

# NÁVRAT K POHYBU PO PRODĚLANÉ MYOKARDITIDĚ



**1. LÉKAŘSKÁ  
FAKULTA**  
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**VŠEOBECNÁ FAKULTNÍ  
NEMOCNICE V PRAZE**

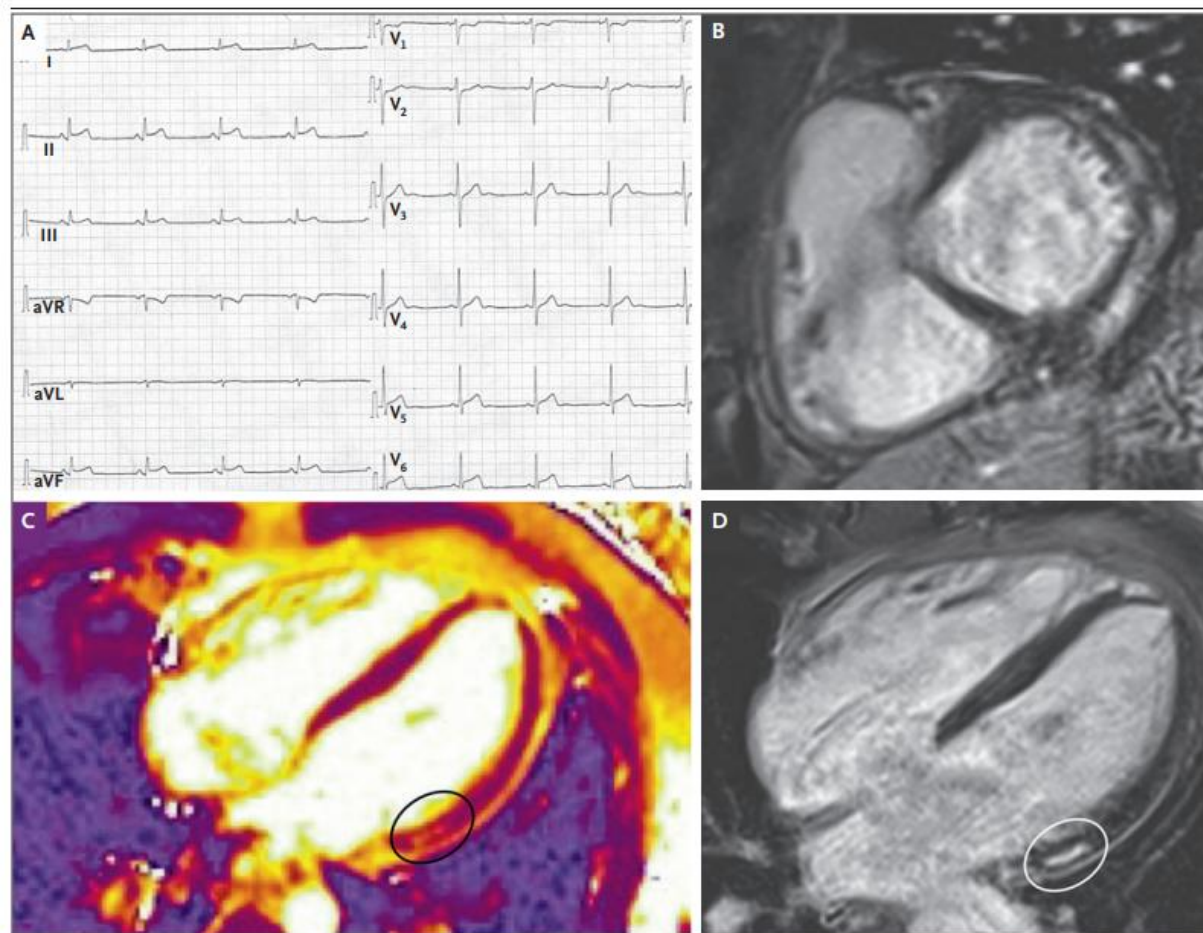
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# Akutní myokarditida

