

(Nejen) ESC Guidelines pro myokarditidy 2025

Jan Krejčí

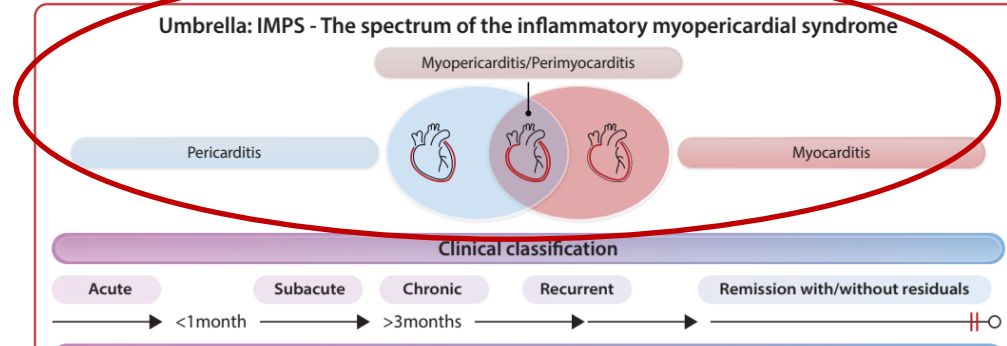
- I. interní kardiologická klinika FN u sv. Anny a Masarykovy univerzity v Brně

ESC guidelines pro myokarditidu a perikarditidu

2025 ESC Guidelines for the management of myocarditis and pericarditis

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

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➤ pojem „zánětlivý myoperikardiální syndrom“ jako zastřešující pojem při zahájení diagnosticko-terapeutického algoritmu

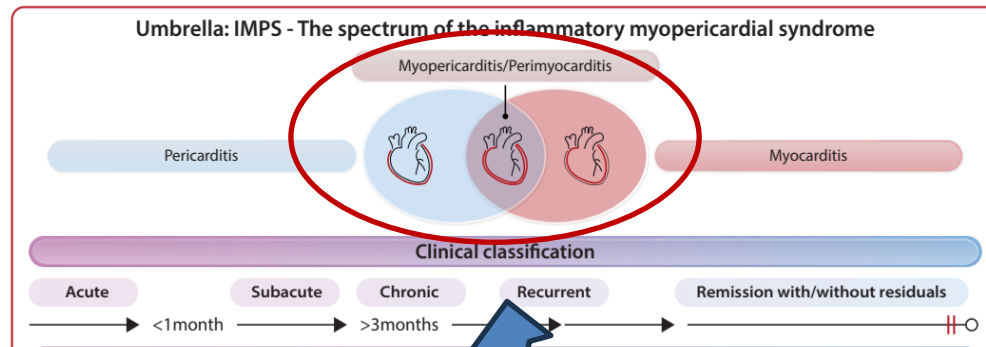
Máme společná guidelines – ale máme jít?

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➤ někdy to smysl může dávat...

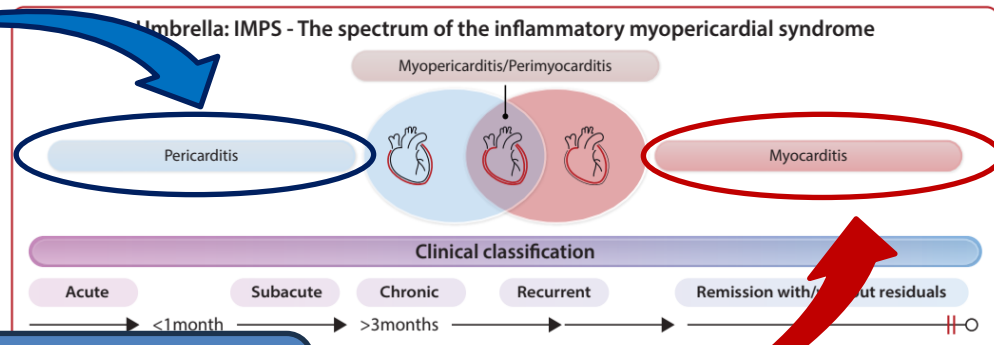


Máme společná guidelines – ale máme jásat?

2025 ESC Guidelines for the management of myocarditis and pericarditis

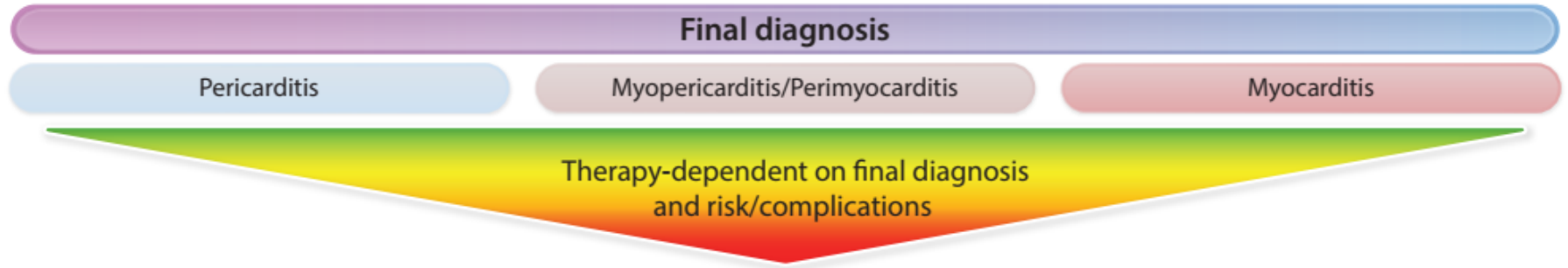
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➤ ...ale ve většině situací je přehlednější věnovat se každému onemocnění separátně

...na konci diagnostického procesu bychom měli mít jasno...



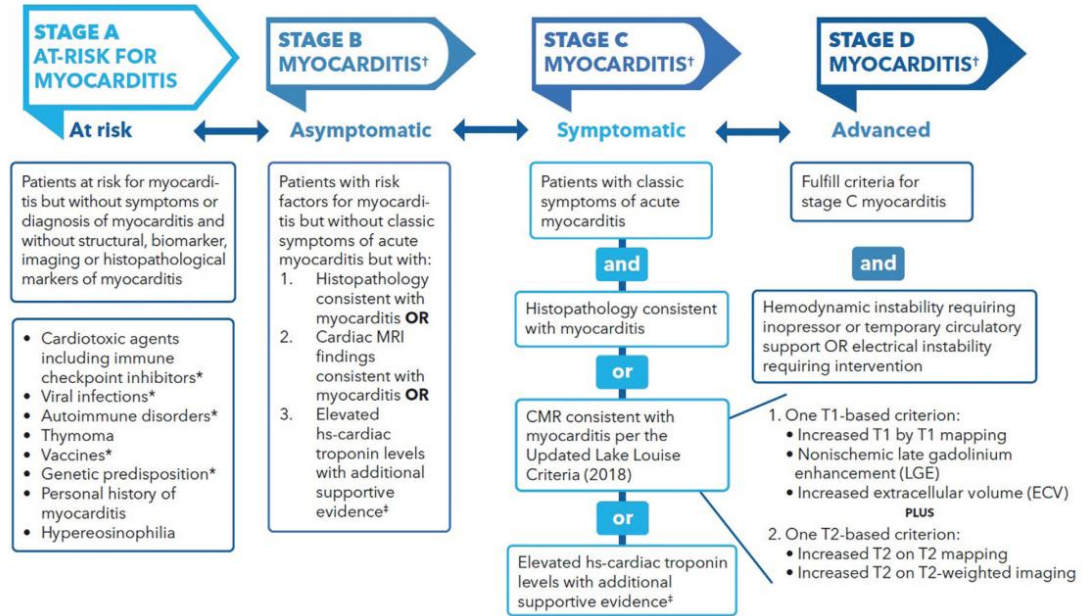
➤ „zánětlivý myoperikardiální syndrom“ není finální diagnóza!

