Effect of chest wall loading during supine and prone position in a critically ill covid-19 patient: case report.

Dott. SERGIO LASSOLA (1), Dott.ssa SARA MIORI (1), Dott. ANDREA SANNA (1), Dott. ROCCO PACE (1), Dott.ssa SANDRA MAGNONI (1), Dott. MICHELE UMBRELLO (2)

(1) Azienda Provinciale per i Servizi Sanitari di Trento, Ospedale Santa Chiara, Trento, Italia.
(2) ASST Santi Paolo e Carlo, Ospedale San Carlo, Milano, Italia.

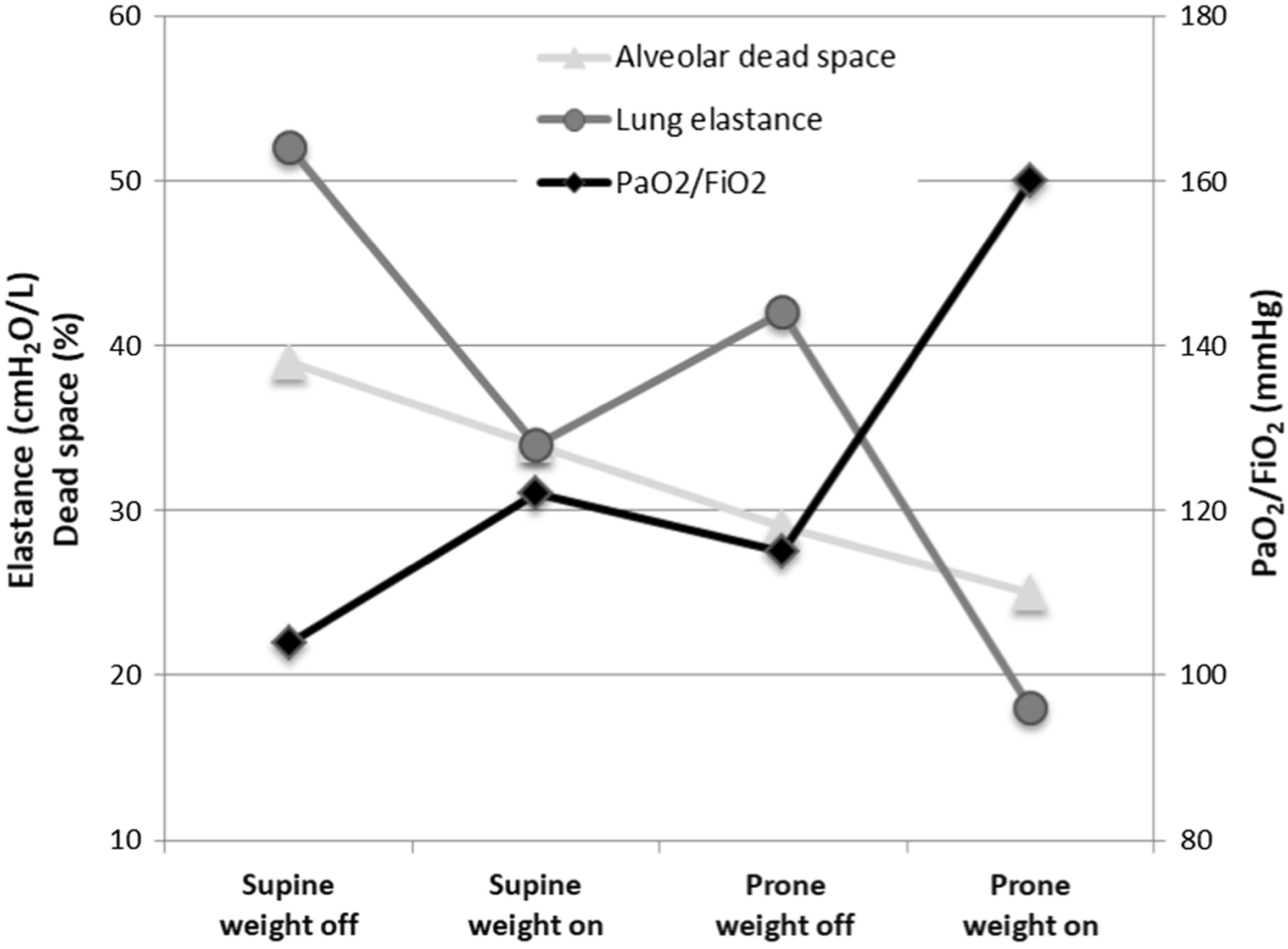
Argomento: Caso clinico

Introduction: we report the effect of loading and unloading the chest wall during prone and supine position in a critically ill patient with COVID-19-related ARDS (C-ARDS).

Case description: a 65-year-old patient with class 2 obesity and no relevant comorbidities needed intubation and mechanical ventilation due to C-ARDS. His respiratory mechanics progressively worsened despite protective ventilation. Respiratory system elastance was > 50 cmH2O/L, and airway driving pressure was 22 cmH2O. It was necessary to institute ultra-protective ventilation (3.5 mL/Kg PBW) with extracorporeal carbon dioxide removal; an esophageal balloon catheter was positioned to investigate partitioned respiratory mechanics and a pulmonary artery catheter was inserted. Compression of the chest wall with a sand bag was performed in the supine and prone position (Fig. 1 shows the lung elastance, alveolar dead space and oxygenation in the different conditions).

In the supine position, external chest wall compression increased the chest wall elastance and reduced the lung elastance, with a consequent reduction in the end-inspiratory transpulmonary pressure and therefore in the stress applied to the lung. Moreover, despite an unmodified minute ventilation, PaCO2 and alveolar dead space decreased and oxygenation increased. Chest wall loading likely led to a reduction in hyperinflation in the non-dependent lung region. Redistribution of ventilation and pulmonary blood flow is likely to account for some of the improved gas exchange during chest wall loading.

Discussion: in the late phase of C-ARDS, the application of a weight on the chest in both supine and prone position improves respiratory mechanics by reducing airway and transpulmonary driving pressures. This maneuver is associated with a decrease in non-dependent lung region overdistension and an increase in dependent region recruitment of aerated lung units, leading to a more homogeneous ventilation.


Alveolar dead space
Lung elastance
PaO2/FiO2
Elastance (cmH2O/L)
Dead space (%)
PaO2/FiO2 (mmHg)
60
50
40
30
20
10
180
160
140
120
100
80
Supine weight off
Supine weight on
Prone weight off
Prone weight on