- Zánětlivé onemocnění myokardu
- Potenciálně ohrožující život



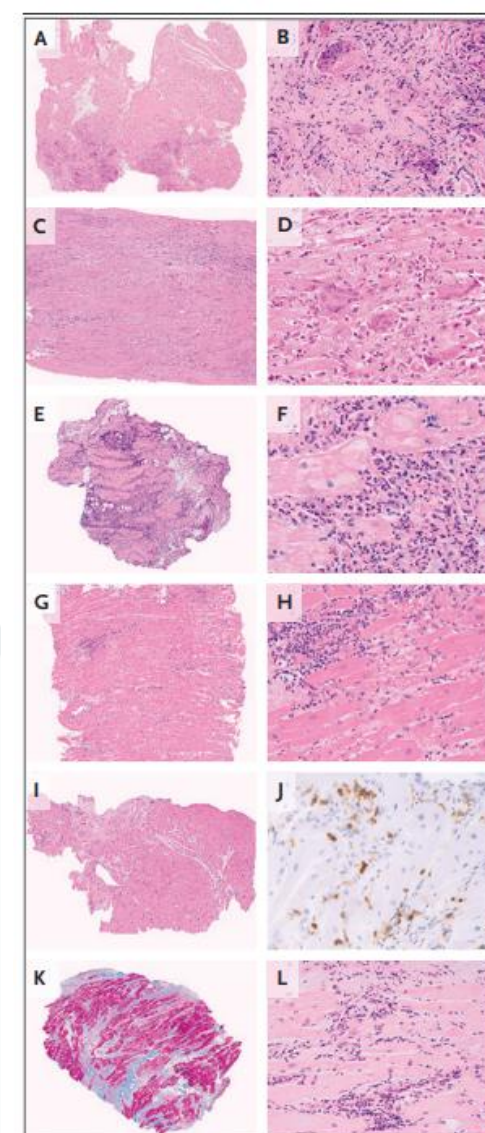
**Figure 1.** Infarct-like Presentation with Preserved Left Ventricular Ejection Fraction (LVEF) in an 18-Year-Old Man with Chest Pain and Gastroenteritis.

A basal 12-lead electrocardiogram (ECG) obtained at admission shows an ST-segment elevation in the inferior leads (Panel A). A cardiac MRI scan shows late gadolinium enhancement with a noncoronary pattern in the orthogonal short-axis view (T1-weighted inversion recovery) (Panel B). A four-chamber view shows myocardial edema as a midwall stria on T2 mapping (Panel C, encircled). Late gadolinium enhancement, with a noncoronary pattern in the same region as the stria in Panel C, is evident on a four-chamber view (T1-weighted inversion recovery) (Panel D, encircled).

# Akutní myokarditida epidemiologie a etiologie

- Incidence 1-10 / 100 000 / rok (před r. 2020)
- Vyšší incidence
  - 20-40 let
  - muži
- Etiologie
  - Infekční
  - Neinfekční

Infectious causes			
<i>Viral</i>	<i>Bacterial</i>	<i>Spirochetal</i>	<i>Protozoal</i>
Coxsackie B virus	Diphtheria	Syphilis	Chagas' disease (South American trypanosomiasis)
Echovirus	Tuberculosis	Leptospirosis	Sleeping sickness (African trypanosomiasis)
Epstein-Barr virus (EBV)	Salmonella	Relapsing fever	Toxoplasmosis
Cytomegalovirus (CMV)	Staphylococcus	Lyme's disease	Malaria
Influenza A and B	Gonococcus		Leishmaniasis
Adenovirus	Clostridium	<i>Mycotic</i>	Amoebiasis
Rubeola	Brucellosis	Candidiasis	
Rubella	Pisttacosis	Histoplasmosis	
Varicella	Tetanus	Sporotrichosis	
Herpes virus	Tularaemia	Coccidiomycosis	<i>Helminthic</i>
Mumps	Streptococcus	Aspergillosis	Trichinosis
Hepatitis virus	Legionnaire's disease	Blastomycosis	Echinococcosis
Poliomyelitis	Meningococcus	Cryptococcosis	Schistosomiasis
Human immunodeficiency virus (HIV) (?)		<i>Rickettsial</i>	Ascariasis
Variola		Typhus	Filariasis
Rabies		Q fever	Parasomiasis
Arbovirus		Rocky Mountain spotted fever	Strongyloidiasis
Mycoplasma pneumoniae			
Noninfectious causes			
<i>Cardiotoxins</i>	<i>Hypersensitivity reactions</i>	<i>Systemic disorders</i>	
Catecholamines	Antibiotics	Collagen – vascular diseases	
Anthracyclines	Diuretics	Sarcoidosis	
Cocaine	Lithium	Kawasaki disease	



