

Esophageal pressure (Pes)

Pleural pressure (Ppl) has been estimated by measuring esophageal pressure (Pes), using an esophageal balloon–catheter system. The respiratory changes in Pes are representative of changes in Ppl applied to the lung surface. The difference between Paw and Pes is a valid estimate of transpulmonary pressure (PL) in the region surrounding the balloon catheter. Because E_{cw} may vary greatly among individuals, adjusting the ventilator settings only on the basis of Paw may not be a satisfactory strategy when ventilating subjects with ARDS. In fact, a positive pressure breath may injure the lung if it results in end-inspiratory alveolar hyperinflation and/or cyclical alveolar opening and collapse. Provided PI is the real “lung-distending” pressure, that is, the main force that promotes alveolar recruitment and lung inflation, a lung-protective ventilation strategy should take this concept (PI) into account. **Esophageal pressure measurement makes this possible in clinical practice.**

Trans-structural Pressures Related to Ventilation:

Pressure difference across the respiratory system (Prs):

$$Prs = Paw - Pbs$$

Pressure difference across the lung (transpulmonary pressure, PL):

$$P_L = Paw - Ppl \rightarrow P_L \approx Paw - Pes$$

Pressure difference across the chest wall (P_{cw}):

$$P_{cw} = Ppl - Pbs$$

Alternatively:

$$\begin{aligned} Prs &= P_L + P_{cw} \\ &= Paw - Ppl + Ppl - Pbs \\ &= Paw - Pbs \end{aligned}$$

Definition of abbreviations: Paw = airway pressure, measured by the ventilator at the proximal end of the airways; Pbs = body surface pressure; Ppl = pleural pressure.

