Case Report

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An Eight-Week Follow-up Study in Patients With COVID-19 Respiratory Failure: Delayed Recovery or Lung Sequel

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ABSTRACT

In recent months, coronavirus disease 2019 (COVID-19) is a significant global health problem that has a tremendous negative impact on the human being, and almost all countries of the world have been affected by the disease. CT imaging techniques have an important role in the primary diagnosis of pneumonia secondary to COVID-19; moreover, the level of pulmonary involvement in CT scan is one of the criteria for disease severity in the acute phase of COVID-19 pneumonia. Still, the role of CT scan in the follow-up period is unknown.

Case Presentation

We have followed up four cases of COVID-19 respiratory failure for clinical and radiologic pulmonary temporal changes for 8 weeks.

Case 1

A37-year-old man without any underlying disease was admitted to the hospital with complaints of fever, dyspnea, and non-producing cough. Due to respiratory distress, he was admitted to the Intensive Care Unit (ICU). Treatment orders were supplemental oxygen with a non-rebreathing face mask with reservoir bag (FiO_2=60%), hydroxychloroquine, Kaletra, and intravenous antibiotic. using supplemental oxygen, O_2 saturation increased from 78% to 88%. Laboratory data on admission are shown in Table 1. On the seventh day, because of persistent hypoxemia despite high FiO_2, physicians prescribed 125 mg methylprednisolone for five days. Symptoms decreased gradually, and on the ninth day, he was transferred to the

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ward. Ultimately, after 12 days of hospital admission, he was discharged with Sao2=90% and RR=20/min in room air. Eight weeks later, dyspnea on activity (function class 2) was the only complaint. The spirometry was compatible with the restrictive ventilator defect (FVC=68%). The first lung CT scan and follow-up CT scan are shown in Figure 1.

Case 2

A previously healthy 69- year-old man, with severe COVID-19 pneumonia was admitted to the ICU due to respiratory distress. On admission, vital signs were as follows: Respiratory Rate: 36 per minute, Temperature: 39.3 C, Pulse Rate: 130 per minute, Arterial oxygen Saturation: 75%. The patient received supplemental O_2 with a non-rebreathing reservoir bag mask, Kaletra, hydroxychloroquine, ribavirin, and antibiotic. During ICU stay, despite high FiO_2, the patient saturation was about 87%. On the tenth day of ICU stay, 125 mg/d methylprednisolone was started for five days. On the fifteenth day, he was transferred to the ward and discharged on the twentieth day with SaO2=88% and RR=22 in room air. Eight weeks later, in a follow-up visit, patients reported dyspnea on exertion and SaO2=94% in room air. Imaging results on admission and in the follow-up are displayed in Figure 2.

A. Axial chest CT scan revealed bilateral multifocal patchy ground-glass opacities. B. Opacities are pronounced, and widespread bilateral consolidations are seen. C. Patchy bilateral consolidations, fibrous bands, and traction bronchiectasis. D, opacities are decreased, and bilateral subpleural ground-glass opacities, fibrous bands, traction bronchiectasis, and mild architectural distortion are noticed.

Case 3

A 47-year-old woman with a past medical history of multiple sclerosis was admitted to the hospital due to COVID-19 infection and SaO_2 was 90%. Treatment orders were nasal O_2 therapy and taking hydroxychloroquine and Kaletra. On the fourth day of admission, SaO_2 decreased to 85%, and the patient was admitted to the ICU. During ICU stay, the patient received supplemental O_2 with a non-rebreathing reservoir bag mask and 125 mg/d methylprednisolone for five days. By improving the patient's condition and SaO_2 on the fourth day of ICU, the patient was transferred back to the ward and finally discharged on the twelfth day with SaO_2=95% in room air. Chest CT scan on arrival and after eight weeks of follow-up are shown in Figure 3. In follow-up visits, spirometry parameters were within a normal range.

A. Axial chest CT scan revealed patchy bilateral consolidations and ground-glass opacities; B. Parenchymal opacities are pronounced, and widespread bilateral consolidations are seen; C. Opacities eliminated and clear lung is seen.

