Arytmogenní kardiomyopatie pravé komory

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listorie arytmogenní kardiomyopatie pravé komor

Giovanni Lancisi
(1654 -1720)

papežský lékař:
Inocenc XI
Klement IX
Inocenc XII

Popsána rodina s chorobou postihující obdobnými obtížemi 4 generace: palpitace, srdeční selhání, náhlou smrt, dilatace a aneuryzmata pravé komory

listorie arytmogenní kardiomyopatie pravé komor

Right Ventricular Dysplasia: A Report of 24 Adult Cases

MARY Right ventricular dysplasia is characterized by an abnormality in the development of part of ght ventricular musculature. Patients with right ventricular dysplasia may present with ventricular tachy-, supraventricular arrhythmias, right-heart failure o ts with right ventricular dysplasia who had recurrent . The male/female ratio was 2.7:1. The mean age at t patients had ventricular tachycardia of a left bundle waves were inverted over the right precordial leads. T ature was usually normal. In six patients who had two-dimensional echocardi d right ventricular diastolic dimensions. All patients had right ventricular angio ventricular dysplasia was substantiated during surgery in 12 patients and at a patients who did not have arrhythmias had right ventricular dysplasia diagnosed graphy.

rcus FI et al., Circulation **1982**;85

RIGHT VENTRICULAR CARDIOMYOPATHY AND SUDDEN DEATH IN YOUNG PE

GAETANO THIENE, M.D., ANDREA NAVA, M.D., DOMENICO CORRADO, M.D., LINO ROSSI, M.D AND NATALE PENNELLI, M.D.

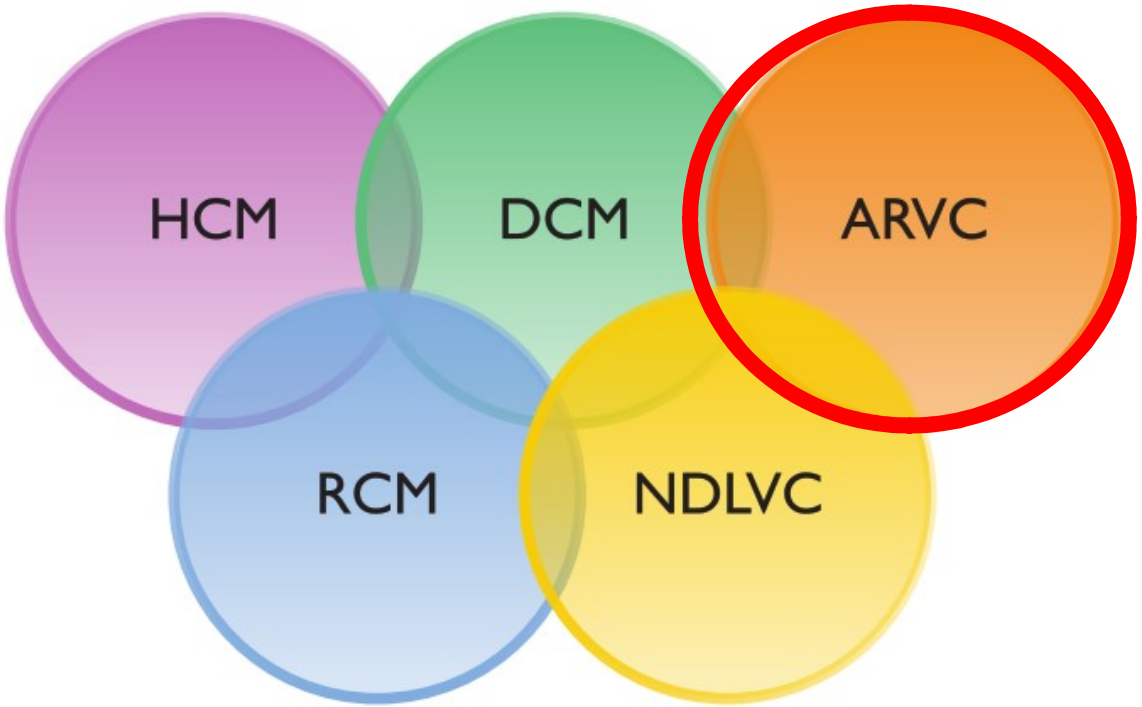
At autopsy, the subjects' heart weights were normal or moderately increased. Two main histologic patterns were identified — a lipomatous transformation or a fibrolipomatous transformation of the right ventricular free wall (6 cases each); in all cases, the left ventricle was substantially spared. Signs of myocardial degeneration and necrosis, with or without inflammatory infiltrates, were occasionally observed.

These findings indicate that right ventricular cardiomyopathy, the cause of which is still unknown, may be more frequent than previously thought. At least in this area of Italy, it may represent an important cause of sudden death among young people. (N Engl J Med 1988; 318:129-33.)

Thiene G et al., NEJM **1988**;318

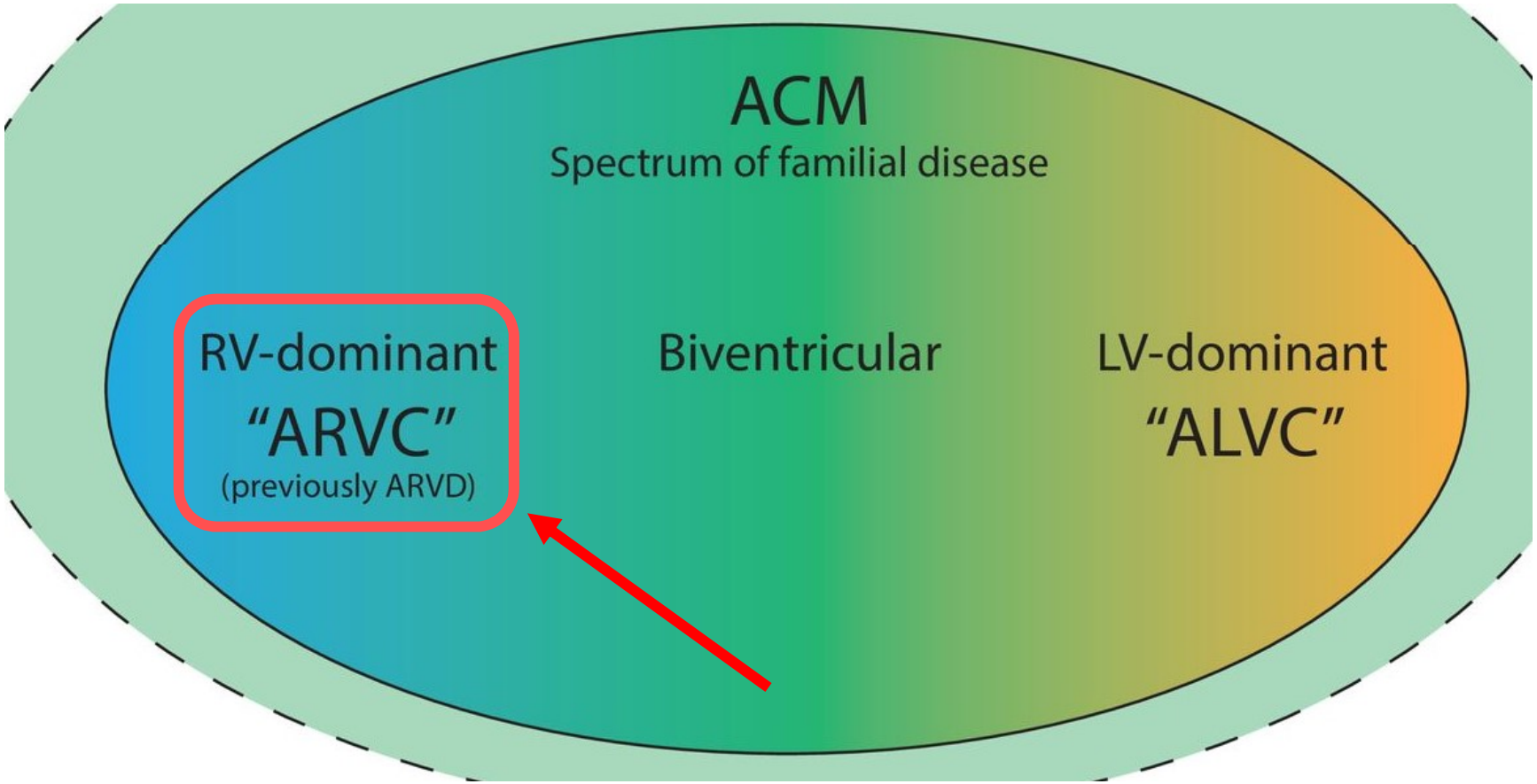
ARVC ~ jeden ze základních fenotypů KMP

= definována jako přítomnost **dominantní dilatace a/nebo dysfunkce pravé komory** v kombinaci **s histologickým průkazem choroby a/nebo EKG abnormalitami**
podle modifikovaných diagnostických kritérií z roku 2010



