,[a] Gianluca Di Bella,[l] on behalf of the "Cardiac Magnetic Resonance" Working Group of the Italian Society of Cardiology



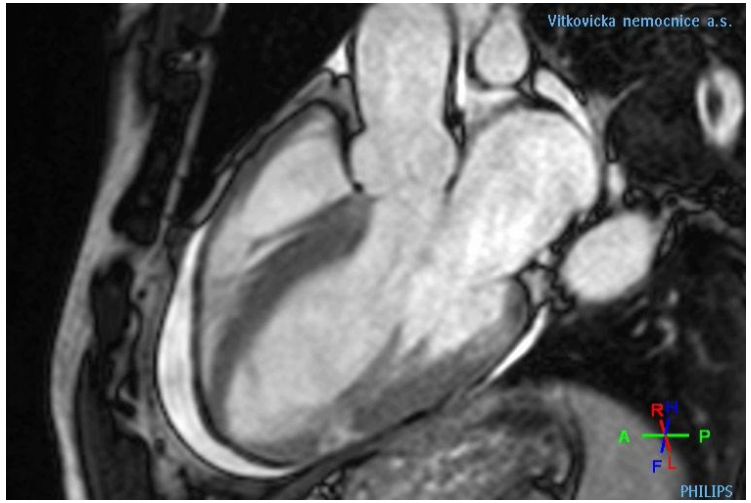
Systolická dysfunkce LK

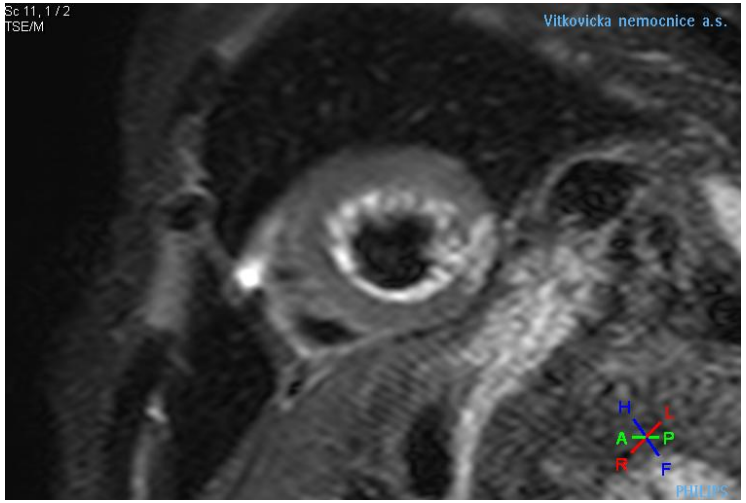
- neischemická x ischemická etiologie dysfunkce

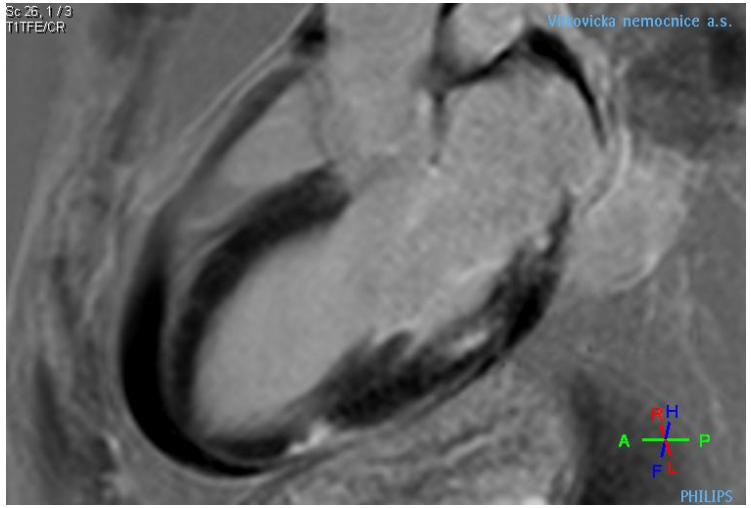
- dilatační x zánětlivá KMP
  - *srdeční sarkoidóza*
  - *Lofflerova endokarditida… endomyokardiální fibróza*

