

fluctuations driving flow. Simultaneous measurement of flow allows the calculation of lung resistance (as flow divided by pressure). In health, R_{aw} is very low (<2 cmH₂O/L/s), and half of the detected resistance resides within the upper airway. In the lung, most resistance originates in the central airways. For this reason, airways resistance measurement tends to be insensitive to peripheral airflow obstruction.

RESPIRATORY MUSCLE STRENGTH To measure respiratory muscle strength, the patient is instructed to exhale or inhale with maximal effort against a closed shutter while pressure is monitored at the mouth. Pressures $>\pm 60$ cmH₂O at FRC are considered adequate and make it unlikely that respiratory muscle weakness accounts for any other resting ventilatory dysfunction that is identified.

Measurement of Gas Exchange • DIFFUSING CAPACITY (D_{LCO}) This test uses a small (and safe) amount of carbon monoxide (CO) to measure gas exchange across the alveolar membrane during a 10-s breath hold. CO in exhaled breath is analyzed to determine the quantity of CO crossing the alveolar membrane and combining with hemoglobin in red blood cells. This “single-breath diffusing capacity” (D_{LCO}) value increases with the surface area available for diffusion and the amount of hemoglobin within the capillaries, and it varies inversely with alveolar membrane thickness. Thus, D_{LCO} decreases in diseases that thicken or destroy alveolar membranes (e.g., pulmonary fibrosis, emphysema), curtail the pulmonary vasculature (e.g., pulmonary hypertension), or reduce alveolar capillary hemoglobin (e.g., anemia). Single-breath diffusing capacity may be elevated in acute congestive heart failure, asthma, polycythemia, and pulmonary hemorrhage.

Arterial Blood Gases The effectiveness of gas exchange can be assessed by measuring the partial pressures of oxygen and CO₂ in a sample of blood obtained by arterial puncture. The oxygen content of blood (CaO_2) depends on arterial saturation (%O₂Sat), which is set by P_{aO_2} , pH, and P_{aCO_2} according to the oxyhemoglobin dissociation curve. CaO_2 can also be measured by oximetry (see below):