Lung Recruiting Effect of Prone Positioning in Spontaneously Breathing Patients with COVID-19 Assessed by Electrical Impedance Tomography

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A 72-year-old male known for having obesity (body mass index of 38 kg/m^2) and for smoking was admitted to the ICU for acute respiratory failure. A chest computed tomography scan revealed interstitial lung infiltrates with subpleural and posterior lung condensation (Figure 1). Coronavirus disease 19 (COVID-19) pneumonia was confirmed by a positive result of real-time RT-PCR from nasal and pharyngeal swab. The patient had a rapid decrease in the ROX (respiratory rate–oxygenation) index (1) (respiratory rate: 28 breaths/min; pulse oximetry: 91%; oxygen flow rate: 5 L/min) and was invited to initiate prone positioning combined with conventional oxygen therapy as the first-line ventilation strategy according to the routine practice in our center (2). Prone positioning was maintained according to patient tolerance for a total duration of 290 minutes. Global and regional ventilation patterns were checked using electrical impedance tomography (Draeger Pulmovista 500). After the start of prone positioning, electrical impedance tomography revealed a constant improvement in global and regional delta end-expiratory lung impedance that predominated in the posterior area of the lungs (Figure 1). At the same time, the respiratory rate decreased from 28 to 20 breaths/min, and the pulse oximetry increased from 91 to 97%, whereas the oxygen flow rate was reduced from 5 L/min to 3 L/min. Finally, intubation was avoided, and the patient was discharged from the ICU. Prone positioning combined with conventional oxygen therapy could be proposed in patients with severe COVID-19 to avoid intubation (2) by promoting alveolar recruitment in the lung area lacking hypoxic vasoconstriction (3, 4). ■

Author disclosures are available with the text of this article at www.atsjournals.org.

References

1. Roca O, Caralt B, Messika J, Samper M, Sztrymf B, Hernández G, *et al.* An index combining respiratory rate and oxygenation to predict outcome of nasal high-flow therapy. *Am J Respir Crit Care Med* 2019;199:1368–1376.
2. Despres C, Brunin Y, Berthier F, Pili-Floury S, Besch G. Prone positioning combined with high-flow nasal or conventional oxygen therapy in severe Covid-19 patients. *Crit Care* 2020;24:256.
3. Perier F, Tuffet S, Maraffi T, Alcala G, Victor M, Haudebourg A-F, *et al.* Effect of positive end-expiratory pressure and proning on ventilation and perfusion in COVID-19 acute respiratory distress syndrome. *Am J Respir Crit Care Med* 2020;202:1713–1717.
4. Zarantonello F, Andreatta G, Sella N, Navalesi P. Prone position and lung ventilation and perfusion matching in acute respiratory failure due to COVID-19. *Am J Respir Crit Care Med* 2020;202:278–279.

Am J Respir Crit Care Med Vol 204, Iss 4, pp 476–477, Aug 15, 2021
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Originally Published in Press as DOI: 10.1164/rccm.202008-3044IM on June 25, 2021
Internet address: www.atsjournals.org

