PŘÍNOS MR SRDCE U SRDEČNÍHO SELHÁNÍ SE SNÍŽENOU EF

Karel Mědílek

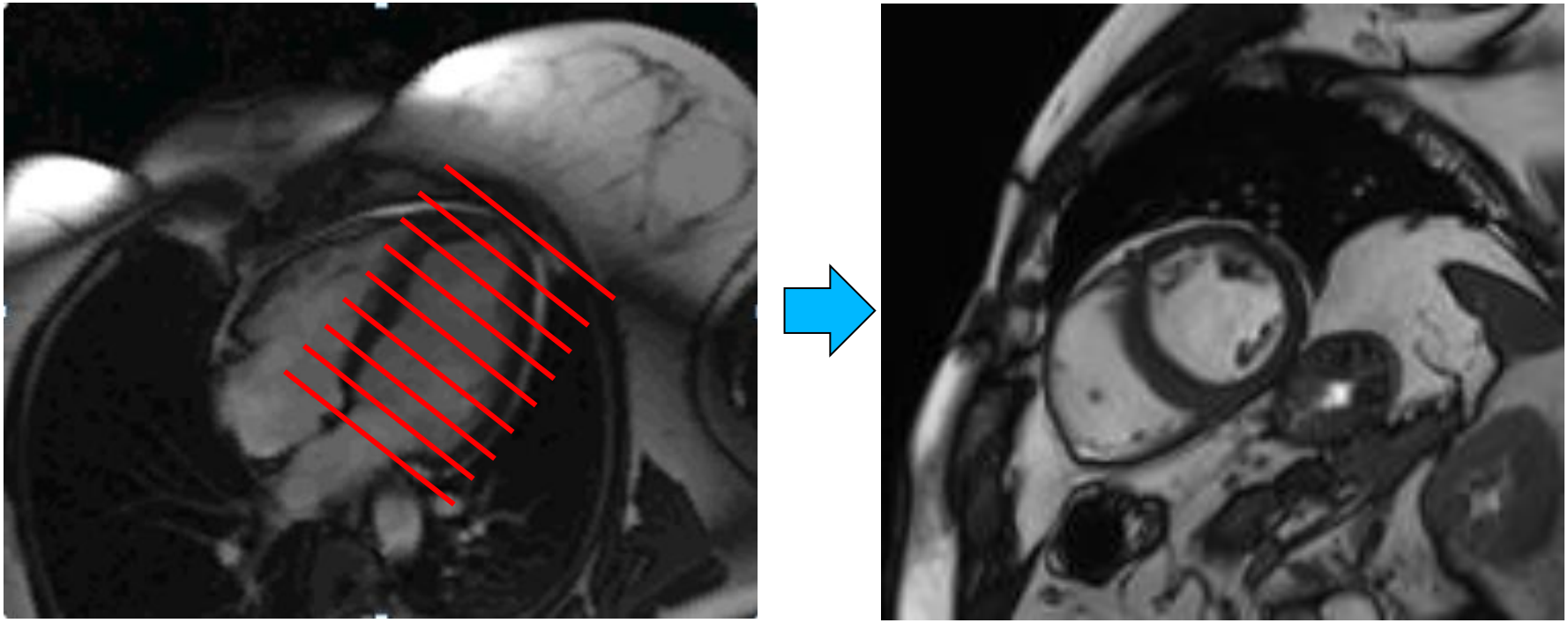
I.Interní kardioangiologická klinika FN Hradec Králové

Lékařská fakulta Hradec Králové, Univerzita Karlova

proč MR srdce

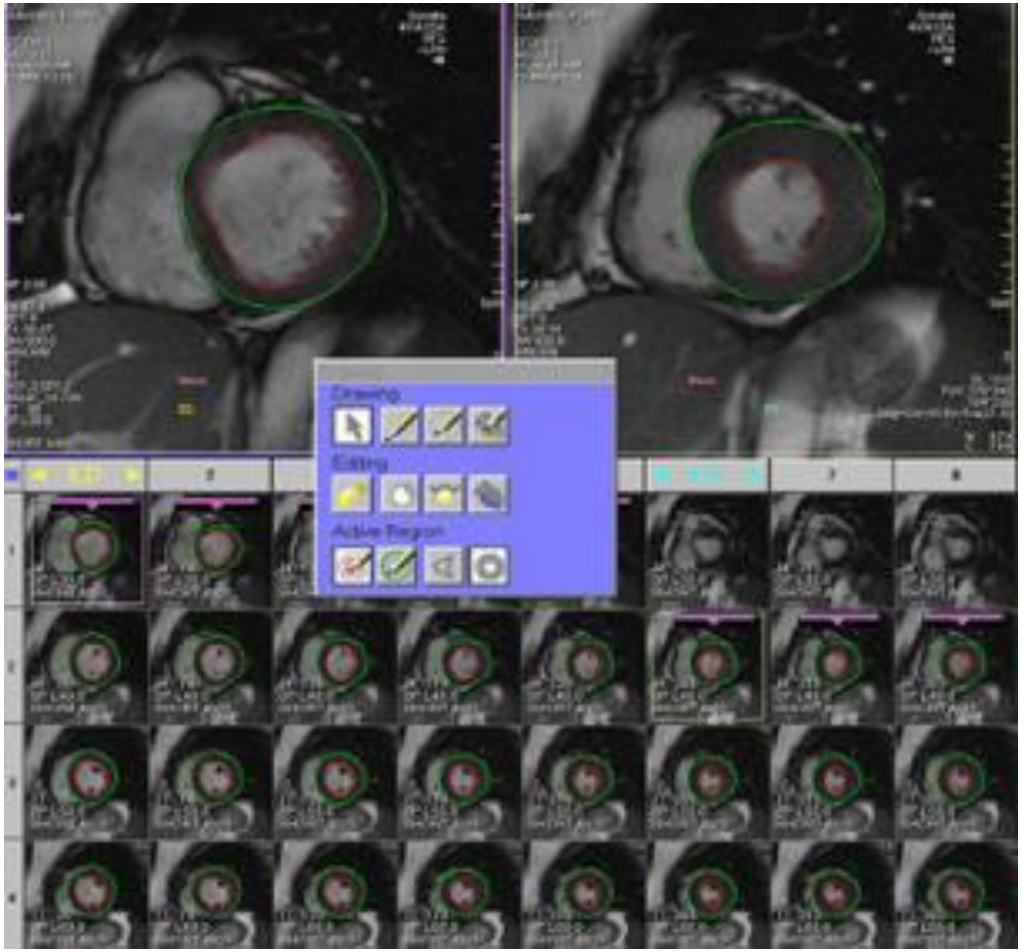
- zhodnocení globální systolické fce LK
- zhodnocení regionální systolické fce LK
- etiologie systolické dysfunkce LK

hodnocení EF LK/PK
metoda disků



dobré rozlišení 1,5 x 1,5 mm
8 mm slice, 2 mm gap
vysoká reproducibilita

hodnocení EF LK/PK
metoda disků



end diastolický frame
end systolický frame

bazálni segment

papilární svaly

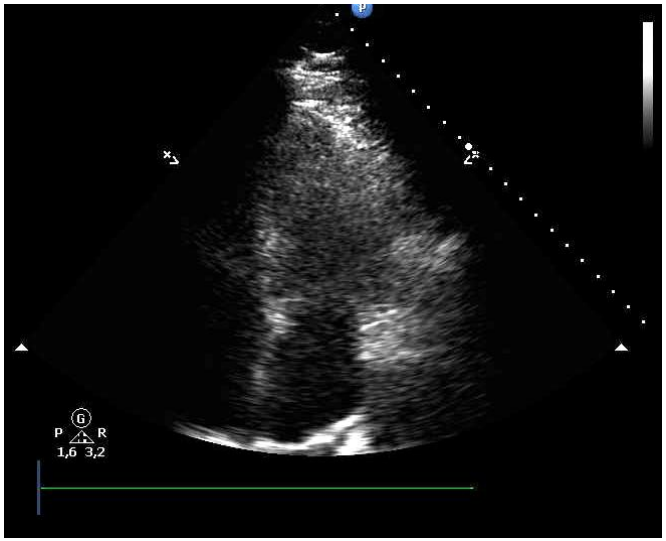
normální hodnoty

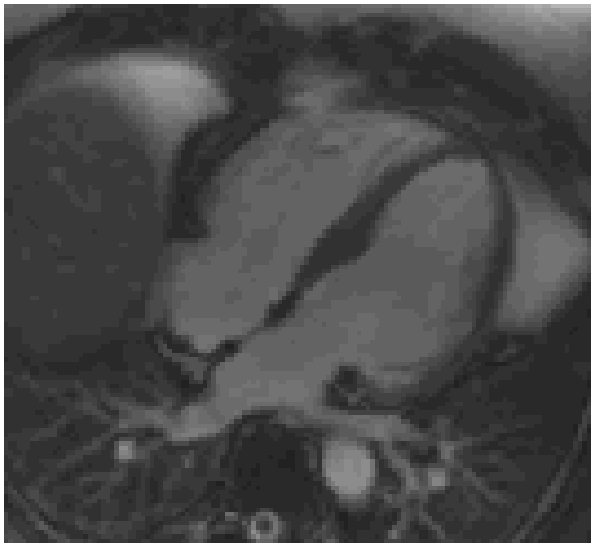
věk	20-29	30-39	40-49	50-59	60-69	70-79
EDV LK muži (ml/m2)	103	101	99	97	95	93
EDV LK ženy (ml/m2)	99	96	93	90	87	84
EF LK muži (%)	57	57	58	58	58	59
EF LK ženy (%)	56	57	58	59	60	60
EDV PK muži (ml/m2)	114	111	106	105	101	98
EDV PK ženy (ml/m2)	102	98	94	90	86	82
EF PK muži (%)	48	50	52	53	55	57
EF PK ženy (%)	49	51	53	55	57	59