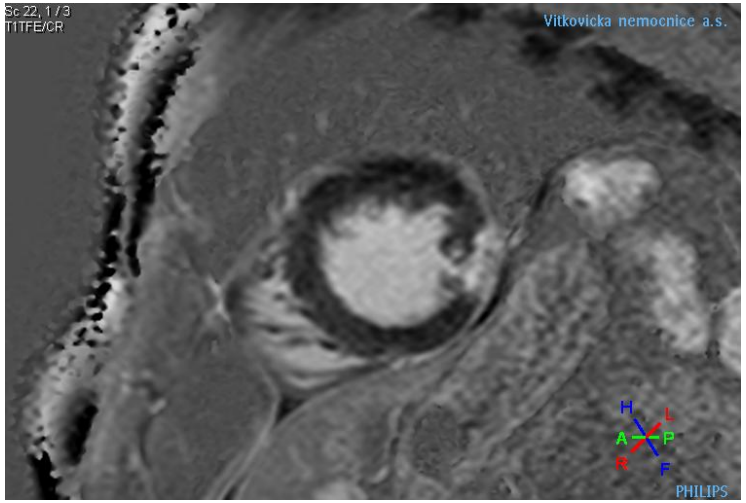
Zánětlivá KMP

chronická myokarditida asociována se systolickou dysfunkcí

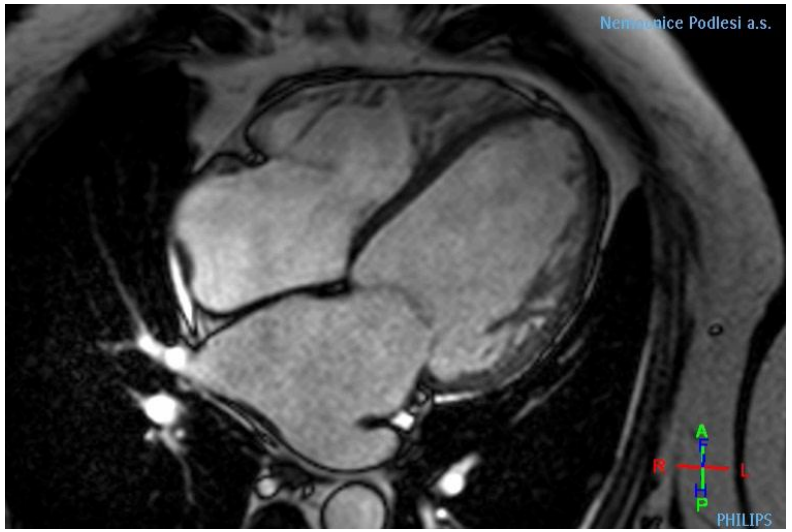


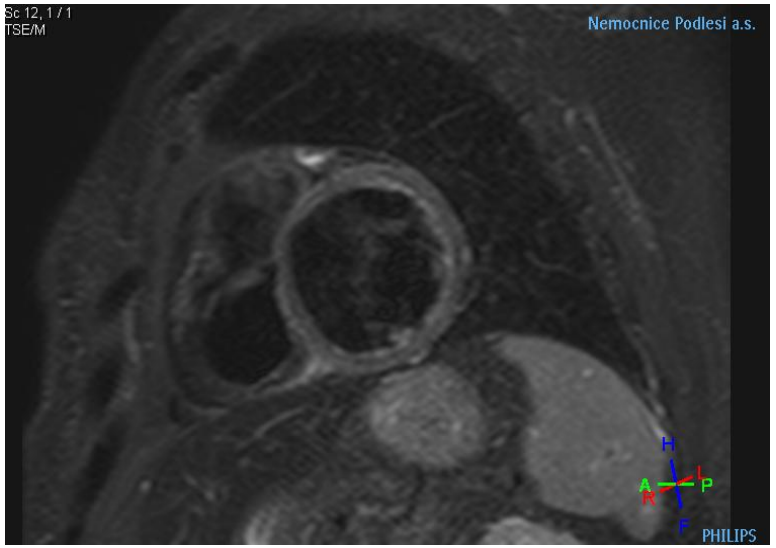


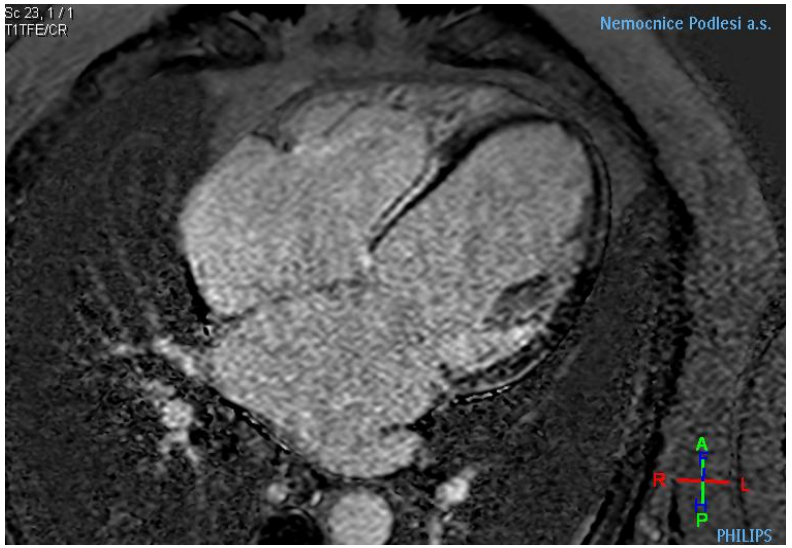


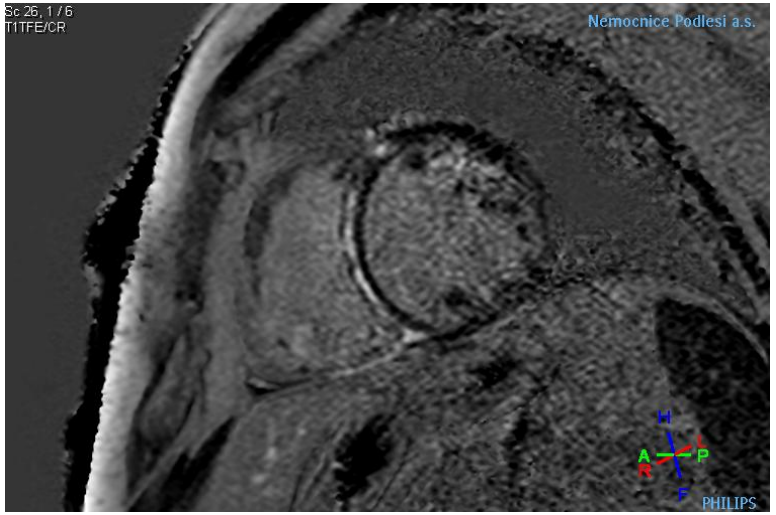


Zánětlivé či pozánětlivé změny?









Journal of Clinical Medicine

MDPI

Article

Using Multiparametric Cardiac Magnetic Resonance to Phenotype and Differentiate Biopsy-Proven Chronic from Healed Myocarditis and Dilated Cardiomyopathy

Patrick Krumm [1], Jan M. Brendel [1,*], Karin Klingel [2], Karin A. L. Müller [3], Jens Kübler [1], Christoph Gräni [4], Meinrad Gawaz [3], Konstantin Nikolaou [1] and Simon Greulich [3]

[1] Department of Radiology, Diagnostic and Interventional Radiology, University of Tübingen, Hoppe-Seyler-Straße 3, 72076 Tübingen, Germany
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[4] Department of Cardiology and Angiology, University of Bern, Freiburgstrasse 18, CH-3010 Bern, Switzerland
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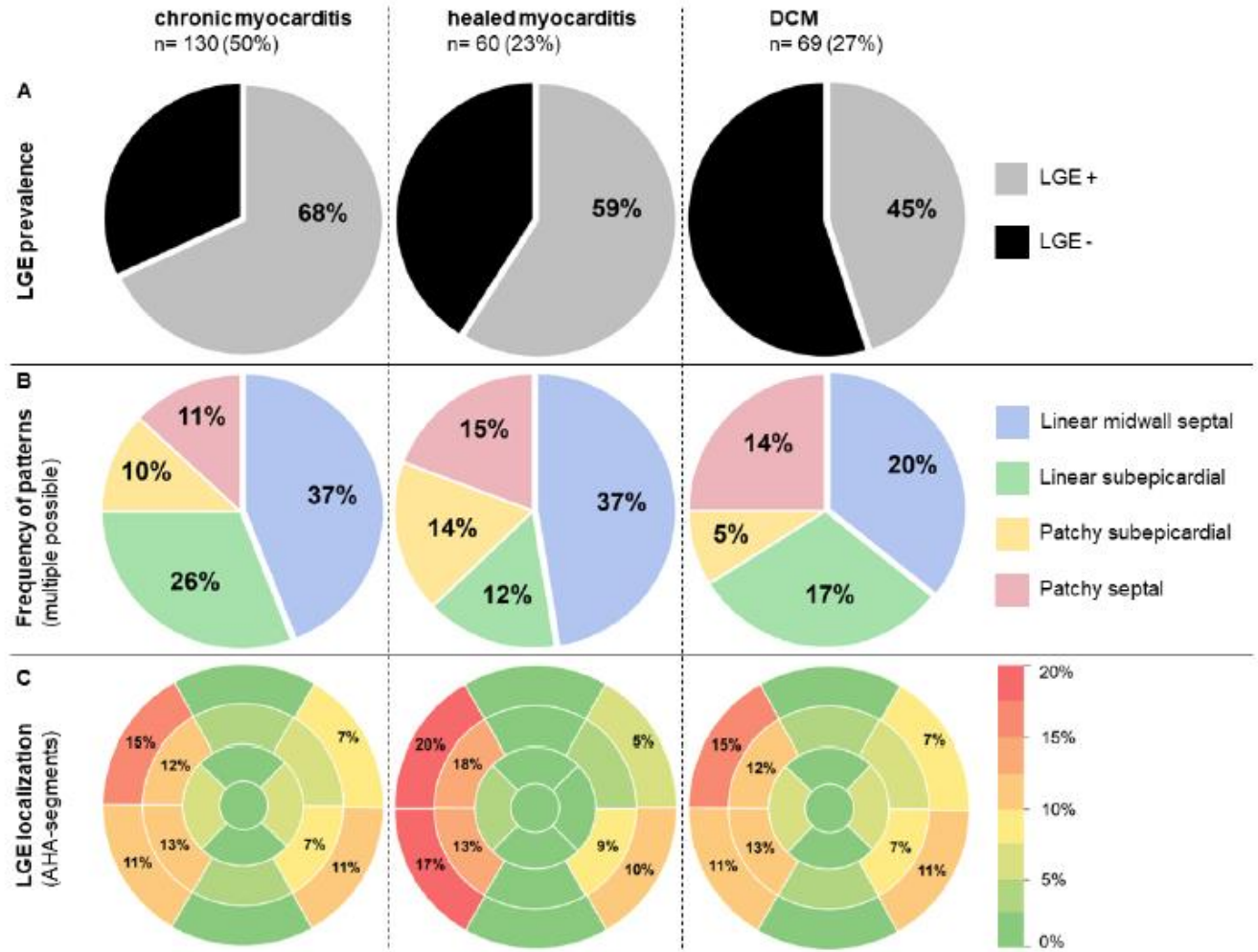

