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## Case Report

# The spider web sign in Covid-19 pneumonia: An interesting case studied to resolution with computed tomography<sup>☆</sup>

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## ABSTRACT

Since the widespread of acute respiratory syndrome infection caused by Coronavirus-19, un-enhanced computed tomography (CT) was considered a useful imaging tool commonly used in early diagnosis and monitoring of patients with complicated Covid-19 pneumonia. Many typical imaging features of this disease were described such as bilateral multilobar ground-glass opacity (GGO) with a prevalent peripheral or posterior distribution, mainly in the lower lobes, and sometimes consolidative opacities superimposed on GGO. As less common findings were mentioned septal thickening, bronchiectasis, pleural thickening, and subpleural involvement. Here we describe the case of a patient, with Covid-19 pneumonia, that had the spider web sign, a triangular or angular GGO in the subpleural lung, documented at CT.

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## Background

Since December 2019 the world is facing a rapidly expanding pandemic of lower respiratory tract infection by a novel coronavirus SARS-CoV-2 (severe respiratory syndrome coronavirus-2). In some patients, this viral infection causes a clinical syndrome referred to as coronavirus disease 2019 (Covid-19), but the heterogeneity of the disease course poses a challenge to healthcare providers and optimal management of patients.

The use of computed tomography (CT) imaging in the diagnosis and follow-up had rapidly grown, and radiological patterns along the disease course are increasingly understood. To date, the most of all the available literature regarding SARS-CoV-2 infection relies on noncontrast CT, which is considered the first-line imaging tool [1] and has even proven useful to diagnose Covid-19 pneumonia when initial polymerase chain reaction screening is negative [2]. Current guidelines advocate the use of noncontrast chest CT for the diagnosis, severity assessment, and monitoring of Covid-19 disease [3].

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**Picture 1 – Chest X-ray showed diffused opacities in both lungs, bilateral peribronchial thickening and bi-basal pleural effusion.**

### Case presentation

A 58 years old man with hypertension and diabetes mellitus was admitted to the emergency department after 7 days with persistent chest pain, shortness of breath, dry cough, and fever (38–38.5°C), without clinical improvements from taking paracetamol at home. He reported that he had no contacts with positive Covid-19 patients, although he comes from a town of our province declared as “red-zone” (near the country of Melito Porto Salvo). The naso-pharyngeal sampling was positive for SARS-CoV-2.

At emergency department the patient had:

- normal baseline ECG and Echocardiographic evaluation;
- chest auscultation revealed a MV significantly reduced in both lung areas;
- arterial blood gas analysis showed hypoxia;
- arterial oxygen saturation (SaO<sub>2</sub>) was 88%;
- laboratory: leukopenia (3.5 G/L); increased values of C-reactive protein (240 mg/L), LDH, and procalcitonin.

A chest X-ray (only supine decubitus) was immediately made, and showed diffused opacities in both lungs, bilateral peribronchial thickening and bi-basal pleural effusion (Picture 1).