2023 ESC Guidelines for the management of cardiomyo

Fenotypy KMP: ACM vs. ARVC



Aidarous S et al., Heart 20

Arytmogenní kardiomyopatie pravé komory

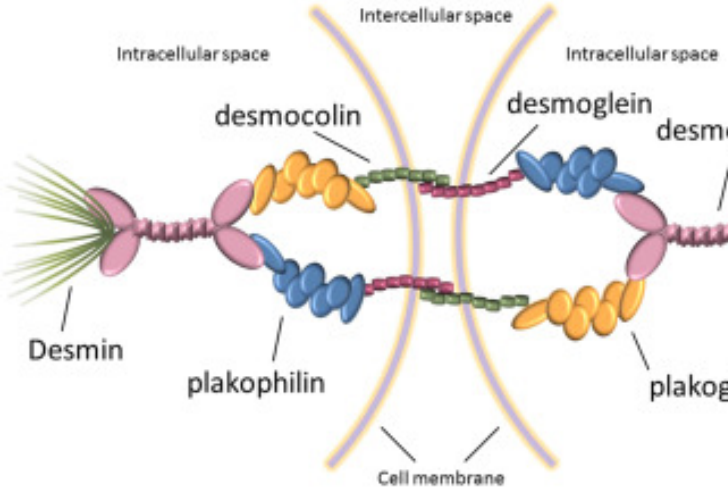
rukturálně charakterizována **progresivní náhradou myokardu pravé komory**
brózní / fibrolipomatózní tkání (možné postižení i LK), **od epikardu k endokardu**

bvykle se manifestuje ve 2.-4 dekádě života, častěji muži (60%)

eneticky podmíněná: většinou AD typ dědičnosti
enetrance ~ věk (pohlaví, fyzická aktivita)
togenní varianty v **genech kódujících**
esmosomální proteiny (PKP2, DSG2, DSP, DSC2, JUP)
v non-desmosomálních genech (TMEM43,DES, PLN…)

ozitivní genetická diagnostika až v 60% případů

tnost cca 1:2,5000-5000 (~ geografická závislost)



Corrado D et al., NEJM 20

ARVC: klinická prezentace

palpitace
synkopy
náhlá zástava oběhu / SCD

→ četné komorové extrasystoly
→ nesetrvalé / setrvalé běhy KT
→ fibrilace komor

zřídka srdeční selhání → komorová systolická dysfunkce

bolestivá myokarditis → hot fáze choroby
(! myslet u rekurentních myokarditi

Corrado D et al., NEJM 20

ARVC: diagnostika

Proposed Modification of the Task Force Criteria

Globální/regionální dysfunkce a strukturální alterace pra
(echokg, MRI, invazivní ventrikulografie PK)

káňová charakteristika stěny PK (EMB, postmortem)

KG repolarizační abnormality

KG depolarizační / převodní abnormality

rytmie (NSVT, SVT, KES)

odinná anamnéza, genetika

Definitivní diagnóza ARVC:

2 velká kritéria

1 velké + 2 malá kritéria

4 malá kritéria

Hraniční diagnóza ARVC:

1 velké a 1 malé kritérium

3 malá kritéria

Možná diagnóza ARVC:

1 velké kritérium

2 malá kritéria

Marcus FI et al., Circulation 2

ARVC: diagnostika

Proposed Modification of the Task Force Criteria

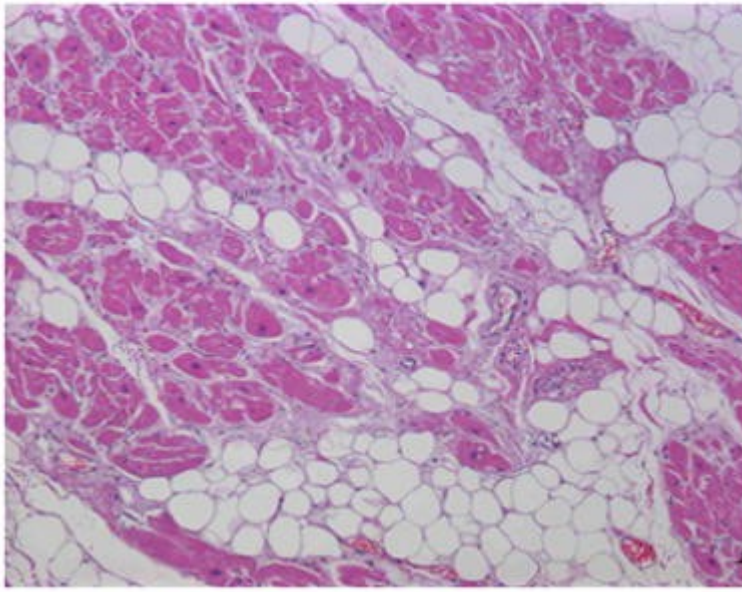
Tkáňová charakteristika stěny PK (EMB, postmortem)

Velké kritérium

Residual myocytes <60% by morphometric analysis (or <50% if estimated), with fibrous replacement of the RV free wall myocardium in ≥1 sample, with or without fatty replacement of tissue on endomyocardial biopsy

Malé kritérium

Residual myocytes 60% to 75% by morphometric analysis (or 50% to 65% if estimated), with fibrous replacement of the RV free wall myocardium in ≥1 sample, with or without fatty replacement of tissue on endomyocardial biopsy



Ideálně EMB navigovaná eletroanatomickým voltážovým mapováním

Marcus FI et al., Circulation 2

ARVC: diagnostika

Proposed Modification of the Task Force Criteria

Rodinná anamnéza, genetika

Velké kritérium

- ARVC/D confirmed in a first-degree relative who meets current TFC
- ARVC/D confirmed pathologically at autopsy or surgery in a first-degree relative
- Identification of a pathogenic mutation categorized as associated or probably associated with ARVC/D in the patient

Malé kritérium

- History of ARVC/D in a first-degree relative in whom it is not possible or practical to determine whether the family member meets current TFC
- Premature sudden death (<35 yrs of age) due to suspected ARVC/D in a first-degree relative
- ARVC/D confirmed pathologically or by current TFC in second-degree relative

Marcus FI et al., Circulation 2

ARVC: diagnostika

Proposed Modification of the Task Force Criteria

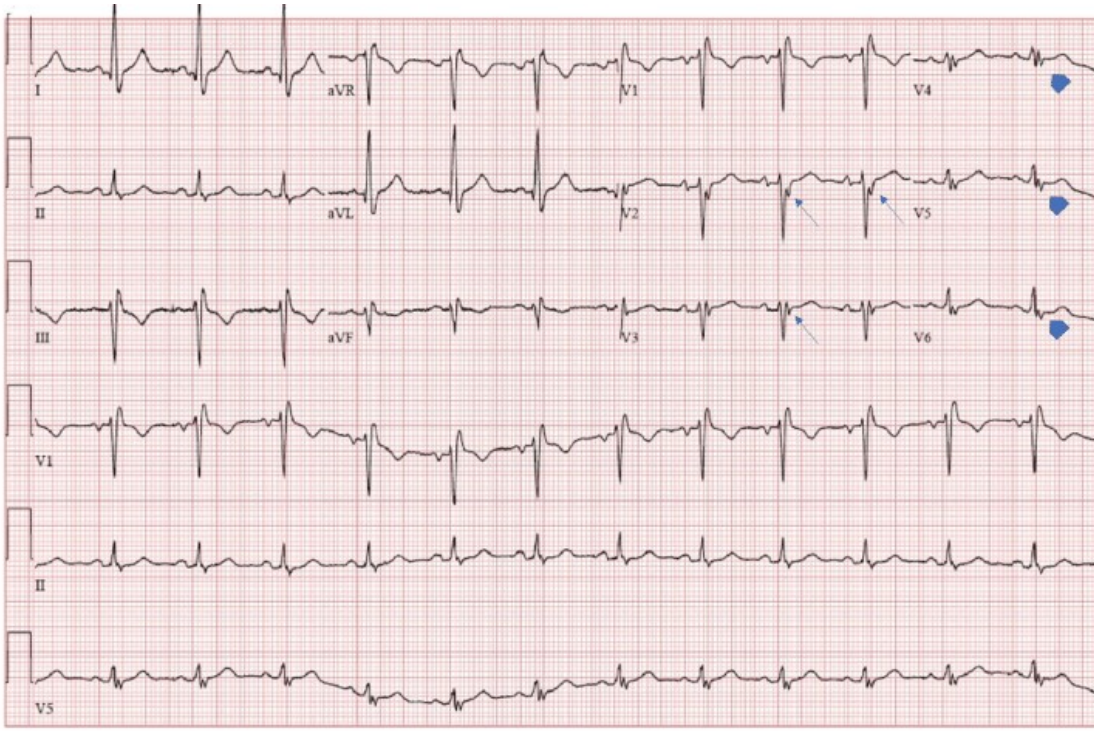
EKG – depolarizační změny

Velké kritérium

Epsilon wave in the right precordial leads (V_1 to V_3)

Malé kritérium

- potentials by SAECG in ≥1 of 3 parameters in the
ence of a QRS duration ≥110 ms on the standard ECG
ltered QRS duration ≥114 ms
uration of terminal QRS <40 μV (low-amplitude signal
uration) ≥38 ms
oot mean square voltage of terminal 40 ms ≤20 μV
minal activation duration of QRS ≥55 ms measured from
nadir of the S-wave to the end of the QRS, including R′, in
V_2, or V_3, in the absence of complete RBBB



