

Examination of pulmonary diffusion and perfusion

Pulmonary perfusion = delivery of deoxygenated blood to the alveoli and removal of oxygenated blood.

- pulmonary perfusion disorders can cause **restrictive or obstructive** lung diseases, e.g. pulmonary hypertension or hypotension, pulmonary artery embolism, etc.)
- reduced perfusion → transfer of reduced amounts of O_2 and CO_2 by blood → pulmonary hypertension → enlargement of the right heart.

Pulmonary diffusion = diffusion of O_2 and CO_2 across the alveolo-capillary membrane (basement membrane of pneumocytes + basement membrane of capillary endothelium + endothelial cells)

- pulmonary diffusion disorders can be caused by a reduction in the diffusion area: e.g. inflammation (and subsequent thickening of the alveolo-capillary membrane), edema (exudation of blood plasma into the interstitium), interstitial lung fibrosis (fibrous tissue moves the alveoli away from the capillaries), anemias, etc.
- reduced diffusion → mainly reduced pO_2

Methods of measuring pulmonary perfusion

Ventilation-perfusion scan

It is a combination of a perfusion scan and a ventilation scan. This type of examination is suitable for suspected pulmonary embolism or a disorder of the lung parenchyma

- **perfusion scan** - principle: administration of a radioactive substance (Technetium) into a vein (or so-called Tc macroaggregates with human albumin) → we monitor the blood flow through the lungs → we detect embolizations, etc.
- **ventilation scan** principle: the examined patient inhales a radioactive substance (e.g. Technetium, Krypton, Xenon) → we monitor the distribution of air in the lungs → we detect embolization
- **evaluation:**
 1. visual (we observe inhomogeneities in the lungs)
 2. quantitative determination of the relative perfusion of the right and left lung or lung segments (correction for different absorption of gamma radiation)
 3. creating a final protocol (images, values, verbal evaluation)

Pulmonary angiography

 For more information see Angiography.

principle: application of x-ray contrast material into a vein → display of blood flow on x-ray

CT

 For more information see CT.

PET

 For more information see PET.

Chest X-ray

 For more information see Chest X-ray.

Examination of pulmonary diffusion

Single breath method

- especially when pulmonary emphysema and lung parenchymal disorders are suspected.
- the examinee inhales a test mixture of gases (with a low concentration of CO and inert gas - e.g. helium or methane) from the device and holds his breath for about 10 seconds. We will then perform an analysis of the expired air. Due to the dilution of the inert gas in the residual volume of the lungs, its concentration in the exhaled air is lower. The same dilution factor also applies to the CO concentration, thanks to which we

determine the original and subsequent alveolar concentration. The given values (including the length of breath holding) are used to calculate the so-called **transfer factor** (also called the „Krogh factor“)

- result:
 - transfer factor below normal → emphysema, disorders of the lung parenchyma (pulmonary vasculitis, granulomatosis, interstitial pulmonary fibrosis)
 - transfer factor above normal → left-right shunts, intrapulmonary bleeding (CO in the alveoli also binds hemoglobin)

Links

External links

- astronuklfyzika.cz (<http://astronuklfyzika.cz/Pulmstat.htm>)
- pats.atsjournals.org (<https://www.atsjournals.org/cgi/content/full/2/6/492>)
- www.upol.cz (http://www.upol.cz/fileadmin/user_upload/LF/Kliniky_a_pracoviste_LF/Plicni/Funk_n_vy_et_en_pl_ic_-_medici.doc)
- www.nlm.nih.gov/medlineplus (<https://medlineplus.gov/ency/article/003854.htm>)
- www.nationaljewish.org (<https://www.nationaljewish.org/treatment-programs/tests-procedures/pulmonary-physiology/pulmonary-function/lung-diffusion-capacity>)

References

- NEČAS, Emanuel. *Pathological Physiology of Organ Systems I*. 1. edition. Karolinum, 2003. 760 pp. ISBN 80-246-0675-5.