Case Report

# Chest Computed Tomography Findings in a Case Series of Coronavirus Disease 2019 (COVID-19) Patients at Siriraj Hospital: Case Report

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***Background***: Recent evidence has demonstrated the high sensitivity of chest computed tomography (CT) in coronavirus disease 2019 (COVID-19) case detection. However, considering the cost and infection control issues, the experience of chest CT for COVID-19 diagnosis in Thailand is still limited.

***Objective***: To present the characteristics of chest CT findings in COVID-19 patients at Siriraj Hospital and compare them with other reports.

***Materials and Methods***: The authors retrospectively reviewed the COVID-19 patients' medical records between April and May 2020. All cases with the presence of chest CT performed during admission were recruited. Clinical data were retrieved from the patients' medical records. All chest imaging results were reported by consensus between the authors.

***Results***: From 103 cases, four cases with a chest CT scan during the admission were recruited. Consistent with previous reports, the common chest CT findings included a ground-glass opacity and consolidation with bilateral involvement. A round-shaped ground-glass opacity or consolidation was evidenced in half of the cases. The only case with the presence of chest CT scan, which was done 77 days after the onset of COVID-19 symptoms, revealed resolution of the abnormal findings.

***Conclusion***: Chest CT findings in four COVID-19 cases at Siriraj Hospital are consistent with previous reports. Common findings include bilateral ground-glass opacity and consolidation.

***Keywords***: COVID-19, SARS-CoV-2, Computed tomography, Case series

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The ongoing coronavirus disease 2019 (COVID-19) pandemic has claimed more than a million lives worldwide. Although less than a quarter of cases present with shortness of breath, the disease commonly involves the lower respiratory tract as evidenced by an abnormal chest radiograph in more than half of the cases[1]. Chest imaging has been recommended for the diagnosis and prognosis of symptomatic COVID-19 cases[2]. However, recognising an abnormal chest radiograph indicating COVID-19 is quite challenging, especially in the early stage. In a study of 636 confirmed COVID-19 cases, only 26.4% of chest radiographs were classified as abnormal according to the initial readings. Even when the chest radiographs were reviewed by radiologists with a greater awareness of positive COVID-19 results, the detection rate was still only increased to 47.1%[3].

Chest computed tomography (CT) is used for COVID-19 diagnosis in some centers, and several studies have reported a high sensitivity and specificity of chest CT for case identification[4,5]. However, due to its high cost and requirement for complicated infection control measures, chest CT is not widely used, especially in developing countries. Notwithstanding the limitations, the knowledge of chest CT findings in COVID-19 might be necessary in some circumstances. For instance, the detection of suggestive patterns from incidental chest CT findings might alert physicians and prompt further investigations[6].

Herein, the clinical information and chest CT

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**Table 1.** Clinical characteristics and laboratory findings of the study patients

| | Case 1 | Case 2 | Case 3 | Case 4 |
|---|---|---|---|---|
| Sex, age (years) | Female, 52 | Female, 30 | Male, 67 | Male, 51 |
| Body mass index (kg/m$^2$) | 30.8 | 20.2 | 26.4 | 24.6 |
| Presenting symptoms | Fever<br>Malaise<br>Sore throat | Fever | Fever<br>Malaise<br>Dry cough | Fever<br>Dry cough<br>Sore throat |
| Coexisting disease | Diabetes | Chronic viral hepatitis B | Diabetes | Hypertension<br>Colorectal cancer |
| Smoking status | Nonsmoker | Nonsmoker | Nonsmoker | Nonsmoker |
| Lowest recorded $SpO_2$ | 98% (room air) | 99% (room air) | 84% ($FiO208_2$ 0.7) | 91% (room air) |
| Respiratory support, maximum $FiO_2$ | No | No | IMV, 1 | HFNC, 0.4 |
| ICU stay (days) | 0 | 0 | 15 | 8 |
| Pharmacologic treatments | | | | |
| Antiviral therapy | HCQ<br>DRV+r | HCQ<br>DRV+r | HCQ<br>LPV/r<br>Favipiravir | HCQ<br>DRV+r<br>Favipiravir |
| Anti-inflammatory therapy | No | No | Tocilizumab | Dexamethasone |
| Antibiotics | No | No | TZP<br>Azithromycin<br>Meropenem | TZP<br>Meropenem |
| Neuromuscular blocking agent | No | No | Cisatracurium | No |
| Discharge status | Improved | Improved | Improved | Improved |