Obrazový archiv VFN

Marcus FI et al., Circulation 2

ARVC: diagnostika

Proposed Modification of the Task Force Criteria

EKG – repolarizační změny

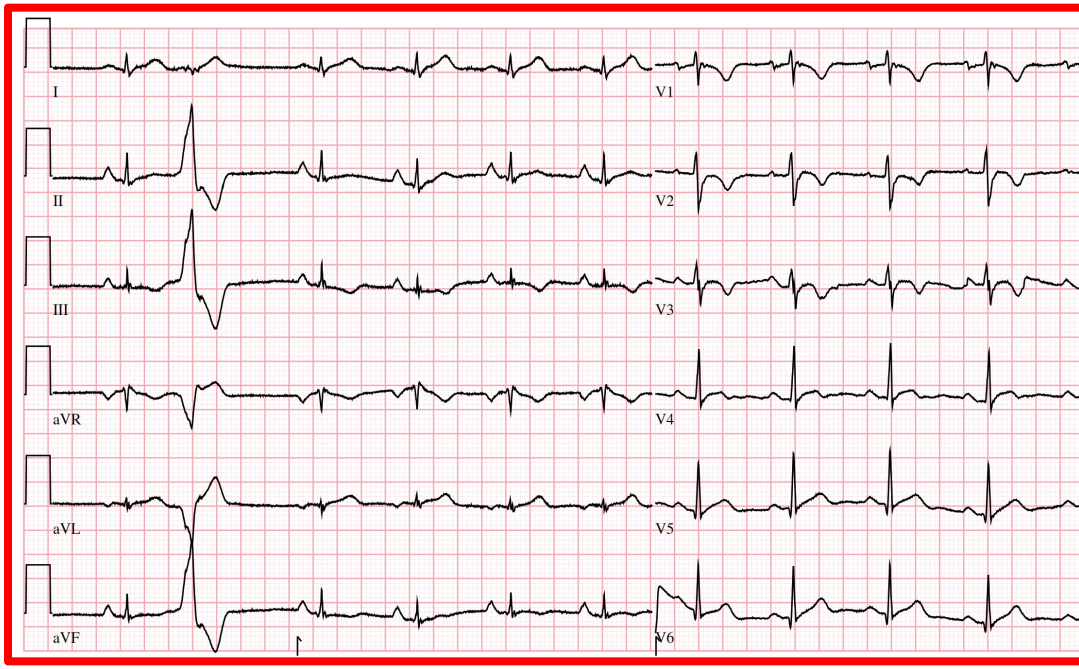
Velké kritérium

erted T waves in right precordial leads (V_1, V_2, and V_3) or beyond in individuals >14 yrs of age (in the absence of complete RBBB QRS ≥120 ms)

Malé kritérium

erted T waves in leads V_1 and V_2 in individuals >14 yrs of e (in the absence of complete RBBB) or in V_4, V_5, or V_6
erted T waves in leads V_1, V_2, V_3, and V_4 in individuals 4 yrs of age in the presence of complete RBBB

!



Obrazový archiv VFN

Marcus FI et al., Circulation 2

ARVC: diagnostika

Proposed Modification of the Task Force Criteria

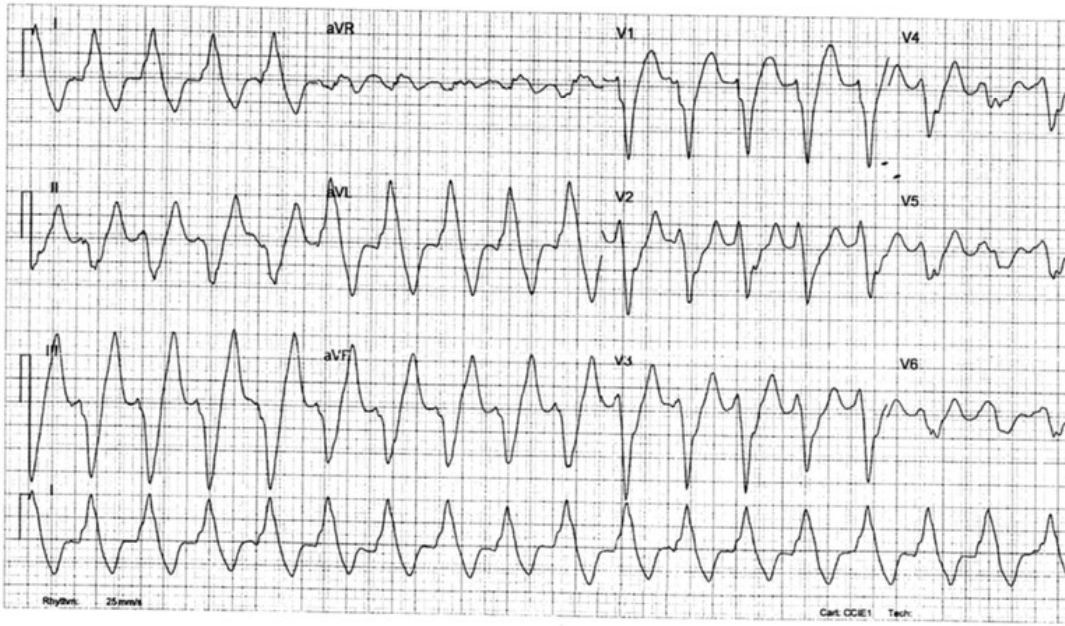
Arytmie

Velké kritérium

sustained or sustained VT of LBBB morphology with superior
xis (negative or indeterminate QRS in leads II, III, and aVF
nd positive in lead aVL)

Malé kritérium

nsustained or sustained RVOT VT of LBBB morphology with
erior axis (positive QRS in leads II, III, and aVF and negative
ead aVL) or with unknown axis
00 ventricular extrasystoles per 24 h (Holter)



Obrazový archiv VFN

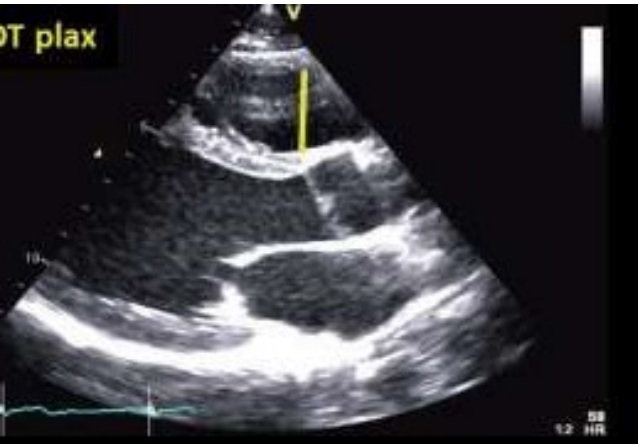
Marcus FI et al., Circulation 2

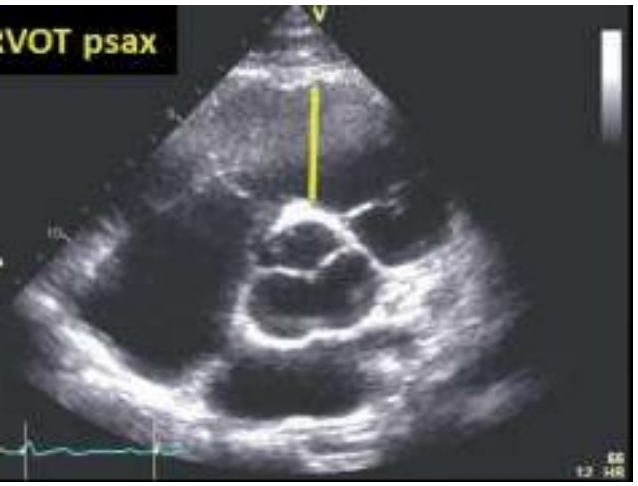
ARVC: diagnostika - echokardiografie

Proposed Modification of the Task Force Criteria

- regionální akineze / dyskineze / aneuryzma PK (! ne hypokinez

- dilatace PK, snížená FAC PK





Velké kritérium

By 2D echo:

- Regional RV akinesia, dyskinesia, or aneurysm
- *and* 1 of the following (end diastole):
  - — PLAX RVOT ≥32 mm (corrected for body size [PLAX/BSA] ≥19 mm/m²)
  - — PSAX RVOT ≥36 mm (corrected for body size [PSAX/BSA] ≥21 mm/m²)
  - — *or* fractional area change ≤33%

Malé kritérium

- Regional RV akinesia or dyskinesia
- *and* 1 of the following (end diastole):
  - — PLAX RVOT ≥29 to <32 mm (corrected for body size [PLAX/BSA] ≥16 to <19 mm/m²)
  - — PSAX RVOT ≥32 to <36 mm (corrected for body size [PSAX/BSA] ≥18 to <21 mm/m²)
  - — *or* fractional area change >33% to ≤40%

Marcus FI et al., Circulation 2

ARVC: diagnostika - echokardiografie

Proposed Modification of the Task Force Criteria

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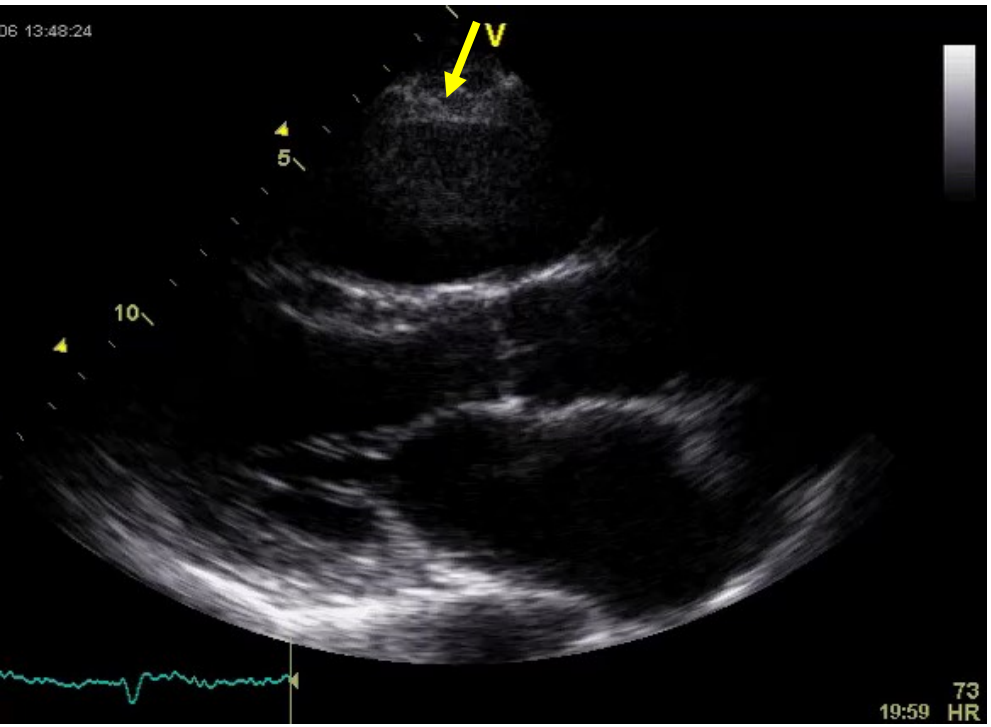