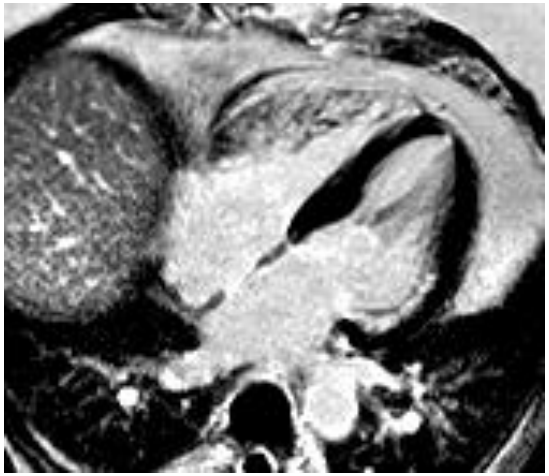
velikost LK, PK - objem v ml/m2

CMR pocket guide 2017 (EACVI)

gold standard…







gold standard…

Patient Name:
Patient ID: Examination Date: 20.12.2016
Patient Height: 187.00 cm. Patient Weight: 130.00 kg. Heart Rate: 58 Beats/mi

Left Ventricle - Absolute

Cardiac Function			Normal Range (M) (MRI)	Units
Ejection Fraction	EF	50.8	56.00 ... 78.00	%
End Diastolic Volume	EDV	190.6	77.00 ... 195.00	ml
End Systolic Volume	ESV	93.8	19.00 ... 72.00	ml
Stroke Volume	SV	96.8	51.00 ... 133.00	ml
Cardiac Output	CO	5.61	2.82 ... 8.82	l/min

EF LK 50,8% SV 96,8 ml

Patient Nam
Patient ID: Examination Date: 20.12.2016
Patient Height: 187.00 cm. Patient Weight: 130.00 kg. Heart Rate: 58 Beats/min

Right Ventricle - Absolute

Cardiac Function			Normal Range (M) (MRI)	Units
Ejection Fraction	EF	40.7	47.00 ... 74.00	%
End Diastolic Volume	EDV	235.1	88.00 ... 227.00	ml
End Systolic Volume	ESV	139.4	23.00 ... 103.00	ml
Stroke Volume	SV	95.7	52.00 ... 138.00	ml
Cardiac Output	CO	5.55	2.82 ... 8.82	l/min

EF PK 40,7% SV 95,7 ml

Patient Nam
Patient ID: Examination Date: 20.12.2016
Patient Height: 187.00 cm. Patient Weight: 130.00 kg. Heart Rate: 58 Beats/min

Left Ventricle - Normalized

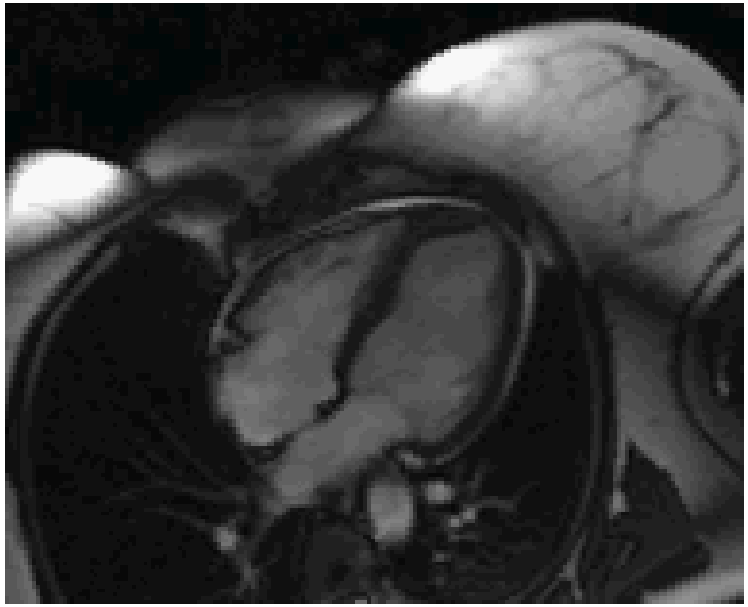
Cardiac Function			Normal Range (M) (MRI)	Units
End Diastolic Volume	EDV	75.5	47.00 ... 92.00	ml/m^2
End Systolic Volume	ESV	37.2	12.75 ... 30.00	ml/m^2
Stroke Volume	SV	38.4	32.00 ... 62.00	ml/m^2
Cardiac Index	CI	2.23	1.74 ... 4.20	l/min/m^2

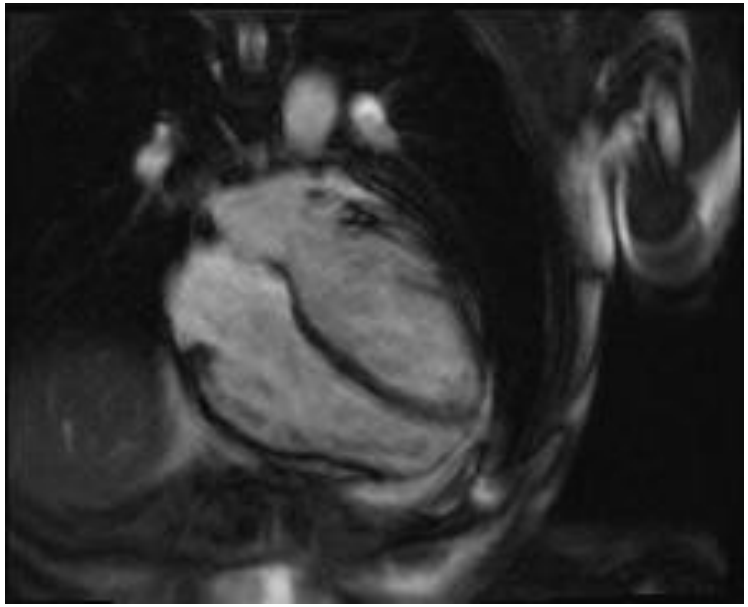
Patient Nam
Patient ID: Examination Date: 20.12.2016
Patient Height: 187.00 cm. Patient Weight: 130.00 kg. Heart Rate: 58 Beats/min

Right Ventricle - Normalized

Cardiac Function			Normal Range (M) (MRI)	Units
End Diastolic Volume	EDV	93.2	55.00 ... 105.00	ml/m^2
End Systolic Volume	ESV	55.3	15.43 ... 42.91	ml/m^2
Stroke Volume	SV	37.9	32.00 ... 64.00	ml/m^2
Cardiac Index	CI	2.20	1.74 ... 4.20	l/min/m^2