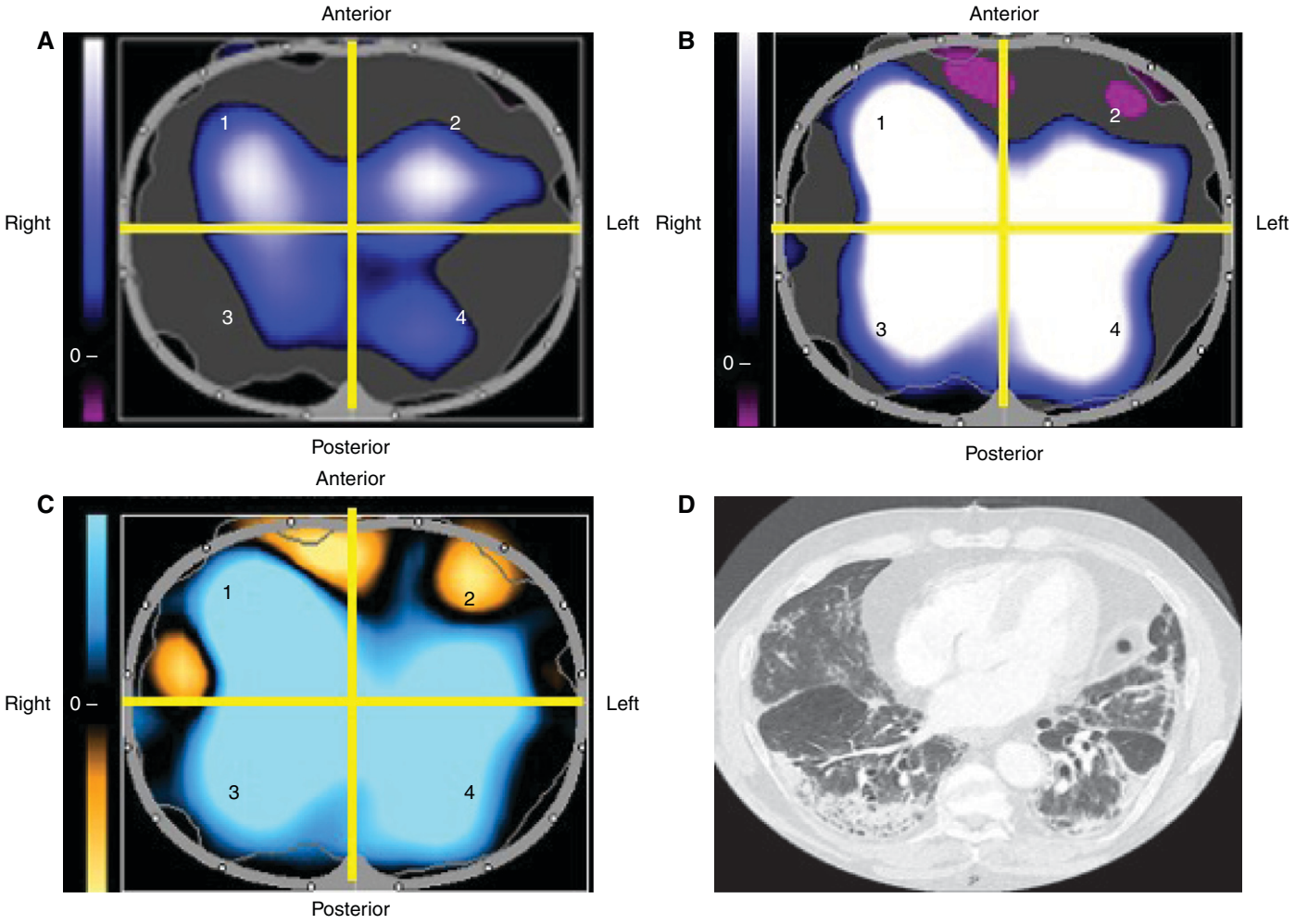

Figure 1. Global and regional ventilation patterns checked using electrical impedance tomography during prone positioning combined with conventional oxygen therapy. Region of interest (ROI) 1 and 2 are anterior area of the lungs, and ROI 3 and 4 are posterior area of the lungs. (*A*) End-expiratory lung impedance (EELI) at baseline before prone positioning. (*B*) EELI at the end of the prone positioning session. (*C*) Variation of regional (ROI ΔEELI) ventilation patterns from supine to prone positioning. ROI 1 ΔEELI = 4.17; ROI 2 ΔEELI = −1.06; ROI 3 ΔEELI = 9.01; and ROI 4 ΔEELI = 5.63. ΔEELI > 0 means lung-recruiting effect. (*D*) Chest computed tomography scan. (*A* and *B*) Blue–white gradient illustrates the distribution of V_T (lower values are blue, and higher values are white). (*C*) Derecruited lung areas are orange, and recruited lung areas are blue.