Lung Volumes

Lung volumes are the volumes of space occupied by the air in the lungs during respiration. The combination of individual volumes creates so-called lung capacities.[1]

The measured parameters are divided into:

- **Static** – the size of the alveolar space **→ inform about possible restriction diseases**.
- **Dynamic** – recording of air flow in the airways **→ inform about obstructive diseases**.

All volumes reported in various publications are averages only. These volumes are individual. They are affected by height, weight, age, training, gender and health. In practice, therefore, the **absolute** value is given in liters and a **relative** percentage is given, which compares the measured results with persons of the same age, sex, height and weight.

Static volumes

Tidal volume (**V_T** or TV) is the volume of one inhalation. It has a value of 0,5 l[2]. It also contains the so-called dead space (anatomic respiratory dead space), which indicates the volume of the airways up to the terminal bronchioles. Its volume is 150 to 200 ml[2]. This volume can be further increased by the volume of such alveoli, which are not capable of exchanging respiratory gases. Then this volume is called the Total functional (dynamic) dead space.

After the normal exhalation, a person still has the opportunity to exhale forcefully, thus exhale air of volume of about 1,7 l[2]. This volume is called the **expiratory reserve volume** (**ERV**).

It is the same for inspiration. We can inhale forcefully even after a normal inhale and inhale a volume of about 3 l[2] of air. This is called the i**nspiratory reserve volume** (**IRV**).

Despite our best efforts, we are not able to completely empty our lungs. About 1,3 l[2] of air always remains in them. This volume is then called the **residual volume** (**RV**).

Helium dilution method is used to determine the residual volume.

🔎 *For more information see Functional examination of the cardiorespiratory system.*

Plicní objemy

Static capacities

Vital capacity (**VC**) – the sum of tidal volume, inspiratory reserve volume and expiratory reserve volume (maximum inhale - maximum exhale);

$$VC = V_T + IRV + ERV$$

Total lung capacity (**TLC**) – the sum of vital capacity and residual volume;

$$TLC = VC + RV = IRV + V_T + ERV + RV$$

Functionoal residual capacity (**FRC**) – volume of air in the lungs after passive expiration;

$$FRC = ERV + RV$$

Dynamic volumes

Minute ventilation (**V_E**) – tidal volume (V_T) multiplied by the frequency of breaths per minute, at rest it is about 8 l/min[3].;

- Alveolar ventilation (V_A) is minute ventilation of the lungs - minute ventilation of the dead space;
- Maximum minute ventilation (MMV, V_{max}) determines the largest possible minute exchange of air (max. 200 l/min[3]);

Forced expiratory volume in one second (**FEV_1**) – the volume of air that is exhaled during the forced exhalation in the first second;

Tiffeneau-Pinelli index is the ratio of FEV_1 and VC. It helps in the diagnosis of obstructive and restrictive lung disease. The physiological value is reported to be **80 %** (0,8).

In restriction disease, the value of the Tiffenea index is usually normal to elevated. In the case of mixed diseases, both obstructive and restrictive, the value is reduced. eg FEV1 / VC = 0.7 -> at the site of suspected asthma, COPD, ...

> In case of **restriction** disease, the value of the Tiffeneau-Pinelli index is usually **normal to elevated**.
> In the case of the **mixed** disease, the value is **reduced**.
> e.g. FEV_1/VC = 0,7 -> at the site of suspected asthma, COPD,...

Links

Related articles

- Functional examination of the cardiorespiratory system
- Respiratory Restriction/Repetitorium

References

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2.
3.

Used literature

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