2024 ACC consensus

2024 ACC Expert Consensus Decision Pathway on Strategies and Criteria for the Diagnosis and Management of Myocarditis

...vytvoření stágingu podobného jako u srdečního selhání

FIGURE 5 Proposed Stages of Myocarditis



Myokarditidy a ZKMP – klinický obraz

Akutní myokarditida – doba od začátku symptomů do 1 měsíce
- **fulminantní myokarditida** je akutní myokarditida s těžkým srd. selháním
až kardiogenním šokem vyžadující terapii inotropy či MCS

Subakutní myokarditida – doba od začátku symptomů 1-3 měsíce

Chronická myokarditida – doba od začátku symptomů více než 3 měsíce

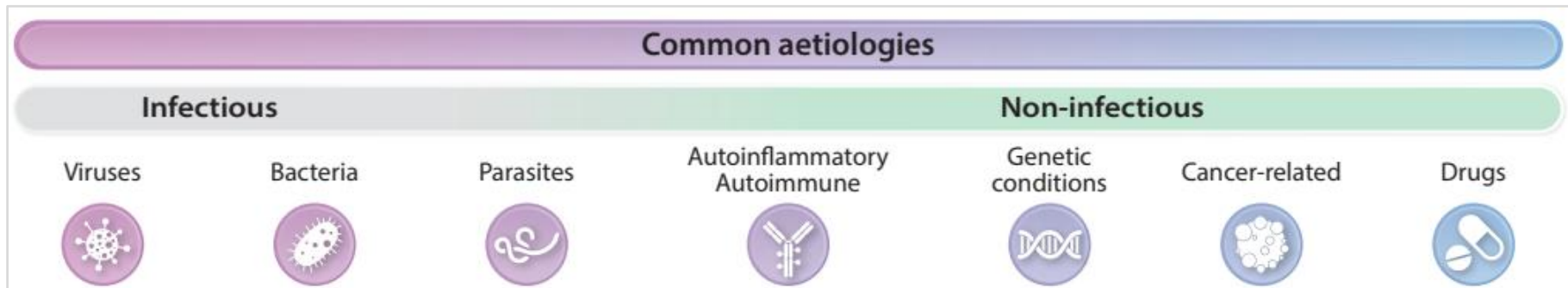


Myokarditidy a zánětlivé kardiomyopatie - etiologie

2025 ESC Guidelines for the management of myocarditis and pericarditis

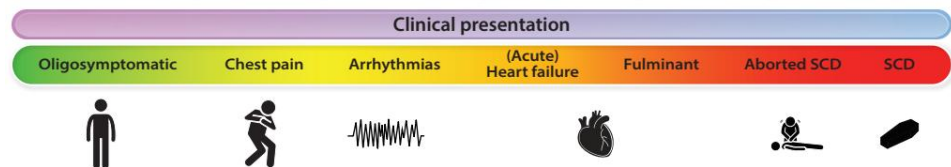
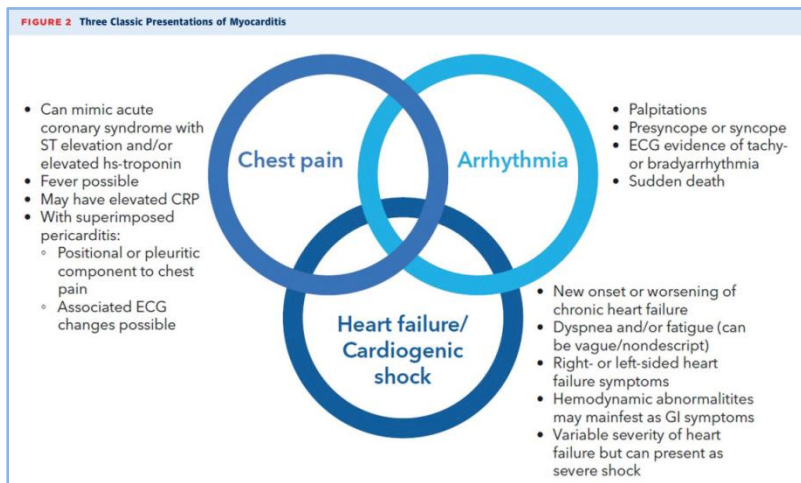
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Myokarditidy a ZKMP – klinický obraz

- **Příznaky mohou být polymorfní a jejich intenzita velmi rozdílná – od oligosymptomatických případů až po kardiogenní šok či SCD**
- **Široké spektrum příznaků komplikuje suspekci – a tedy i diagnostiku**



Myokarditidy a ZKMP – kdy na dg myokarditidy myslet?

Tab. 1. Diagnostická kritéria pro klinickou diagnostiku myokarditidy.

Diagnóza myokarditidy je pravděpodobná v přítomnosti jednoho z klinických příznaků a alespoň jednoho diagnostického kritéria; minimálně dvou diagnostických kritérií u asymptomatického jedince.

1 + 1



Klinické příznaky

- bolesti na hrudi
- příznaky srdečního selhání (akutního či chronického)
- arytmiické příznaky (palpitace, synkopy, náhlá srdeční smrt)

Diagnostická kritéria

I. EKG nálezy

(atrioventrikulární blokády, raménkové blokády, ST/T změny, supraventrikulární či komorové arytmie, snížená voltáž QRS komplexů, přítomnost Q kmitů)

II. Znamky nekrózy myokardu

(elevace troponinů či CK-MB)

III. Funkční a strukturální abnormality při echokardiografickém či MRI vyšetření

(porucha funkce levé či pravé komory, s/bez přítomné dilatace levé/pravé komory, hypertrofie stěn, perikardiálního výpotku, nitrosrdečních trombů)

IV. Tkáňová charakteristika při MRI vyšetření

(naplněna alespoň dvě Lake Louise kritéria – edém tkáně, časné a pozdní syčení myokardu gadoliniem)

