Supine vs. prone chest CT in a COVID-19 patient during mechanical ventilation

Clinical History:

A 72-year-old female patient with a history of ischaemic stroke, ocular myasthenia, arterial hyper-tension, and hypercholesterolaemia was admitted to the emergency department because of dyspnoea. She reported having fever and cough for a week. At admission, her pulse oximeter saturation was 84%, the tympanic temperature was 37.6 °C. Laboratory findings revealed elevated C-reactive protein (19.69 mg/dL, normal range 0.01-0.5 mg/dL) and mild lymphopenia (0.7X10^3/mm^3, normal range 1.0-4.0 X10^3/mm^3). The patient also underwent non-contrast chest CT.

Imaging Findings:

The non-contrast chest CT performed at admission (Fig. 1) showed bilateral, symmetrical, sub-pleural ground-glass opacities (GGO), predominantly in the right lower lobe, with initial interlobular septal thickening (crazy-paving pattern). There was no radiological evidence of pleural effusion or mediastinal lymphadenopathy. These findings were highly suspicious for SARS-CoV-2 infection. AP chest X-ray (Fig. 2) on day two from admission showed interval intubation, internal jugular vein CVC, nasogastric tube, and bilateral patchy airspace opacities. A new chest CT scan (Figs. 3-5) was performed on day three of admission, in both supine and prone positions during mechanical ventilation. Compared to the prior CT, the supine scan showed a significant increase in the extent and attenuation of the opacities with pulmonary consolidation and atelectasis of the right lower lobe. The prone scan showed a partial recovery of the aerated lung parenchyma in the right inferior lobe with a small area of residual consolidation in the posterior segment of the right lower lobe.

Discussion:
Background
COVID-19 is an infectious disease that causes mild symptoms in most people; however, some patients, especially those who have comorbidities and the elderly, can progress to pneumonia and acute respiratory distress syndrome (ARDS) [1,2]. Nevertheless, also healthy and young people can develop a severe illness as it happened in Northern Italy with “patient 1”, a man in his 30s [3].

Clinical Perspective
Most patients affected by COVID-19 present primarily with fever, myalgia or fatigue, and dry cough [1], others may not have clinical symptoms nor radiological abnormalities at presentation [4]. At present, the RT-PCR test is the gold standard for the final diagnosis of COVID-19 [5], even if it is burdened by a false negative rate. Patients who progress to ARDS and multi-organ failure could benefit from methylprednisolone to decrease the risk of death [6]. In patients with severe ARDS, prone ventilation has been demonstrated to improve oxygenation and respiratory compliance compared to supine positioning [7].

Imaging Perspective
Chest CT scan could be useful for diagnosis of COVID-19 in highly suspected patients, but it should not be used for screening or early diagnosis because of its low specificity that does not allow differentiation between COVID-19 pneumonia and other cases of infection [8]. Chest CT has a role in the follow-up of patients until complete recovery [9]. Patients who develop respiratory deterioration and instability can benefit from lung ultrasonography that is more sensitive than chest X-ray for evaluation of pneumonia and ARDS [10]. CT scan in supine and prone position allows to investigate the modification in lung morphology with changes in body position, and leads to a description in vivo of the lung pathology in ARDS.

Outcome
Since admission, the patient was given antiviral treatment based on lopinavir/ritonavir. Due to the rapidity of respiratory deterioration, she however was transferred to the intensive care unit where she underwent invasive mechanical ventilation. Meanwhile, laboratory testing for SARS-CoV-2 returned positive. The patient is currently in the intensive care unit and her clinical condition is stable.

Take-home Message
Patients that develop ARDS require a big effort to adjust the ventilatory strategy [11]. The chest CT has a great impact on therapeutic strategy since it allows to guide response to a prone position and for making decisions related to weaning the patient form ventilatory support. The addition of a prone scan may be useful to identify the most efficacious strategy for the ventilation of these patients.

Written informed patient consent for publication has been obtained.

Differential Diagnosis List: COVID-19 acute respiratory distress syndrome (ARDS), Idiopathic pulmonary fibrosis (IPF), Multifocal bacterial pneumonia, Acute respiratory distress syndrome (ARDS)

Final Diagnosis: COVID-19 acute respiratory distress syndrome (ARDS)
References:


Figure 1

a

**Description:** Non-contrast chest CT obtained in the emergency department showed bilateral subpleural ground-glass opacities (GGO) with crazy-paving pattern.  
**Origin:** Department of Radiology, Humanitas Clinical and Research Hospital, Humanitas University, Milan, Italy, 2020

b

**Description:** The coronal view obtained at the inferior lobes showed major involvement of the right lower lobe.  
**Origin:** Department of Radiology, Humanitas Clinical and Research Hospital, Humanitas University, Milan, Italy, 2020
Description: AP chest X-ray obtained on the second day of admission demonstrated diffuse bilateral opacities, tracheal cannula, na-sogastric tube, internal jugular CVC. Origin: Department of Radiology, Humanitas Clinical and Research Hospital, Humanitas University, Milan, Italy, 2020.
Figure 3

a

Description: Non-contrast chest CT in axial view during supine positioning obtained on the third day of admission demonstrated extensive pulmonary consolidation of the right lower lobe and patchy opacities in the upper lobe. Origin: Department of Radiology, Humanitas Clinical and Research Hospital, Humanitas University, Milan, Italy, 2020

b

Description: Non-contrast chest CT scan in axial view in prone positioning demonstrated recovery of aerated lung parenchyma in the right lower lobe. Origin: Department of Radiology, Humanitas Clinical and Research Hospital, Humanitas University, Milan, Italy, 2020
**Figure 4 a**

**Description:** Non-contrast chest CT in sagittal view during supine positioning obtained on the third day of admission demonstrated extensive pulmonary consolidation of the right lower lobe and patchy opacities with initial consolidation in the upper lobe. **Origin:** Department of Radiology, Humanitas Clinical and Research Hospital, Humanitas University, Milan, Italy, 2020.
**Description:** Non-contrast chest CT scan in sagittal view in prone positioning demonstrated recovery of aerated lung parenchyma

**Origin:** Department of Radiology, Humanitas Clinical and Research Hospital, Humanitas University, Milan, Italy, 2020
**Figure 5**

**Description:** Non-contrast chest CT in coronal view during supine positioning obtained on the third day of admission demonstrated extensive pulmonary atelectasis of the right lower lobe. **Origin:** Department of Radiology, Humanitas Clinical and Research Hospital, Humanitas University, Milan, Italy, 2020.
**Description:** Non-contrast chest CT scan in coronal view in prone positioning demonstrated a small area of residual parenchymal consolidation in the posterior segment of the right lower lobe.

**Origin:** Department of Radiology, Humanitas Clinical and Research Hospital, Humanitas University, Milan, Italy, 2020.