Obrazový archiv VFN

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Marcus FI et al., Circulation 2

ARVC: diagnostika - echokardiografie

Proposed Modification of the Task Force Criteria

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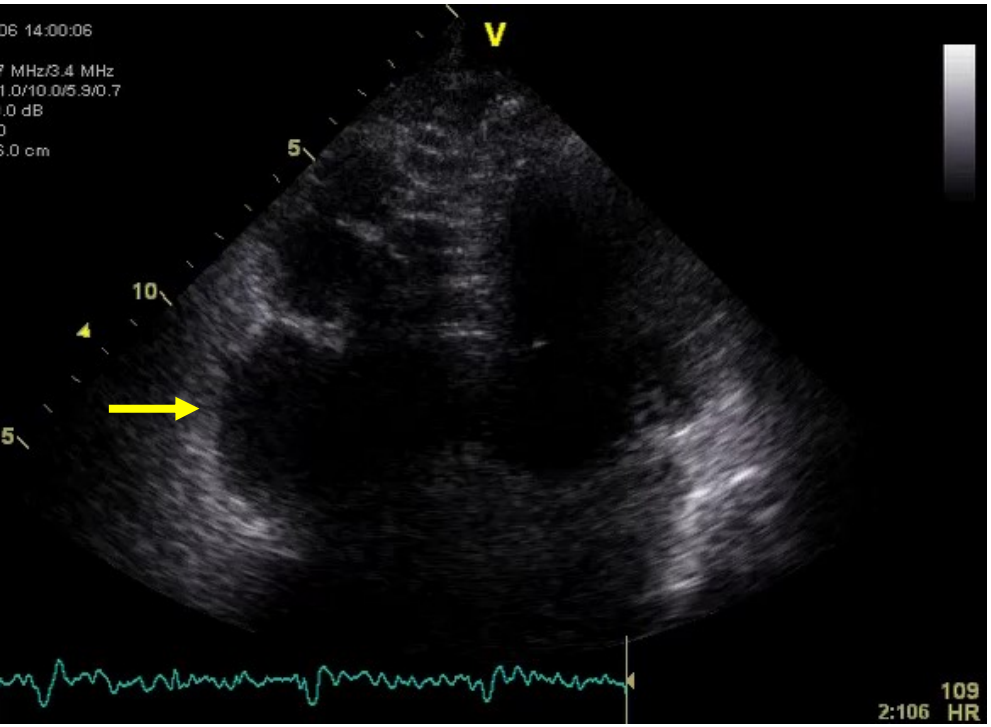

Obrazový archiv VFN

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  - — *or* fractional area change ≤33%

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  - — *or* fractional area change >33% to ≤40%

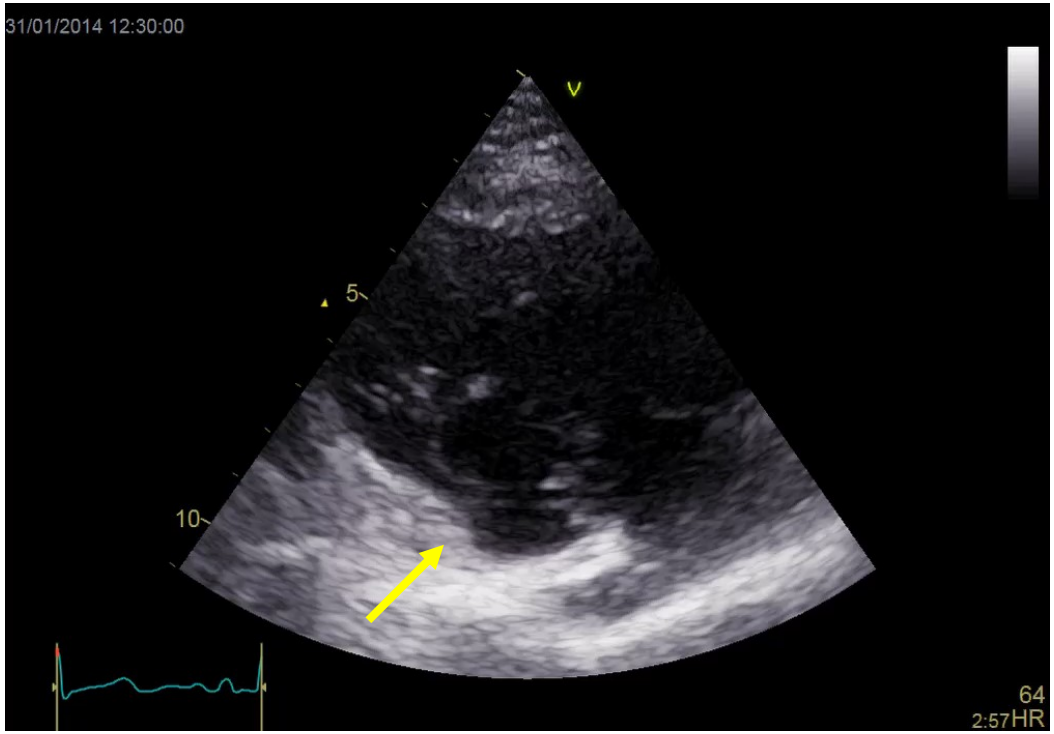
Marcus FI et al., Circulation 2

ARVC: diagnostika - echokardiografie

lokální akineze / aneuryzma PK

→ modifikované či netradiční projekce na PK !

Projekce na vtok PK



Obrazový archiv VFN

The diagnostic performance of imaging methods in ARVC using the 2010 Task Force criteria

MRI = u ARVC zobrazovací metoda prvé volby

criteria by echocardiography or CMR (as defined by 2010 Task Force criteria)

	CMR negative	CMR positive	Total
Echocardiography negative (*n*)	21	36	57
Echocardiography positive (*n*)	9	36	45
Total	30	72	102

Diagnostic performance for echocardiography when compared with CMR. PPV 80%, NPV 37%, sensitivity 50% and specificity 70%. $P = 0.06$.

Borgquist R et al., EHJ-CV Imaging 2

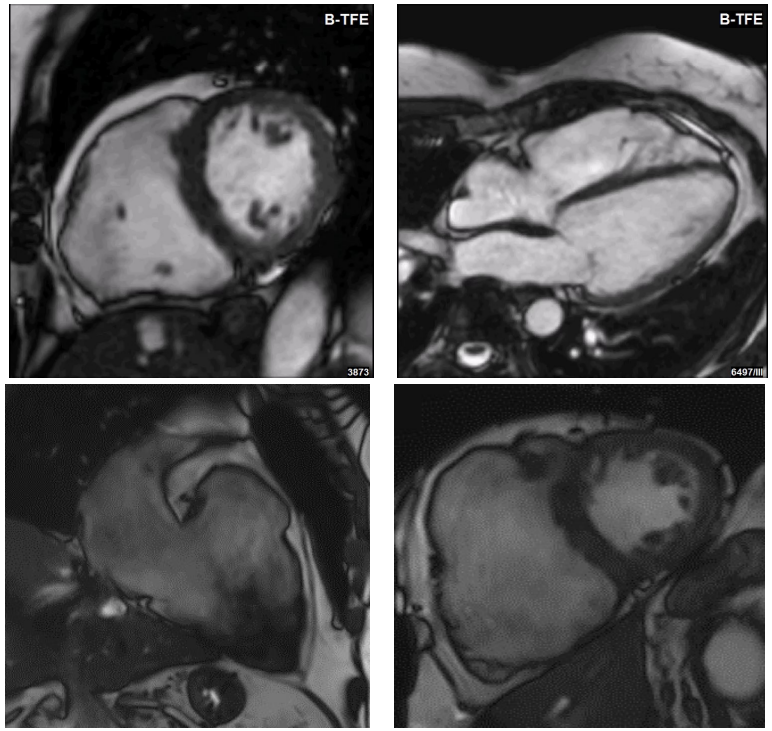
ARVC: diagnostika - MRI

Proposed Modification of the Task Force Criteria

- regionální akineze / dyskineze / aneuryzma PK (! ne hypokineze)

- dilatace PK, snížená FAC PK

- není zahrnuto LGE (tkáňová charakteristika) !