0 + 2

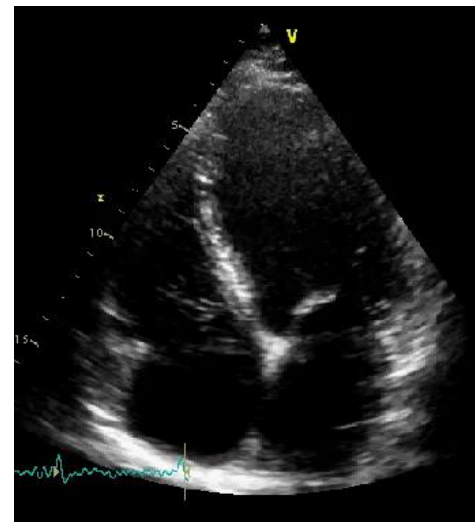


Myokarditidy a ZKMP – neinvazivní diagnostika - EKG

- **jednoduché a dostupné vyšetření**
- **Nespecifický obraz - přítomnost arytmií, změny PQ a ST-T úseku, prodloužení PQ intervalu či QRS komplexu, přítomnost Q kmitů...**
- přítomnost poruch rytmu svědčí pro určité typy postižení – u nemocných mladších 55 let s nejasnou etiologií atrioventrikulární blokády vyššího stupně, byla v 25% zjištěna GCM či srdeční sarkoidóza
- denivelace ST úseků jsou difúzní a nesledují povodí koron. tepen – současná přítomnost perikarditidy
- **...ale nález může být normální...**

Myokarditidy a ZKMP – neinvazivní diagnostika - ECHOkg

- **jednoduché a dostupné vyšetření**
- **snížení systolické funkce LK – většinou difúzní porucha kinetiky, ale může být i regionální...**
- **...ale nález může být zcela normální...**



Myokarditidy a ZKMP – neinvazivní diagnostika - ECHOkg

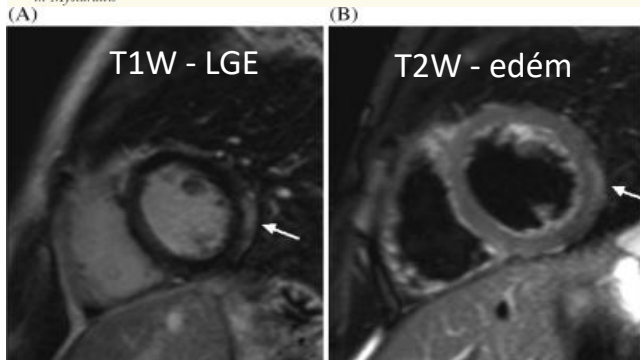
- **ztluštění stěn s malou dutinou LK a systolickou poruchou u fulminantních forem**
- **perikardiální výpotek**



Myokarditidy a ZKMP – neinvazivní diagnostika – MRI

Cardiovascular Magnetic Resonance in Myocarditis: A JACC White Paper

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Hassan Abdel-Aty, MD,§ Matthias Gutberlet, MD,** Sanjay Prasad, MD,††
Anthony Aletas, 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



„Lake Louise Criteria“

- edém tkáně
- časné sycení
- pozdní sycení

Při pozitivě alespoň 2 kritérií

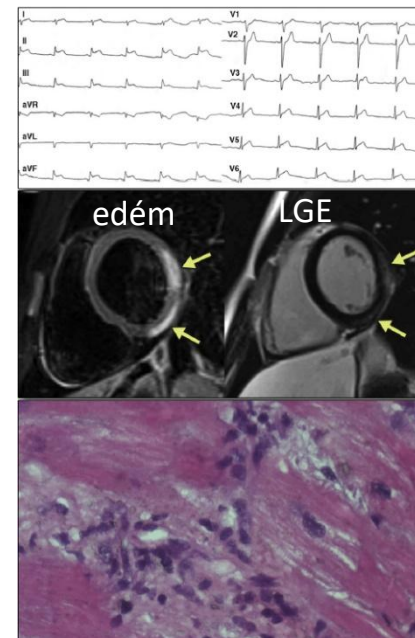
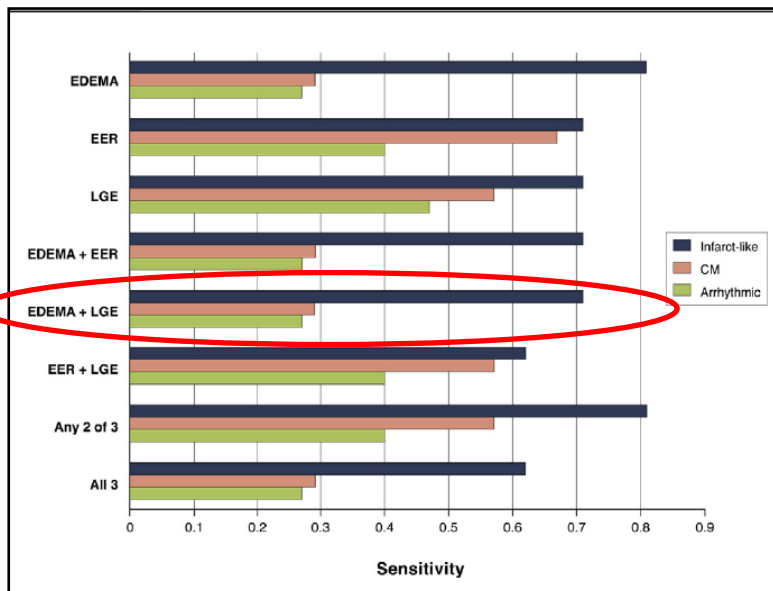
- Senzitivita 67%
- Specifita 91%

Přítomnost dysfunkce LK či perikardiálního výpotku zvyšuje pravděpodobnost dg.

Myokarditidy a ZKMP – neinvazivní diagnostika – MRI

CMR Sensitivity Varies With Clinical Presentation and Extent of Cell Necrosis in Biopsy-Proven Acute Myocarditis

Marco Francone, MD, PhD,* Cristina Chimenti, MD, PhD,†‡ Nicola Galea, MD,*
Fernanda Scopelliti, PhD,§ Romina Verardo, PhD,§ Roberto Galea, MD,||
Iacopo Carbone, MD,* Carlo Catalano, MD,* Francesco Fedele, MD,† Andrea Frustaci, MD†§



- senzitivita MRI je nejvyšší pro akutní MC manifestující se bolestmi na hrudi
- Nízká pro KMP a arytmiicky se manifestující MC

Myokarditidy a ZKMP – neinvazivní diagnostika – MRI

JACC STATE-OF-THE-ART REVIEW

Cardiovascular Magnetic Resonance in Nonischemic Myocardial Inflammation

Expert Recommendations

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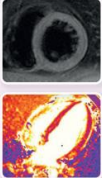
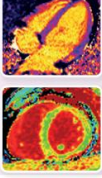
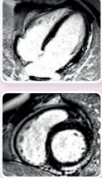
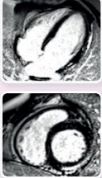


† T1 – edema (intra or extra-cellular), hyperemia/capillary leak, necrosis, fibrosis
 EGE – hyperemia, capillary leak
 LGE – necrosis, fibrosis, (extracellular acute edema)
 † ECV – edema (extracellular), hyperemia/capillary leak, necrosis, fibrosis

TABLE 3 Updated Recommendations of CMR Criteria of Myocardial Inflammation

Original Lake Louise Criteria I (Any 2 Out of 3)	Updated Lake Louise Criteria II (2 Out of 2)
Main criteria	
T2-weighted imaging Regional* high T2 SI or Global T2 SI ratio ≥ 2.0 † in T2W CMR images	T2-based imaging Regional* high T2 SI or Global T2 SI ratio ≥ 2.0 † in T2W CMR images or Regional or global increase of myocardial T2 relaxation time†
Early gadolinium enhancement SI ratio myocardium/skeletal muscle (EGE ratio) of ≥ 4.0 † in EGE images	T1-based imaging Regional or global increase of native myocardial T1 relaxation time or ECV†† or Areas with high SI in a nonischemic distribution pattern in LGE images
Late gadolinium enhancement Areas with high SI in a nonischemic distribution pattern in LGE images	
Supportive criteria	
Pericardial effusion in cine CMR images	Pericardial effusion in cine CMR images or High signal intensity of the pericardium in LGE images, T1-mapping or T2-mapping or T1 mapping or T2 mapping
Systolic LV wall motion abnormality in cine CMR images	Systolic LV wall motion abnormality in cine CMR images