gold standard, ale….
dechové artefakty





zkrácení délky sekvence
- snížení FOV - redukce počtu fází
- redukce počtu řezů

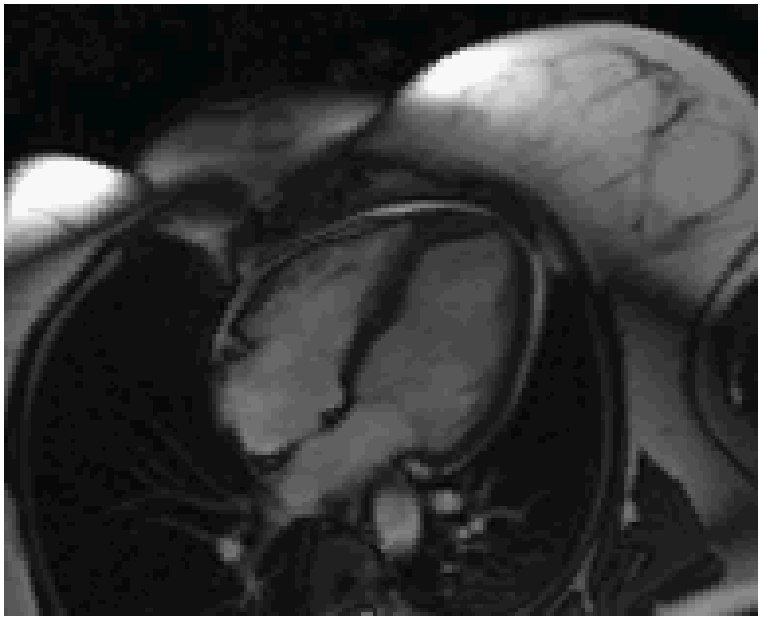
akvizice v end inspiriu

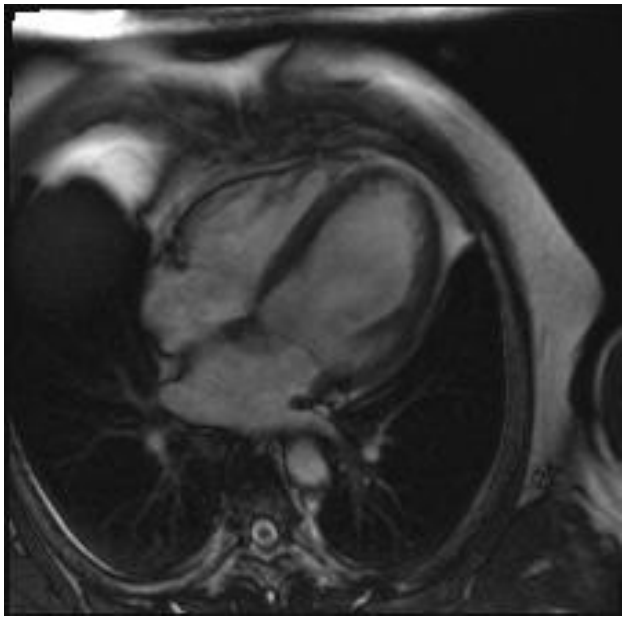
použití respiračního navigátoru

komunikace s pacientem

opakování sekvence

gold standard, ale….
nepravidelná tepová frekvence

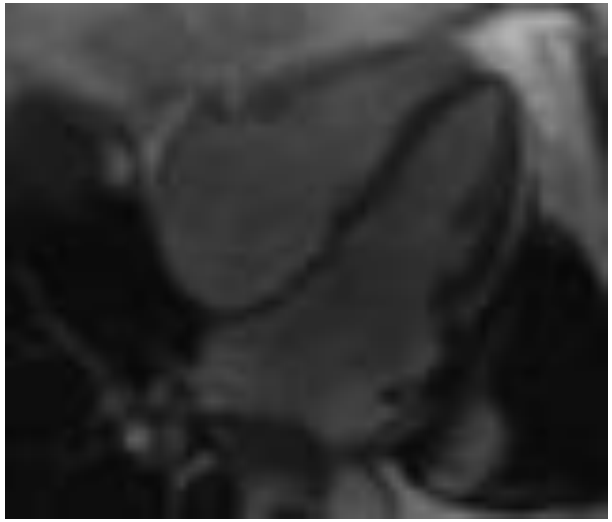




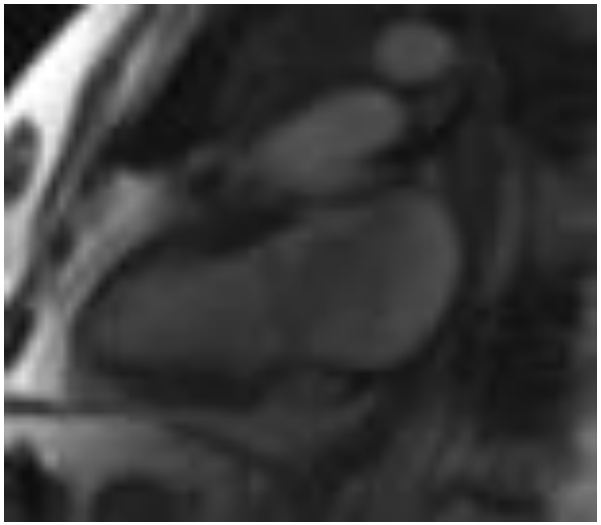
medikamentózní korekce rytmu/TF
prospektivní gating
arrhytmia rejection

