Imaging of the acute chest

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SZEGEDI TUDOMÁNYEGYETEM
ÁOK, RADIOLÓGIAI KLINIKA,
SZEGED
ACCIDENTS, URGENT SITUATIONTS

it can occur anywhere, anytime with anybody
DURING EMERGENCY CARE

• consequences of the false diagnosis can be fatal
• we rarely succeed without Imaging techniques
• the more serious the case is, the bigger need we have for consultation
CARRYING OUT THE EXAMINATION

- course of the examination should be adjusted to the status of the injured/patient
- the risk caused by the diagnostic procedure should not be greater than the expected health benefit
CHEST

- scene of breathing and circulation, diseases and injuries of this region are life-threatening
EVALUATING METHODS

- native radiography (2 direction if possible)
- fast CT (native, contrast enhanced, 3D)
- MR (native, contrast enhanced, angio)
- DSA (with intervention if needed)
NATIVE RADIOGRAPHY

Basic examination

Always necessary in case of:

- the possibility of open injury and foreign body
- blunt chest and abdominal injury
- polytrauma, suspicion of bone fracture
- unconscious patient / injured
NATIVE RADIOGRAPHY

necessary:

• Internal medicine diseases (fluid, ptx, dyspnoea etc.)
• shock-lung
• toxic or cardiac edema
• pulmonary embolism, infarct
NATIVE RADIOGRAPHY

bullet in the pericardium – without ptx or fluid
FAST* CT SCAN

- mediastinal and pulmonary diseases
- partial ptx
- bronchial diseases
- pulmonary embolism
- diaphragm rupture
- aortic rupture, dissection
- vertebral fractures and dislocations

*/ spiral, multi-detector = volume scanning
CONTRAST-ENHANCED CT-SCAN

pulmonary embolism
3D CT-SCAN

clavicle fracture – without vascular injury
MR-SCAN

- **Without contrast material:** fluids, haematomas
- **With contrast material or blood flow sensitive technique:**
  - pulmonary embolism
  - aortic dissection or rupture
occlusion of the left carotid and subclavian arteries
DIGITAL SUBTRACTION ANGIOGRAPHY

• vascular injuries unclarified with other techniques, e.g. rupture of the axillary or subclavian artery

• pulmonary embolism

• It can be combined with: embolectomy, thrombolysis, angioplasty etc.
DIGITAL SUBTRACTION ANGIOGRAPHY

normal situation
CHEST EMERGENCY SITUATIONS
BONES OF THE CHEST

rib fracture: simple, serial, windos-like
  → subpleural haemorrhage, haemothorax, ptx, haemoptx → hypoxia

sternum fracture → heart contusion

vertebral fracture
  → paralysis, dystelectasis, paralytic ileus
serial rib fracture, ptx and foreign bodies
BONES OF THE CHEST

rib fracture and its complications
BONES OF THE CHEST

pneumothorax, Rib fracture

ptx

fast evaluation: VCT

serial rib fracture
PLEURA

- **pneumothorax (ptx)**
  - simple: cough, asphyxia
  - ventil: needs follow up
  - tension: mediastinum dislocation → decreased respiratory surface and circulatory failure

- **haemothorax, haemopneumothorax**
  - extent of blood loss?

- **hydrothorax**: „CVC displacement“, „infusion-thorax“
PLEURA

breathing in

breathing out
PLEURA

tension pneumothorax
PLEURA

tension ptx
haemothorax > 2500 ml
haemopneumothorax („stabbing”)
PLEURA

„canule displacement”
LUNG

• **contusion**: interstitial haemorrhage

• **pulmonary haematoma**: circumscribed haemorrhage in the lungs

• **interstitial emphysema**: perforation of the air filled structures into the mediastinum
pulmonary contusion
LUNG

pulmonary haematoma
LUNG

- **atelectasis:**
  - obstructive
  - reflectorice (Fleischner)

- **aspiration:**
  aspiration+atelectasis+inflammation
iatrogenic, obstructive atelectasis
Fleischner-atelectasis: warning signal for abdominal catastrophe
LUNG

aspiration pneumonia
LUNG

pulmonary oedema

- alveolar ← left ventricle failure, drug overdose (cocaine, heroine)
- interstitial ← mitral vitium, poisonings, overfilling with infusion
- mixed ← hypoxia, shock, burning, uraemia, barbiturate-poisoning
alveolar pulmonary oedema
LUNG

shock-lung, also called adult respiratory distress syndrome (ARDS):

• severe trauma, hypoxia, bleeding, sepsis, poisoning, burning etc. →

• capillary microthrombosis + enhanced capillary permeability + interstitial / alveolar oedema + spotty atelectasis
ARDS in pancreatitis
LUNG

haemorrhagic shock-lung
BRONCHI

- obstruction: foreign body (Holzknecht-symptom)
- rupture: deceleration injury, explosion
- haemorrhage: tumor, tbc, irritative gases
mucous plug blocking the bronchus
complete atelectasis of the right lung caused by foreign body aspiration
PULMONARY BLOOD VESSELS

• **pulmonary embolism** ← prolonged immobilisation + deep vein thrombosis → negative finding

• **pulmonary infarct** → positive X-ray finding

• **fat embolism**: femoral / tibial fracture, after osteosynthesis
embolism of the left pulmonary artery
embolism of the right pulmonary artery
pulmonary infarct
HEART AND PERICARDIUM

- **angina, myocardial infarct:** coronaryography, thrombolysis, dilatation
- **haemo- / haemopneumopericardium:** US, CT, native X-ray (penetrating injury, foreign body)
CORONARY ARTERIES

CT-angio: soft and calcified plaques
CORONARY ARTERIES

coronarogram: left branch stenosis
AORTA

- **aneurysm rupture (spontaneous):** US, CT, MR
- **aortic dissection (degenerative):** US, CT, MR
- **traumatic rupture (deceleration injury):** native X-ray, angiogram can be life-saving
spontaneous aneurysm rupture, the adventitial layer is delaying the bleeding out
AORTA

aortic dissection (3D CT)
AORTA

aortic dissection (MR)
AORTIC ARCH

dissection of the brachiocephalic artery (2D US)
AORTIC ARCH

dissection of the brachiocephalic artery (color Doppler US)
AORTA

traumatic aortic rupture (deceleration injury)
• mediastinal emphysema ← increased pressure (PEEP), esophagus perforation or decubitus (native X-ray) → mediastinal abscess

• trachea / main bronchus rupture ← increased thoracic pressure, compression by the steering wheel, vacuum-bomb
pneumomediastinum
MEDIASTINUM

iatrogenic trachea perforation
• **esophagus rupture** ← trauma, cola, sodium bicarbonate
• **esophagus perforation**: mostly iatrogenic, instrumental
• **foreign body**: chest X-ray + swallow examination
ESOPHAGUS

iatrogenic esophagus perforation
ESOPHAGUS

stuck coin (old type 2 Ft coin)
DIAPHRAGM

• **rupture**: chest X-ray + abdominal US + upper passage examination, CT

• **diaphragmatic hernia**: mostly in newborns
traumatic rupture of the diaphragm
DIAPHRAGM

- traumatic rupture (CT-scan with i.v. and p. o. contrast material)