MRI diagnostika myokarditid

Criterion	Methods	Example images and pathology	Parameters for reporting	
			For myocarditis	For pericardial involvement
T2-based criterion	T2-weighted imaging or T2 mapping	<p>Myocardial oedema</p> 	<ul style="list-style-type: none"> • Presence, extent, and location of oedema (T2 weighted) • Regional high T2 SI or global high T2 SI (T2-weighted) • Regional or global increase of myocardial T2 times 	
		<p>Myocardial oedema/ diffuse fibrosis</p> 		
T1-based criterion	Native T1 mapping/ post-contrast T1 mapping (ECV)/ T1-weighted imaging	<p>Focal myocardial fibrosis/scar</p> 	<ul style="list-style-type: none"> • Description of focal increases • Regional or global increase of native myocardial T1 times • Regional or global increase ECV values 	
	Late gadolinium enhancement	<p>Focal myocardial fibrosis/scar</p> 	<ul style="list-style-type: none"> • Presence, pattern, extent, and location of LGE (positive if areas with high SI in a nonischaemic distribution pattern) • Thrombi (if present) • Total LGE/LV mass (%) (no routine) 	

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}

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	B
I	C

Myokarditidy – diagnostika

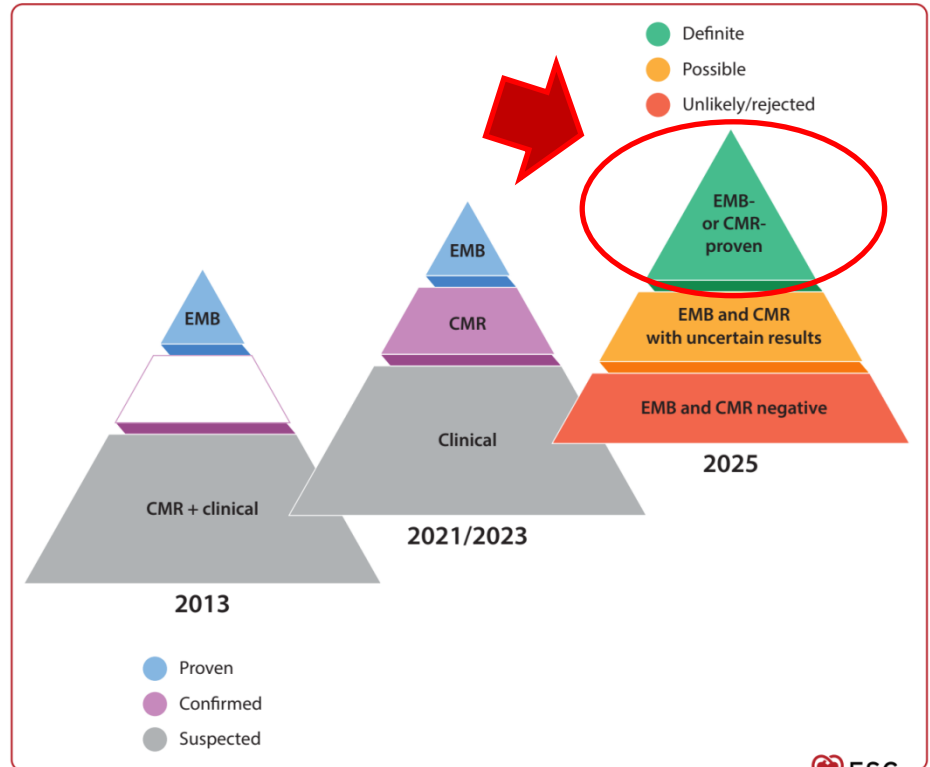
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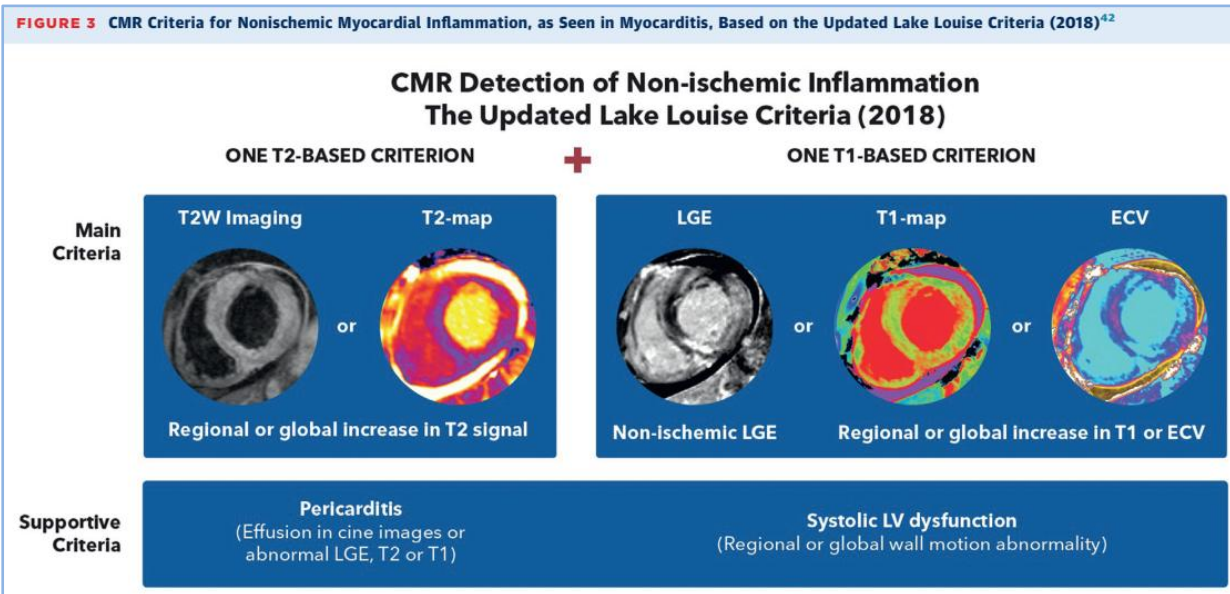
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Definitivní dg. už nevyžaduje provedení EMB!

„Zrovnoprávnění“ neinvazivní a invazivní diagnostiky má svá úskalí...