Figure 2. CMR tissue characterization by LGE: overall prevalence and frequency of patterns as well as the frequency of LGE localization per AHA-Segment. (**A**) The prevalence of LGE and (**B**) frequency

Journal of Clinical Medicine

MDPI

Article

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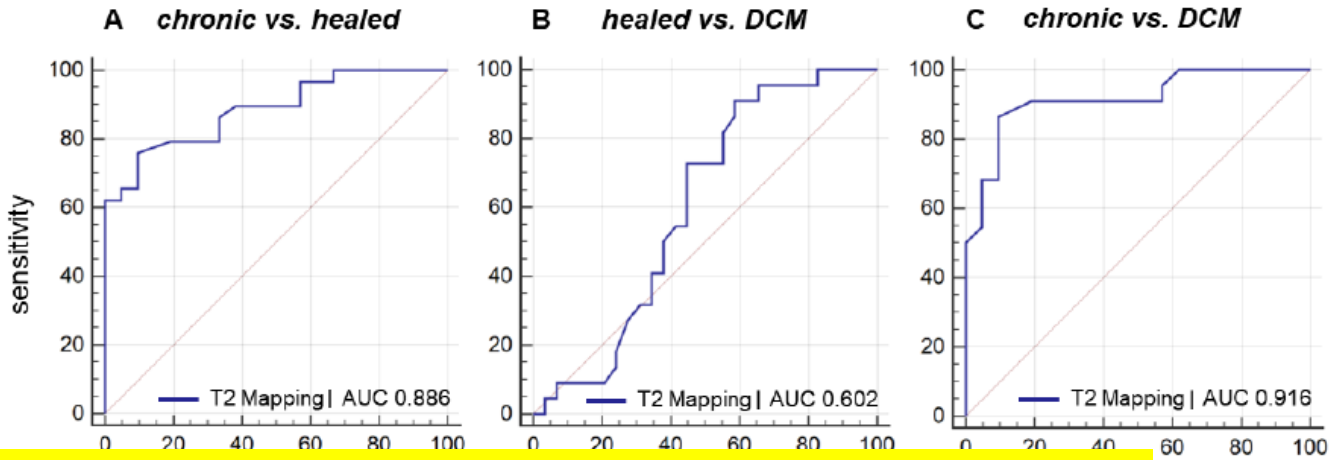
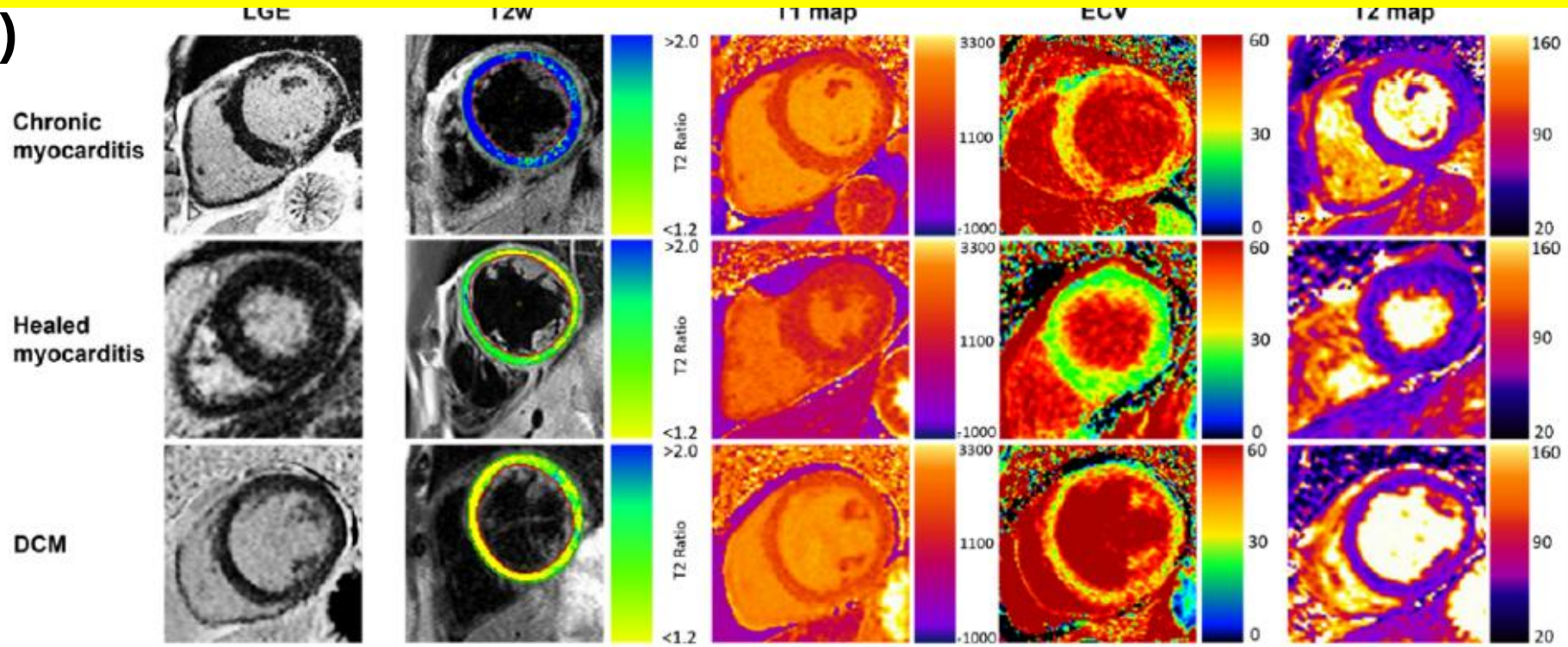
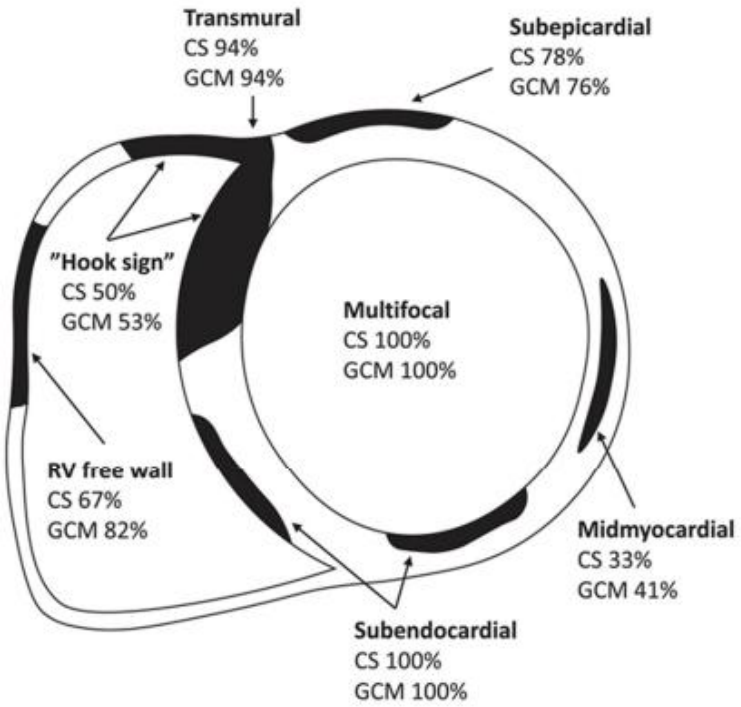
[4] Department of Cardiology and Angiology, University of Bern, Freiburgstrasse 18, CH-3010 Bern, Switzerland
* Correspondence: jan.brendel@med.uni-tuebingen.de



T2 rel. čas > 52ms = chronická myokarditida (senzit. 86 %, specif. 91 %)



Sarkoidóza



biomedicines
MDPI

Review

Multiparametric CMR in Myocarditis: A Comprehensive Review of Diagnostic Advances, Prognostic Value, and the Challenge of Genetic Mimics

