Current Application of Cardiac Imaging: MRI

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www.umg-radiologie.de
No conflict of interest

This talk deals with techniques used in clinical daily routine

All of the indications for cardiac MRI are within national/international guidelines

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Cardiac MRI - the toolbox

- Ischemia
- Vitality
- Myocarditis
- Cardiomyopathy
- Tumor
- Thrombus
- Congenitals

MRI: the largest imaging toolbox of all imaging modalities

but still not enough for all questions at hand...

- perfusion
- late enhancement
- function
- angio
- flow
- fibrosis / tissue mapping
- anatomy
- edema
- iron-load
Cardiac MRI - current use

- Ischemia
- Vitality
- Myocarditis
- Cardiomyopathy
- Tumor
- Thrombus
- Congenitals

specific question = specific answers
= short exam times
= less patient discomfort
Cardiac MRI - Ischemia

First pass perfusion imaging:

- without vasodilatation (rest)
- with maximal vasodilatation
  Adenosine 140µg/kg/min

Detection of significant stenoses during vasodilatation

Hypoperfusion \( \rightarrow \) Coronary artery disease

Scanner time effort: 30min

- Ischemia
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Adenosine, Regadenosone, Dipyridamole, vs. Dobutamine: all work nicely...
Cardiac MRI - Ischemia

First pass perfusion imaging:

• without vasodilatation (rest)
• with maximal vasodilatation
  Adenosine 140µg/kg/min

Detection of significant stenoses during vasodilatation

Hypoperfusion ➔ Coronary artery disease

Scanner time effort: 30min
Cardiac MRI - Ischemia

- Save exam
- Patient must be prepared
- Indirect localisation of stenoses!

Negative stress test: no MACE in the next 3-5 years

n= 461 Patienten: Dob + Adenosin; 3 Jahr Verlauf

MR-IMPACT II
MR superior to SPECT at detection of obstructive coronary artery disease

Schwitter; JCMR 2012
465 pat; multicenter; multivendor
- Ischemia
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Ischemia - MRI

combined with function and vitality:
detect hibernation and stunned myocardium
Late Enhancement

Late Gd Enhancement

Delayed Enhancement

LE = LGE = DE

It’s all the same.

Infarct transmurality determines success of revascularization

>75% transmural infarct by LGE: revascularization is of no benefit


Cardiac - MRI current use...

- Ischemia
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Late Enhancement
Late Gd Enhancement
Delayed Enhancement
LE = LGE = DE
It’s all the same....
Myokardialial Viability - a case

63 yo man
Acute myocardial infarction
Occluded LAD
Rescue-cath

MRI:
Viability?

Function on day 2 after MI
Viability in MRI?

function

Vitality: 51-75% transmurality
Viability? Prognosis?

Same patient after 6 months
Vitality?

Same patient 6 months later…

Vitality: acute

function: 6 mo later

Vitality: 6 months later
Cardiac MRI - current use

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Ischemia
Viability
Myocarditis
Cardiomyopathy
Congenitals
Tumor / Thrombus

www.ebay.de
Giant-cell myocarditis

Imaging: St. Vinzenz, Paderborn

Acute myocarditis vs coronary event: difficult decision in daily routine…

- Ischemia
- Vitality
- Myocarditis
- Cardiomyopathy
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- Congenitals
Primary DCM vs. post ischemic DCM: MRI helps...

Idiopathic dilatative cardiomyopathy (DCM)
Primary DCM vs. post ischemic DCM: MRI helps...

- Ischemia
- Vitality
- Myocarditis
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- Congenital
Hypertrophic non-obstructive Cardiomyopathy (HCM)

Late Enhancement → intramyocardial fibrosis
The more the worse the prognosis…

Cardiac - MRI current use...

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Amyloidosis- secondary cardiomyopathies

- MRI is diagnostic
- Diffuse LE
- Primary cardiac amyloidosis has been reported

LE helps in detection cardiac involvement
- Amyloidosis
- Sarcoidosis
- Fabry-disease....
Thrombus or Tumor?

- Ischemia
- Vitality
- Myocarditis
- Cardiomyopathy
- Tumor
- Thrombus
- Congenitals

Thrombus in LV/RV: easy….
Thrombus in LA/RA: well, not so easy….

Thrombus!
Tumor vs. Thrombus: Cardiac Myxoma

- Ischemia
- Vitality
- Myocarditis
- Cardiomyop
- Tumor
- Thrombus
- Congenitals

Myxoid myxoma vs. old, organized thrombus: hard to discriminate – even for the pathologist....
Flow measurements in MRI
Valve regurgitation / stenosis…

Phase contrast flow
• Quantitative
• Fast
• Accurate

Oldest quantitative technique in MRI...

Cardiac - MRI current use...

- Ischemia
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Regurgitation volume:
- Ascendens = 10.5 l/min
- Insufficiency = 4.5 l/min
- Regurgitation Fr: 43%
- Effective CO: 6 l/min
Partial anomalous pulmonary venous return (PAPV)

Echo: \( \frac{Q_p}{Q_s} = 2.5 \)
No ASD / VSD
Shunt?

MRI: \( \frac{Q_p}{Q_s} = 2.6 \)
No ASD
But...

PAPV: 3 l/min

Cardiac - MRI current use...

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MRI excels in anatomic coverage and functional information...
Partial anomalous pulmonary venous return (PAPV)

Echo: Qp/Qs = 2.5
No ASD / VSD
Shunt?

MRI: Qp/Qs = 2.6
No ASD
But…

PAPV:3 l/min

• Ischemia
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MRI excels in anatomic coverage and functional information...
Cardiac MRI – Take home…

Established in clinical routine

- Ischemia
- Vitality
- Myocarditis
- Cardiomyopathy
- Tumor
- Thrombus
- Congenital anomalies

There is no single modality to solve all diagnostic problems in cardiology…

Still increasing in its imaging possibilities

However: intense training is a must for proper use
Cardio-MRT/CT @ Göttingen, Germany

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