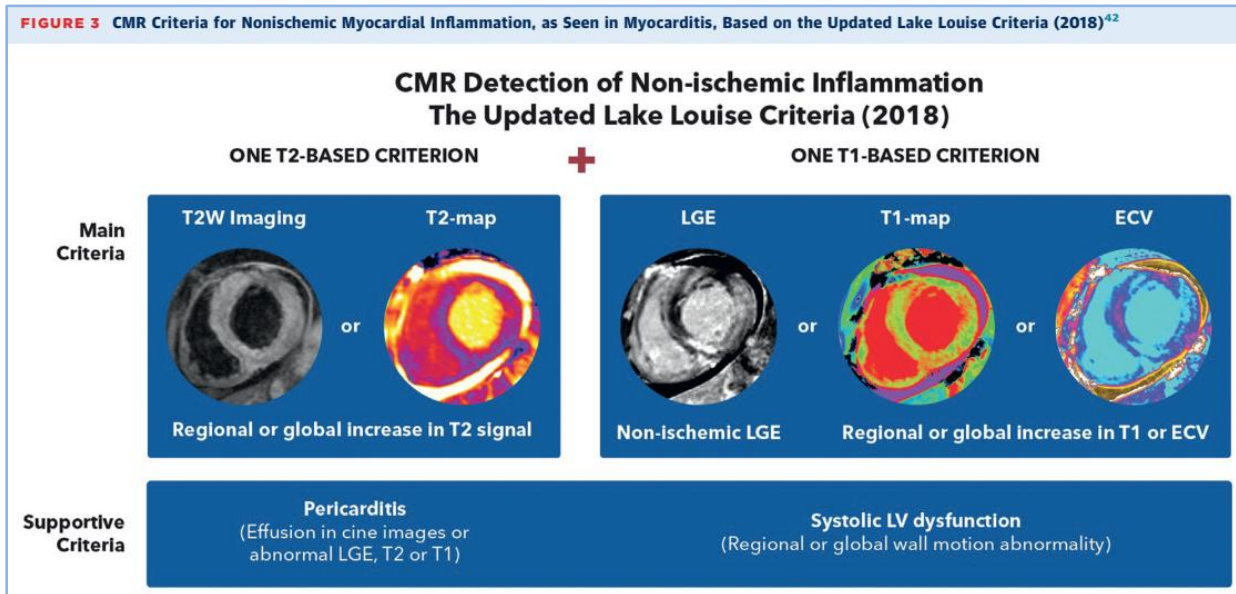


MRI diagnostika myokarditid... aneb 1+1=dg



MRI je nejdůležitější neinvazivní metoda diagnostiky

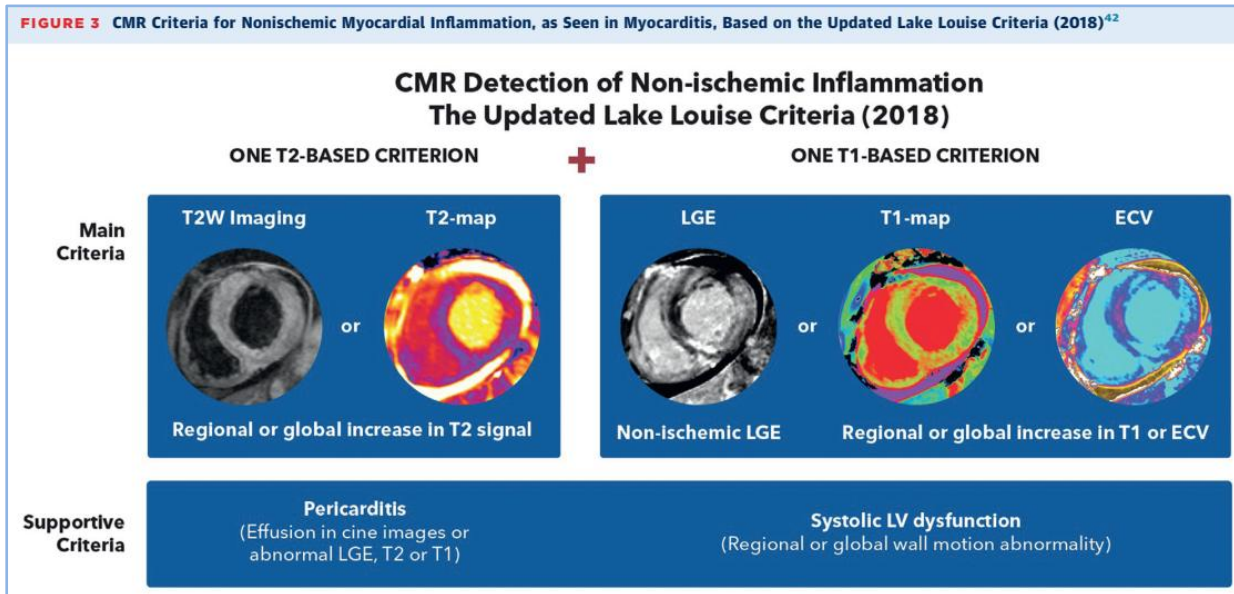
MRI diagnostika myokarditid... aneb 1+1=dg



MRI je nejdůležitější neinvazivní metoda diagnostiky

nerozliší (imuno)histologický podtyp myokarditidy

MRI diagnostika myokarditid... aneb 1+1=dg



MRI je nejdůležitější neinvazivní metoda diagnostiky

nerozliší (imuno)histologický podtyp myokarditidy

jednotlivé podtypy mají odlišnou prognózu i léčbu

EMB není indikována u všech nemocných se susp. myokarditidou, ale svou roli stále má...

Recommendation Table 6 — Recommendations for endomyocardial biopsy (see Evidence Table 6)

Recommendations	Class ^a	Level ^b
EMB ^c is recommended in patients with high-risk myocarditis ^d , and/or haemodynamic instability, and/or in patients with intermediate-risk myocarditis not responding to conventional therapy in order to detect a specific histologic subtype and to assess the presence of viral genome for treatment. ^{34,63,73,131}	I	C

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Diagnostický algoritmus pro myokarditidy – role EMB

Recommendation Table 6 — Recommendations for endomyocardial biopsy (see Evidence Table 6)

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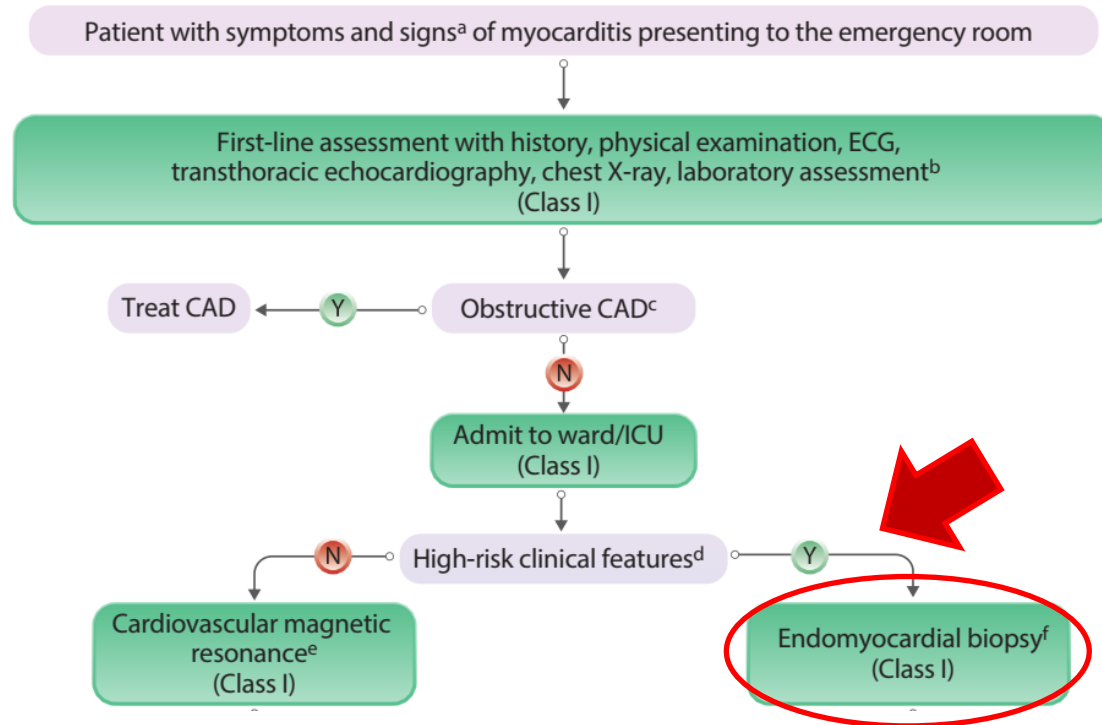
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Table 7 Clinical risk stratification to guide treatment in inflammatory myopericardial syndrome