Case 4

A 60-year-old woman without a past medical history was admitted to the hospital with a COVID-19 diagnosis and SaO_2 was 89%. Treatment orders were oxygen therapy with a nasal cannula and taking hydroxychloroquine and Kaletra. On the fifth day of admission, the patient's condition deteriorated and SaO_2 decreased to 82% and she was admitted to the ICU. In ICU, the patient was treated with supplemental O_2 with a non-rebreathing reservoir bag mask. Five days later, the patient's condition improved, and readmitted to the ward. Finally, on the seventeenth day, the patient was discharged with SaO2=96% in room air. The patients' lung imaging on admission and follow-up are displayed in Figure 4.

Discussion

In recent months, the health care systems encountered an abundance of COVID-19 patients with pulmonary in-

Table 1. Laboratory findings

	Case 1	Case 2	Case 3	Case 4
Lymphocyte count on admission	800	250	603	808
ESR	70	67	93	37
CRP	87	95	82	34
Ferritin	513	546	617	430
S/F ratio×(ICU admission time)	146	141	176	180

* S=SpO2; F=FiO2; ESR: Erythrocyte Sedimentation Rate; CRP: C-reactive protein.

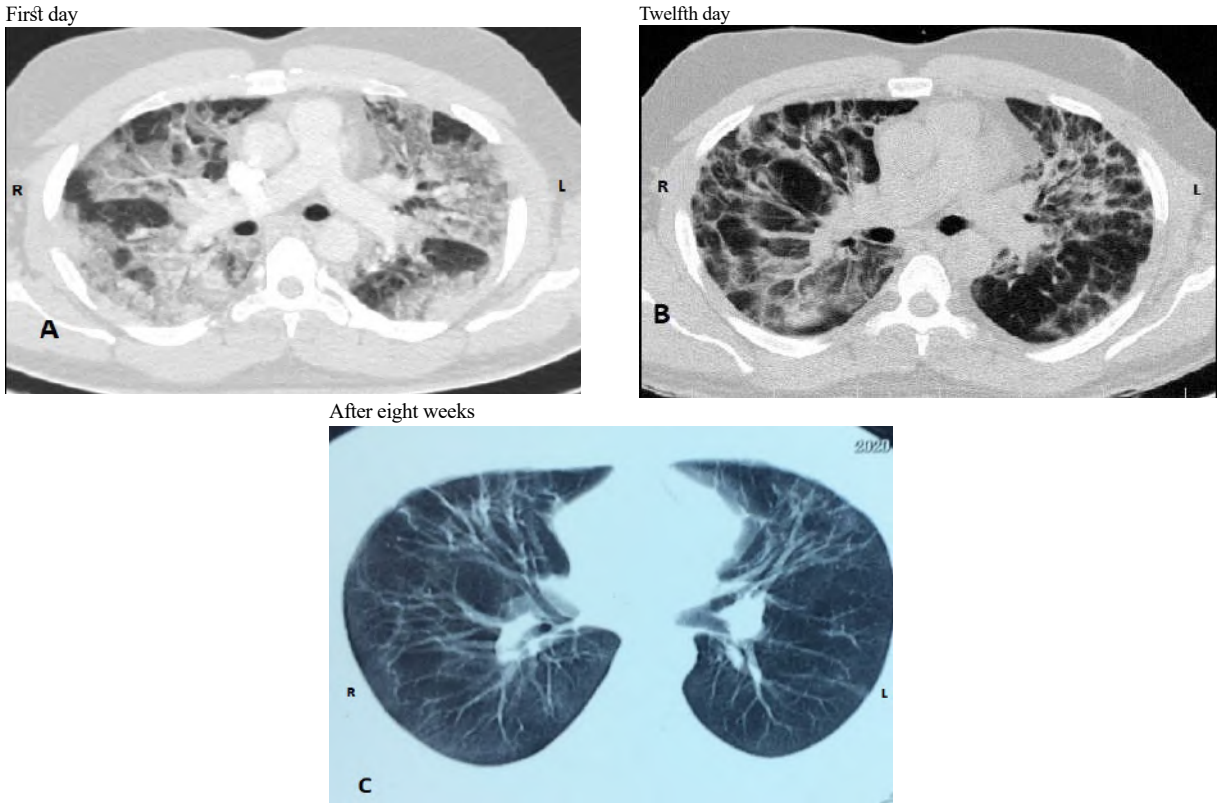

Figure 1. Patient imaging results

A: Axial chest CT scan revealed widespread consolidations and ground-glass opacities; B: reticular opacities, fibrous bands, and patchy consolidations with traction bronchiectasis; C: opacities are reduced, and residual reticular opacities and fine fibrotic bands are seen.

