CCTA and CMR in Ischemic Heart Disease

Read with the Experts

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Patient #1

- 56 y/o male patient
- Atypical chest pain, emergency department
- Negative ECG, negative enzymes
- Risk factors: smoker, hypertension, hyperlipidemia
- Exclusion CAD → Cardiac CTA
Ca-Scoring

Agatston Score = 0.7
4-chamber view thin MIP
CPR-reconstruction

RCA

LAD

CX
LAD

CPR

CPR

axial

Thin MIP SA

Thin MIP 2CV
myocardium

basal

mid cavity

apical
myocardium
Patient #1

- Agatston score 0.7
- No stenosis, plaque formation in the mid LAD
- Dominant RCA
- “Flash”-examination with a dose of 1.3mSv
- No stenoses in the coronary arteries, no CAD
What myocardial territory is mostly supplied by the LAD?

a. Anterior wall and anterior septum
b. Posterior/Inferior wall
c. Basal third of the myokcardium
d. Right ventricle wall
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Infarkt / post Infarkt:

Which vessel territory?

anterior wall = LAD
Patient #2

- 61y/o male patient
- Recurrent atypical chest pain, emergency department
- Negative ECG, Hyperlipidemia
- CT → Exclusion/detection CAD
Ca-Scoring

Agatston Score = 331 (LAD, CX, RCA)
CPR

Aberrant RCA –
malignant variation
Aberrant RCA – malignant variation

Aus: Schöpf, CT of the heart
dominance? contraction?
Patient #2 (NF3)

- Agatston Score 331 with diffuse excentric calcifications in all three vessels
- Aberrant origin of the RCA from left aortic sinus (malignant variation)
- Dominant RCA
- Borderline stenosis CX.
- Negative coronary cath, <50% stenosis CX
What is right regarding malignant coronary artery variants?

a. Myocardial bridging is always a malignant variant
b. A malignant variant is an aberrant coronary artery ventral to the aorta
c. A malignant variant is a coronary artery between two low pressure systems
d. A coronary artery between aorta and main pulmonary artery is a malignant variant
What is right regarding malignant coronary artery variants?

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Patient #M1

- 69 y/o male patient
- History of acute myocardial infarction 12 days ago
myocardial ischemia

Wall motion irregularity
myocardial ischemia

Edema after infarct
myocardial ischemia

Necrosis +/- microvascular obstruction

Transmurality + microvascular obstruction (no reflow) → influence on prognosis
What of the following signs are a negative prognostic factor regarding myocardial infarction?

a. Large edema
b. Edema 2 month after cardiac event still visible
c. Transmural infarction and signs of microvascular obstruction
d. Wall motion abnormalities of the left and right ventricle
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a. Large edema
b. Edema 2 month after cardiac event still visible
c. **Transmural infarction and signs of microvascular obstruction**
d. Wall motion abnormalities of the left and right ventricle
Patient #3 (NF4)

- 64 y/o male patient
- Recurrent chest pain, inconclusive tread mill test
- Cardiac CTA – exclusion/detection CAD
Ca-Scoring

Agatston-Score = 3
Rotating CPR
SA thin MIP

diastrase
basal          mid-cavity          apical

systole
Aortic valve
Mitral valve
Large FOV

Lung window

Soft tissue window
Patient #3 (NF4)

- Agatston Score 3
- >50% stenosis upper marginal branch by mixed plaque
- RCA dominance, no further stenoses
- Other parts of the heart are regular
Agatston Score = 0 means:

a. No coronary artery stenosis
b. No calcifications in the coronary arteries
c. No aortic valve calcifications
d. Patent aortic valve
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a. No coronary artery stenosis
b. No calcifications in the coronary arteries
c. No aortic valve calcifications
d. Patent aortic valve
How to describe coronary artery lesions?