Risk	High risk	Intermediate risk	Low risk
Myocarditis	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> New/progressive dyspnoea Non-sustained ventricular arrhythmias Persistent release or relapsing troponin 	Stable symptoms or oligosymptomatic
	<p>Imaging criteria:</p> <ul style="list-style-type: none"> Newly reduced LVEF (<40%)^a Extensive LGE on CMR^a 	<p>Imaging criteria:</p> <ul style="list-style-type: none"> Newly mildly reduced LVEF (41%–49%) and/or WMA Preserved LVEF (≥50%) and LGE ≥2 segments on CMR 	<p>Imaging criteria:</p> <ul style="list-style-type: none"> Preserved LVEF (≥50%) without LGE or limited LGE (<2 segments) on CMR

Eur Heart J. 2025 Oct 22;46(40):3952-4041.

Diagnostický algoritmus pro myokarditidy – role EMB

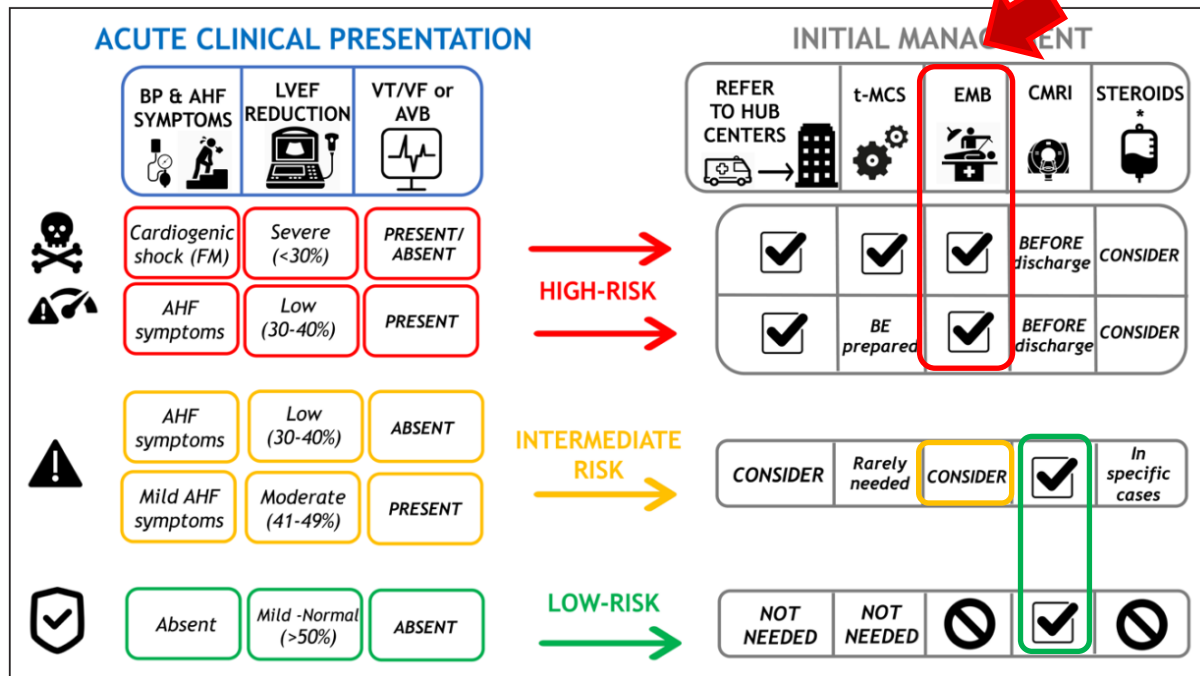


Eur Heart J. 2025 Oct 22;46(40):3952-4041.

Kdy indikovat EMB u nemocných s podezřením na myokarditidu?

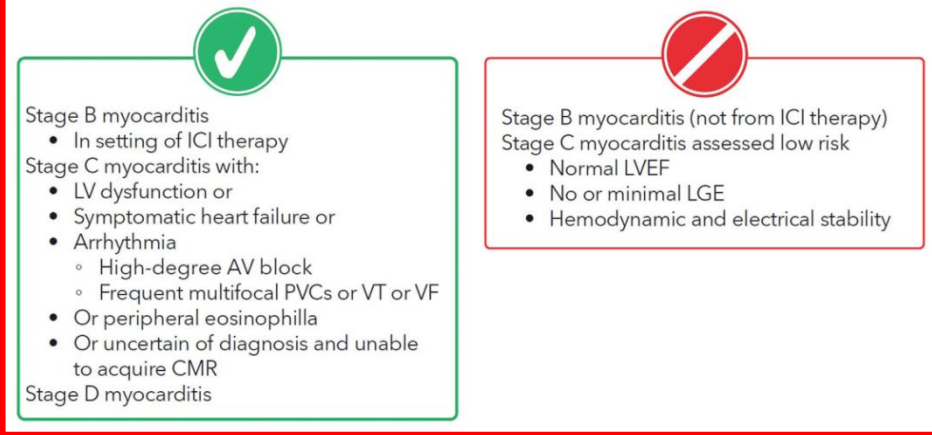
Management of Acute Myocarditis and Chronic Inflammatory Cardiomyopathy

An Expert Consensus Document



Circ Heart Fail. 2020 Nov;13(11):e007405.

