

■ RESPIRATORY SYSTEM MECHANICS

Respiratory system mechanics can be measured in patients during mechanical ventilation ([Chap. 302](#)). When volume-controlled modes of mechanical ventilation are used, accompanying airway pressures can easily be measured as long as the patient is breathing passively. The peak airway pressure is determined by two variables: airway resistance and respiratory system compliance. At the end of inspiration, inspiratory flow can be stopped transiently. This end-inspiratory pause (*plateau pressure*) is a static measurement, affected only by respiratory system compliance and not by airway resistance. Therefore, during volume-controlled ventilation, the difference between the peak (airway resistance + respiratory system compliance) and plateau (respiratory system compliance only) airway pressures provides a quantitative assessment of airway resistance. Accordingly, during volume-controlled ventilation, patients with increases in airway resistance typically have increased peak airway pressures as well as abnormally high gradients between peak and plateau airway pressures (typically $>10\text{--}15\text{ cmH}_2\text{O}$) at a constant inspiratory flow rate of 1 L/s. The compliance of the respiratory system is defined by the change in volume of the respiratory system per unit change in pressure.

The respiratory system can be divided into two components: the lungs and the chest wall. Normally, respiratory system compliance is $\sim 100\text{ mL/cmH}_2\text{O}$. Pathophysiologic processes such as pleural effusions, pneumothorax, and increased abdominal girth all reduce chest wall compliance. Lung compliance may be reduced by pneumonia, pulmonary edema, alveolar hemorrhage, interstitial lung disease, or auto-PEEP. Accordingly, patients with abnormalities in compliance of the respiratory system (lungs and/or chest wall) typically have elevated peak *and* plateau airway pressures but a normal gradient between these two pressures. Auto-PEEP occurs when there is insufficient time for emptying of alveoli before the next inspiratory cycle. Because the alveoli have not decompressed completely, alveolar pressure remains positive at the end of exhalation (*functional residual capacity*). This phenomenon results most commonly from obstruction of distal airways in disease processes such as asthma and COPD. Auto-PEEP with resulting