Respiratory restriction/Repetitorium

🔎 *For more information see Interstitial lung processes, Lung compliance, Lung volumes, Acute respiratory distress syndrome.*

right|650px|link=Breathing restriction occurs in situations where lung compliance decreases (interstitial lung processes) or chest wall compliance (obesity, congenital or acquired chest deformities). Lung compliance is determined by the properties of the lung tissue (the amount of tissue in the lung interstitium) and the presence of surfactant in the alveoli. The shape of the ribcage and the state of the chest musculature determine the compliance of the chest wall.

Factors influencing gas exchange on the alveolocapillary membrane

The alveolocapillary membrane represents the interface between the blood in the pulmonary vascular bed and the air present in the alveolus. Gas exchange takes place here, which is influenced by several factors:

- The thickness of the alveolocapillary membrane (increases as a result of the proliferation of ligaments in the interstitium).
- Total alveolar area (decreases due to alveolar fusion in emphysema or after resection of part of the lung tissue).
- Gas diffusion coefficient (it is directly proportional to the solubility of the gas in the membrane environment and inversely proportional to its molecular weight).
- Pressure gradient of the gas on the membrane (difference of the partial pressure of the gas in the blood and in the alveolar air).

Breath work

We define breathing work as the effort required to overcome the elasticity of the lung tissue and chest wall and the resistance of the airways. It is inversely proportional to lung compliance (compliance).

Conditions leading to reduced lung compliance

Reduced lung compliance is caused by acute or chronic changes in the pulmonary interstitium and at the level of the alveolocapillary membrane. Its functionality is limited by this, as a result total lung capacity is reduced. This condition can occur in several situations:

- changes after lung tissue resection,
- diffuse infiltrative lung disease and pulmonary fibrosis,
- exogenous allergic alveolitis (farmer's lung, etc.),
- sarcoidosis,
- pneumoconiosis,
- pneumonia,
- acute respiratory distress syndrome – ARDS (*acute respiratory distress syndrome*).

Resection of part of lung tissue

After the resection of a part of the lungs, the rest of them is stretched almost to the maximum during normal exercise. As a result of the physical properties of the lung tissue, its compliance decreases in these limit volumes.

Diffuse infiltrative lung disease and pulmonary fibrosis

Diffuse infiltrative lung disease is characterized by the presence of chronic inflammation with proliferation of tissue in the alveolar septa. This reduces the efficiency of gas exchange on the alveolocapillary membrane and at the same time (by increasing the stiffness of the lung tissue) compliance decreases and work of breathing increases. It is often a disease without a known etiology of inflammation (idiopathic interstitial pneumonia) or the etiological agent is present in the environment (post-radiation pneumonia, drug-induced lung damage, exogenous allergic alveolitis, pneumoconiosis, etc.).

Exogenous allergic alveolitis

Exogenous allergic alveolitis (EAA) represents an aggravated allergic reaction which, unlike asthma bronchiale, primarily affects the alveoli. Similar to asthma, the causal treatment is the removal of the allergen, which alone prevents the progression of interstitial fibrosis. The most common triggering antigen is the spores of the fungus Actinomyces, we are talking about the so-called farmer's lung.

Sarcoidosis

Sarcoidosis is an idiopathic systemic inflammatory disease characterized by the presence of noncaseating granulomas in the pulmonary interstitium with bilateral hilar lymphadenopathy.

Pneumoconiosis

Pneumoconioses are a broad group of diseases in which an inflammatory reaction to an exogenous object in the lung interstitium occurs (most often silicon oxides, coal dust, asbestos, beryllium, etc.). Macrophages are unable to neutralize it, which results in the formation of a fibrous knot in the vicinity. This can continue to grow even after the end of the exposure in the case of silicon dioxide (silicosis). Some inflammations affect the pulmonary interstitium diffusely.

Pneumonia

Pneumonia is typically considered an infectious inflammation with exudation mainly into the alveoli (causing agents: Staphylococcus, Streptococcus pneumoniae, Klebsiella) or into the interstitium (Atypical pneumonia). At the same time, the term idiopathic interstitial pneumonia describes a non-infectious fibrous process in the lung interstitium without a proven infectious or other etiology.

ARDS

Acute respiratory distress syndrome is particularly dangerous for patients in shock, when severe damage to the alveolocapillary membrane leads to insufficiency of its function. In general, this can occur either from the side of the alveolus (aspiration of stomach contents, inhalation of toxic gases, drowning), or pulmonary capillaries (hypoperfusion in shock, spillage of pancreatic enzymes into the bloodstream in [[Acute deceased

Links

Related Articles

- lungs
- gas exchange between lungs and tissues
- pleural disseases

Sources

- VÍZEK, Martin. *Repetitorium* [online]. [cit. 2012-06-04]. <https://web.archive.org/web/20130512032641/http://pf.lf2.cuni.cz/vyuka/repetitorium.html>

References

- GUYTON, Arthur C a John E HALL. *Textbook of medical physiology.* 11. vydání. Philadelphia : Elsevier Saunders, 2006. 1152 s. ISBN 0-7216-0240-1.
- KUMAR, Vinay, Abul K ABBAS a Nelson FAUSTO. *Robbins & Cotran Pathologic Basis of Disease.* 7. vydání. Elsevier, 2004. 0 s. ISBN 978-0-7216-0187-8.