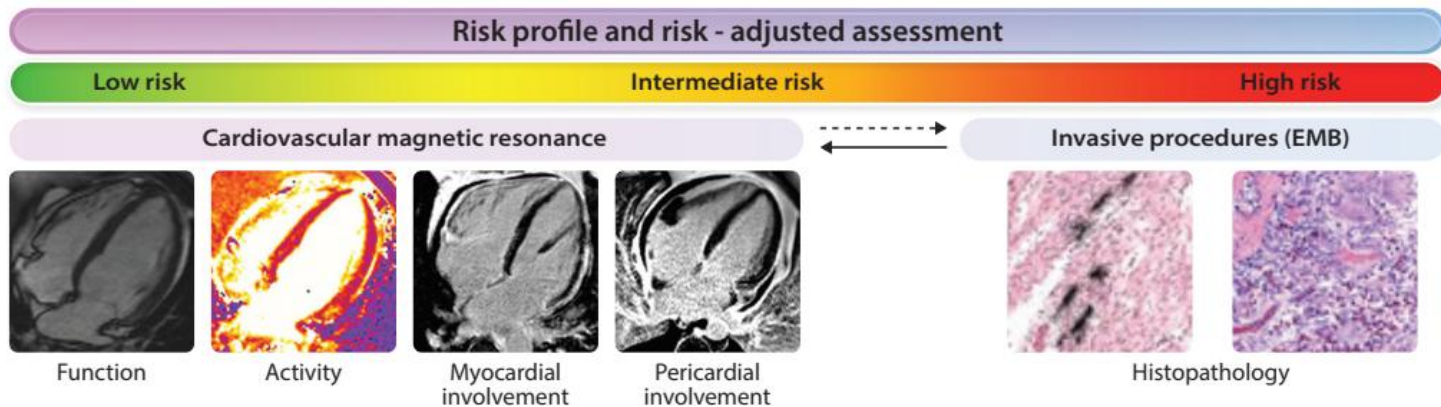
FIGURE 6 When to Perform EMB in Patients With Suspected Myocarditis



2025 ESC Guidelines for the management of myocarditis and pericarditis

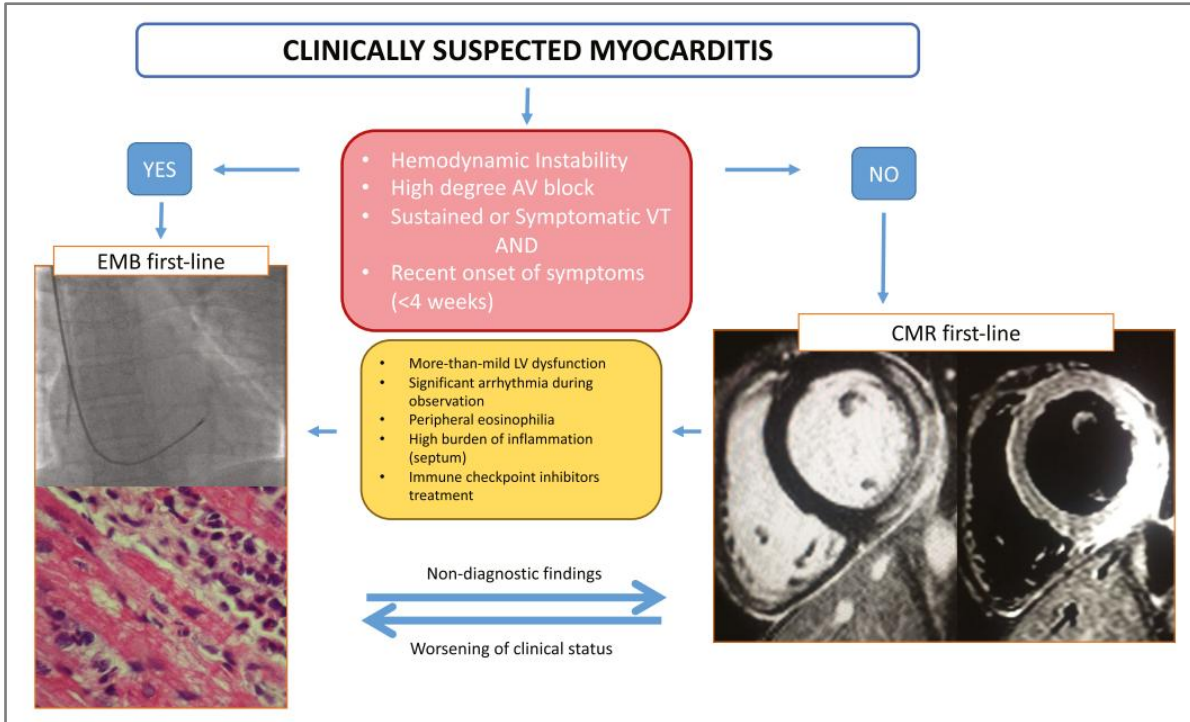
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Invazivní a neinvazivní dg nestojí proti sobě, ale doplňují se!

State-of-the-Art of Endomyocardial Biopsy on Acute Myocarditis and Chronic Inflammatory Cardiomyopathy



Hodnocení EMB dle ESC guidelines 2025

Table 11 Parameters for reporting by endomyocardial biopsy

Criteria	Parameters for reporting
Histology (paraffin-embedded EMB, at least 3 EMB)	Presence and extent of cardiomyocyte necrosis, inflammation, fibrosis
Immunohistology (paraffin-embedded EMB, at least 3 myocardial samples)	Presence, extent, localization, and typing of immune cells in the myocardium: CD3 ⁺ T lymphocytes, CD68 ⁺ macrophages (≥ 14 leucocytes/mm ² with T lymphocytes ≥ 7 cells/mm), ¹⁰ HLA-DR expression in immune cells and endothelial cells

Term	Predominant inflammatory cells
Active lymphocytic myocarditis	CD3 ⁺ T lymphocytes >7/mm ² , CD68 ⁺ macrophages
Persistent lymphocytic myocarditis	CD3 ⁺ T lymphocytes >7/mm ² , CD68 ⁺ macrophages
Resolved lymphocytic myocarditis	–
Eosinophilic myocarditis (acute stage)	Eosinophils, CD3 ⁺ T lymphocytes, CD68 ⁺ macrophages
Giant-cell myocarditis (acute stage)	Eosinophils, CD68 ⁺ giant cells, CD3 ⁺ T lymphocytes, CD68 ⁺ macrophages
Sarcoidosis	CD68 ⁺ giant cells, granuloma, CD3 ⁺ T lymphocytes, CD68 ⁺ macrophages

Myokarditidy a ZKMP – IS léčba

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Immunosuppressive therapy		
Corticosteroids should be considered in patients with fulminant, non-infectious forms of myocarditis to stabilize the patients.	IIa	C
Corticosteroids may be considered in patients with acute myocarditis with impaired LVEF if refractory to standard HF therapy to stabilize patients.	IIb	C
Routine use of immunosuppressive therapy is not recommended in acute myocarditis with preserved LV function because no outcome benefit has been shown.	III	C

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Myokarditidy a ZKMP – IS léčba

Table 12 Therapy for specific forms of myocarditis

Lymphocytic myocarditis (virus-negative)	
1st line therapy	Non-severe: prednisone 1 mg/kg/day p.o. then tapered Severe: i.v. methylprednisolone 7–14 mg/kg/day for 3 days, then 1 mg/kg/day p.o.
2nd line therapy	Oral corticosteroids + azathioprine ^a or mycophenolate mofetil ^b , cyclosporine ^c , methotrexate ^d
3rd line therapy	IVIg ^e or plasmapheresis ^f
Eosinophilic myocarditis	
1st line therapy	Same as lymphocytic myocarditis + Treat EM-associated condition if identified
2nd line therapy	Same as lymphocytic myocarditis + Treat EM-associated condition if identified
3rd line therapy	–
Giant-cell myocarditis	
1st line therapy	Non-severe: prednisone 1 mg/kg/day p.o. then tapered Severe: i.v. methylprednisolone 7–14 mg/kg/day for 3 days, then 1 mg/kg/day p.o. + immunosuppressive (azathioprine ^a or mycophenolate mofetil ^b , cyclosporine ^c)
2nd line therapy	Antithymocyte Globulin (ATG) ^g cyclophosphamide ^h , rituximab ⁱ
3rd line therapy	–
Cardiac sarcoidosis	
1st line therapy	Non-severe: prednisone 1 mg/kg/day p.o., tapering from 40–60 mg daily Severe: i.v. methylprednisolone 7–14 mg/kg/day for 3 days, then 1 mg/kg/day p.o.
2nd line therapy	Methotrexate ^d (1st choice), or azathioprine ^a mycophenolate mofetil ^b , cyclophosphamide ^h
3rd line therapy	Infliximab ^j or adalimumab ^k , rituximab ⁱ

Eur Heart J. 2025 Oct 22;46(40):3952-4041.