Obrazový archiv VFN

Velké kritérium

By MRI:

- Regional RV akinesia or dyskinesia or dyssynchronous RV contraction
- *and* 1 of the following:
  - Ratio of RV end-diastolic volume to BSA ≥110 mL/m² (male) or ≥100 mL/m² (female)
  - *or* RV ejection fraction ≤40%

Malé kritérium

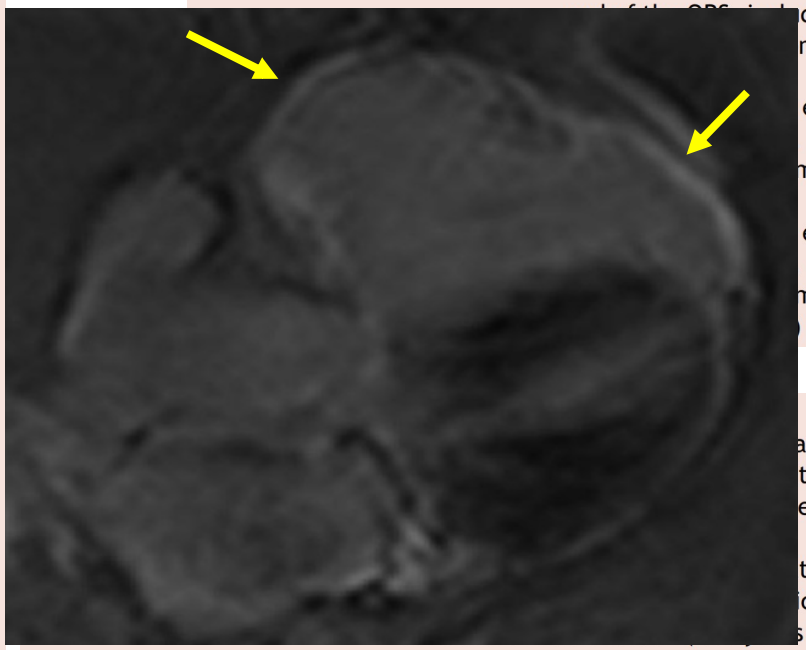
- Regional RV akinesia or dyskinesia or dyssynchronous RV contraction
- *and* 1 of the following:
  - Ratio of RV end-diastolic volume to BSA ≥100 to <110 mL/m² (male) or ≥90 to <100 mL/m² (female)
  - *or* RV ejection fraction >40% to ≤45%

Marcus FI et al., Circulation 2

ARVC: diagnostika – Padovská kritéria ACM

kritéria pro ARVC

orpho-functional entricular abnormalities	***Major*** • Regional RV akinesia, dyskinesia, or bulging *plus* one of the following: - Global RV dilatation (increase of RV EDV according to the imaging test specific nomograms for age and sex) - Global RV systolic dysfunction (reduction of RV EF according to the imaging test specific nomograms for age and sex) ***Minor*** • Regional RV akinesia, dyskinesia, or aneurysm of RV free wall
tructural myocardial onormalities	***Major*** • Transmural LGE (stria pattern) of ≥1 RV region(s) (inlet, outlet, and apex in two orthogonal views) ***Major*** • Fibrous replacement of the myocardium in ≥1 sample, with or without fatty tissue
epolarization onormalities	***Major*** • Inverted T waves in right precordial leads (V_1, V_2, and V_3) or beyond in individuals with complete pubertal development (in the absence of complete RBBB) ***Minor*** • Inverted T waves in leads V_1 and V_2 in individuals with completed pubertal development (in the absence of complete RBBB) • Inverted T waves in V_1, V_2, V_3, and V_4 in individuals with completed pubertal development in the presence of complete RBBB
IV. Depolarization abnormalities	***Minor*** • Epsilon wave (reproducible low-amplitude signals between end of QRS complex to onset of the T wave) in the right precordial leads (V_1 to V_3) • Terminal activation duration of QRS ≥55 ms measured from the nadir of the S wave to the ding R', in V_1, V_2, or V_3 mplete RBBB)
	extrasystoles (>500 per or sustained ventricular morphology
	extrasystoles (>500 per or sustained ventricular morphology with inferior



ative who meets diagnostic criteria
topsy or surgery in a first-degree relative
ely pathogenetic ACM mutation in the patient under
tive in whom it is not possible or practical to determi
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s of age) due to suspected ACM in a first-degree relat
• ACM confirmed pathologically or by diagnostic criteria in second-degree relative

Obrazový archiv VFN

Corrado D et al., Int J Cardiology 2

ARVC: diagnostika – význam EKG !

nejčasnější manifestace ~ obvykle EKG změny

⇓

strukturální abnormality ~ echokg, MRI

diagnóza založená jen na zobrazovacích metodách, s kompletně normálním EKG
⇒ podezřelé …

Haugaa KA et al., EHJ-CV Imag 2

ARVC: management

- ✓ zabránit progresi choroby
- ✓ ovlivnit symptomy
- ✓ zabránit komplikacím ~ prevence SCD (sekundární, primární)

ARVC ~ jedna z nejčastějších příčin SCD
u mladých jedinců, zvláště sportovců

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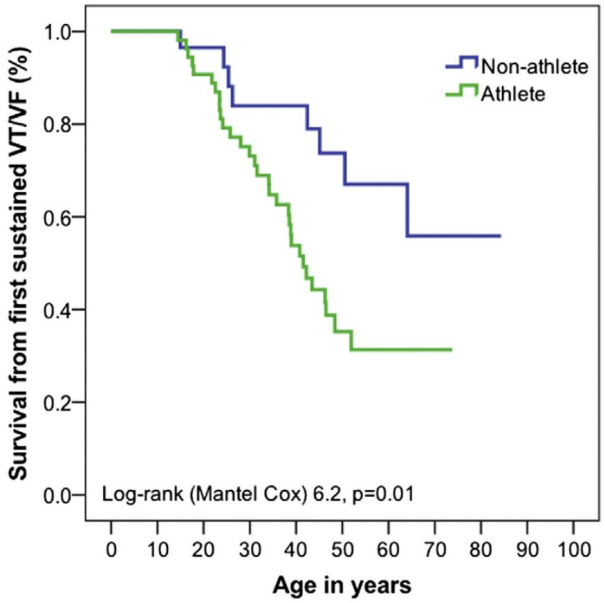
ARVC: prevence progrese choroby

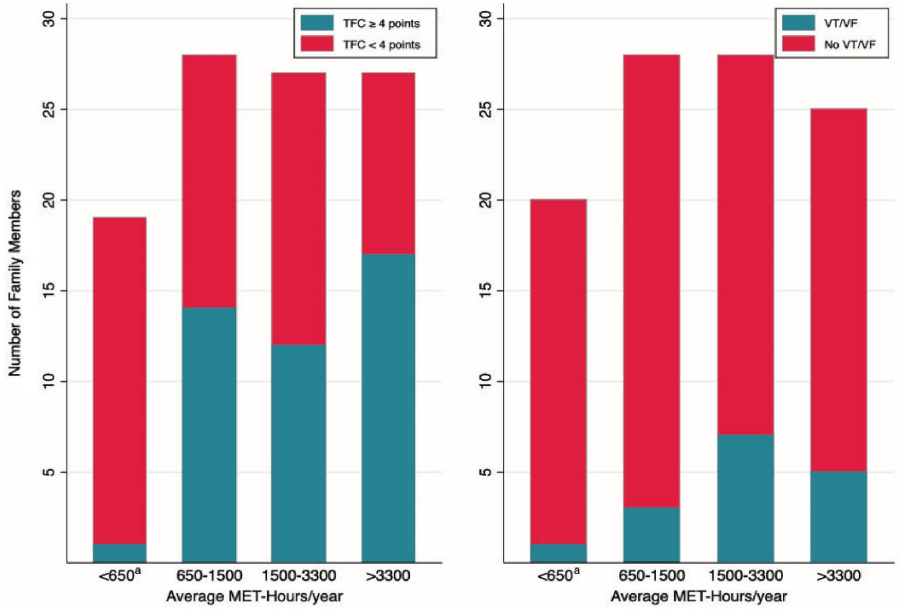
restrikce sportovní zátěže ! ~ redukce progrese již diagnostikované choroby (KT, srdeční selhání)

~ oddálení fenotypické exprese u G+/P- jedinců

< 650 MET hodin/rok ~ 30 minut svižné chůze denně



James CA et al., JACC 2013;62



Wang W et al., Europace 2020;22

ARVC: ovlivnění symptomů - antiarytmika

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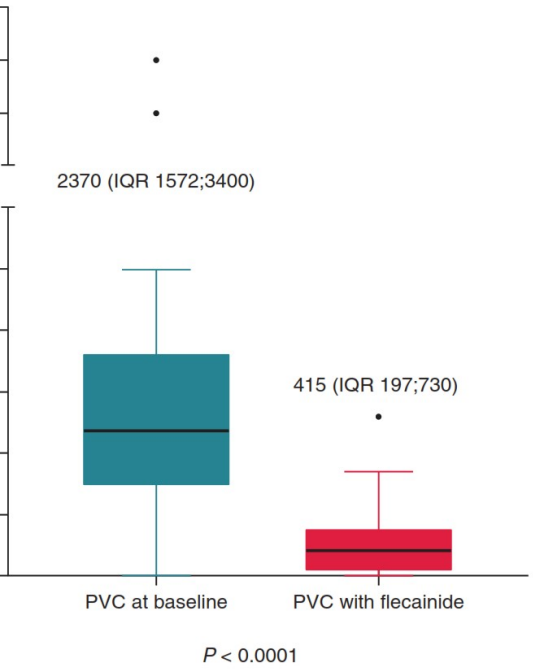
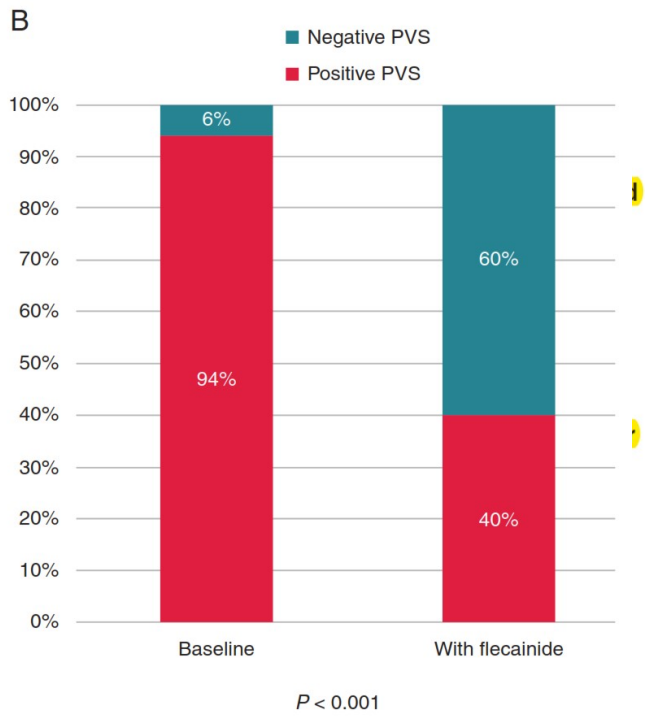
Safety and efficacy of flecainide associated with beta-blockers in arrhythmogenic right ventricular cardiomyopathy