Wissam Alam [1,*], Houssem Hamrouni [2], Ivelina Choneva [2] and Cyrus Moini [1]

[1] Cardiology Department, Groupe Hospitalier Sud Ile de France, 77000 Melun, France; cyrus.moini@ghsif.fr
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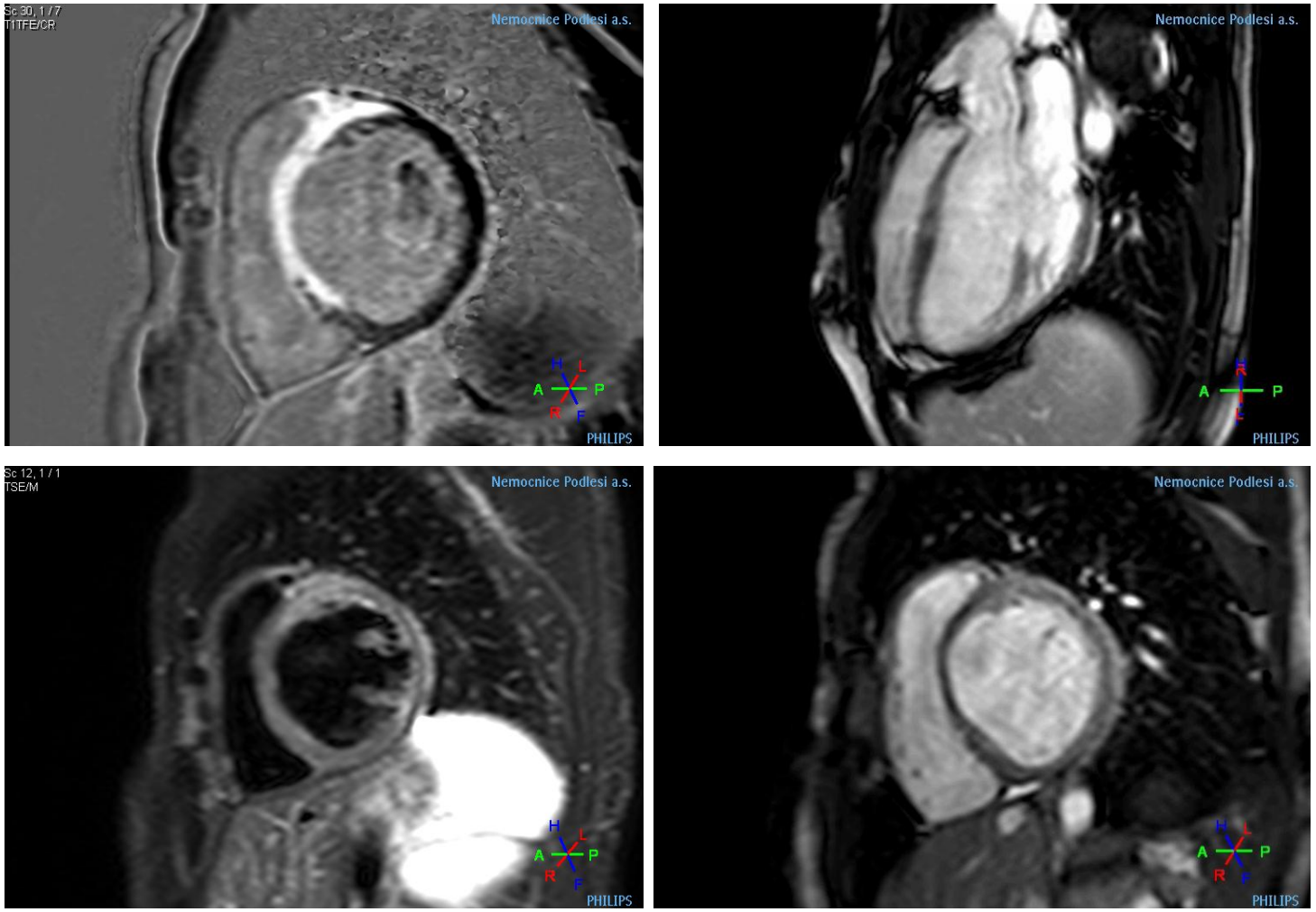
* Correspondence: wissam.alam@ghsif.fr or alam.wissam@gmail.com

