Cardiac Imaging
Anatomy & imaging methods
Schema of heart silhouette in sagittal projection
Chest X-ray
CT axial anatomy – MSCT
CT MIP and MPR reconstructions
Coronary arteries
CT – VRT reconstruction
MR – different planes
Coronarography

Left coronary artery
Coronarography

Right coronary artery
Pathologic findings: plain chest film
Lung vascular pattern

- **Normal**
  - Visible to 2/3 of lungs, the width of truncus intermedius a. pulm. to 14 mm
  - Craniocaudal Q quotient 0.8 A/B to 1.2 (till 1.4)
- **Widened**
  - Wide shadows visible to the periphery, cranio-caudal index Q = 1
- **Poor**
  - Narrow shadows not visible to the periphery, narrow pulmonary artery, increased transparency
Cardiomegaly

• Cardiomegaly vs. enlargement of the heart chambers

  1) Valvular diseases
  2) Pericardial effusion
  3) Atrial septal defect
  4) Eisenmenger syndrome
  5) Cardiomyopathy
  6) Ebstein malformation
  7) Myocarditis
Cardiomegaly

Measurement of the Cardiothoracic ratio:
A / B < 0.5 is normal (< 0.6 in infants).
Cardiomegaly

Pericardial effusion
Enlargement of the L atrium

- **preload** - mitral insufficiency, atrial and ventricular septal defects, ductus arteriosus patens
- **afterload** - mitral stenosis
- **secondary in the left ventricle insufficiency**
Enlargement of the L ventricle

- **myocardial disease** – ischemic heart disease, myocarditis, cardiomyopathy
- **preload** - aortic resp. mitral insuf., atrial septal defect, ductus arteriosus patens
- **afterload** - aortic stenosis, coarctation, systemic hypertension
- **enormous blood flow** - anemia, arterio-venous fistula

LV - apex to the left and laterally
Enlargement of the R atrium

- Preload (volume) –
  tricuspid insufficiency, atrial septal defect, ebstain anomaly
- Afterload (pressure) –
  pulmonary hypertension
- Right ventricle insufficiency

RA – right contour
Enlargement of the R ventricle

- secondary in the left heart = postcapillary pulmonary
- hypertension - left ventricle insufficiency, mitral disease
- pulmonary hypertension - PE, COPD, idiopathic
- afterload - pulmonary valvar stenosis
- preload - ASD, VSD

RV – cranial displacement of the apex
Small heart shadow

1) Lung emphysema
2) Dehydratation
3) Constrictive pericarditis
Small heart shadow

Lung emphysema:
- increased lung volumes
- flattened diaphragms
- wide separation of the ribs
- elongated narrow heart shadow
- pulmonary vessels appear to be diffusely decreased
Heart diseases
Heart diseases of adults

- **Ischemic heart disease**
  - X-ray (lung congestion, cardiomegaly, Kerley lines, pleural effusion)
  - AG (coronarography)
    - Atherosclerotic changes – stenosis, occlusion, thrombus
    - Percutaneous Transluminal Angioplasty
  - ECHO
  - CT
  - MR
  - Nuclear medicine
Heart diseases of adults

- Ischemic heart disease

Coronary AG

CT

MR
Stenosis of LAD

Angiography

after stent implantation
Heart diseases of adults

- **Valvular diseases** – insufficiency, stenosis
  - X-ray
    - Indirect changes (enlargement of chambers, pulmonary vessels)
  - Echocardiography
    - Morphology, flow
  - CT
    - Morphology
  - MR
    - Morphology, flow
Heart diseases of adults

- Valvular diseases

MRI: Mitral stenosis

MRI: Mitral regurg.
Heart diseases of adults

• Valvular diseases

MRI: Mitral regurg.

MRI: Aortic stenosis
Heart diseases of adults

• **Myocardial diseases**
  – Myocarditis, Cardiomyopathy
  – (X-ray)
  – Echocardiography
  – CT
  – MR
Heart diseases of adults

- Myocardial diseases

MRI: Myocarditis

MRI: HOCM
Heart diseases of adults

- **Pericardial diseases**
  - Paricarditis acute, Constrictive pericarditis
  - with or without effusion

  - X-ray
    - **Effusion** – widening of shadow, tent shape, change shape according to the position
    - **Constrictive p. - calcification**
  - Echocardiography
  - CT
  - MR
Heart diseases of adults

- Pericardial diseases

X-ray and CT: Pericardial constriction

MR: Effusion
Heart diseases of adults

- **Tumors and pseudotumors**
  - Localization: pericardial, myocardial, intracavital
  - Thrombus, myxoma, fibroma, angiosarcoma, rhabdomyosarcoma, vegetation (infective endocarditis), metastasis, pericardial cyst
Heart diseases of adults

- Tumors and pseudotumors

CT: Myxoma of LA

MRI: Myxoma of LA
Congenital heart disease
Cardiac defects

- Atrial septal defect
  - L→P shunt: cardiomegaly, RA, RV and PA enlargement, increased pulmonary vascularity

- Ventricular septal defect
  - L→P shunt: cardiomegaly, LA enlargement, increased pulmonary vascularity

- Tetralogy of Fallot
  - VSD, overriding of aorta, pulm. stenosis, RV hypertrophy
  - Coeur en sabot (wooden-shoe heart), pulmonary hypovascularity

- Ebstein's anomaly
  - Displacement of tricuspid valve into the right ventricle, cardiomegaly - globular heart
Congenital heart diseases

- **Vascular abnormalities**
  - Persistent ductus arteriosus
    - L→P shunt, PA, LA, LV and ascending aorta enlargement, increased pulmonary vascularity
  - Coarctation of the aorta
    - Figure 3 sign, CM, LV hypertrophy, costal indentation
  - Pulmonary stenosis
    - Poststenotic dilatation of the trunk and left main pulmonary artery, RV hypertrophy
  - Transposition of the great arteries
    - Ovoid heart configuration, narrow vascular pedicle, increased pulmonary vascularity
Congenital heart diseases
Diagnostic algorithm

• **ECHO (US)**
  Valves, pericardial fluid, intraluminal changes

• **X-ray**
  Heart size and configuration, size of the heart chambers, pulmonary vascularity, effusion

• **Angiography, Coronarography**
  size and shape of chambers, blood flow, coronary anomalies

• **MR**
  Complex assessment of the intra- and extracardial findings, myocardial perfusion
ASD
-cardiomegaly,
-right atrial prominence,
-upturned apex,
-increased pulmonary vascular markings

VSD
-normal cardiac size
-main pulmonary artery enlarged
-Peripheral vasculature small
Anomaly origin of r. interventricularis ant. left coronary artery from lung artery
Fallot’s tetralogy
- Normal size heart
- Silhouette is normal or prominent RV
- Concavity of in the main pulm. artery
- Lifted apex
- Right aortic arch (25%)

Coeur en Sabot Sign
Fallot’s tetralogy
TOF, after correction
Severe coartation of aorta
Recoarctation

- Measuring of velocity
- Calculation pressure gradient