Marcus GM et al, Europace 2009;11:211-217

		CI 95%	p-value
Beta-blockers (yes vs no)	0.54	0.13–2.14	0.378





Recommendations	Class[a]	Le
Beta-blocker therapy is recommended in ARVC patients with VE, NSVT, and VT.[920–922]	I	
Amiodarone should be considered when regular beta-blocker therapy fails to control arrhythmia-related symptoms in patients with ARVC.[921,922]	IIa	
Flecainide in addition to beta-blockers should be considered when single agent treatment has failed to control arrhythmia-related symptoms in patients with ARVC.[923,924]	IIa	
Catheter ablation with availability for epicardial approach guided by 3D electroanatomical mapping of VT should be considered in ARVC patients with incessant VT or frequent appropriate ICD interventions for VT despite pharmacological therapy with beta-blockers.[925,929–934]	IIa	

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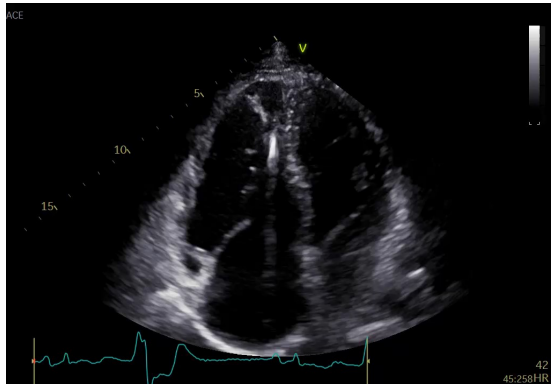
ARVC: prevence SCD (~ implantace ICD)

✓ **Známky vysokého rizika:**

- synkopa (arytmická)
- nesetrvalá KT
- EF pravé komory < 40%
- EF levé komory < 45%
- indukovatelná setrvalá monomorfní KT při EFS



Recommendations	Class[a]	Level[b]
Secondary prevention		
An ICD is recommended to reduce the risk of sudden death and all-cause mortality in patients with ARVC who have survived a cardiac arrest or have recovered from a ventricular arrhythmia causing haemodynamic instability.[939,943,944,948,949]	I	A
An ICD should be considered in ARVC patients who have suffered a haemodynamically tolerated VT.[522,939,943–945,948–950]	IIa	B
Primary prevention		
High-risk features[c] should be considered to aid individualized decision-making for ICD implantation in patients with ARVC.[538,939]	IIa	B
The updated 2019 ARVC risk calculator should be considered to aid individualized decision-making for ICD implantation in patients with ARVC.[d,524,526,536–539]	IIa	B

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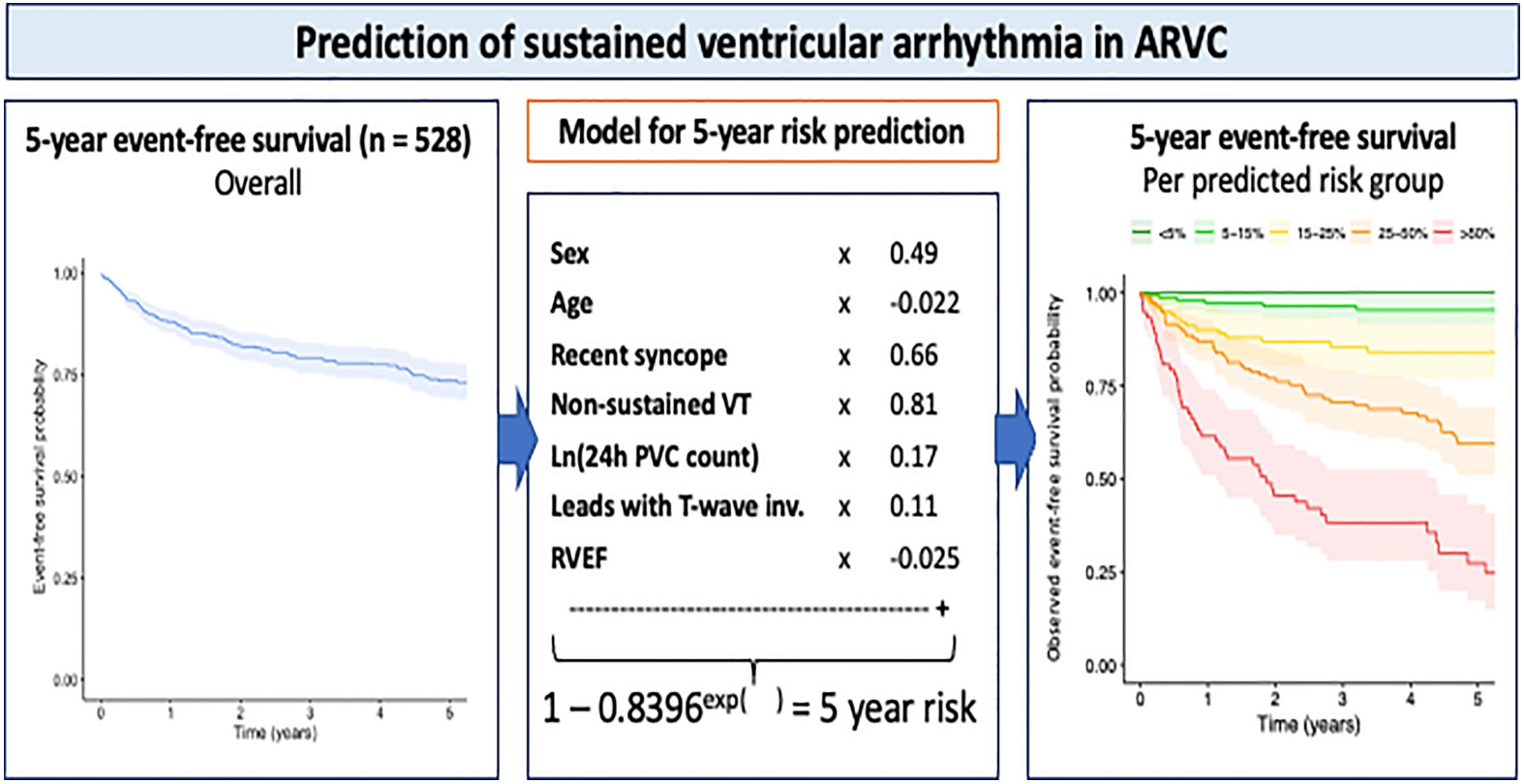
A new prediction model for ventricular arrhythmias in arrhythmogenic right ventricular cardiomyopathy

528 jedinců s definitivní dg. ARVC, bez anamnézy setrvalé KT či SCD, 5 registrů v EU a USA



Cadrin-Tourigny J et al., EHJ 2

ARVC: kalkulátor rizika

https://arvcrisk.com

at diagnosis

t which the patient fulfilled ARVC diagnosis as per 2010 Task Force ia (Marcus et al. 2010)

ale ○Female

diac syncope (<6 months)

s ○No

pe suspected to be caused by cardiac arrhythmia within 6 months prior to osis.

◆ Number of inverted T-waves

0

Total number of precordial and inferior leads with inverted T-waves on standard 12-lead ECG.

◆ Maximum 24 hours PVC count

Maximum number of PVCs in 24 hours registered by continuous ECG monitoring (e.g. Holter)

◆ History of non-sustained VT

○Yes ○No

Specified as a recorded ventricular tachycardia (>100bpm) ending spontaneously within 30 seconds.

◆ Right ventricular ejection fraction (%)

50

As measured by cardiac MRI.