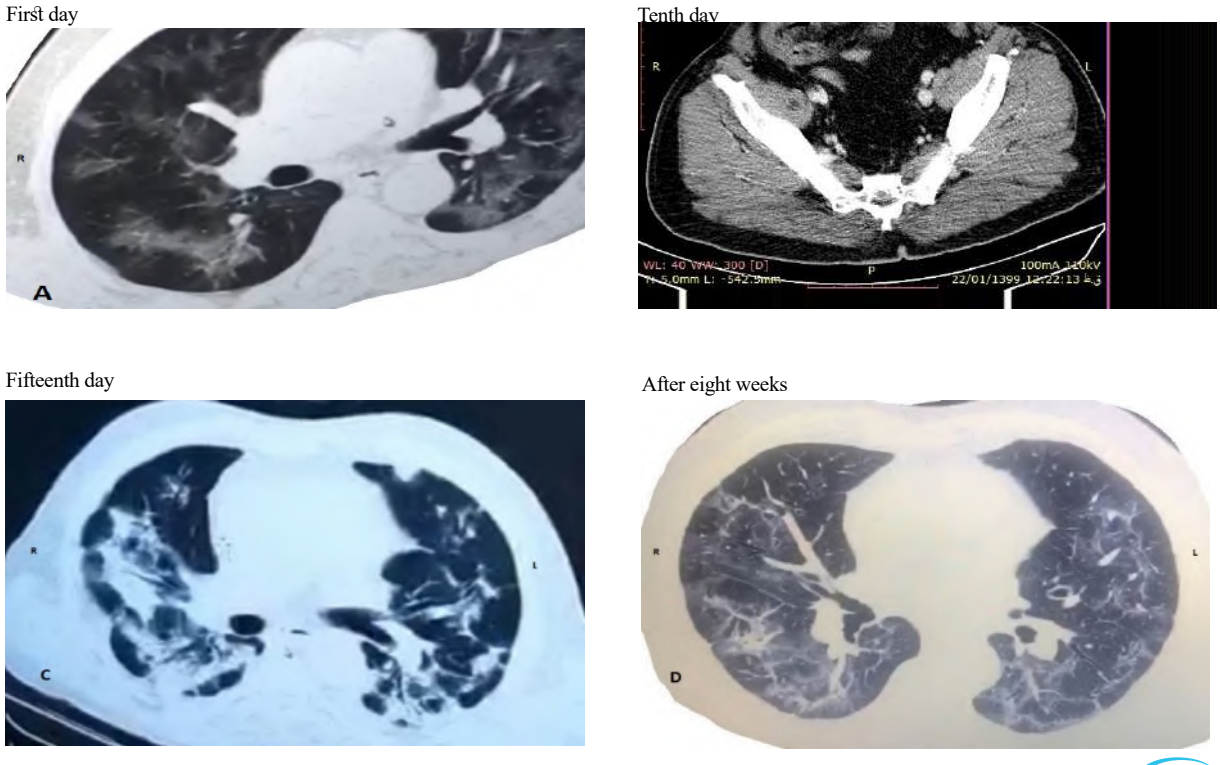

Figure 2. Pateint imaging results

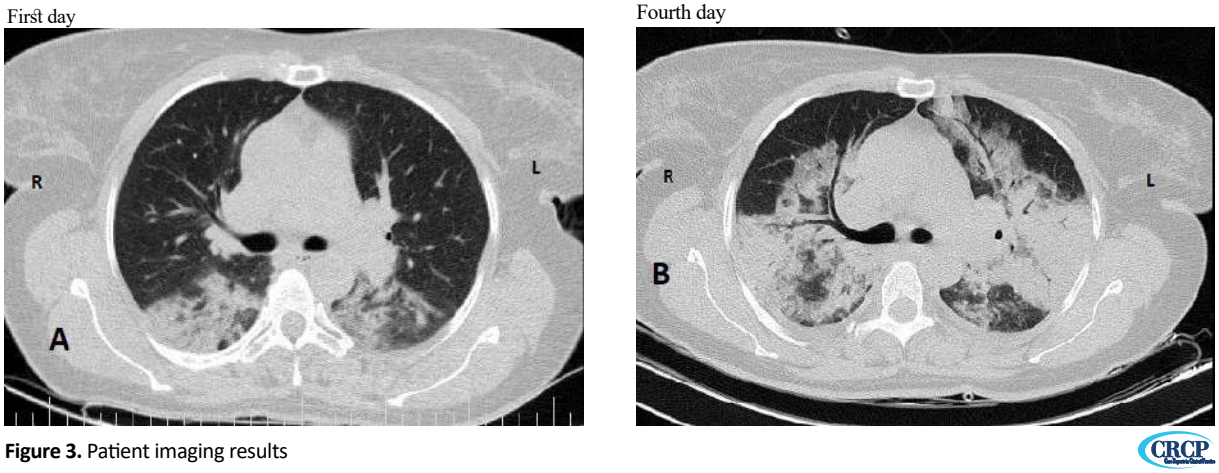

Figure 3. Patient imaging results

volvement, and it is important to give more priority to which patients for follow-up visits.Although pulmonary involvement in the acute phase consists of ground-glass opacity and consolidation that are more prominent in the lung periphery [1-4]. There is uncertainty about long-term changes in the lung parenchyma in COVID-19 pneumonia.

Usually, in the late phase of Acute Respiratory Distress Syndrome (ARDS), pulmonary changes begin to resolve. Still, the speed and extent of recovery are different in patients, and many factors can influence the amount of repair, such as comorbidities. Typical findings of ARDS in later stages include ground-glass opacity and coarse reticular changes in non-dependents parts of the lungs. These abnormalities may be related to barotrauma secondary to invasive mechanical ventilation [5].

A study conducted by Yuhui Wang for the evaluation of temporal changes in lung CT scans during hospital admis-