**Figure 5. Histologic Types of Myocarditis Diagnosed by Means of Endomyocardial Biopsy.**  
Shown with hematoxylin and eosin staining are histologic samples of cardiac sarcoidosis (Panel A, with a close-up view in Panel B), giant-cell myocarditis (Panel C, with a close-up view in Panel D), eosinophilic myocarditis (Panel E, with a close-up view in Panel F), lymphocytic diffuse myocarditis (Panel G, with a close-up view in Panel H), and lymphocytic focal myocarditis (Panel I, with a close-up view in Panel L) (CD3 antibody). Trichrome

# Myokarditida a sport / pohybová aktivita

- Intenzivní PA
  - zvyšuje replikaci viru
  - Potlačuje imunitní odpověď
  - ↑↑ sympatikus a katecholaminy

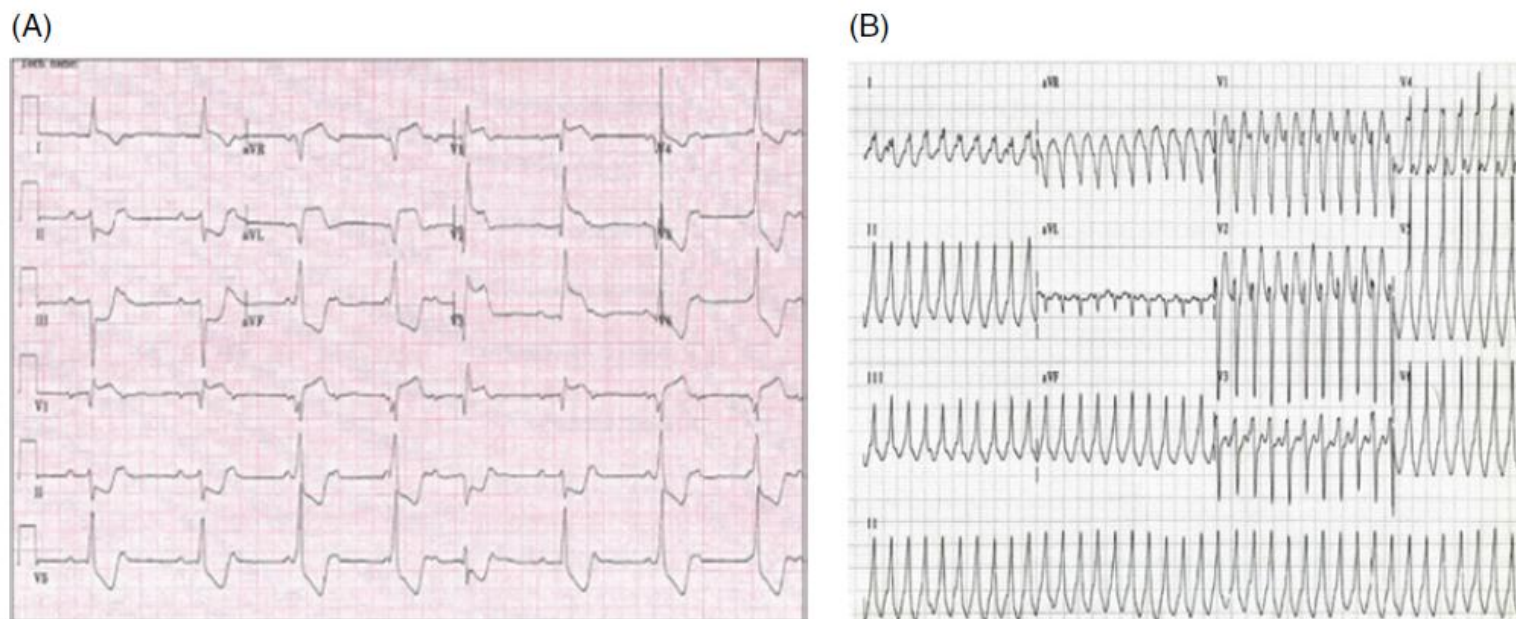


Figure 32.3 Arrhythmias in myocarditis. (A) Complete AV block. (B) Ventricular tachycardia