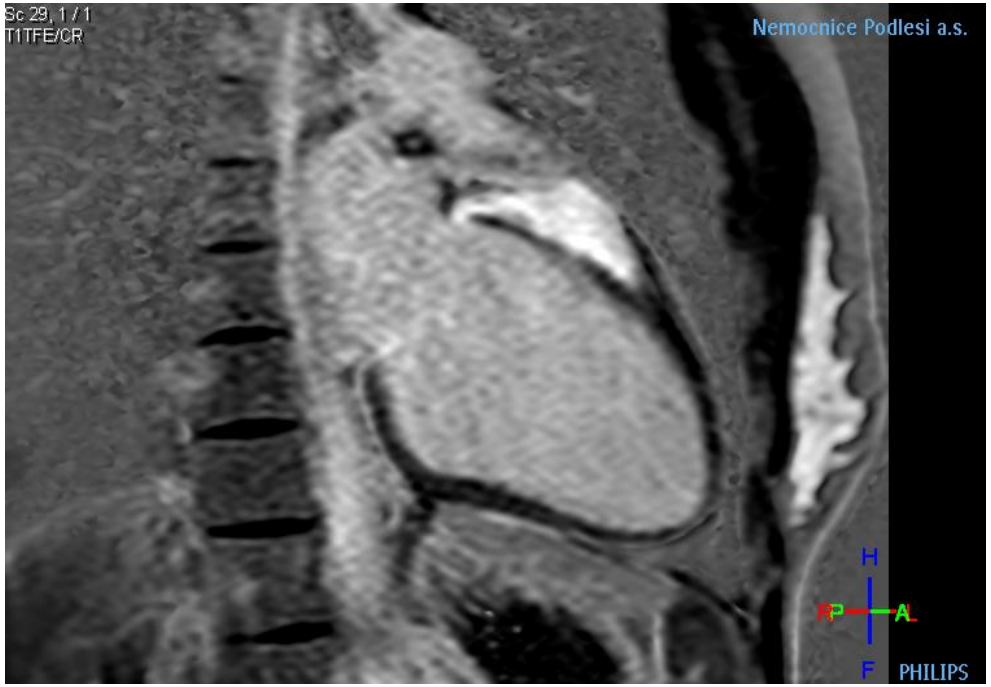


vyšší stupeň A-V blokády < 60 let

Sarkoidóza

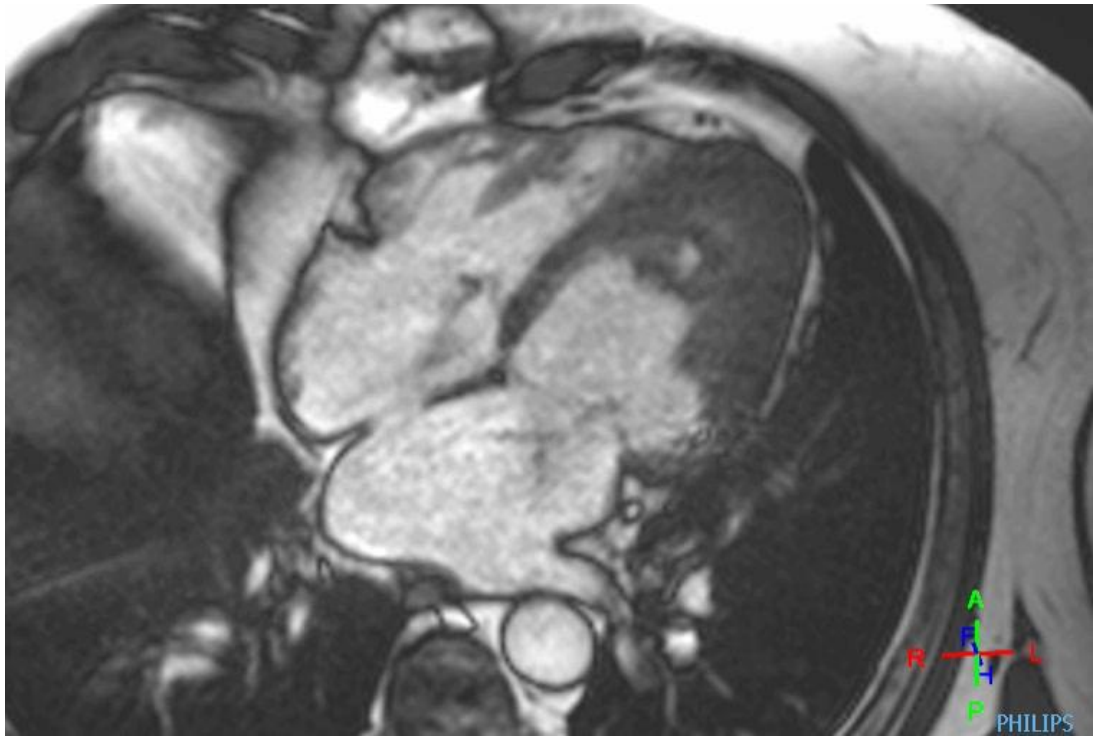
- „chameleon disease“ – může napodobit jakoukoliv jinou patologii (ARVC, IM, akutní myokarditida, HCM, DCM, akutní perikarditida)

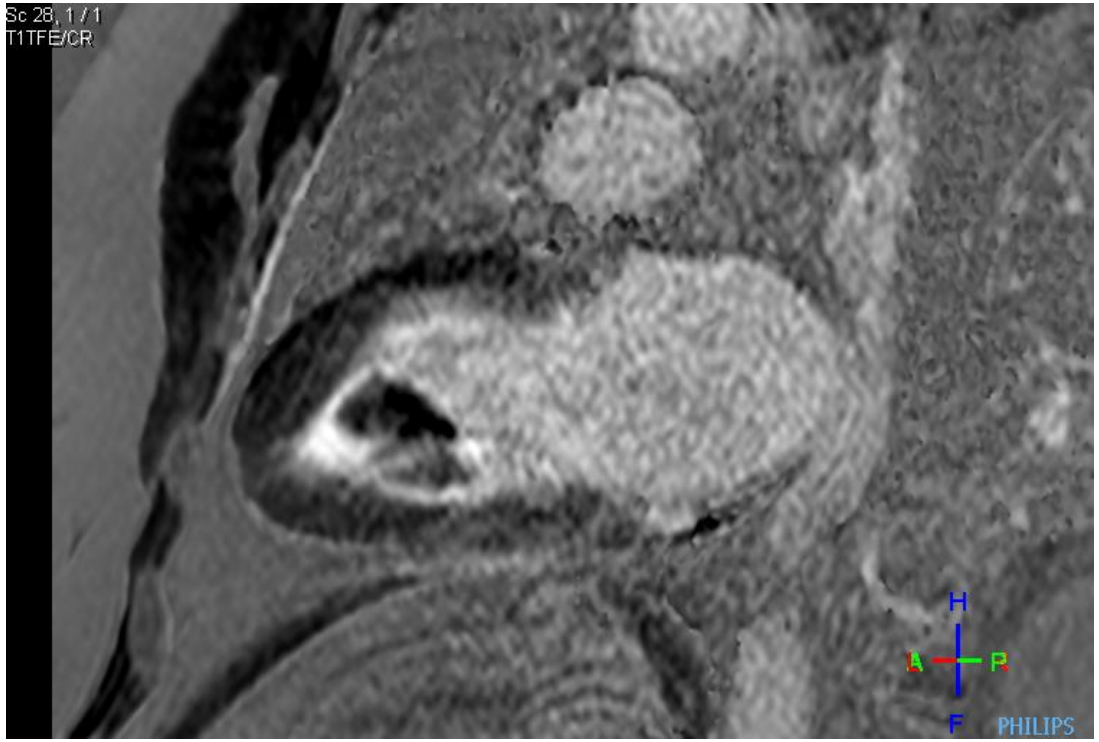
IM napodobující obraz

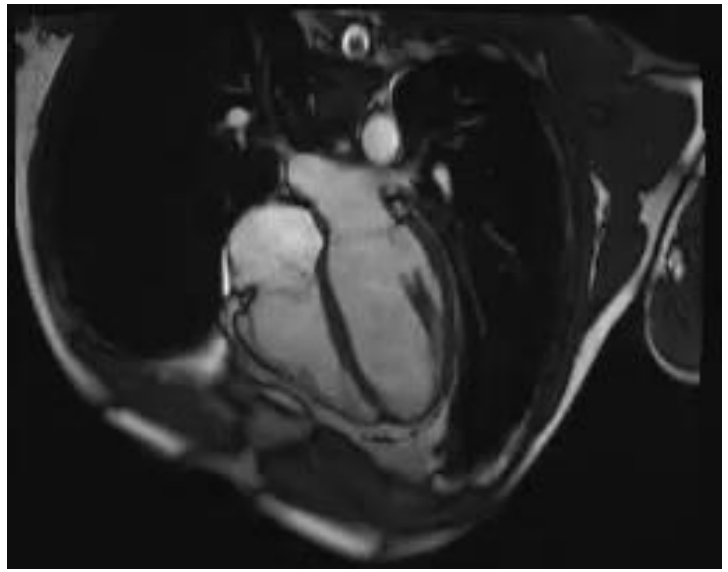


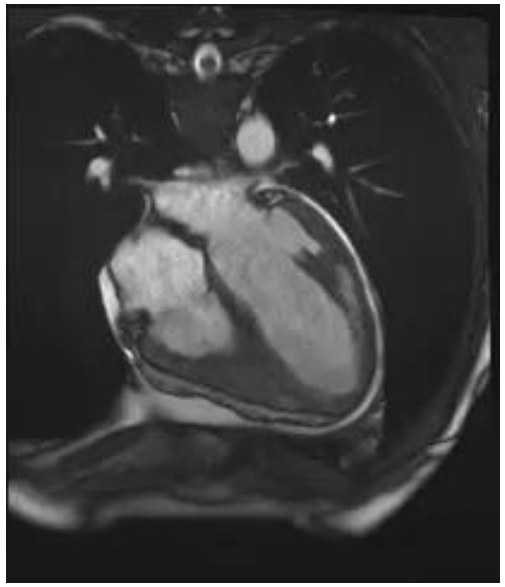
HCM napodobující obraz

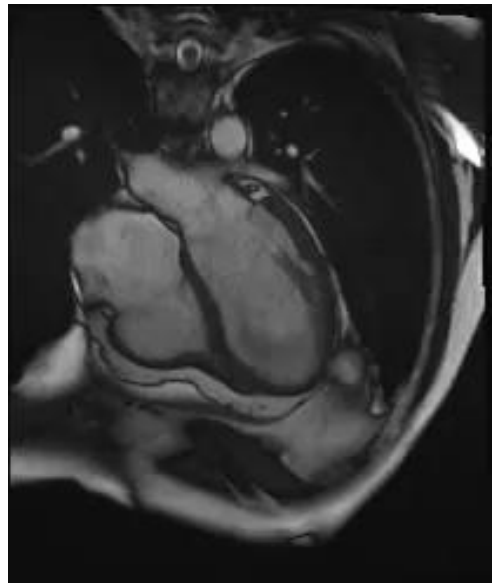
Eozinofilní myokarditida/endomyokardiální fibróza