$SpO_2$=pulse oxygen saturation; $FiO_2$=fraction of inspired oxygen; IMV=invasive mechanical ventilation; HFNC=high flow nasal cannula; ICU=intensive care unit; HCQ=hydroxychloroquine; DRV+r=darunavir + ritonavir; LPV/r=lopinavir/ritonavir; TZP=piperacillin-tazobactam

findings of four COVID-19 cases admitted to Siriraj Hospital between April 2020 and May 2020 were reported. The follow-up chest CT results of one patient that undergone another chest CT 77 days after the onset of COVID-19 symptoms were also presented.

## Materials and Methods

The present study was a single-center, retrospective study conducted at Siriraj Hospital, a Mahidol University affiliated hospital in Bangkok, Thailand. The study was approved by the Siriraj Institutional Review Board, approval number 738/2020. All medical records of admitted COVID-19 cases between April 2020 and May 2020 were screened for the presence of chest CT scan performed during admission. All cases were confirmed positive by reverse transcription polymerase chain reaction (RT-PCR) for SARS-CoV-2 from the patients' respiratory specimens. The patients' demographic data, comorbidities, smoking status, severity of hypoxemia, length of intensive care unit stay, and treatments received were reviewed. All chest radiographs and CT studies performed during the admission for COVID-19 treatment and any chest CT studies performed after recovery from COVID-19 were reviewed by the authors to reach consensus. Each record was labelled with the assigned code number to ensure the de-identification of patient information.

## Results

From the 103 patients who were admitted to Siriraj Hospital with the diagnosis of COVID-19, four Thai patients underwent chest CT to evaluate the extent of lung involvement. All cases presented with fever, and two had non-productive cough. Two female patients (case 1 and case 2) had mild disease without oxygen desaturation or admission to the intensive care unit (ICU). Two male patients (case 3 and case 4) had severe disease with oxygen desaturation, with lowest pulse oxygen saturation records of 84% and 91%, respectively. Case 3 received invasive mechanical ventilation and a neuromuscular blocking agent, while case 4 received high flow oxygen cannula (HFNC). All the patients received hydroxychloroquine and antiretroviral protease inhibitor. Only the severe cases received viral ribonucleic acid polymerase inhibitor (favipiravir) and anti-inflammatory therapy (Table 1).

**Table 2.** Radiologic findings of the study patients

| | Case 1 | Case 2 | Case 3 | Case 4 |
|---|---|---|---|---|
| Chest radiograph | | | | |
| Time after symptom onset | 6 days | 1 day and 6 days | 18 days | 2 days |
| Abnormal findings | Abnormal | Normal | Abnormal | Abnormal |
| • Bilateral/unilateral | Bilateral | - | Bilateral | Bilateral |
| • Ground glass opacity | Peripheral<br>Lower | - | Diffuse | - |
| • Consolidation | - | - | Focal at LUL | - |
| • Interstitial opacity | Nodular<br>Peripheral<br>Lower | - | - | Reticular<br>Peripheral<br>Lower |
| • Pleural effusion | - | - | - | - |
| Chest CT | | | | |
| Time after symptom onset | 6 days | 4 days | 23 days | 3 days |
| $SpO_2$ room air (CT day) | 99% | 100% | 96% | 99% |
| Abnormal findings | Abnormal | Normal | Abnormal | Abnormal |
| • Bilateral/unilateral | Bilateral | - | Bilateral | Bilateral |
| • Number of affected lobes | 5 | - | 5 | 4 |
| • Ground glass opacity | Peripheral<br>Lower<br>Round-shape | - | Diffuse | Peripheral<br>Lower |
| • Consolidation | - | - | Focal at LUL<br>Peripheral<br>Round-shape | Focal at LLL<br>Peripheral |
| • Interstitial opacity | - | - | - | - |
| • Pleural effusion | - | - | - | - |

$SpO_2$=pulse oxygen saturation; LUL=left upper lobe; LLL=left lower lobe

The chest radiographs were normal in one patient (case 2), who was a young adult with mild symptoms. The chest CT of case 2 was consistently normal. The chest radiographs of the other cases showed bilateral opacities. Despite mild symptoms, a peripheral lower lobe predominance of ground-glass and nodular opacities were present in case 1. Different patterns were revealed in the chest radiographs of the 2 severe cases. Diffuse ground-glass opacities and focal consolidation were evidenced in case 3, while a peripheral lower lobe predominance of reticular opacities was present in case 4 (Table 2).