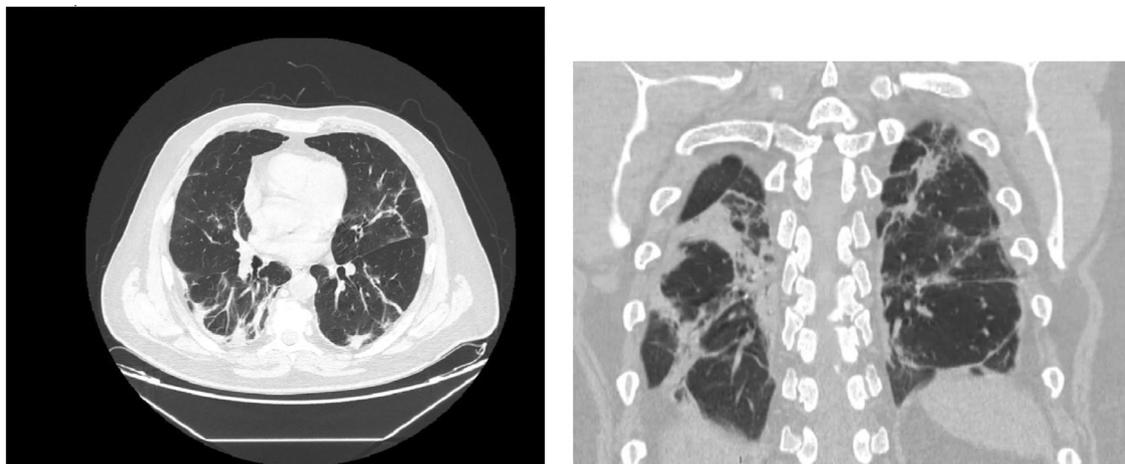
A chest CT scan was urgently performed, in basal conditions and high resolution algorithm (HRCT), with a 64-slices multidetector scanner, and the images so obtained were analyzed with a slice-thickness of 1.2 mm and MPR reconstructions (axial, sagittal, and coronal). HRCT had documented in both lungs the presence of multiple thickenings with a “ground glass” pattern and some areas with “crazy-paving” patterns, due to the coexistence of “ground-glass” areas, of

interstitial consolidations and thickenings. In the mediastinum there were some small, reactive, lymphnodes. There were not evidence of pericardial effusion, but a minimal bilateral basal pleural effusion was present.

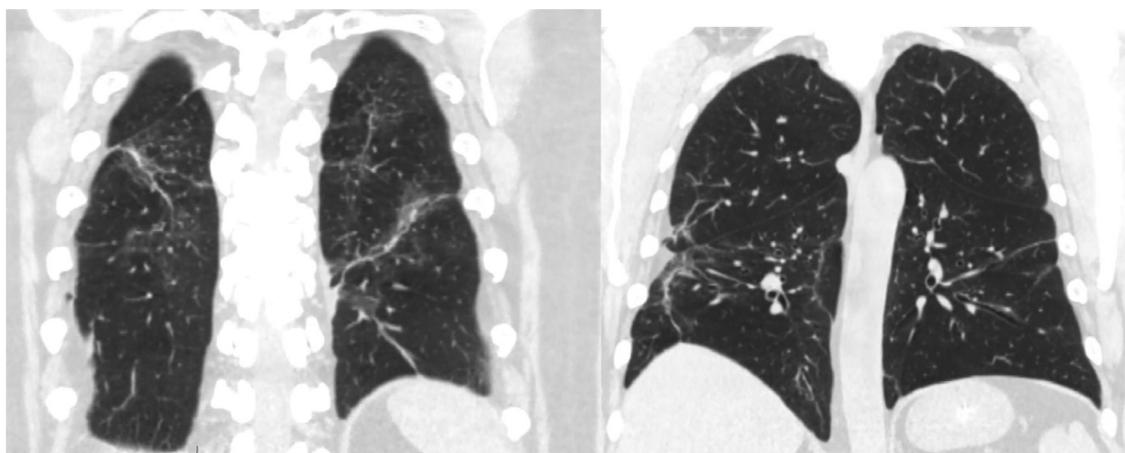
CT also clearly showed the spider web sign, here represented by a triangular and angular area of ground-glass opacity (GGO), in the subpleural basal area of the right lung, with the internal interlobular thickened like a network; the adjacent pleura was pulled and formed a spider-web-like shape in the corner (Picture 2a, b).

In consideration of the worsening of the clinical conditions, the patient was immediately hospitalized in the Infectious Diseases Unit of Infectious Diseases of our Hospital (Covid-19 reference HUB Hospital for the entire province of Reggio Calabria), and a multidrugs therapy with also high-flow O<sub>2</sub> was immediately begun. On the seventh day of therapy the patient showed a modest, but progressive, improvement in the clinical and laboratory picture, with a fair distance of the PCR, LDH values; leukopenia stable. On the tenth day a chest HRCT was repeated, to re-evaluate the radiological situation. HRCT had documented (Picture 3a, b), in both lungs, a reduction of the parenchymal GGO thickenings and of the areas with a “crazy-paving” pattern, which, however, were still in the middle and peripheral camps, bilaterally. The stretching of the visceral pleura still persisted in the right posterior basal area, from which septa and branches with a fibro-sclerotic appearance departed. No pleural effusions were visible.