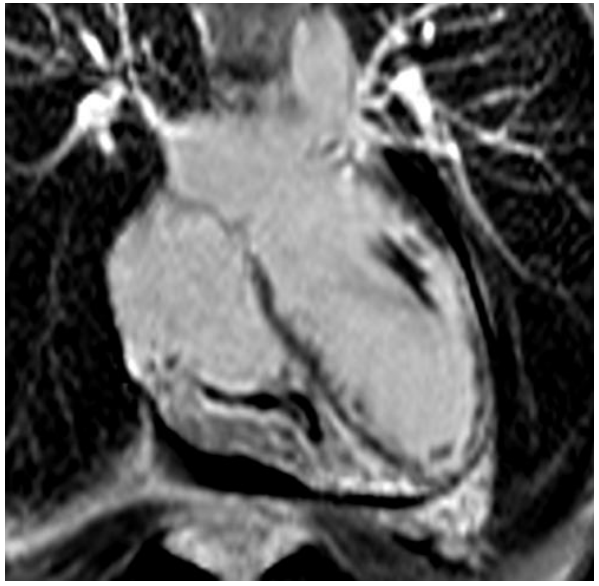




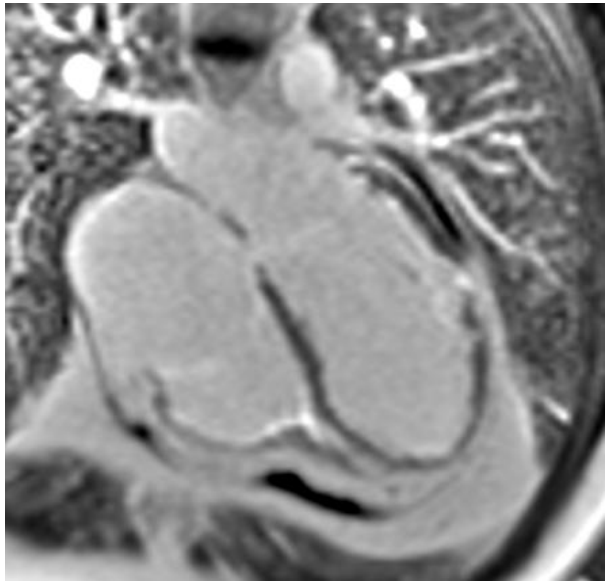


hypereozinofilie

imatinib + warfarin

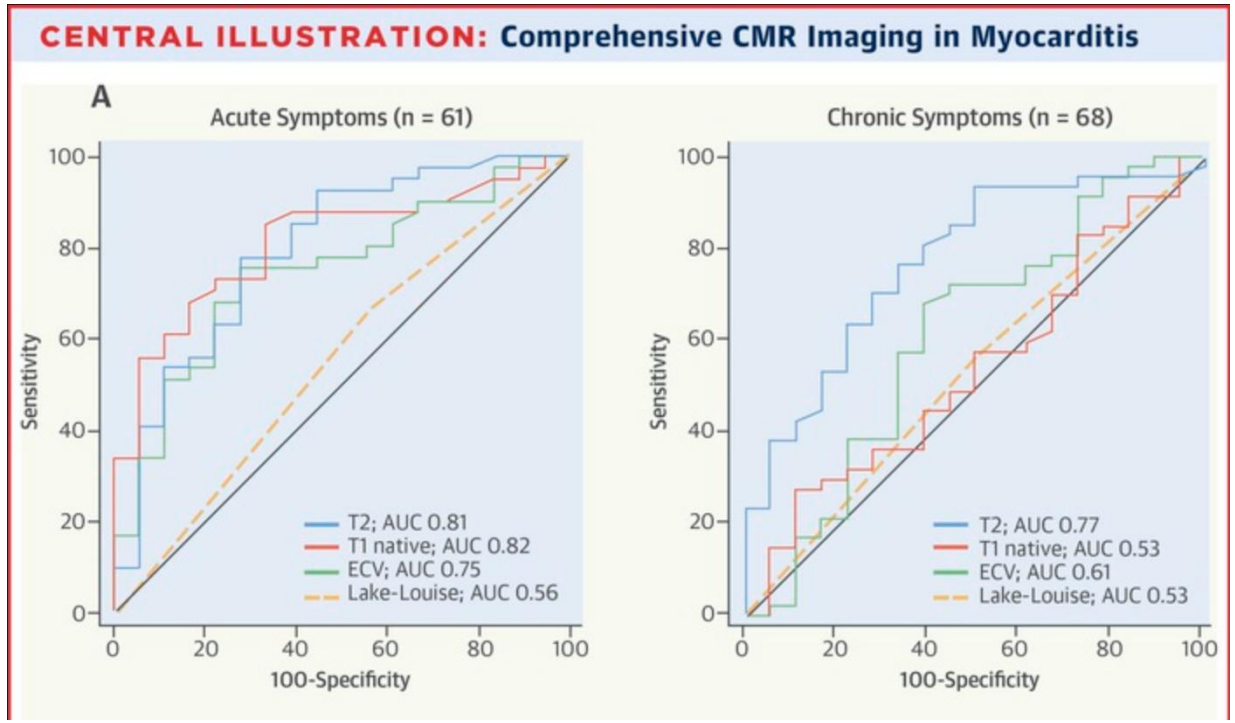


myeloidní neoplázie s hypereozinofilií



kortikoidy +

Problémy v praxi



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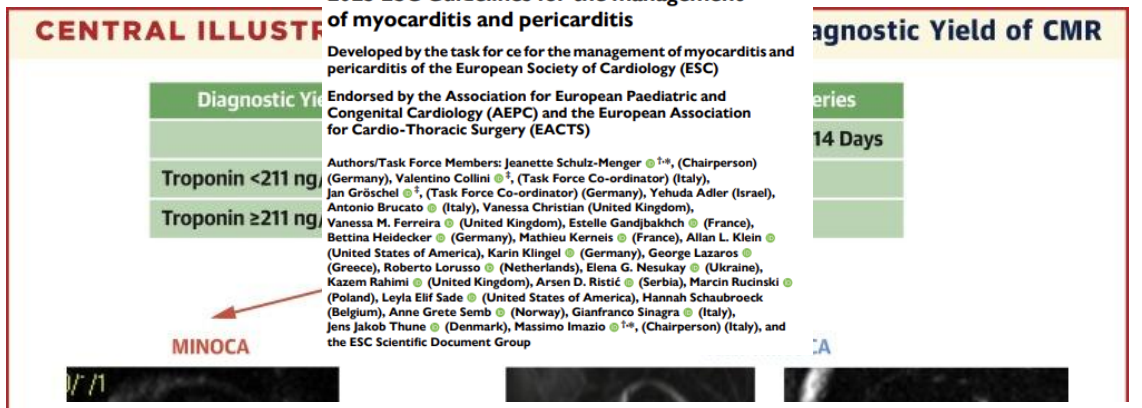
Comprehensive Cardiac Magnetic Resonance Imaging in Patients With Suspected Myocarditis

The MyoRacer-Trial

Philipp Lurz, MD, PhD,[a] Christian Luecke, MD,[b] Ingo Eitel, MD,[c,d] Felix Föhrenbach, MD,[a] Clara Frank, MD,[b] Matthias Grothoff, MD,[b] Suzanne de Waha, MD,[c,d] Karl-Philipp Rommel, MD,[a] Julia Anna Lurz, MD,[e] Karin Klingel, MD,[f] Reinhard Kandolf, MD,[f] Gerhard Schuler, MD,[a] Holger Thiele, MD,[c,d] Matthias Gutberlet, MD[b]



ESC European Society of Cardiology
European Heart Journal (2025) 46, 3952–4041
https://doi.org/10.1093/eurheartj/ehaf192
ESC GUIDELINES

2025 ESC Guidelines for the management of myocarditis and pericarditis

Developed by the task for ce for the management of myocarditis and pericarditis of the European Society of Cardiology (ESC)

