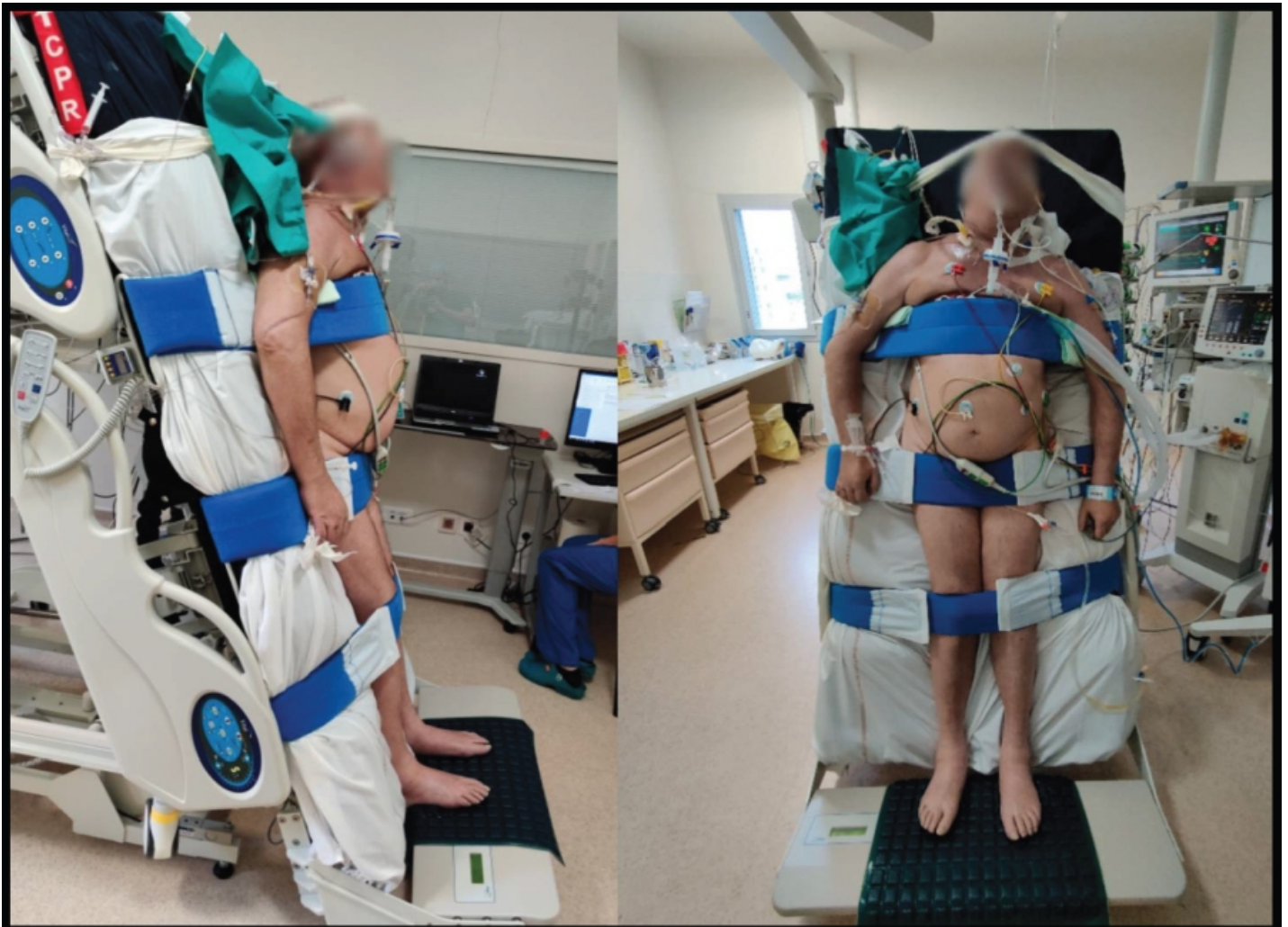


Physiological Effects and Safety of Bed Verticalization in Patients with Acute Respiratory Distress Syndrome

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BACKGROUND : Prone positioning has been proposed as a key aspect of care in acute respiratory distress syndrome (ARDS), more than ever with emergence of COVID-19 pandemic, but sometimes at the cost of burdensome procedure and serious adverse events. Bed verticalization (standing upright) could be an efficient alternative to prone position. Semi-seated position (45-degree head-up, 45-degree legs-down) have already been studied and show promising results, but to our knowledge no study has evaluated the mechanical and physiological impacts of complete patient verticalization during ARDS. The objective was to evaluate the safety and physiological effects of bed verticalization of sedated and ventilated patients with ARDS. **METHODS :** Patients were gradually verticalized, using a dedicated bed, at 0°, 30°, 60° and 90° by steps of 30 minutes. At each position step, multiparametric measurements were performed, including hemodynamic data with pulmonary artery catheter, ventilatory parameters, arterial and central venous gasometry, end-expiratory lung volume, esophageal pressures, and electrical impedance tomography. All these measurements were set to assess effects of verticalization on hemodynamics, ventilatory mechanics and hemostasis.



RESULTS : A total of 30 patients were included and received verticalization. No serious side effects or adverse event occurred during the verticalization procedures. Mean arterial pressure, and cardiac output remained stable in different patient position. EELV of predicted body weight (PBW) increased significantly from 26,14 (14,85; 33,03) to 34,18 (26,69; 36,72) mL.kg⁻¹, between baseline to 90° (P<0,0001). Alveolar strain was significantly lower (0,26 [0.19; 0.43] to 0.19 [0.16; 0.23], P=0,0016). Although static respiratory system compliance decreased (40,32 [26,86; 51,17] to 25,00 [20,56; 36,69] mL.cmH₂O⁻¹.kg⁻¹, baseline and 90° position, respectively, P<0,0001), pulmonary compliance did not decreased significantly between these two steps (47,22 [38,54; 83,10] to 43,11 [29,58; 64,07] cmH₂O, P=0,84), as well as total mechanical power (10,32 [8,48; 13,16] to

10,32 [8,80; 16,22] J.min⁻¹, P=0,94). Transpulmonary shunt significantly decreased between baseline to 90° (0,19 [0,14; 0,25] to 0,12 [0,06; 0,16], P<0,0013), and PaO₂/FiO₂ increased significantly (115,5 [83,8; 140,0] to 136,4 [113,0; 185,6] mmHg, P=0,020). CONCLUSION : Bed verticalization in ARDS is feasible, safe, and shows promising results on hemostasis and respiratory mechanic with minimal impact on hemodynamics. A randomized control trial, comparing verticalization to standard care or prone positioning is needed to conclude on verticalization clinical efficiency and eventually to identify some responders patients.

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