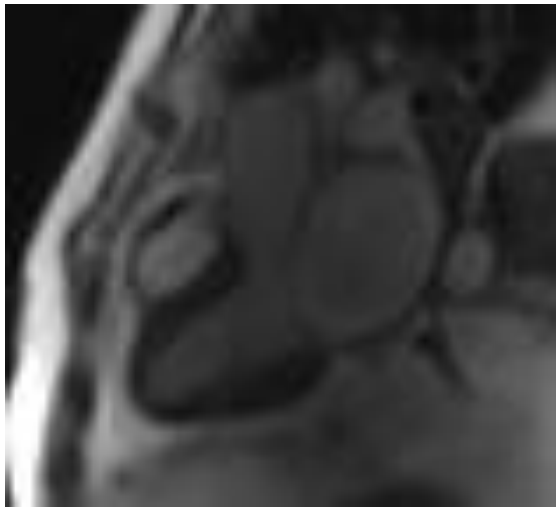
opakování sekvence
real time imaging

„real time“ sekvence

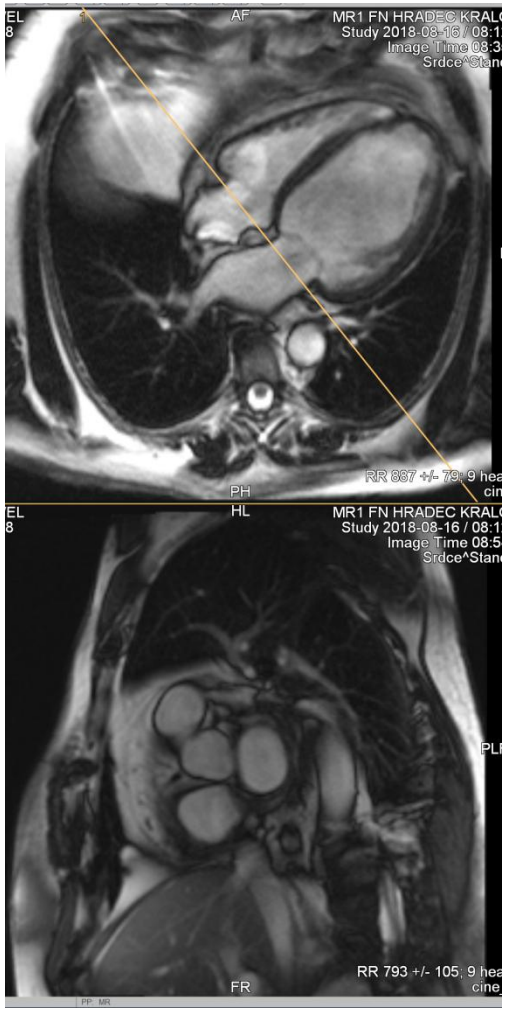


tachy Fis

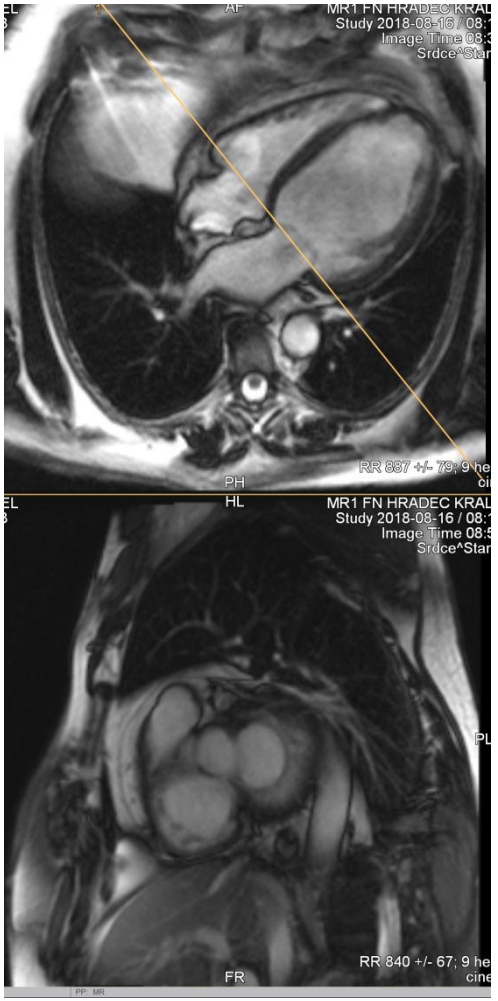




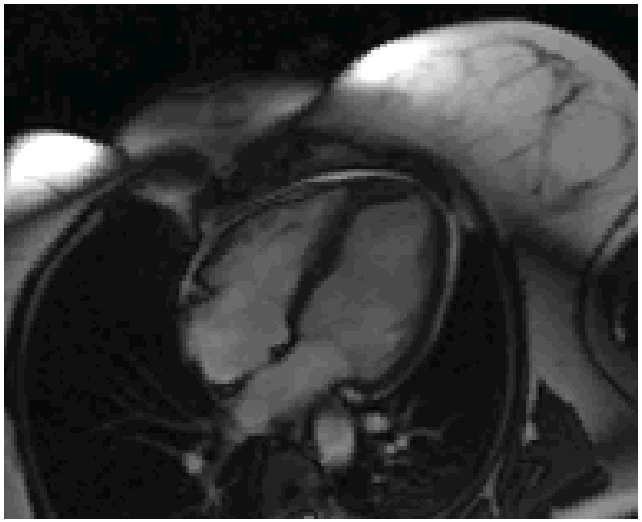
gold standard, ale….
bazální segment

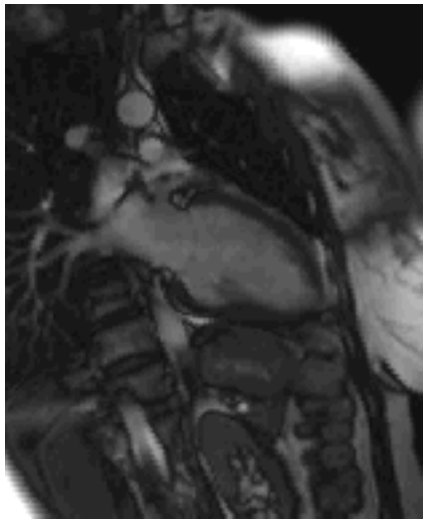


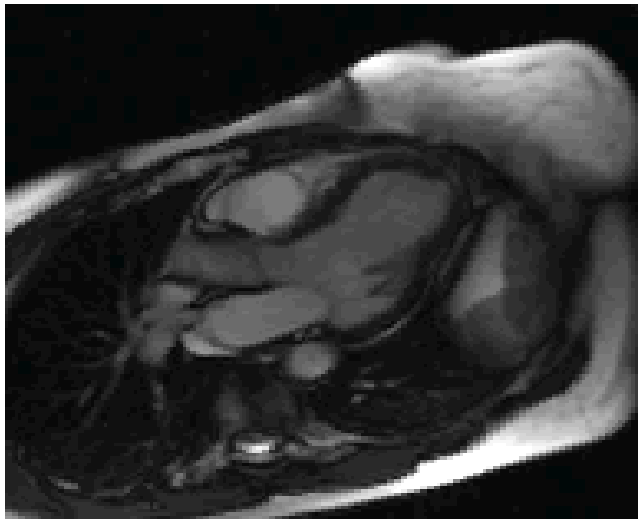
automatické software



projekce
stejné jako u echokardiografie





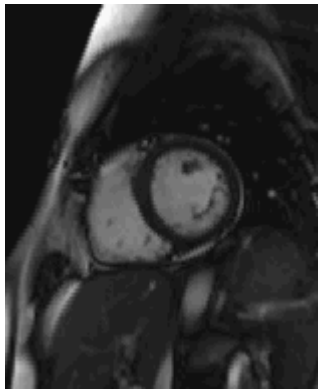


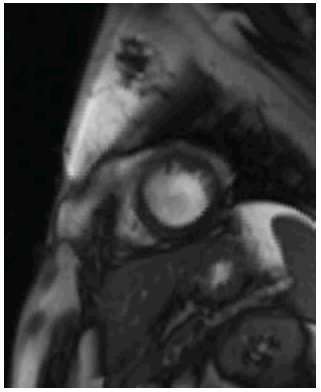
4CH

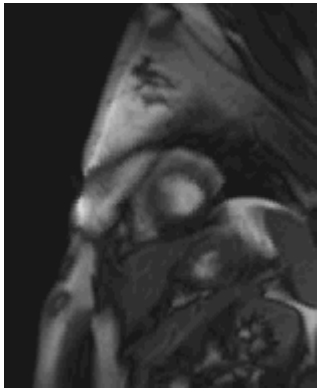
2CH

3CH

SAX

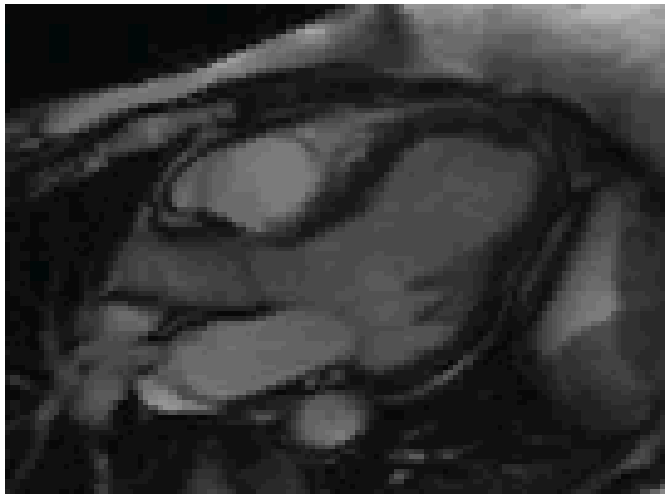




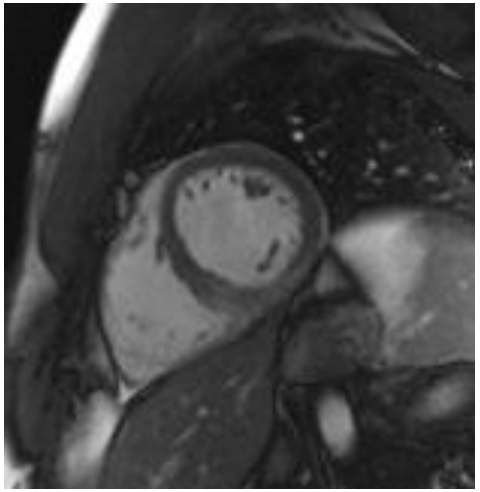


SAX

RWMA ischemické etiologie

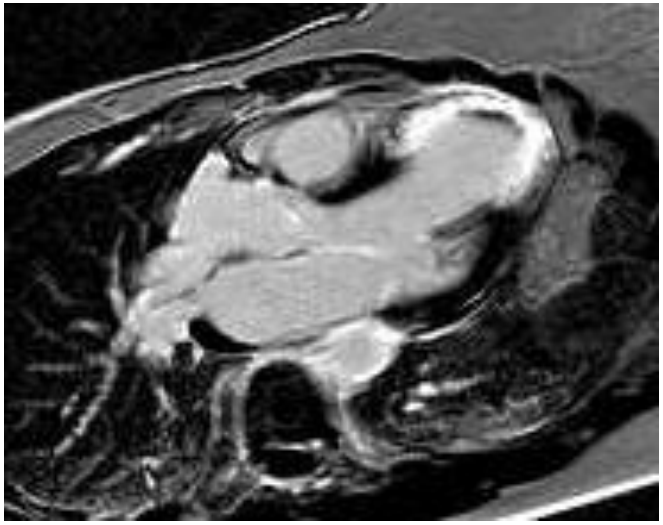


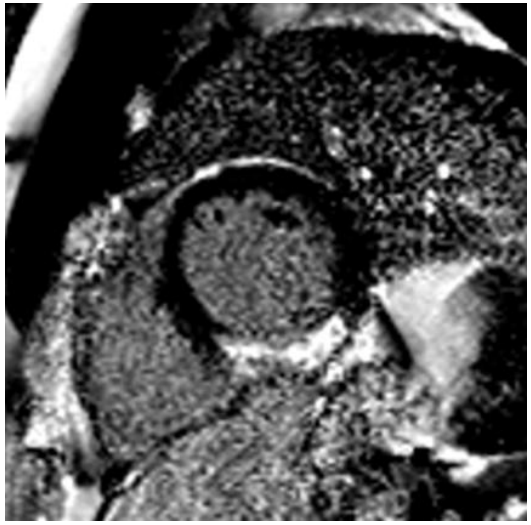
RIA

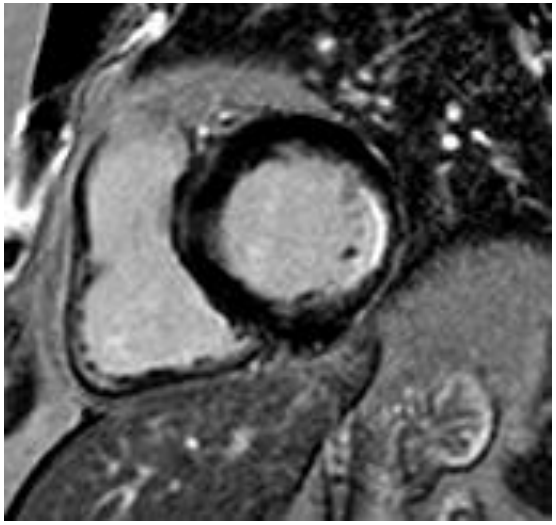


ACD

RCx







LGE

RWMA neischemické etiologie

- **myokarditida**

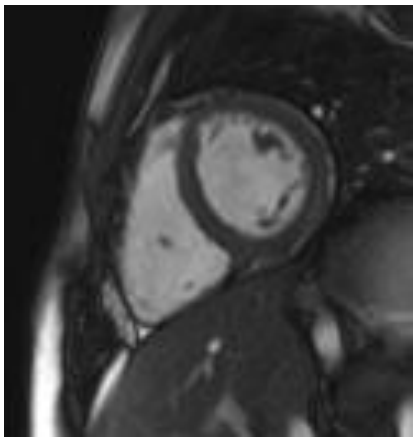
edém na T2 vážených skenech

↑signál na EGE

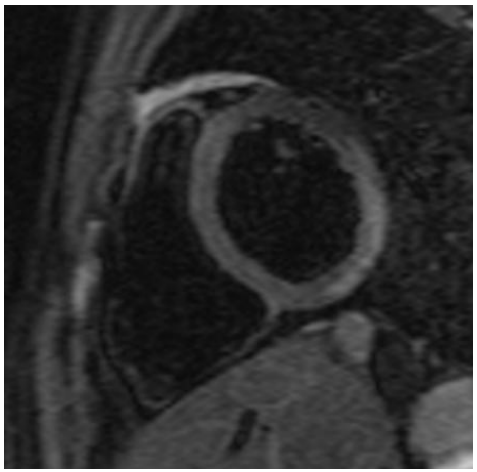
LGE nekoresponduje s koronární distribucí

epikardiální/midendokardiální poškození

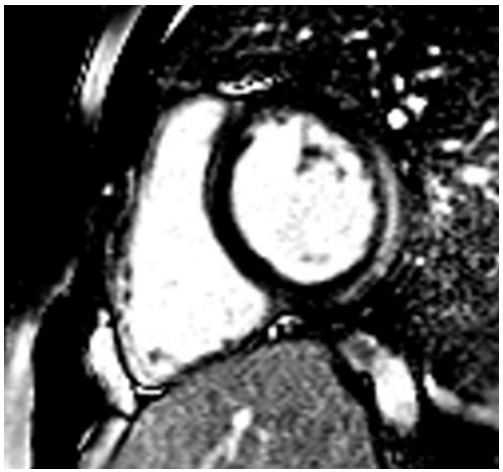
myoperikarditida



cine



T2



EGE

LGE

RWMA neischemické etiologie

sarkoidosa

nedilatovaná LK, RWMA, dilatace síní

LGE - intramurální, mnohočetné, zvláště basální laterální segment, nekoronární distribuce