- < 35 (-40) let

Table 1. Causes of Sudden Death in 387 Young Athletes.\*

Cause	No. of Athletes	Percent
Hypertrophic cardiomyopathy	102	26.4
Commotio cordis	77	19.9
Coronary-artery anomalies	53	13.7
Left ventricular hypertrophy of indeterminate causation†	29	7.5
Myocarditis	20	5.2
Ruptured aortic aneurysm (Marfan's syndrome)	12	3.1
Arrhythmogenic right ventricular cardiomyopathy	11	2.8
Tunneled (bridged) coronary artery‡	11	2.8
Aortic-valve stenosis	10	2.6
Atherosclerotic coronary artery disease	10	2.6
Dilated cardiomyopathy	9	2.3
Myxomatous mitral-valve degeneration	9	2.3
Asthma (or other pulmonary condition)	8	2.1
Heat stroke	6	1.6
Drug abuse	4	1.0
Other cardiovascular cause	4	1.0
Long-QT syndrome§	3	0.8
Cardiac sarcoidosis	3	0.8
Trauma involving structural cardiac injury	3	0.8
Ruptured cerebral artery	3	0.8

\* Data are from the registry of the Minneapolis Heart Institute Foundation.<sup>6,28</sup>

† Findings at autopsy were suggestive of hypertrophic cardiomyopathy but were insufficient to be diagnostic.

‡ Tunneled coronary artery was deemed the cause in the absence of any other cardiac abnormality.

§ The long-QT syndrome was documented on clinical evaluation.

# Aktuální doporučení – návrat ke sportu

- Podmínky k uschopnění sportovce po prodělané myokarditidě
  - Echo / MR srdce
  - Holter EKG
  - Zátěžový test

**Table 10** Recommendations for athletes with myocarditis

	Class/level of evidence
1. General consensus exists that athletes with diagnosis of myocarditis should be restricted from exercise programmes for a period of 3–6 months, according to the clinical severity and duration of the illness, LV function at onset, and extent of inflammation on the CMR. This time period is considered appropriate to ensure clinical and biological resolution of the disease. <sup>3,4,105,118–120</sup>	Class IIb/Level C
2. Individuals with previous myocarditis have an increased risk for recurrence and silent clinical progression of the disease. Therefore, athletes with previous myocarditis should undergo a periodical re-assessment, particularly within the first 2 years.	Class IIa/ Level C
3. It is reasonable for athletes to resume training and competition after a myocarditis if all of the following criteria are met: (1) LV systolic function has returned to the normal range. (2) Serum biomarkers of myocardial injury have normalized. (3) Clinically relevant arrhythmias, such as frequent or complex repetitive forms of ventricular or supraventricular arrhythmias are absent on 24-h ECG monitoring and exercise test.	Class IIa/ Level C
4. The clinical significance of persistent LGE in an asymptomatic athlete with clinically healed myocarditis is unknown, however, myocardial scar is a potential source of ventricular tachyarrhythmias. <sup>111–113</sup> At present, it seems reasonable for these athletes to resume training and participate in competitive sport if LV function is preserved and in the absence of frequent or complex repetitive forms of ventricular or supraventricular arrhythmias during maximal exercise and on 24-h ECG monitoring (including session of training/competition). Asymptomatic athletes with LGE, however, should remain under annual clinical surveillance.	Class III/ Level C