- detection
- localisation
- qualitative grading of stenosis
- quantitative grading of stenosis
detection of stenosis
detection of stenosis

different planes!!!!
quality of stenosis

- non calcified
- mixed
- calcified
plaque characterization

Optical coherence tomography (OCT) vs. DSCT

Spatial resolution
OCT ...... 10μm
CT ......... 240μm

A – normal vessel
B – fibrous atherosclerotic plaque
C – atherosclerotic plaque with lipid-core
D – calcified atherosclerotic plaque

Tsunenari S et al. Int J of Cardiology 2009 epub
plaque characterization

IVUS vs. DSCT

plaque characterization

IVUS vs. DSCT

- HU measurement of plaques still problematic
- density depends on contrast media density, scan parameters, calcifications,...

quantification of stenosis

- less than 50%
- more than 50%
- occlusion
- compare stenosis vs. normal vessel
- 50% diameter = 75% area!
What are the lesions a normal coronary angiogram may conceal?
quantification of stenosis

positive remodeling
Patient #4 (NF9)

- 69 y/o female patient
- Atypical chest pain, positive treadmill test, patient refuses invasive coronary angiography
- Cardiac CTA → Detection of CAD
- CTA high-pitch “Flash” technique, low dose, 1.1 mSv
Rotating CPR
Thin MIP

RCA
4CV Thin MIP
Thin MIP

Aortic Valve
SA Thin MIP

basal

mid cavity

apical
Patient #4 (NF9)

- Cardiac CTA “Flash”-technique, dose 1.1 mSv
- Dominant RCA
- > 50% stenosis proximal/mid RCA by non-calcified plaque
- LAD and CX regular
- Minor aortic valve calcifications
- The other parts of the heart are normal
Short axis view in cardiac CT is NOT used for ...

a. Assessment of the left ventricle myocardium
b. Longitudinal plane of the RCA
c. Axial visualisation of the RCA
d. Axial visualisation of the LAD
Short axis view in cardiac CT is NOT used for ...

a. Assessment of the left ventricle myocardium
b. Longitudinal plane of the RCA
c. Axial visualisation of the RCA
d. Axial visualisation of the LAD
Patient #M2

• 55 y/o male patient
• History of acute myocardial infarction 2 weeks ago
Which vessel territory?

Anterior wall + anterior septum = LAD
Patient #5

• 55 y/o male patient
• Recurrent chest pain
• Inconclusive treadmill test
• Cardiac CTA in order to exclude CAD
cardiac cath

RCA

LCA
cardiac cath

Herzkatheter-Kurzprotokoll vom 28.03.2011:
Gefäßzugang: A.fem.re. 6 french --> Verschluss mit Femoseal.
Koronare 1-Gefäßerkranung-
Signifikante Stenose der mittleren Circumflexa.
Erfolgreiche Angioplastie der CXm.
Implantation eines beschichteten Drug Eluting-Stents
(Xience Prime LL 2.75/38 mm)

That’s all???
Ca-Score

Agatston-Score = 0
SA thin MIP

basal

apical

mid cavity
Patient #5 (NF36)

- Agatston Score 0
- Diffuse wall irregularities CX
- > 50% stenosis mid CX
- Wall irregularities LAD, large non-calcified plaque proximal RCA!
- Wall irregularities LAD
- CA: 1-vessel disease (???)
- Drug-Eluting Stent (2.75/38mm)
Patient #6 (KH42)

- No clinical information – CAD?
- Cardiac CTA → detection/exclusion CAD
- Agatston Score 32
SA thin MIP

Verschluss RCA
SA thin MIP

Plaque LM

regular contraction
SA thin MIP

Accessory appendage
Patient #6 (KH42)

- Agatston Score 32
- 7mm occlusion mid RCA, minor calcifications
- wall irregularities LAD, no > 50% stenosis
- dominant RCA
- CA: recanalisation/stent
take home points

✓ Structured reporting
✓ Coronary arteries: multiplanar reformations + reporting!
✓ Check images exactly!
✓ Get maximum amount of information out of dataset
✓ CTA – more information than CA
✓ no calcification ≠ no stenosis