Imaging of the heart
Methods of examination

- **x-ray** (rough estimation of size/shape + evaluation of lung circulation)
- **ultrasound** (evaluation of size, wall thickness and movement, flow, pericardium)
- **interventional procedures** (evaluation of size, flow, coronaries + therapeutic interventions)
- **computed tomography** (evaluation of coronary arteries, size, shape, wall thickness, pericardium, muscle perfusion)
- **magnetic resonance imaging** (evaluation of size, shape, wall thickness, pericardium, muscle perfusion, metabolism)
- **perfusion scintigraphy** (evaluation of muscle perfusion)
Left ventricle
Left atrium

Department of Radiology, Faculty of General Medicine, University of Szeged, Hungary
Myocardiopathy

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Pericardial effusion

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Sclerosing pericarditis
Acute left heart failure

- rapid onset of left ventricle insufficiency
- acute pulmonary vein hypertension
- acute interstitial and alveolar edema
Acute left heart failure
Chronic left heart failure

- aortic valve disease (stenosis, insufficiency, etc.)
- left ventricle dilatation
- (relative) mitral insufficiency
- left atrium dilatation
- chronic pulmonary vein hypertension
- ABCD + chr. interstitial edema
- pulmonary artery hypertension
- CPCD, CPC, RHF

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### Stage of Congestive Heart Failure

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
<th>Pulmonary Vessels</th>
<th>Cardiomegaly</th>
<th>Edema</th>
<th>Interstitial</th>
<th>Alveolar</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Redistribution</td>
<td>Pulmonary vessels</td>
<td>Cardiomegaly</td>
<td>Broad vascular pedicle (non acute CHF)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Interstitial edema</td>
<td>Kerley lines</td>
<td>Peribronchial cuffing</td>
<td>Hazy contour of vessels</td>
<td>Thickened interlobar fissure</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Alveolar edema</td>
<td>Consolidation</td>
<td>Air bronchogram</td>
<td>Cottonwool appearance</td>
<td>Pleural effusion</td>
<td></td>
</tr>
</tbody>
</table>
Chronic congestive heart failure

Normal

Kerley B

Normal
RIGHT SIDED FAILURE
(Cor Pulmonale)

- Fatigue
- ↑ Peripheral Venous Pressure
- Ascites
- Enlarged Liver & Spleen
- May be secondary to chronic pulmonary problems
- Distended Jugular Veins
- Anorexia & Complaints of GI Distress
- Weight Gain
- Dependent Edema

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Computed tomography:

Long scan time – movement artifacts

Solution:

- ECG gating/triggering
- electron-beam CT
- multislice CT

Morphology, movement, perfusion, calcification
CT of the heart: indication

- Coronary artery Ca scoring
- Coronary arteriography
- Myocardium perfusion
- Analysis of wall movement
- Fusion of CT and electrophysiological measurement results
The amount of calcium is usually expressed as an Agatston score, which is based on the area and the density of the calcified plaques. 10, 11-99, 100-400, and above 400 have been proposed to categorize individuals into groups having minimal, moderate, increased, or extensive amounts of calcification.
Agatston score

The total Agatston score of 425.31 is higher than 75.7% of 75 year old men. This score is similar to the average 75 year old man.

A positive coronary calcium result indicates the presence of coronary plaque. The amount of calcium is related to the risk of obstructive plaque disease. A calcium score between 100 and 400 indicates a moderate calcium burden and an increased risk for obstructive plaque disease.
Irregular plane 2D
Diameter-analysis
Coronary MIP
Volume rendering
Coronaria volume rendering
Long and short axis reconstruction
Cine-CT
LCA aneurysm
RCA/LCA stenosis
Left ventricle aneurysm
Pulmonary vein stenosis
A mitrális billentyű systole-ban és diastole-ban
A mitrális billentyű systole-ban és diastole-ban
Anatómia: aorta billentyű
Anatómia: aorta billentyű
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Magnetic resonance imaging

Long scan time – movement artifacts

Solution:

– ECG gating/triggering
– echo-planar sequences
– gradient echo sequences

Morphology, perfusion, kinetics, spectroscopy
Plain „white blood” and „black blood” technique
Contrast-enhanced MR angiocardiology
Standard plains
Short axis
Standard plains
2 chamber – long axis
Standard plains
4 chamber – long axis
Definition of wall thickness
3D visualization
Regional wall movement
Perfusion MRI & late enhancement

Normal myocardium

Contrast Injection

Infarcted myocardium

first passage

Late enhancement

time
End-diastole

End-systole

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PET vs. MRI

- perfusion
- metabolism
- late enhancement

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Diseases of the heart:

- diseases of the coronary arteries (AMI)
- high blood pressure (systemic, pulmonary)
- inflammatory changes (endo-, myo-, pericarditis)
- congenital disorders
- acquired valve diseases
- other cardiomyopathies (HOCM, CCM, aneurysm)