hilová lymfadenopatie

NCCMP

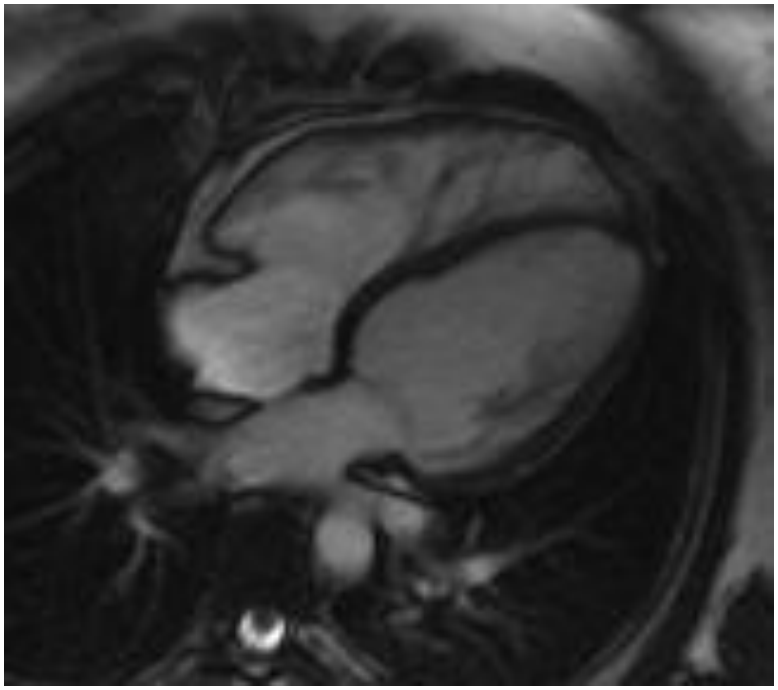
RWMA

LGE v pozdní fázi

non-kompaktní/kompaktní

vrtstva v diastole >2,3

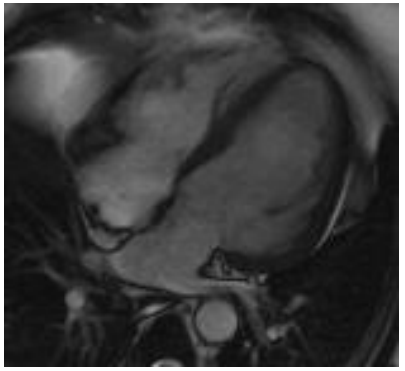
Takotsubo KMP

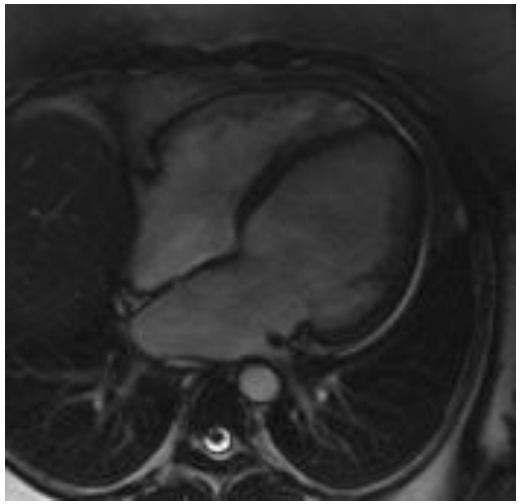


dilatační KMP

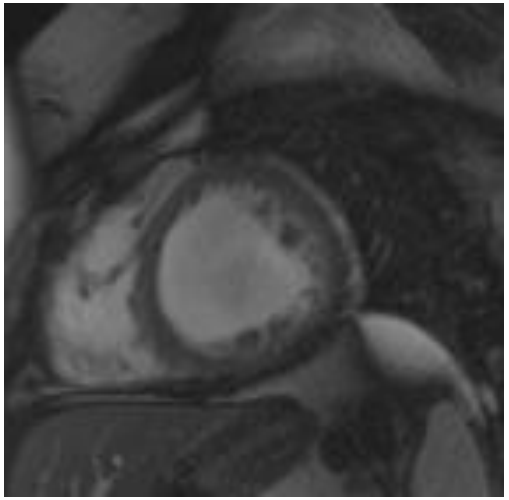
midwall LGE

LBBB





4CH



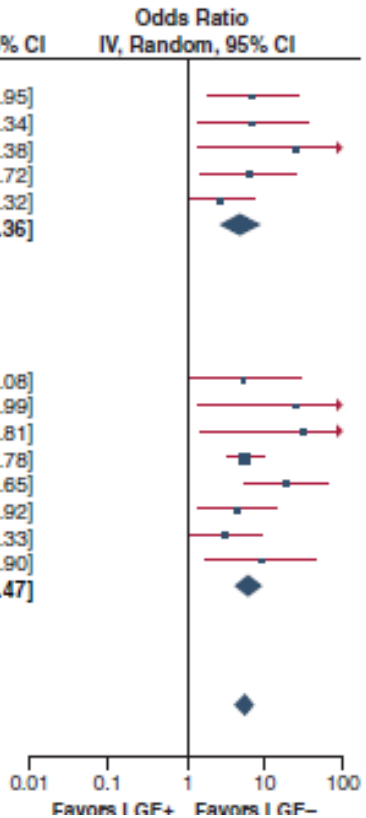
SAX

LGE

LGE u ICHS/DKMP
rizikový faktor SCD, chron. SS

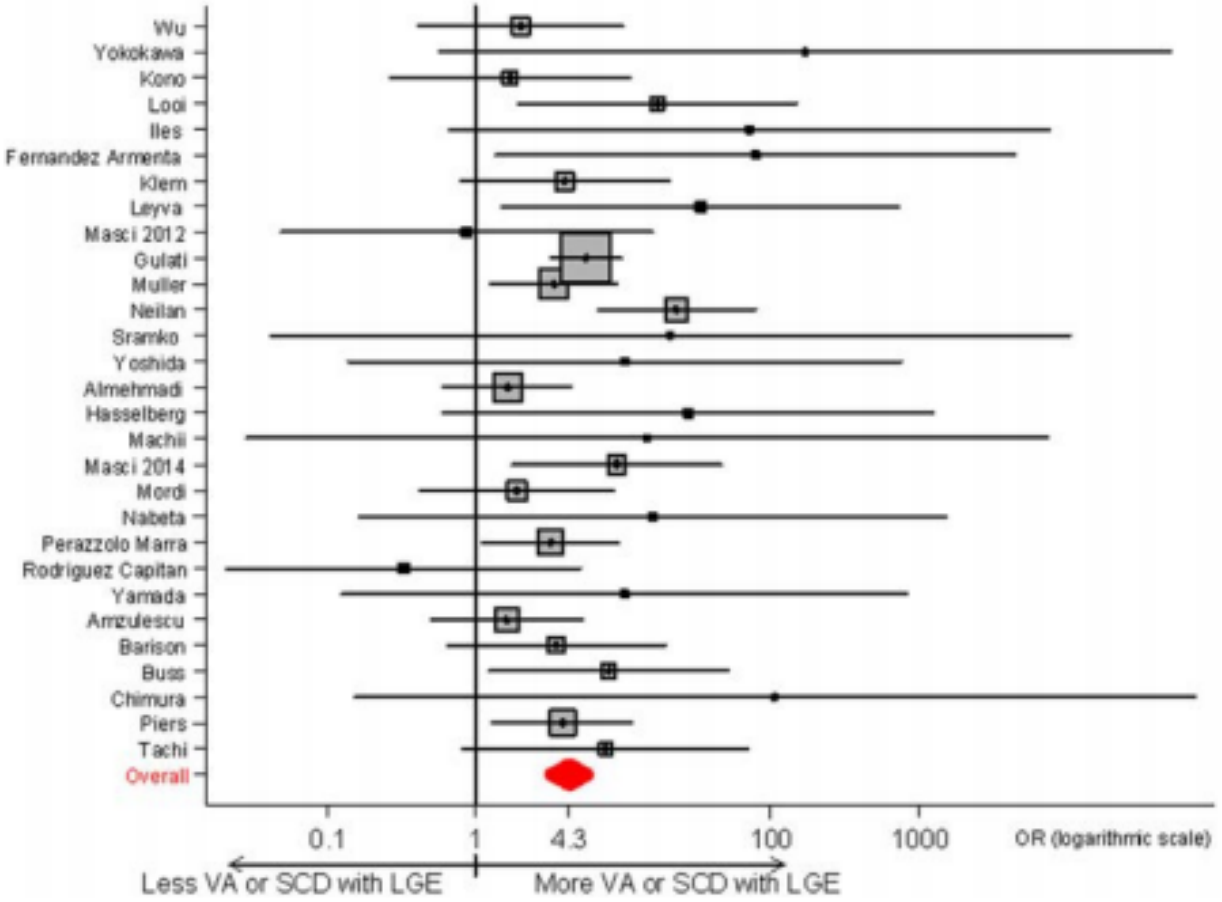
FIGURE 2 Individual and Pooled ORs for LGE Cardiac Magnetic Resonance in Different Cardiomyopathy Etiologies