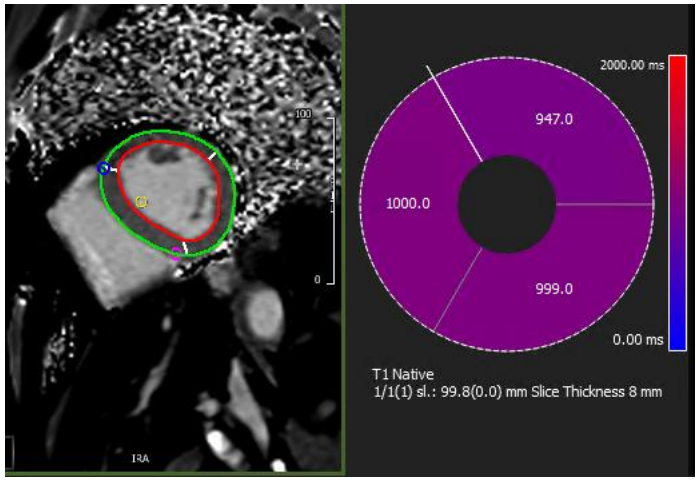
Endorsed by the Association for European Paediatric and Congenital Cardiology (AEPC) and the European Association for Cardio-Thoracic Surgery (EACTS)

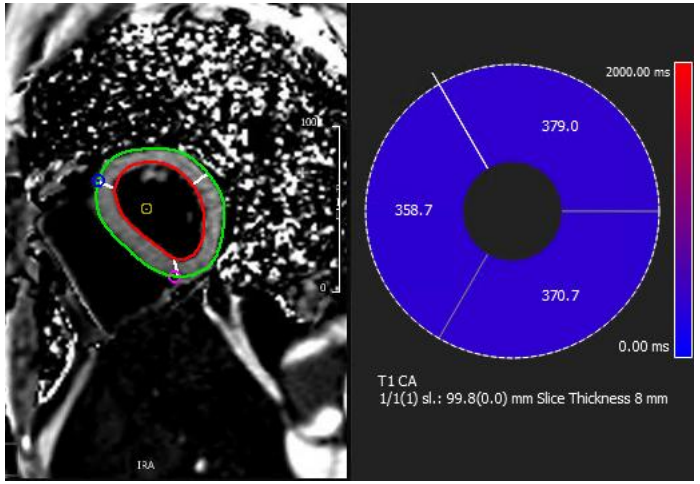
Authors/Task Force Members: Jeanette Schulz-Menger [†,*], (Chairperson) (Germany), Valentino Collini [‡], (Task Force Co-ordinator) (Italy), Jan Gröschel [‡], (Task Force Co-ordinator) (Germany), Yehuda Adler (Israel), Antonio Brucato (Italy), Vanessa Christian (United Kingdom), Vanessa M. Ferreira (United Kingdom), Estelle Gandjbakhch (France), Bettina Heidecker (Germany), Mathieu Kerneis (France), Allan L. Klein (United States of America), Karin Klingel (Germany), George Lazaros (Greece), Roberto Lorusso (Netherlands), Elena G. Nesukay (Ukraine), Kazem Rahimi (United Kingdom), Arsen D. Ristić (Serbia), Marcin Rucinski (Poland), Leyla Elif Sade (United States of America), Hannah Schaubroeck (Belgium), Anne Grete Semb (Norway), Gianfranco Sinagra (Italy), Jens Jakob Thune (Denmark), Massimo Imazio [†,*], (Chairperson) (Italy), and the ESC Scientific Document Group

5.6. Cardiovascular magnetic resonance

Cardiovascular magnetic resonance is the accepted gold standard for the quantification of biventricular function and detection of WMA. Cardiovascular magnetic resonance has the advantage of tissue differentiation, non-invasively detecting myocardial and pericardial inflammation, as well as fibrosis.[30] The diagnostic targets in non-ischaemic myocardial inflammation include myocardial oedema, hyperaemia and capillary leak, and necrosis/fibrosis (see Supplementary data online, *Figure S2*).[161–164] The diagnostic accuracy of CMR is higher if performed early in the time course of disease (best within the first 2 weeks).

T1 mapping





T1 Map Analysis Results

Global Myo Across Slices

Native T1	986 ± 63 ms
CA T1	369 ± 38 ms

Slice 1 Regional Results

Native T1 (ms)
Myo 986 ± 63

CA T1 (ms)
Myo 369 ± 38

ECV (%)
Information is not available due to missing data.

λ (%)
Information is not available due to missing data.

metaanalýza 120 publikací, n= 5541 zdravých subjektů

Parameter	Field Strength (T)	Technique	No. of Studies	Mean Native T1 (msec)	Mean ECV (%)
Native T1					
All vendors	1.5	All	76	976 (969, 983)	NA
Siemens	1.5	MOLLI	37	977 (969, 985)	NA
Siemens	1.5	ShMOLLI	19	954 (949, 958)	NA
Philips	1.5	MOLLI	20	994 (974, 1014)	NA
All	3.0	All	62	1159 (1143, 1175)	NA
Siemens	3.0	MOLLI	28	1192 (1171, 1214)	NA
Siemens	3.0	ShMOLLI	7	1170 (1152, 1188)	NA
Philips	3.0	MOLLI	27	1122 (1100, 1143)	NA
ECV					
All	All	All	95	NA	25.9 (25.6, 26.2)
All	1.5	All	55	NA	25.9 (25.5, 26.3)
Siemens	1.5	MOLLI	33	NA	25.8 (25.3, 26.3)
Siemens	1.5	ShMOLLI	7	NA	26.9 (25.9, 27.6)
Philips	1.5	MOLLI	15	NA	25.6 (24.7, 26.6)
All	3.0	All	40	NA	25.9 (25.4, 26.5)
Siemens	3.0	MOLLI	17	NA	26.4 (25.6, 27.2)
Philips	3.0	MOLLI	21	NA	25.4 (24.9, 26.0)

Gottbrecht M. et al. Native T1 and Extracellular Volume Measurements by Cardiac MRI in Healthy Adults: A Meta-analysis., Radiology 2019

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Review

Multiparametric CMR in Myocarditis: A Comprehensive Review of Diagnostic Advances, Prognostic Value, and the Challenge of Genetic Mimics

Wissam Alam [1,*], Houssem Hamrouni [2], Ivelina Choneva [2] and Cyrus Moini [1]