# Data – pilotní studie

**Table 2** Overall findings at time of onset, 3 and 6-month follow-up.

Baseline characteristics all cases of myocarditis	Time of symptom onset	3-month follow-up	6-month follow-up	12-month follow-up	P Value
<u>CMR/Echocardiography</u>	<u>n = 30</u>	<u>n = 30</u>	<u>n = 26</u>	<u>n = 19</u>	
Mean LVEF (±SD)	58 (±7.44)	59 (±6)	59.4 (±4.8)	58 (±5.3)	NS
<u>Resting ECG</u>	<u>n = 30</u>	<u>n = 30</u>	<u>n = 26</u>	<u>n = 19</u>	
Number of malignant arrhythmias	0	1	0	0	NS
Number of benign arrhythmias	8	6	4	4	NS
<u>48-h-Holter ECG</u>	<u>n = 0</u>	<u>n = 30</u>	<u>n = 26</u>	<u>n = 19</u>	
Number of malignant arrhythmias	/	1	0	0	NS
Number of benign arrhythmias	/	6	6	4	NS
Median APC/QRS % (IQR)	/	0.0172 (0.008–0.047)	0.036 (±0.055%)	0.034 (0.002–0.06)	NS
Median PVC/QRS % (IQR)	/	0.008 (0–0.0029)	0.16% (±0.782%)	0.0026 (0–0.02)	NS
<u>Exercise stress test</u>	<u>n = 0</u>	<u>n = 29</u>	<u>n = 25</u>	<u>n = 19</u>	
Mean performance, watts (±SD)	/	190 (±67)	195 (±75)	206 (±75)	NS
Mean % of predicted maximum watt	/	95% (±27)	98 (±26)	105 (±26)	NS
Number of malignant arrhythmias	/	0	0	0	NS
<u>Laboratory results (median)</u>	<u>n = 30</u>	<u>n = 30</u>	<u>n = 26</u>	<u>n = 19</u>	
Mb, ng/l (IQR)	32 (0–111)	27 (0–40)	22.7 (±31.1)	27 (0–43)	0.011
TnT-hs, ng/l (IQR)	350 (88–1104)	2.5 (0–7)	4.4 (±7.5)	0 (0–7)	<0.001
CK, U/l (IQR)	238 (128–587)	97 (66–156)	130.3 (±63)	119 (75–193)	0.001
NT-proBNP, ng/l (IQR)	251 (45–676)	30 (11–44)	63 (±84)	38 (13–121)	0.05
CRP, mg/l (IQR)	21 (3–66)	0.7 (0.4–2.6)	1.6 (±1.8)	0.9 (0.5–1.6)	<0.001
Lc, G/L (IQR)	7 (6–9)	6.8 (5.9–7.2)	5.9 (±2.3)	6 (5.6–7.6)	NS

# Kardiovaskulární rehabilitace pro pacienty s myokarditidou?



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COMMENTARY

## Viral myocarditis: a forbidden indication for cardiac rehabilitation?

**Bernhard Schwaab<sup>1</sup>, Ingrid Kindermann<sup>2</sup>, Birna Bjarnason-Wehrens<sup>3</sup>, Axel Preßler<sup>4</sup>, Josef Niebauer<sup>5,6</sup>, Bernhard Rauch<sup>7</sup>, Heinz Völler<sup>8,9\*</sup>, and Rona Reibis<sup>8,10</sup>**



