M.Vizir, T.Ashcheulova, E.Kisilenko

**Whole-body pletysmography – technology and clinical significance.**

Plethysmography (gr. plethysmos - filling, zoom + graphō - write, record) method of the study of vascular tone and blood flow in vessels of small caliber, based on the graphic registration of the pulse and slow fluctuations of the volume of any part of the body associated with the dynamics of blood filling of the vessels. As a specific method there is so-called general plethysmography, or whole-body plethysmography (WBP) used to study the function of external respiration and cardiac output.

WBP is carried out by placing of the subject in a sealed camera of special plethysmograph. The study of respiratory function using the WBP based on registration of the respiratory fluctuations of the chest volume with the simultaneous connection of the respiratory tract of the subject through the duct with sensors for registering the air flow rate (pneumotachography) and pressure in the oral cavity. Introduction into the esophagus of the subject catheter with a balloon allows to register intraesophageal pressure, conventionally equated with intrapleural. In addition to such parameters of breathing as breathing capacity, inspiratory and expiratory reserve volume, forced expiratory volume etc. which can be defined by methods of spirography and pneumotonometry, with WBP we can get options that allow us to evaluate the mechanics of breathing: the distensibility of the lungs and respiratory resistance to air flow. This specific airway resistance (R) can be interpreted as the work to be performed by volume displacement (cmH2O**)**to establish flow rate (l/s).

Simultaneous registration of pneumotachography (changing of flow rate) and the pressure in the plethysmograph chamber allows to determine R during quiet breathing in any phase of the respiratory cycle on the exhale and the inhale. So specific airway resistance is a measure of airway obstruction and indicates the alveolar pressure needed to establish a flow rate of 1l.

Also the WBP allows to assess functional residual capacity (FRC), the volume of air present in the lungs at the end of passive expiration. Total airway resistance is calculated as the ratio of R to FRC.

Distensibility (compliance) of the lung, decreasing with the sealing of lung tissue, characterized by the ratio of the increase of gas volume in the lungs to increase transpulmonary pressure, the definition of which is associated with the additional measurement of intraesophageal pressure. Modern apparatus for WBP have a special device for registration of the loop "pressure - volume" during the respiratory cycle, which allows to determine the distensibility of the lungs and the total nonelastic resistance.

These measures represent different functional aspects and should all be considered. The measurement relies on the fact that generation of airflow needs generation of pressure. Pressure generation means that a mass of air is compressed or decompressed relative to its equilibrium volume. This difference is called "shift volume". As the body box is sealed and has rigid walls, its free volume experiences the same, mirror image-like shift volume as the lung. This shift volume can be measured via the variation of box pressure. The relationship between shift volume and alveolar pressure is assessed in a shutter maneuver, by identifying mouth and alveolar pressure under zero-flow conditions. These variables are combined to obtain FRC, R and total airway resistance.