Nefarmakologická léčba

Recommendation Table 14 — Recommendations for management of arrhythmias and prevention of sudden cardiac death in myocarditis (see Evidence Table 14)

Recommendations	Class ^a	Level ^b
Pacing in myocarditis		
Temporary transvenous external pacing should be considered in patients with acute myocarditis and high-degree conduction disorders as a bridge to recovery. ^{86,317,335}	IIa	C
WCD in myocarditis		
A WCD should be considered for 3–6 months in patients with sustained ventricular arrhythmia during the acute phase of myocarditis as a bridge to recovery. ^{323,325,327–330}	IIa	C
Ablation in myocarditis		
Catheter ablation, performed in specialized centres, should be considered in post-myocarditis patients with recurrent symptomatic SMVT or ICD shocks in whom AAD are ineffective, not tolerated, or not desired. ⁵⁸	IIa	C

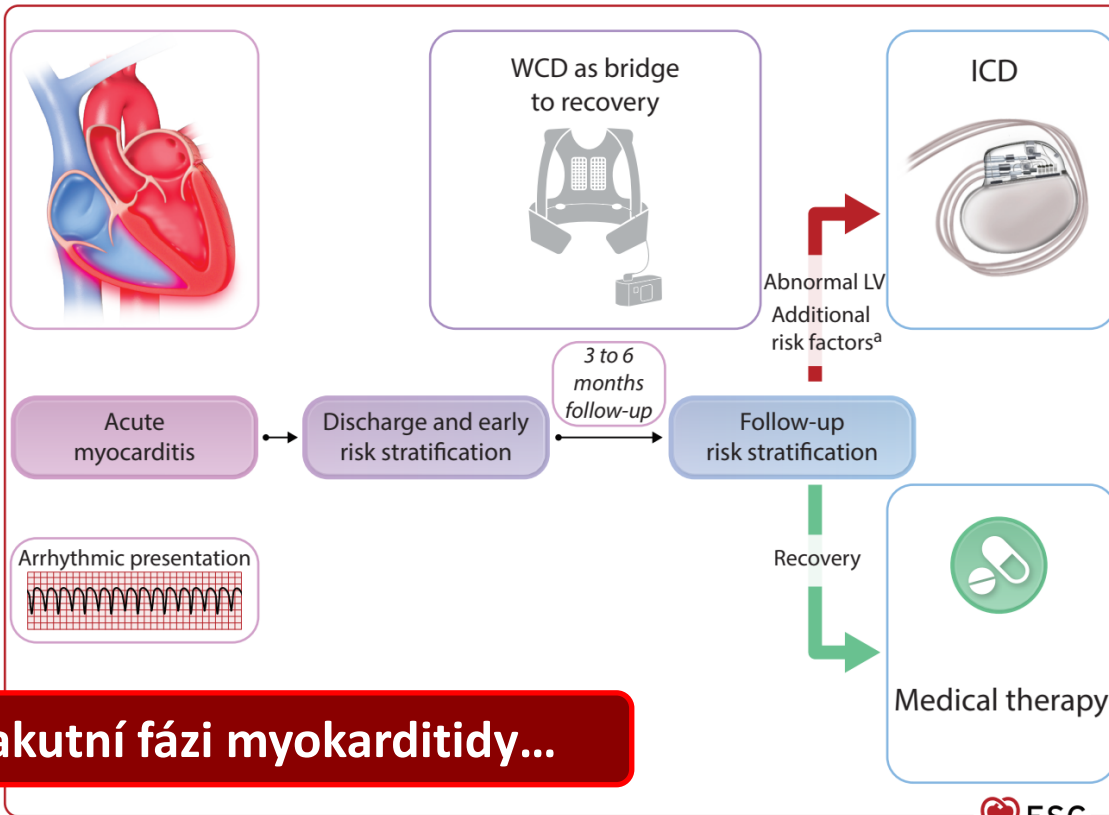
ICD in myocarditis		
Secondary prevention		
ICD implantation is recommended in patients with non-active ^c myocarditis and haemodynamically not-tolerated sustained VT to prevent SCD. ^{78,79,322,336}	I	C
ICD implantation should be considered in patients with non-active ^c myocarditis and haemodynamically tolerated sustained VT to prevent SCD. ^{78,79,322,336}	IIa	C
ICD implantation may be considered in patients with acute myocarditis and sustained VA (VT/VF) in the acute phase to prevent SCD. ^{71,79,89,222,323–325}	IIb	C
Primary prevention		
ICD implantation may be considered in patients with myocarditis after the acute phase (3–6 months) and persistent risk factors for VA ^d to prevent SCD. ^{89,332–334,336.}	IIb	C

Nefarmakologická léčba

2025 ESC Guidelines for the management of myocarditis and pericarditis

Developed by the task force 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)



...snaha o zdrženlivost v akutní fázi myokarditidy...

Větší benevolence a individualizace ve fyzickém zatěžování

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Recommendation Table 26 — Recommendations for physical activity and myocarditis/pericarditis (see Evidence Table 26)

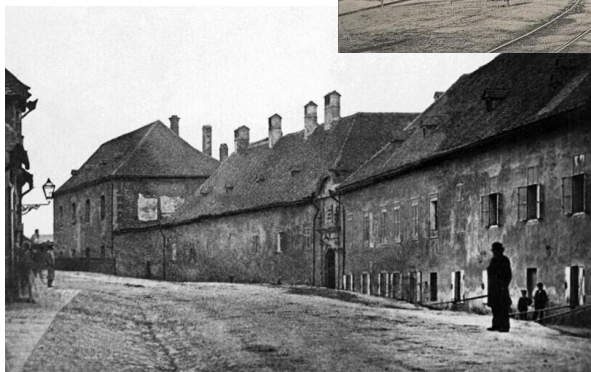
Recommendation	Class ^a	Level ^b
Restriction of physical exercise until remission, for at least 1 month, is recommended in athletes and non-athletes after IMPS using an individualized approach to accelerate recovery.	I	C

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Eur Heart J. 2025 Oct 22;46(40):3952-4041.

Závěry

- Posílení role MRI v diagnostice myokarditid
- Realistické vymezení role EMB v diagnostice myokardidy, modifikace histologického hodnocení
- Méně konkrétní doporučení pro léčbu myokarditid
- Role nefarmakologických přístupů (ICD, VA ECMO + Impella)
- Individualizace restrikce fyzické zátěže po akutní myokarditidě



Děkuji za pozornost!