◆ OPTIONAL: programmed ventricular stimulation

◉N/A ○Positive ○Negative

Positive if induction of sustained monomorphic VT lasting >30s or with hemodynamic compromise

ARVC: kalkulátor rizika

https://arvcrisk.com

PATIENTS WITHOUT PRIOR SUSTAINED VA

Risk of first sustained VA (any type), within:

◉5 years ○2 years ○1 year

Adjusted by PVS result (if available):

ALL PATIENTS WITH DEFINITE ARVC

I.e. regardless of prior sustained VA

Risk of fast VT(>250bpm)/VF/SCA, within:

◉5 years ○2 years ○1 year

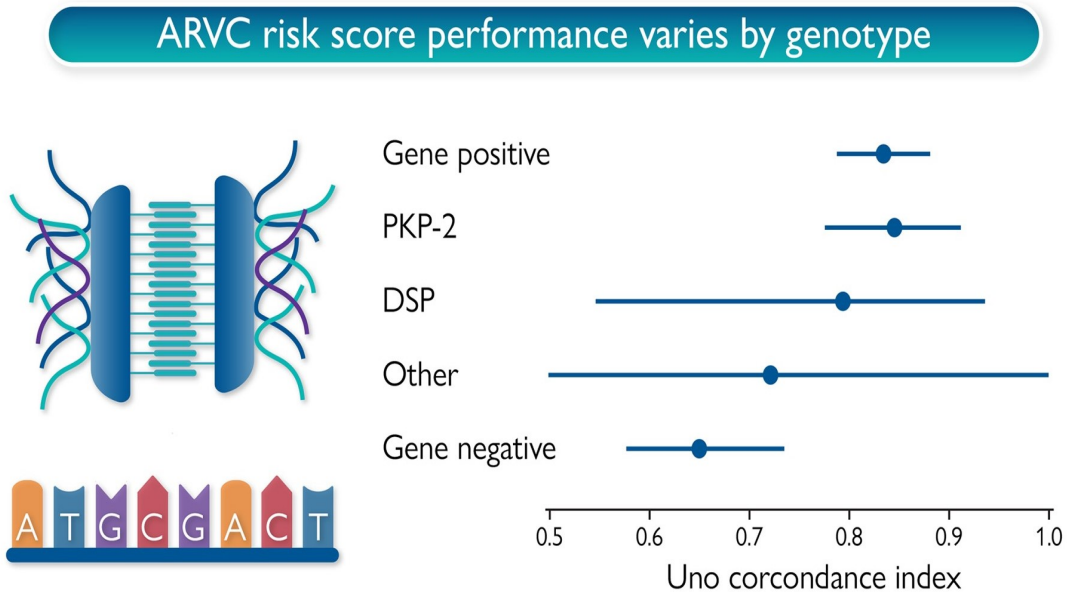
consider the following: in those patients who have >15% 5-year risk, an ICD should be considered; in those patients with a 5% to 15% 5-year risk, an ICD may be considered; and in those with <5% 5-year risk, an ICD should generally be avoided. These risk

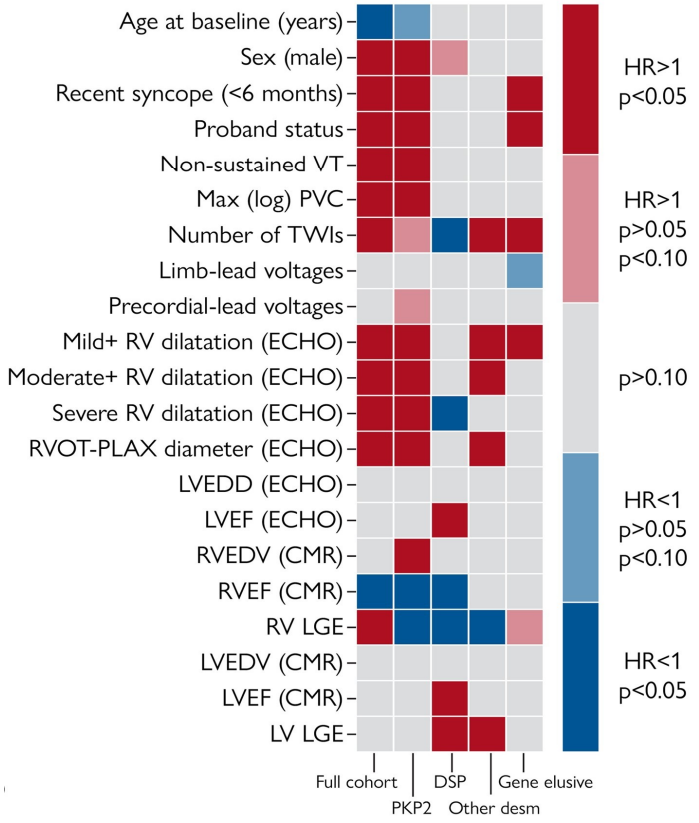
Krahn AD et al., JACC EP

ARVC: kalkulátor rizika – genotyp ?

Importance of genotype for risk stratification in arrhythmogenic right ventricular cardiomyopathy using the 2019 ARVC risk calculator

554 jedinců s definitivní dg. ARVC,
bez anamnézy setrvalé KT či SCD, 17 center ze 7 zemí



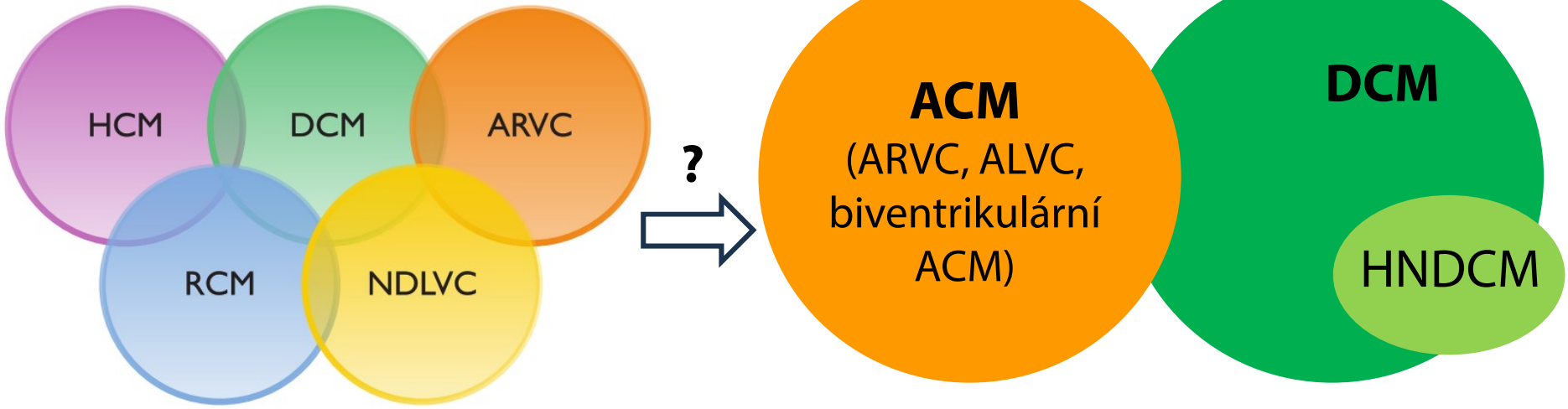


Protonotarios A et al., EHJ 2

Závěr

- Je obtížné hovořit o samotné A… … když víme, že existuje ACM !

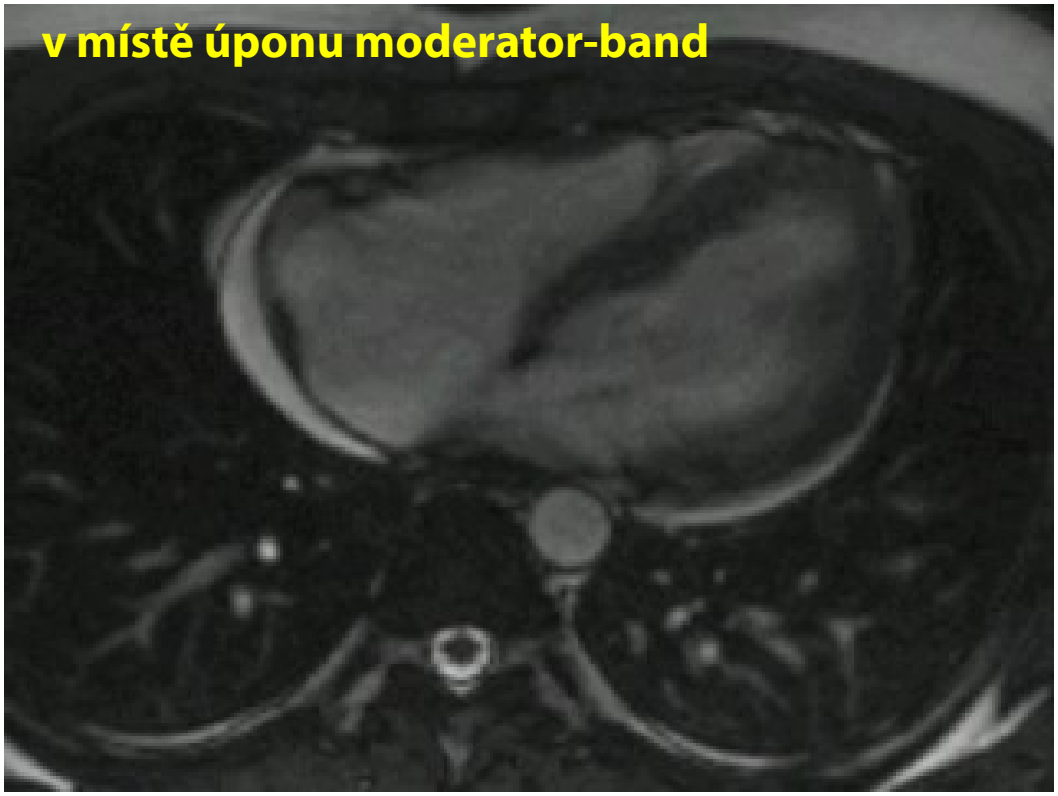
**O ACM vs. NDLVC na
XXVII. výroční konferenci ČASS,
která se uskuteční ve dnech 8.11.-9.11.2024
v hotelu Orea Resort Santon v Brně**



Děkuji za pozornost !