Study or Subgroup	LGE+ Events	LGE+ Total	LGE- Events	LGE- Total	Weight	Odds Ratio IV, Random, 95% CI
1.1.1 Studies With Ischemic Cardiomyopathy						
Roes (8)	15	45	3	46	4.8%	7.17 [1.91, 26.95]
Boyé (13)	14	32	2	20	3.2%	7.00 [1.39, 35.34]
De Hann (14)	14	36	0	19	1.0%	25.13 [1.41, 449.38]
Alexandre (15)	11	30	3	36	4.3%	6.37 [1.58, 25.72]
Demirel (16)	27	62	7	32	8.8%	2.76 [1.04, 7.32]
Subtotal (95% CI)		**205**		**153**	**22.1%**	**5.05 [2.73, 9.36]**
Total Events	81		15			
Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 3.20$, df = 4 (P = 0.53); $I^2 = 0\%$						
Test for Overall Effect: Z = 5.15 (P < 0.00001)						
1.1.2 Studies With Nonischemic Cardiomyopathy						
Assomull (17)	5	35	2	66	2.9%	5.33 [0.98, 29.08]
Iles (18)	9	31	0	30	1.0%	25.76 [1.42, 465.99]
Leyva (19)	3	20	0	77	0.9%	31.00 [1.53, 627.81]
Gulati (11)	42	142	23	330	27.2%	5.61 [3.21, 9.78]
Neilan (20)	34	81	3	81	5.5%	18.81 [5.47, 64.65]
Muller (21)	16	94	4	91	6.5%	4.46 [1.43, 13.92]
Perazzolo-Marra (22)	17	76	5	61	7.5%	3.23 [1.12, 9.33]
Masci (23)	6	61	2	167	3.2%	9.00 [1.76, 45.90]
Subtotal (95% CI)		**540**		**903**	**54.6%**	**6.27 [4.15, 9.47]**
Total Events	132		39			
Heterogeneity: $Tau^2 = 0.01$; $Chi^2 = 7.26$, df = 7 (P = 0.40); $I^2 = 4\%$						
Test for Overall Effect: Z = 8.72 (P < 0.00001)						



Disertori et al. Myocardial Fibrosis Assessment by LGE Is a Powerful Predictor of Ventricular Tachyarrhythmias in Ischemic and Nonischemic LV Dysfunction. J Am Coll Cardiol Img 2016;9:1046–55

LGE u DKMP
rizikový faktor SCD, chron. SS



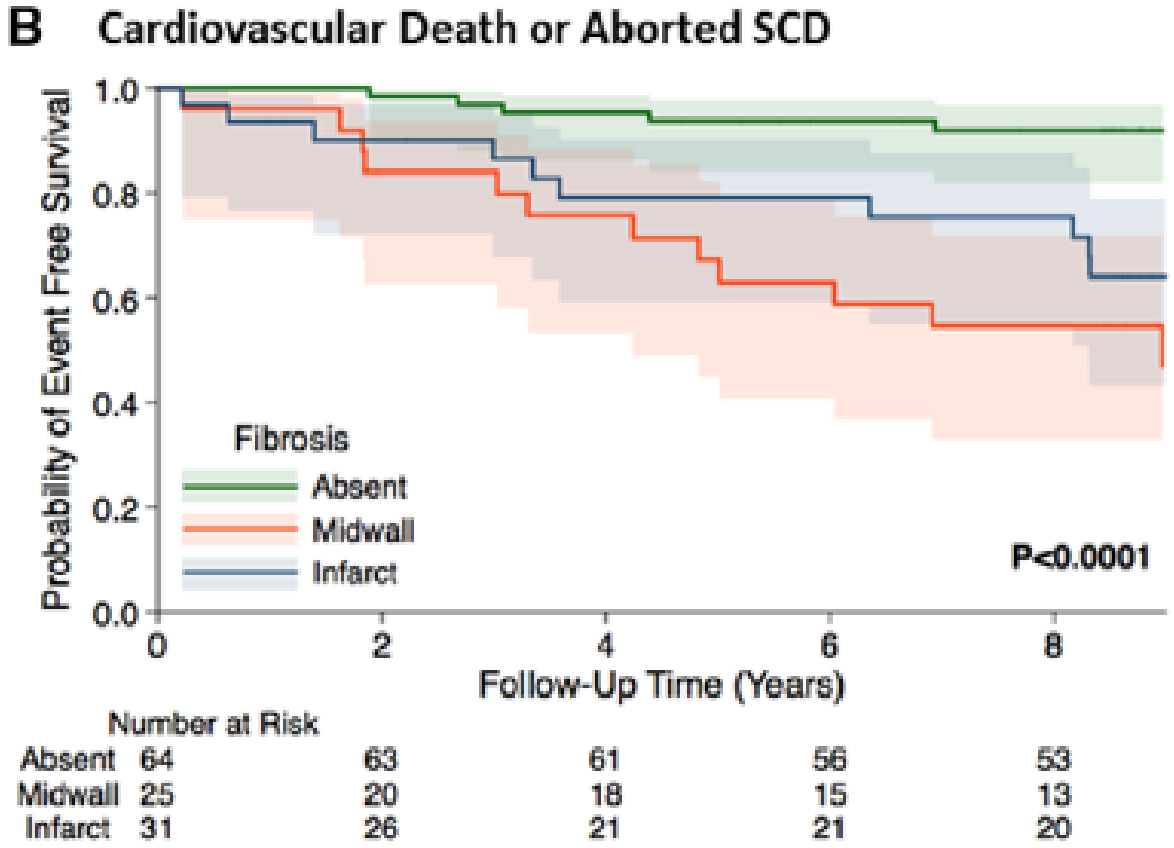
Di Marco et al. Late Gadolinium Enhancement and the Risk for Ventricular Arrhythmias or Sudden Death in Dilated Cardiomyopathy. JACC: HEART FAILURE VOL. 5, NO. 1, January 2017 , 28-38

2017 AHA/ACC/HRS Guideline for Management of Patients With Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death

7.2. Nonischemic Cardiomyopathy

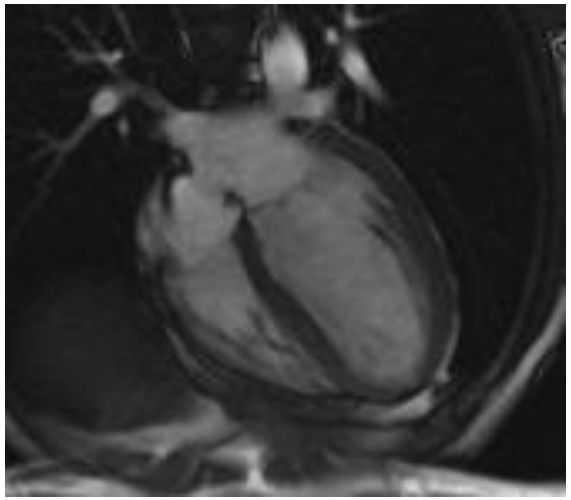
Recommendations for Patients With NICM References that support the recommendations are summarized in Online Data Supplement 24.		
COR	**LOE**	**Recommendations**
I	B-NR	1. In patients with suspected NICM from myocardial infiltrative processes, cardiac MRI with late gadolinium enhancement is useful for diagnosis (1-3).
IIa	B-NR	2. In patients with suspected NICM, cardiac MRI with late gadolinium enhancement can be useful for assessing risk of SCA/SCD (1-3).
IIa	C-EO	3. In patients with NICM who develop conduction disease or LV dysfunction at less than 40 years of age, or who have a family history of NICM or SCD in a first-degree relative (<50 years of age), genetic counseling and genetic testing are reasonable to detect a heritable disease that may clarify prognosis and facilitate cascade screening of relatives (4, 5).

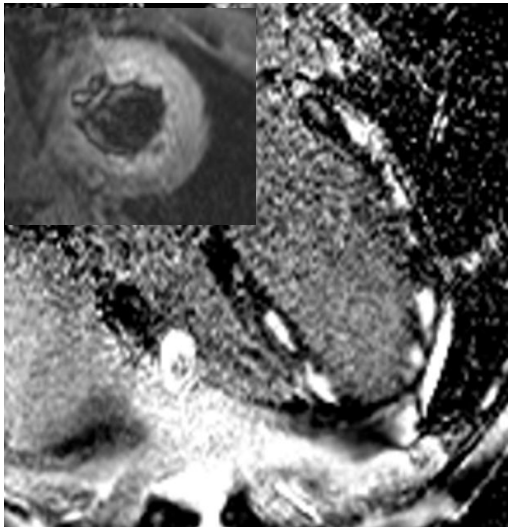
LGE u ICHS/DKMP rizikový faktor SCD, nové SS