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[2] Radiology Department, Groupe Hospitalier Sud Ile de France, 77000 Melun, France; houssem.hamrouni@ghsif.fr (H.H.); ivelina.choneva@ghsif.fr (I.C.)
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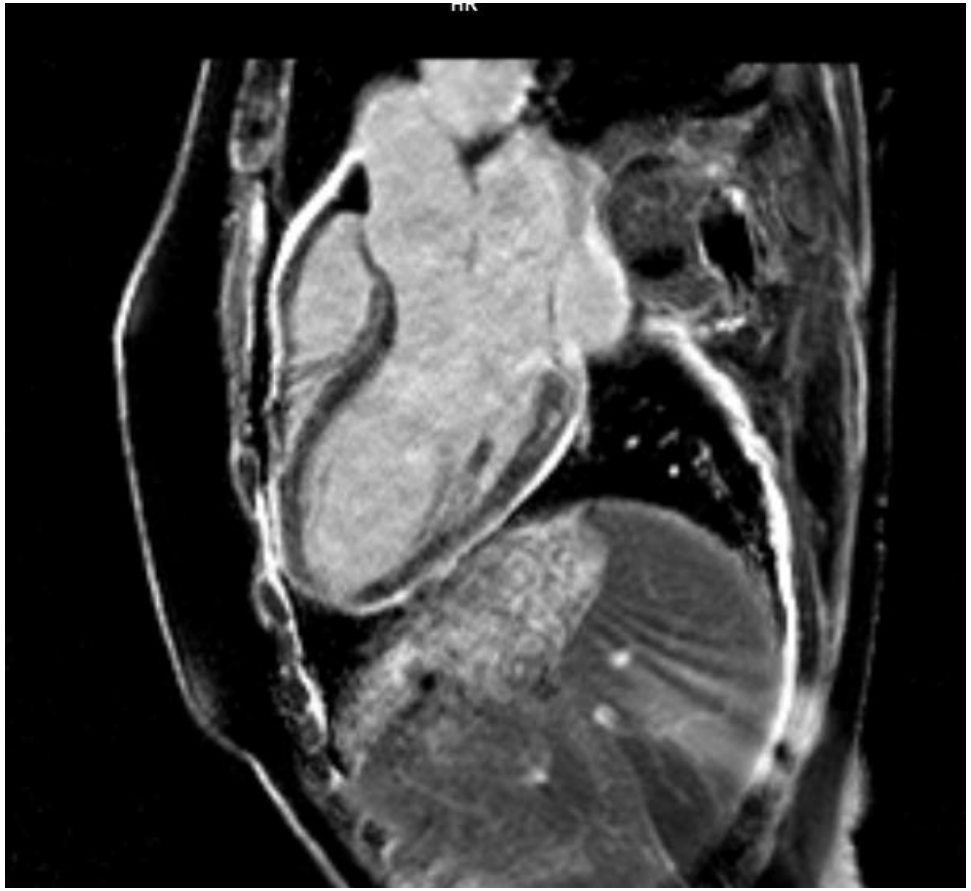
	Category	Sub-Category	Examples/Specific Triggers
1.	Infectious Agents	Viral (DNA)	Parvovirus 819, Adenovirus, HHV-6, EBV, CMV, HSV
		Viral (RNA)	Coxsackievirus (A and B), SARS-CoV-2, Influenza A/B, HIV, Hepatitis C
		Bacterial	*Staphylococcus*, *Streptococcus*, *Corynebacterium diphtheriae*, Mycoplasma
		Spirochetes	*Borrelia burgdorferi* (Lyme disease), Leptospira
		Fungal/Protozoal	Aspergillus, Candida/*Trypanosoma cruzi* (Chagas), *Toxoplasma gondii*
2.	Immune Mediated	Autoimmune Disorders	SLE, Sarcoidosis, Giant cell myocarditis, Rheumatoid arthritis
		Hypersensitivity	Allergic reactions to Penicillin, Clozapine, Sulfonamides, Cephalosporins
		Vaccine related	mRNA COVID-19 vaccines, Smallpox vaccine
3.	Toxic & Drugs	Oncology Therapies	Immune Checkpoint Inhibitors (ICIs), Anthracyclines, Trastuzumab
		Recreational/Toxins	Cocaine, Amphetamines, Alcohol, Carbon monoxide
		Heavy Metals	Iron (Hemochromatosis), Copper, Lead
		Venoms	Scorpion stings, Snake bites, Bee/Wasp stings
4.	Physical Agents		Radiation therapy, Electric shock, Heatstroke
5.	Genetic Mimics	Desmosomal/Others	ACM (e.g., PKP2, DSP), LMNA, FLNC mutations
6.	Idiopathic		No specific cause identified (approx. 50% of cases)

Autoimunitní onemocnění

- 37-letá žena
- susp. na SLE t.č. bez terapie
- atypický hrudní dyskomfort
- Troponin T 49 ng/l
- EKG bez jednoznačné patologie
- ECHO bpn



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Original research

Diagnostic utility of the revised Lake Louise criteria in myocarditis associated with active autoimmune rheumatic disease

Alina Hua[a,b], Blanca Domenech-Ximenos[a,c], Begona Lopez[d], Giovanni Sanna[d], Amedeo Chiribiri[a], Ronak Rajani[a,b], Michael Marber[b], David D'Cruz[d], Michelle Fernando[d], Tevfik F. Ismail[a,b,*]

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- imunosuprese
- klinika + Tn 72-318 ng/l
- obě LLC kritéria – 32 % (specif. 100 %)
- alespoň jedno LLC – 65 % (specif. 76 %)

Kontrolní skupina:

- zvýšený nativní T1 – 24 %
- T2 – norma

	Myocarditis (n = 37)	Control (n = 25)
Autoimmune diagnosis		
Systemic Lupus Erythematosus	16 (43)	10 (40)
EGPA	6 (16)	5 (20)
Dermatomyositis	6 (16)	1 (4)
Behçet's disease	3 (8)	0 (0)
Mixed Connective Tissue Disease	2 (5)	2 (8)
Leukocytoclastic vasculitis	1 (3)	0 (0)
Overlap syndrome	1 (3)	0 (0)
Sjogren's syndrome	1 (3)	1 (4)
Undifferentiated CTD	1 (3)	0 (0)
Takayasu's arteritis	0 (0)	3 (12)
Granulomatosis with polyangiitis	0 (0)	2 (8)
Systemic sclerosis	0 (0)	1 (4)

Contents lists available at ScienceDirect

Trends in Cardiovascular Medicine

journal homepage: www.elsevier.com/locate/tcm

Myocarditis and pericarditis in focus: A critical appraisal of the 2025 ESC vs ACC position statements from the Italian society of cardiology working group on cardiomyopathies and pericardial diseases

Massimo Imazio[a,b,*], Valentino Collini[b], Marco Merlo[c], Alberto Aimo[d,e], Camillo Autore[f], Andrea Barison[d,e], Barbara Bauce[g], Elena Biagini[h], Francesco Cappelli[i], Silvia Castelletti[b], Flavio D'Ascenzi[j], Cesare De Gregorio[k], Francesca Marzo[l], Beatrice Musumeci[m], Roberto Pedrinelli[n], Stefania Paolillo[o], Pasquale Perrone-Filardi[o], Giuseppe Limongelli[p], Gianfranco Sinagra[c]

Myocarditis: Comparative use of Cardiac Magnetic Resonance (CMR) and endomyocardial biopsy (EMB).

Diagnostic test	2025 ESC Guidelines	2024 ACC Consensus
CMR	CMR considered a noninvasive diagnostic gold standard. Adopts updated Lake Louise Criteria (LLC): CMR evidence of non-ischemic inflammation requires ≥1 T2-based sign (edema) plus ideally ≥1 T1-based sign (LGE or mapping abnormality). Having both T2 and T1 criteria increases specificity; if only one is positive in a fitting clinical scenario, myocarditis can still be diagnosed (with lesser certainty).	Strongly emphasizes CMR as a pivotal diagnostic tool: if patient is stable, CMR (with T1/T2 mapping) should be obtained to confirm inflammation. Recognizes that CMR can "noninvasively" diagnose myocarditis previously confirmed only by biopsy. If CMR is contraindicated or nondiagnostic, other imaging (e.g. FDG-PET) may provide incremental information.
EMB	Still considered the reference standard for etiologic diagnosis. ESC advises selective use of EMB: indicated when results would change management (e.g., suspected giant cell myocarditis, unclear diagnosis, or failure to improve). A "paradigm shift" is noted: routine biopsy is not required in all cases now that CMR can confirm inflammation in uncomplicated cases.	Provides detailed guidance on when to perform EMB. EMB is recommended if the diagnostic/prognostic benefit outweighs risk – particularly if specific diagnoses requiring targeted therapy are suspected (giant cell, eosinophilic, sarcoidosis, etc.). A decision algorithm stratifies which suspected myocarditis patients need early EMB . ACC notes biopsy is under-utilized but can be lifesaving (e.g., early EMB in fulminant cases improves 1-year transplant-free survival).

Závěr

- CMR je zásadní zobrazovací metodou pro stanovení diagnózy myokarditidy
- má být provedené u všech pacientů včetně kontrolního vyšetření do 6 měsíců od vzniku potíží
- unikátní metoda k průkazu přidružené perikarditidy
- přináší prognostické informace
- pomáhá odlišit pacienty s genetickým podkladem onemocnění

Děkuji Vám za pozornost