POZOR: „Pitfalls“ u MRI hodnocení ARVC

Apikolaterální bulging

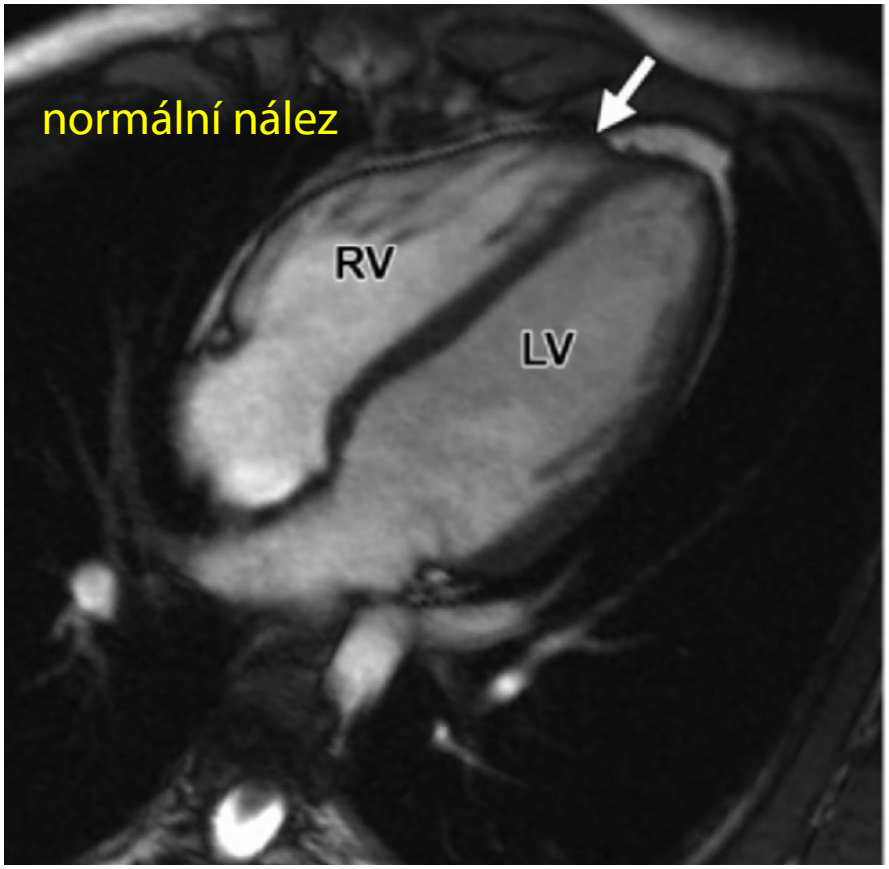


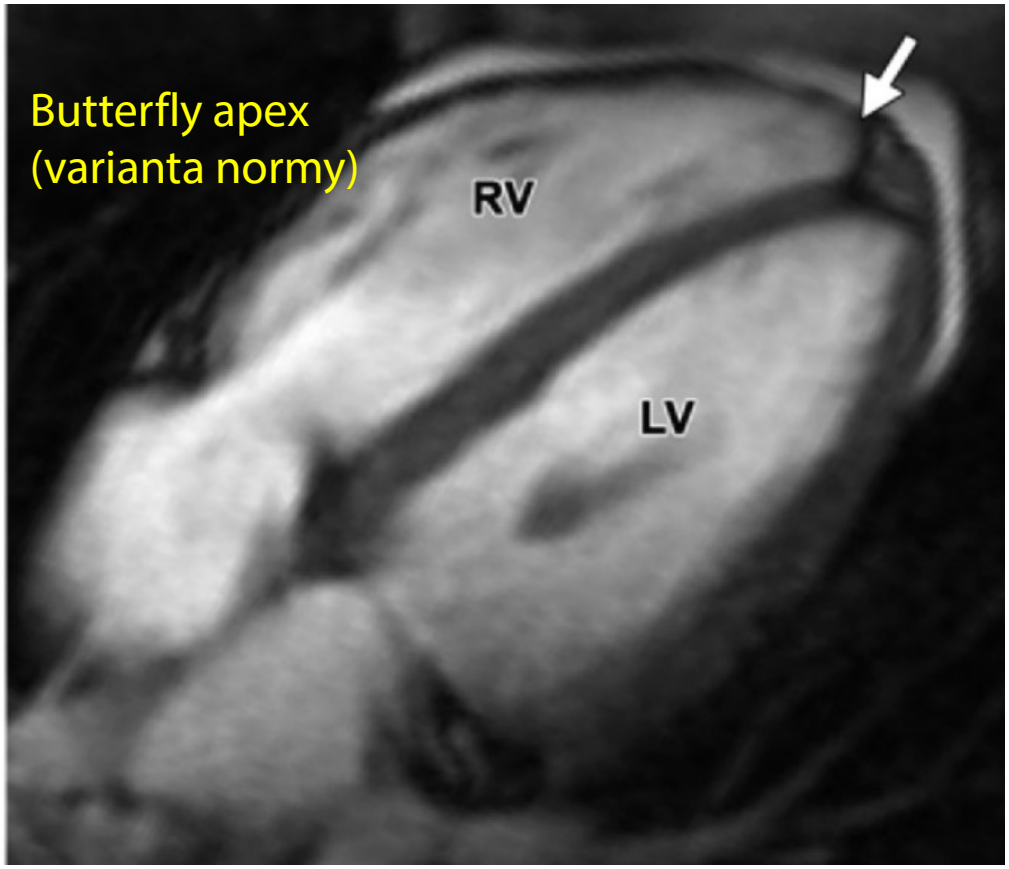
Dle autorů citace: Izolovaná porucha kinetiky hrotu PK není typická pro ARVC

Rastegar N et al., Radiographics 2014;3

POZOR: „Pitfalls“ u MRI hodnocení ARVC

Butterfly apex

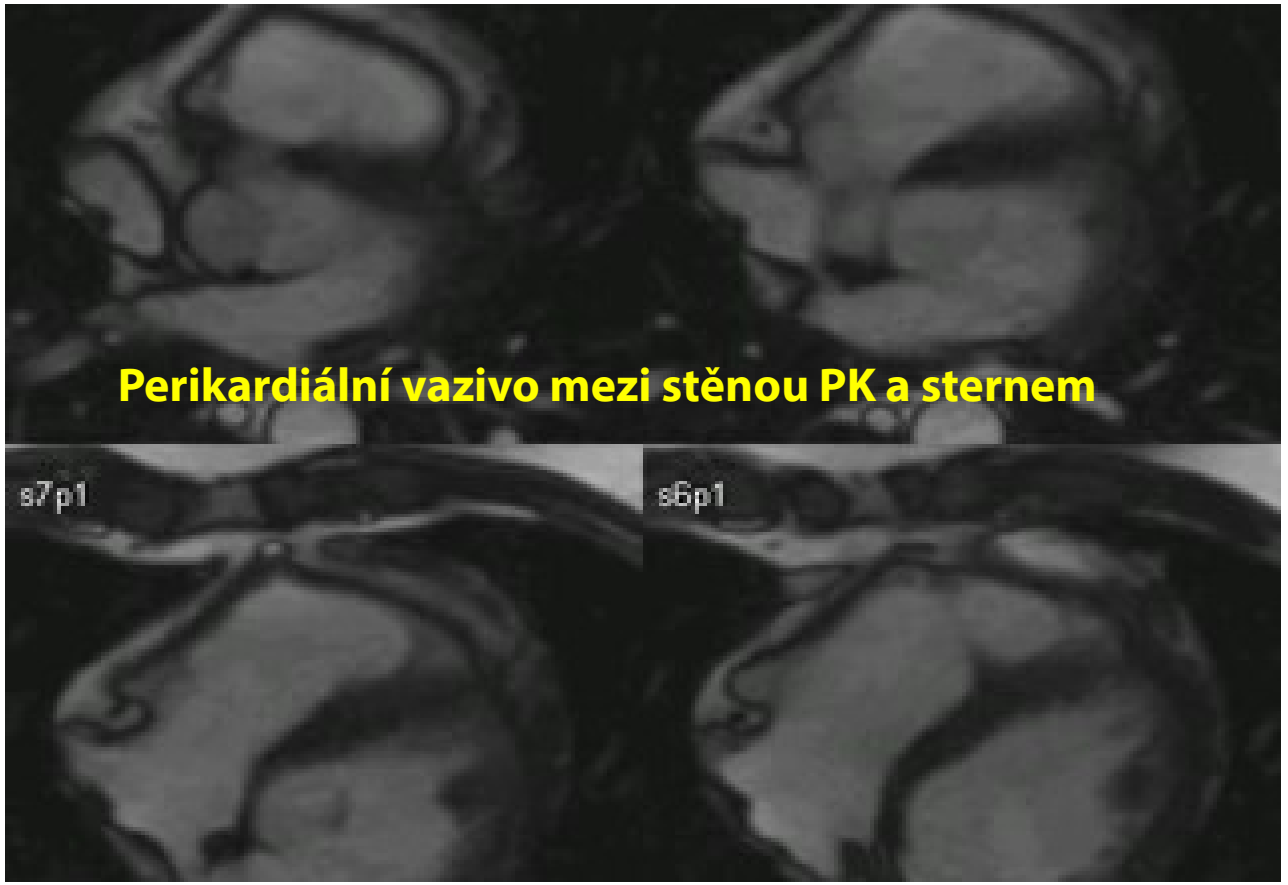




Rastegar N et al., Radiographics 2014;3

POZOR: „Pitfalls“ u MRI hodnocení ARVC

Tethering volné stěny PK



Rastegar N et al., Radiographics 2014;3