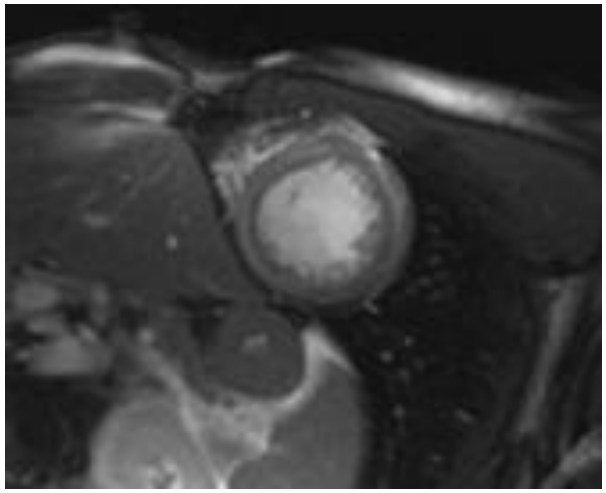


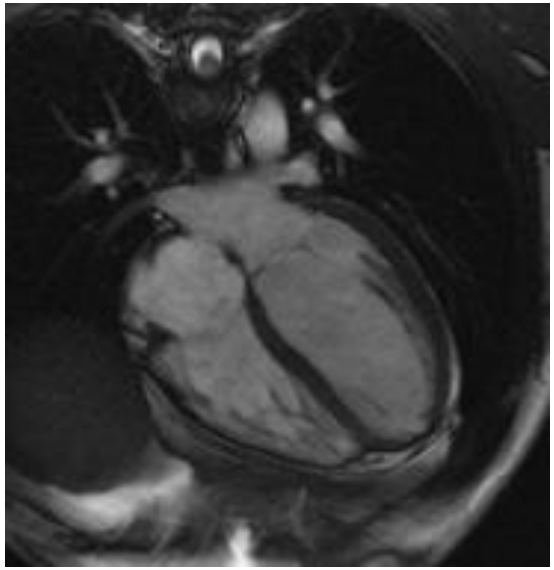
Gulati A. Absence of Myocardial Fibrosis Predicts Favorable Long-Term Survival in New-Onset Heart Failure. Circ Cardiovasc Imaging. 2018;11:e007722. DOI: 10.1161/CIRCIMAGING.118.007722

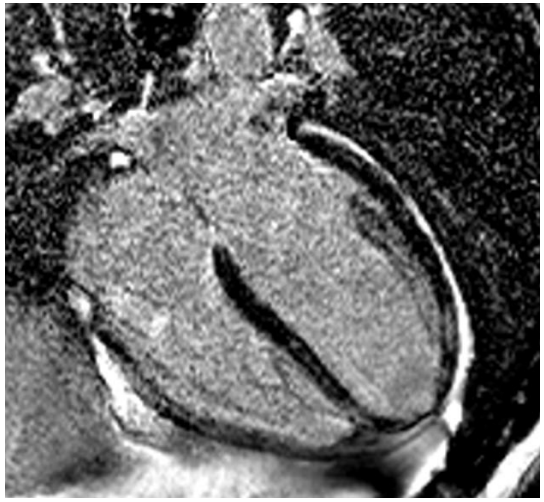
myokarditida- reversibilní dysfce

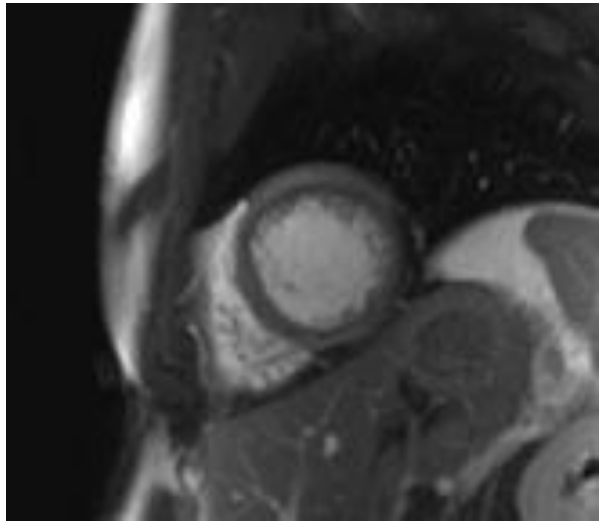








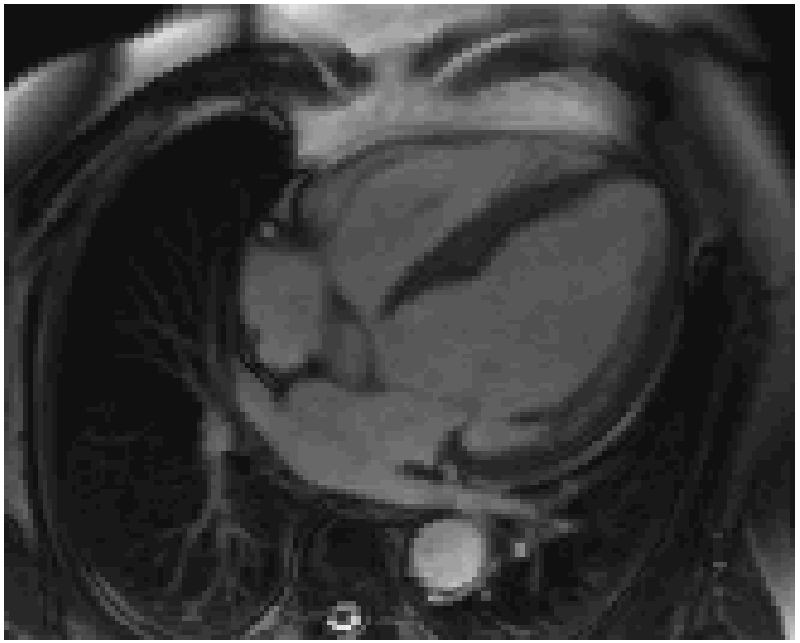


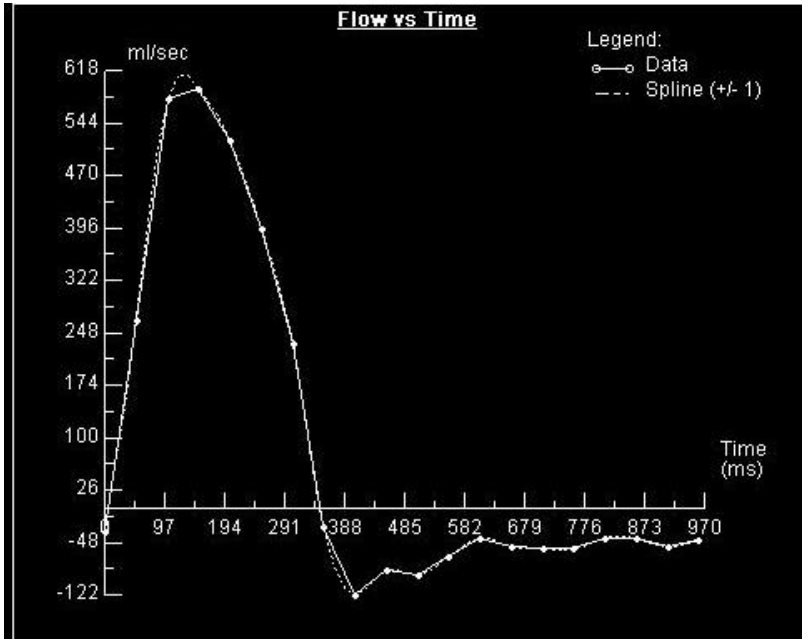


iron overload cardiomyopathy

- primární hemochromatóza
- postransfuzní hemosideróza
- dg. laboratorní
- T2* v septu > 20ms riziko SS vysoké
- T2* v septu < 10ms riziko SS nízké
- postižení obou komor, systolická dysfce
- restriktivní typ méně častý
- současné postižení jater
- řízení chelátové terapie