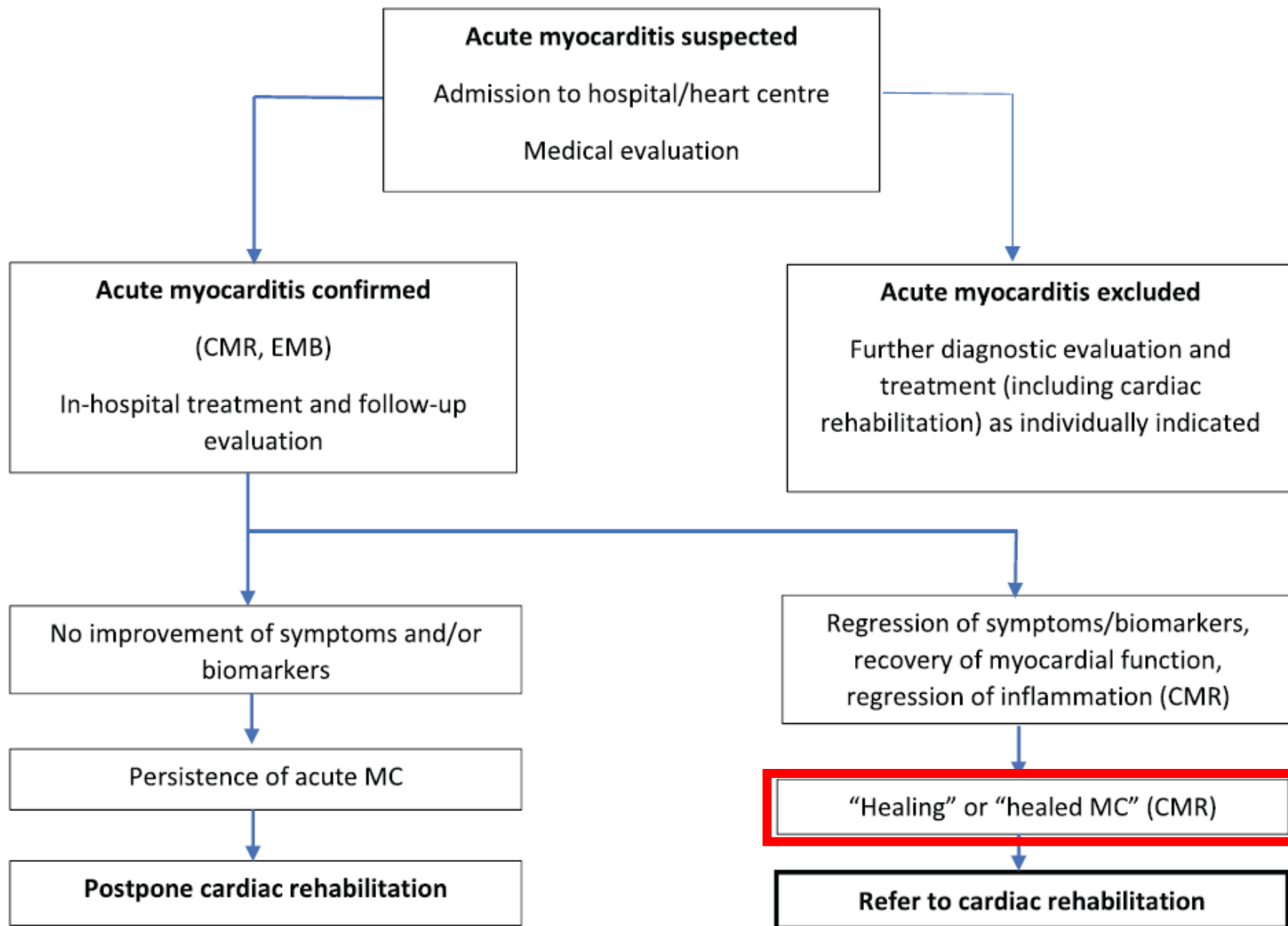


# Za hospitalizace

- Fyzioterapie zaměřená na prevenci komplikací z imobilizace
  - Trombózy
  - Svalové atrofie







**Figure 1** Flow chart for the management of myocarditis patients.



## „Hojící se myokarditida“

- MR srdce – regredující nálezy
- Normální kardiomarkery, Bez arytmií
- Může být perikardiální výpotek
- EF LK max. lehce snižená ale zvětšující se
- Nejsou známky edému myokardu
  
- Zátěžový test do maxima – kontraindikován
- Cvičení o nízké intenzitě
- Týdně: Klinický stav, klidové EKG, kardiomarkery, Echo

## „Zhojená myokarditida“

- Vše normální vč. Regrese perikard. Výpotku
  
- Zátěžový test do maximu – s opatrností
- Individuální preskripce dynamické a odporové zátěže
- Vyšetření dle klinického stavu





# Intenzita KVR / pohybových aktivit

HEALING MC	RATE	PERCEIVED EXERTION	RATE	HEALED MC
	20		20	
	19	extremely hard	19	
	18		18	
	17	very hard	17	
	16		16	
	15	hard / heavy	15	
	14		14	
	13	somewhat hard	13	
	12		12	
	11	light	11	
	10		10	
	9	very light	9	
	8		8	
	7	extremely light	7	
	6		6	

6/8 to 10/11	10/12 to 14
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# Závěr

- Problematika pohybové aktivity u pacientů s myokarditidou je komplexní
- Chybí jasná EBM data
- Pohybová aktivita o nízké – střední intenzitě pravděpodobně bezpečná





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Děkuji za pozornost