Abnormal chest CT findings were present in three cases. Bilateral ground-glass opacity was commonly observed in all cases, comprising of diffuse pattern in case 3 (Figure 2) and peripheral lower lobe predominance in cases 1 and 4 (Figure 1, 3). Focal consolidation was present in the two severe cases (cases 3 and 4). Round-shaped lesions were demonstrated in two cases, round ground-glass opacity in case 1 (Figure 1) and round consolidation in case 3 (Figure 2). No interstitial opacity or pleural effusion was evidenced in any of the four study cases.

Only one case had another chest CT after hospital discharge. Case 4 had undergone chest CT for colorectal cancer follow-up 75 days after a previous study, or 77 days after the onset of COVID-19 symptoms. The study showed complete resolution of the focal consolidation and almost complete resolution of the peripheral ground-glass opacities (Figure 4). Some residual ground-glass opacities could be observed in both lower lobes.

## Discussion

Accumulating evidence has revealed some common and uncommon features of chest CT findings in COVID-19 cases. Despite its sensitivity for the detection of subtle lung parenchymal changes, the clinical use of chest CT for COVID-19 case identification is still limited. Given the fact

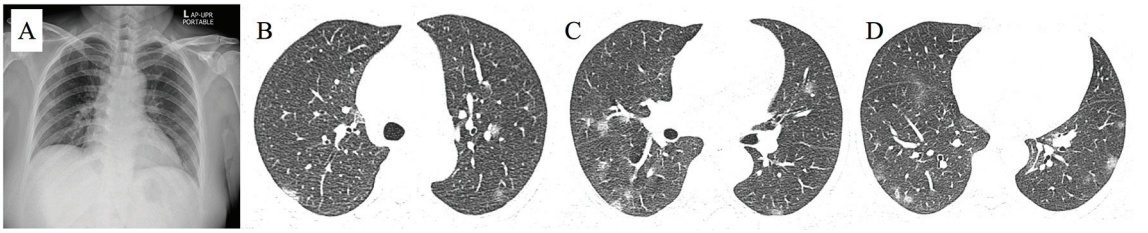


**Figure 1.** Chest imaging of case 1, revealing the bilateral lower lung zone had predominantly ground-glass and nodular opacities on the chest radiograph (A) and bilateral round-shaped ground-glass opacities on the chest computed tomography scan (B-D).


**Figure 2.** Chest imaging of case 3, revealing the bilateral lung had diffuse ground-glass opacities on the chest radiograph (A) and bilateral ground-glass opacities on the chest computed tomography scan (B-D) with a focal peripheral left upper lobe consolidation (B).

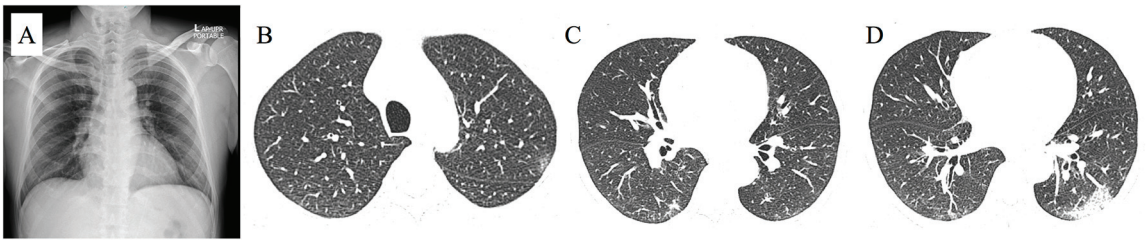


**Figure 3.** Chest imaging of case 4, revealing the bilateral lower lung zone had peripheral reticular opacities on the chest radiograph (A) and bilateral ground-glass opacities on the chest computed tomography scan (B-D) with a focal left lower lobe consolidation (D).

