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Lung recruitability in ARDS H1N1 patients

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Dear Editor,

In 2009, a newly identified H1N1 virus rapidly led to a worldwide pandemic infection [1]. The mortality rate was 5–7% in hospitalized patients and approximately 20% among those admitted to the intensive care unit (ICU) [2]. The H1N1 infection occasionally developed into acute respiratory distress syndrome (ARDS), and in some cases the hypoxemia was so severe as to require advanced rescue therapies, such as extracorporeal support. To the best of our knowledge, however, the quantitative characteristics of the ARDS

due to the H1N1 virus as assessed by computed tomography (CT) have not yet been reported.

We report here three patients with severe ARDS associated to H1N1 infection who were admitted to our ICU and in whom lung weight, edema, and recruitability were evaluated by a lung CT scan and subsequently by the PEEP test. Patient 1 was aged 49 years and had a body mass index (BMI) and a PaO₂/FiO₂ of 42.5 kg/m² and 170 at PEEP 10 cmH₂O, respectively; patient 2 was aged 42 years and had a BMI and a PaO₂/FiO₂ of 34.7 kg/m² and 108 at PEEP 10 cmH₂O, respectively; patient 3 was aged 49 years and had a BMI and a PaO₂/FiO₂ of 26.2 kg/m² and 225 at PEEP 10 cmH₂O, respectively.

The real time PCR test for H1N1 in the nasopharyngeal swab was positive for all three patients, while all blood and tracheal cultures were negative. Oseltamivir and empiric antibiotic agents were used in the first week of admission to the ICU. One patient due to clinical deterioration also required extracorporeal support. Two patients survived the infection and were eventually discharged from the hospital.

At 6, 10, and 10 days post-admission, two lung CT scans at 5 and 45 cmH₂O of airway pressure were

performed in all three patients, and the lung recruitability was computed as the amount of not aerated lung tissue at 5 cmH₂O which regained aeration at 45 cmH₂O [3]. Within 1–2 h following the CT scan, we randomly performed the PEEP test at PEEP 5 and 15 cmH₂O maintaining a constant minute ventilation and inspiratory oxygen fraction. The gas exchange and respiratory mechanics were recorded 20 min after each PEEP change.

Examination of the lung CT scan showed bilateral consolidations and ground glass opacity areas with minimal pleural effusions. The total lung weight and volume were almost twofold greater than normal at 5 cmH₂O of PEEP [3]. The weight of lung of each patient recruited to aeration when the airway pressure was increased to 45 cmH₂O corresponded to 18.5, 31.0, and 16.3% of the total lung weight, respectively. All of these values are higher than the median values of recruitability that we found in previous series of ARDS patients (12%) [3].

Respiratory mechanics, gas exchange, and lung recruitability values are reported in Table 1. The dissociation between recruitability and gas exchange is not surprising and likely reflects changes in pulmonary blood flow distribution,

Table 1 Gas exchange, respiratory mechanics, and lung recruitability of the three patients

Clinical parameters	Patient 1		Patient 2		Patient 3	
	PEEP 5	PEEP 15	PEEP 5	PEEP 15	PEEP 5	PEEP 15
Respiratory system compliance (mL/cmH ₂ O)	49.7	49.7	43.9	49.4	38.8	30.0
Physiological dead space	0.45	0.50	0.48	0.45	0.55	0.56
PaO ₂ /FiO ₂	126	159	103	148	159	154
PaCO ₂ (mmHg)	46.4	48.2	40.8	40.0	42.6	44.2
Total lung weight (g) ^a	1,644	1,822	1,498	1,586	1,593	1,634
Total lung volume (mL) ^a	2,432	4,761	2,297	5,030	2,496	3,844
Weight of recruitable lung (g)	265		463		249	

^a Values computed at 45 cmH₂O of airway pressure

PaO₂ (partial pressure of oxygen), PaCO₂ (partial pressure of carbon dioxide) in arterial blood; FiO₂, fraction of inspired oxygen (percentage of oxygen) in a gas mixture

which cannot be measured in clinical practice.

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