

Effects of positive end-expiratory pressure on regional compliances according to the regional lung recruitability.

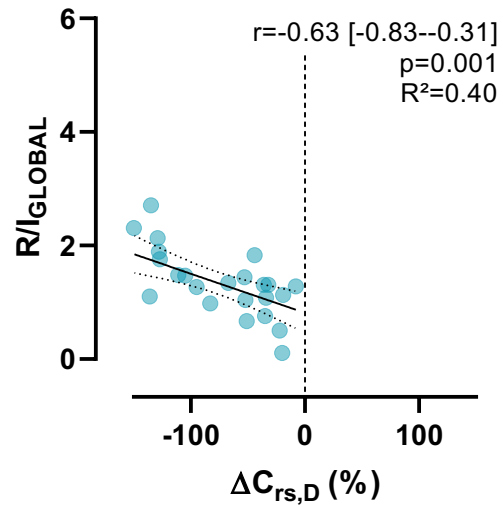
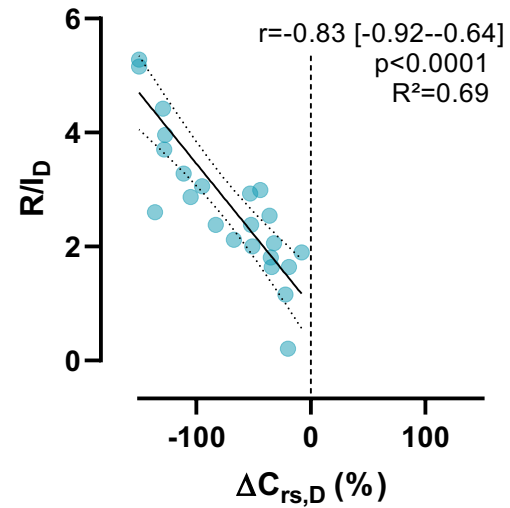
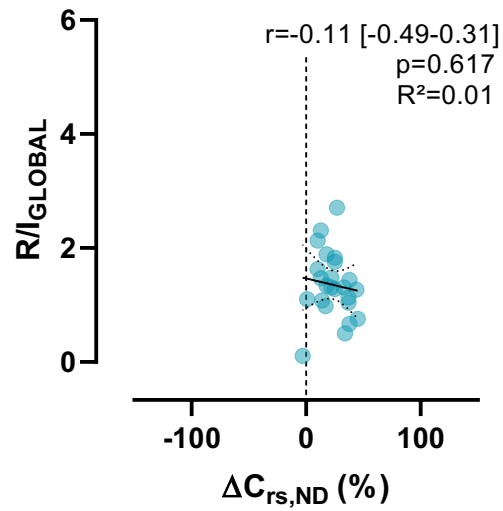
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Introduction: The recruitment-to-inflation (R/I) ratio is a simple bedside method to evaluate the potential for lung recruitment (PLR) and identify patients who could benefit from high positive end-expiratory pressure (PEEP). Using electrical impedance tomography (EIT), we developed a method to calculate the regional R/I ratios of the non-dependent and dependent lung. The aim of this study was to assess the ability of regional R/I ratios on predicting PEEP-induced changes in collapse and overdistention, estimated by regional compliances.

Methods: This was an experimental study in Yorkshire pigs (33-43 kg). Lung injury was induced by surfactant lavage and high-stretch ventilation. From EIT records during a single breath maneuver (SBM) from PEEP of 15 to 5 cmH₂O, we calculated the R/I ratio of the whole (R/I_{GLOBAL}), non-dependent (R/I_{ND}), and dependent lung (R/I_D). A high PLR was defined as a R/I ratio above the median for the population. We also measured the regional change in compliance (ΔC_{rs}) induced by the SBM.

Results: We included 25 pigs with moderate-to-severe ARDS, with a mean P_aO_2/F_iO_2 of 176 ± 96 and a mean respiratory system compliance of 17 ± 4 mL/cmH₂O. The median R/I_{GLOBAL} was 1.31 [1.04-1.63]. The R/I ratio was not evenly distributed throughout the lung: the R/I_D was significantly higher than the regional R/I_{ND} (2.54 [1.90-3.28] vs. 0.60 [0.41-0.81], $p < 0.0001$). Both the R/I_{GLOBAL} and the R/I_D had a high negative correlation with the ΔC_{rs} occurring in the dependent lung during the SBM ($r = -0.63$, $R^2 = 0.40$, $p = 0.001$ and $r = -0.83$, $R^2 = 0.69$, $p < 0.0001$) (Figure 1A, B). The higher the R/I_D, the greater decrease in C_{rs} in the dependent lung due to alveolar collapse at low PEEP. The ΔC_{rs} in the dependent lung was significantly lower in patients with a high regional PLR (i.e. $R/I_D \geq 2.54$) than in patients with a low regional PLR ($-119 \pm 44\%$ vs. $-38 \pm 22\%$, $p < 0.0001$). In contrast, neither the R/I_{GLOBAL} nor the R/I_{ND} were correlated with the ΔC_{rs} occurring in the non-dependent lung (Figure 1C, D).

Conclusion: Regional R/I ratios provided additional information to predict the effect of PEEP on collapse in the dependent part of the lung.

A**B****C****D**