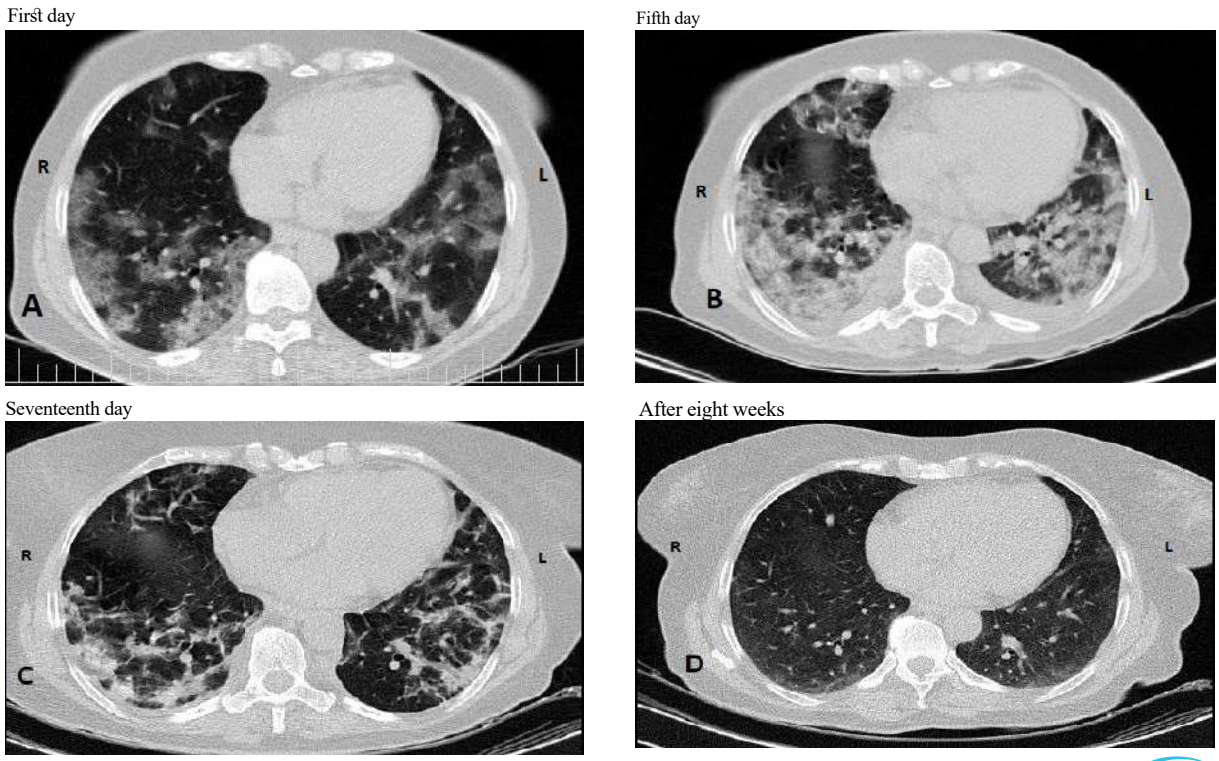

Figure 4. Patient imaging results

A. Axial chest CT scan revealed bilateral multifocal patchy ground-glass opacities with a crazy-paving pattern; B. opacities are progressed, and bilateral diffused consolidations and ground-glass opacities are seen; C. bilateral subpleural consolidations, fibrous bands, and fibrous bands; D. opacities are resolved, and a clear lung is seen.

sion showed that the lung involvement begins rapidly and peaked on the sixth–eleventh days of disease. On the hospital discharge day, only four patients had complete resolution, and 66 of them showed residual lung abnormalities. The median follow-up period of the patients was 16 days [6]. All follow-up visits were limited to admission time and did not discriminate between mild and severe cases.

Carlos Toufen et al. followed up four cases of ARDS related to H1N1 infection for six months. These patients showed a restrictive pattern in spirometry and various degree of lung abnormalities after two months of follow-up. After six months of follow-up, they had significant improvement in symptoms and lung CT scan findings. As COVID-19 is a viral infection, in severe forms, patients may experience a slow remission. In this regard, symptomatic patients during two months of follow-up should be considered for a delayed recovery in contrast to a permanent lung sequel, and an invasive approach should be considered only in situations where symptoms and imaging results are deteriorating [7].

All of our cases based on $SpO2/FiO_2$ were categorized as cases with moderate ARDS. In studies, $SpO2/Fio_2$ has been surrogated as an alternative for $Po2/FiO_2$ for the diagnosis of ARDS [8]. Lung CT scan of the case 1 on the fourteenth days of admission showed fibrotic band formation, and in the second patient, bronchial dilation in association with fibrotic changes (that all of were declined) remained in CT scans after 8 weeks of follow-up. These patients did not have a previous pulmonary disease and cigarette smoking history and were not under invasive ventilation. It suggests that these pulmonary changes may be related to the natural course of the illness and long-term use of supplemental oxygen with high Fio_2. It seems that bronchial dilation and fibrotic band formation on the fourteenth day CT scan predict residual lung abnormalities after 8 weeks of follow-up. ICU length of stay was longer and hypoxemia was more severe in cases 1 and 2, in contrast to patients 3 and 4. However, clinical presentations at onset and laboratory findings were not significantly different between them.

Conclusion

In clinical practice, a more severe and extended period of hypoxemia, length of ICU admission, and CT scan changes, such as fibrotic bands, reticulation, and bronchial dilation in the acute phase should be prioritized for a follow-up visit. These may predict the possibility of residual lung abnormalities in imaging and patient symptoms.

Ethical Considerations

Compliance with ethical guidelines

There were no ethical considerations to be considered in this research.

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Conflict of interest

The authors declared no conflict of interest.

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