aortální/mitrální insufucience





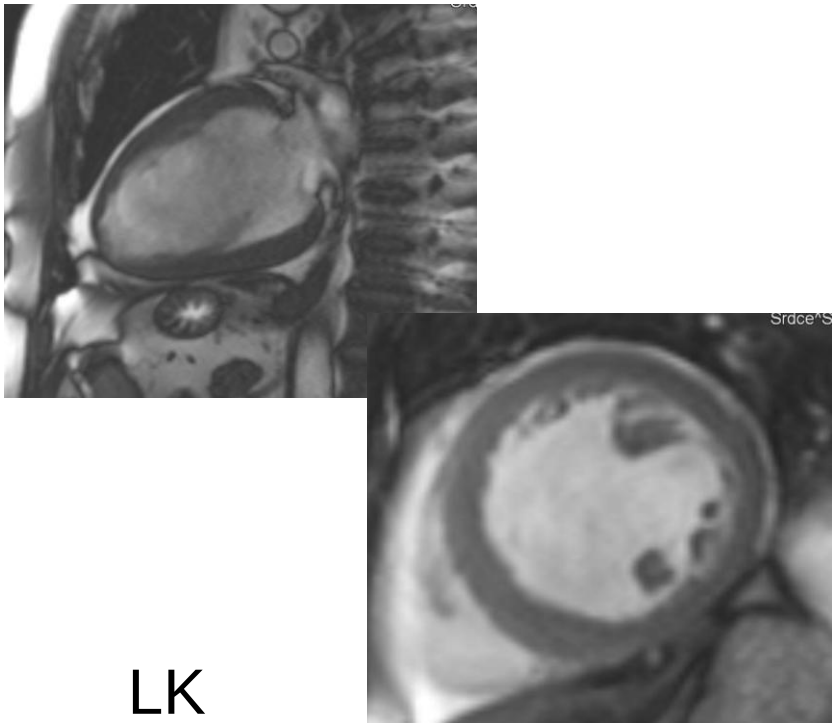
4CH

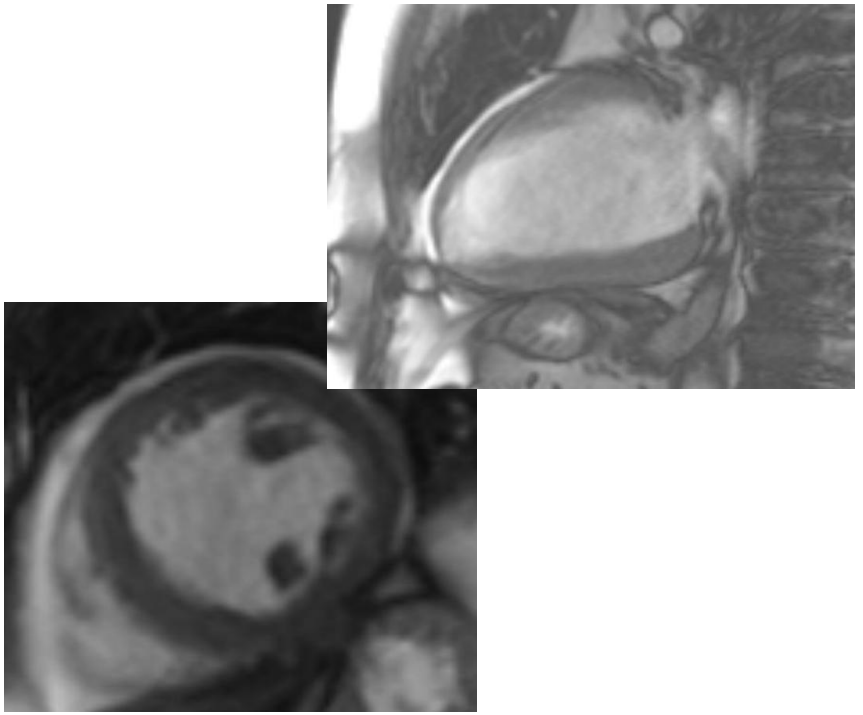
EDV 320 ml, tj. 160 ml/m2
ESD 220 ml, tj. 110 ml/m2
EF 33%

flow asc. Ao

forward 129 ml
reverse 38 ml
RF 29%

kontraktilní rezerva dobutamin 5,10 ug/kg/min

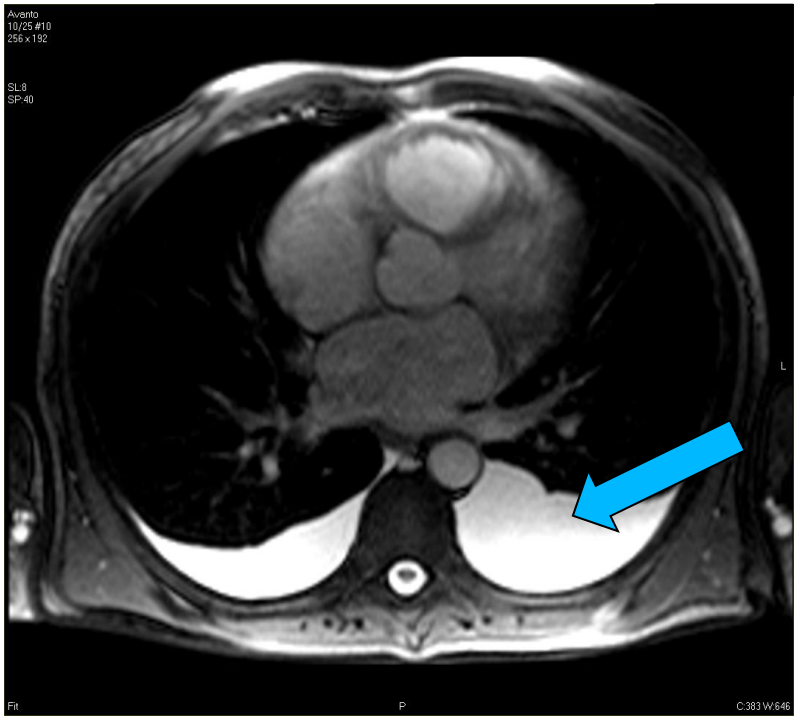


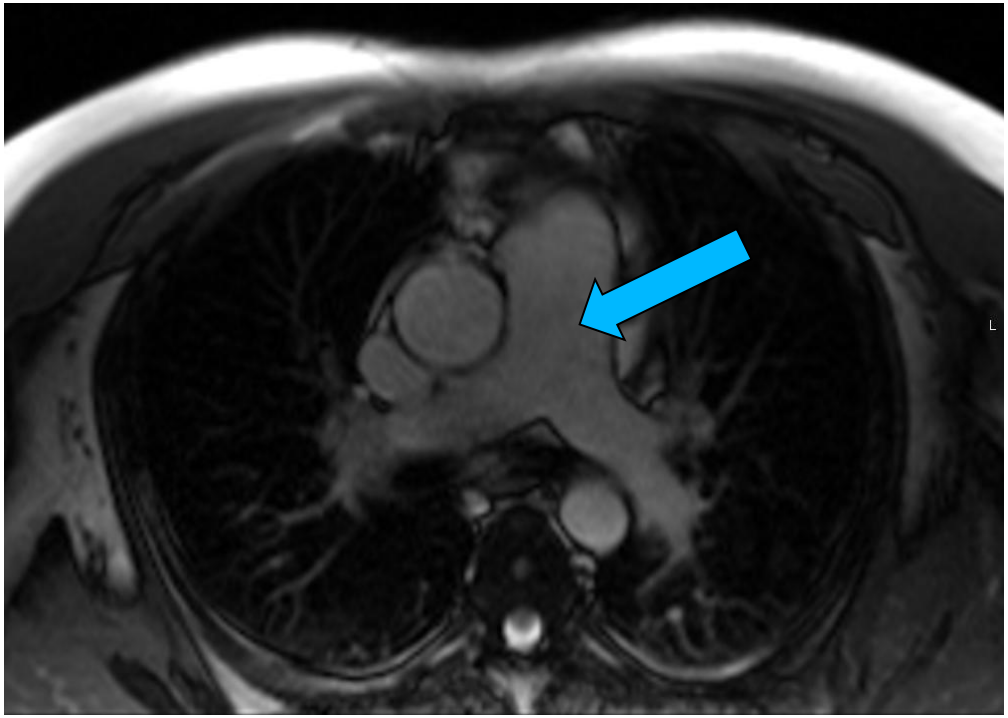


LK
TF 75…110/min.
EF 20…37%
EDVi 148…125 ml/m2
SV 29…46 ml/m2

PK
EF 37…54%

pleurální výpotek
dilatace plicnice





kmen AP> 30mm-nepřímá známka plicní hyperteze

limitace

artefakty

- dýchání
- kovové implantáty, pacemakery…
- FOV artefakt („překlápění“),
- „chemical shift“ artefakt….

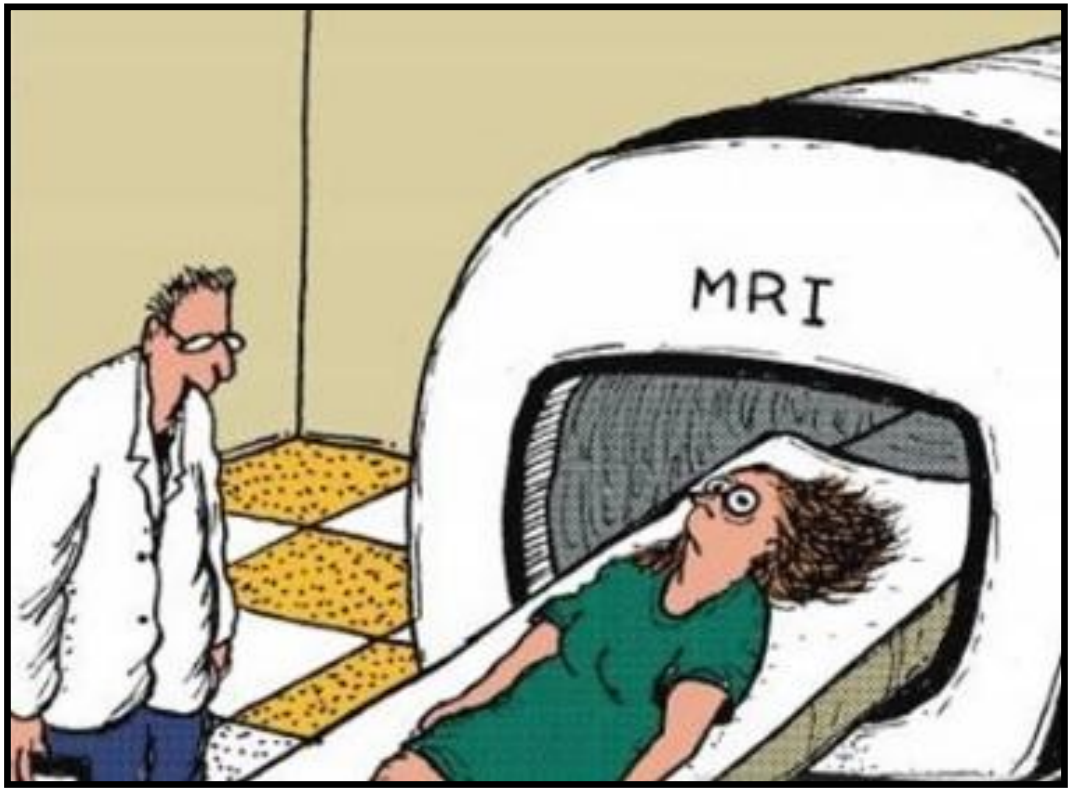
nekvalitní EKG křivka

nepravidelná srdeční akce (ES, Fis)

netolerance horizontály, nemožnost zadržet dech

CHRI-eGFR < 30ml/min/1,73m2, KI-dialyzovaní

šířka tubusu 50 cm 1,5T, 60 cm 3T



„Tak paní Nováková, teď s Vámi zajedeme do přístroje a uděláme obrázky Vašeho mozku, abychom konečně přišli na to, proč máte ty záchvaty klaustrofobie!“