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Introduction:
Assessment of pleural pressure by measuring esophageal pressure (Pes) is useful to guide optimal ventilator settings in patients with respiratory failure. However, the measurement of Pes is affected by several factors, including filling volume of an esophageal balloon and an esophageal wall elastance. Recently, Mojoli et al. have reported an in vivo calibration method (M method) to make reliable the measurement of both absolute values of Pes (abs Pes) and tidal swings of Pes (ΔPes). In contrast, the validity of Pes measurement by a commercially available ventilator has not been investigated. Thus, we evaluated the accuracy of abs Pes and ΔPes measured by AVEA ventilator (CareFusion, Yorba Linda, USA), which regulates a filling volume of balloon automatically and is the only approved equipment to measure Pes in Japan, by comparison with the M method.

Methods:
Four anesthetized and paralyzed pigs (40.9-42.8 kg) were mechanically ventilated and subjected to lung injury by saline lung lavage. In each pig, two different extrathoracic pressures were applied by using a thoraco-abdominal belt. Abs end-expiratory Pes and ΔPes were measured by AVEA ventilator and the M method, and obtained values were compared for their correlation and agreement.

Results:
Comparison of the two methods showed that correlation coefficients of abs end-expiratory Pes and ΔPes were 0.85 (P = 0.007) and 0.88 (P = 0.004), respectively. By Bland-Altman analysis, the bias and precision of abs end-expiratory Pes were -2.2 and 2.3, and those of ΔPes were 0.1 and 3.4, respectively (Figure1,2).

Conclusion:
Abs end-expiratory Pes tended to be higher in the A method than in the M method. ΔPes of the two methods were well correlated. In our animal model, the accuracy of Pes measured by AVEA ventilator was clinically acceptable when compared to the M method.

Image 1:

Agreement between the two methods of measuring absolute end-expiratory Pes by Bland-Altman analysis
Agreement between the two methods of measuring tidal swings of Pes by Bland-Altman analysis