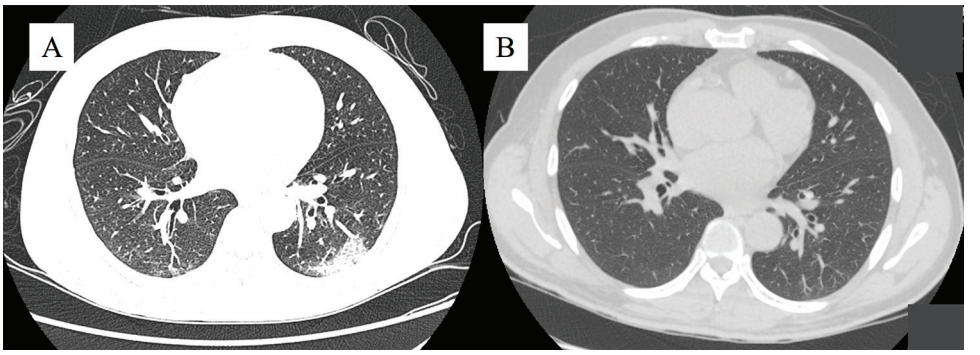


**Figure 4.** Chest computed tomography of case 4, revealing peripheral subpleural consolidation in the left lower lobe on the initial study (A), which disappeared after 75 days follow-up (B).

that chest CT is widely used for other reasons, the incidental case detection of COVID-19 is probable, especially during the current ongoing pandemic. The rapid recognition of suspicious findings would aid mitigating the disease spreading. In the present study, the authors presented the chest CT findings of four COVID-19 cases. Two of them had significant hypoxemia requiring invasive and non-invasive

respiratory support. It is worth noting that all the cases with abnormal chest CT had detectable abnormalities on their chest radiographs.

Three patients showed abnormal chest CT findings, and one patient showed unremarkable findings. Ground-glass opacity and consolidation were reported in three cases. Two cases showed rounded ground-glass opacity or consolidation. No interstitial infiltrate was observed. Consistently, a systematic review demonstrated the existence of some common CT findings of COVID-19, including ground-glass opacities 86%, consolidation 52%, and reticulation 50%. Normal CT findings are reported in 10% of patients[7]. A round-shaped morphology has been described on the chest CTs of COVID-19 patients with a frequency of 54%[8]. Abnormal findings in the three cases in the present study involved both lungs, predominantly at the peripheral lung zones, consistent with a reported 75% bilateral involvement in the systematic review.

The one case with normal chest CT findings in the present study was a young patient with mild disease. Chest CT was performed four days after the onset of fever. It might be possible that the virus involved only the upper respiratory tract in this patient. However, performing the chest CT too early might lead to show normal findings. A recent report revealed that a proportion of COVID-19 cases have initial normal chest CT but later develop new lesions that shows up on follow-up studies; whereby after a follow-up period of up to 12 days, 34% exhibited abnormal chest CT findings[9].

One patient in the present study underwent follow-up chest CT, which showed complete resolution. The latter CT scan was performed 75 days after the first one. A retrospective study of COVID-19 cases underwent subsequent chest CT scan at least 75 days after the previous scan has recently been reported[10] and stated that just over half of such cases exhibited a complete resolution of chest CT within 75 to 114 days follow-up. Furthermore, compared with the complete CT resolution group in that study, the patients with persistent abnormalities were initially more severe, both clinically and radiologically. The case in the present study was, however, a severe case.

## Conclusion

The present case series were the Siriraj Hospital experience of performing chest CT in COVID-19 cases. The findings are consistent with previous reports from more experienced centers. Ground-glass opacity and consolidation were the most common findings, which sometimes presented in a round shape. The common distribution included bilateral and peripheral involvement. The time since symptom onset to detectable chest CT abnormality remains unanswered. There was evidence of complete resolution after 75 days.

## What is already known on this topic?

Common chest CT findings in COVID-19 cases include bilateral ground-glass opacity, consolidation, and reticulation.

## What this study adds?

Four COVID-19 cases admitted at Siriraj Hospital underwent chest CT and revealed similar findings as previously reported in other countries.


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## Conflicts of interest

All authors declare they have no conflicts of interest.

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