The patient continued, although slowly, to improve his general clinical conditions, and even the laboratory exams gradually tended to return to the reference values. During the third week of hospitalization, the naso-pharyngeal sampling had become negative for SARS-CoV-2. Thus, after another chest HRCT (Picture 4a, b), which had documented the almost



**Picture 2 – (a, b):** Chest HRCT showed in both lungs the presence of multiple thickenings with a “ground glass” pattern and some areas with “crazy-paving” patterns. The spider web sign was represented by a triangular and angular area of GGO, in the sub-pleural basal area of the right lung; the adjacent pleura was pulled and formed a spider-web-like shape in the corner.



**Picture 3 – (a, b):** Chest HRCT (10th day of hospitalization) showed a reduction of the parenchymal bilateral GGO thickenings and of the areas with a “crazy-paving” pattern. The stretching of the visceral pleura still persisted in the right posterior basal area.

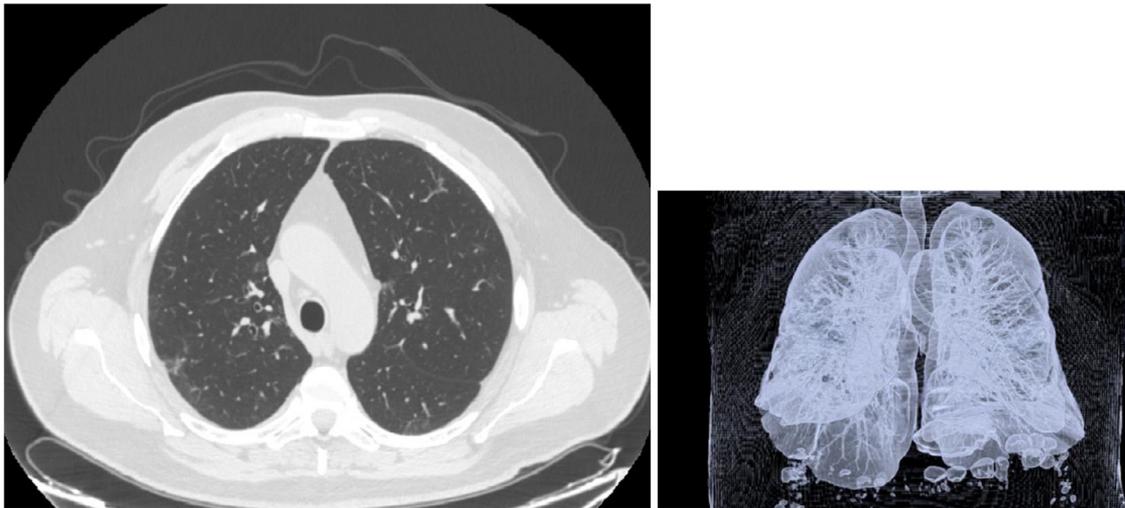
complete resolution of the bilateral pulmonary parenchymal pathological findings already described, the patient was discharged.

## Discussion

In the literature, several studies are reporting parenchymal findings of Covid-19 pneumonia. CT findings of Covid-19 pulmonary infection are: bilateral, peripheral, and basal predominant GGO; crazy-paving pattern; consolidations; nodules; reticulations; interlobular septal thickenings; linear opacities; subpleural curvilinear lines; bronchial wall thickenings, often with an extensive geographical distribution. There are also lymph node enlargements, pleural effusion, and pericardial effusion [4–7]. Some studies described the

evolution of imaging features of Covid-19 pneumonia: an increase in GGOs and a progressive transformation of GGO into multifocal consolidative opacities, septal thickenings and development of a crazy-paving pattern [8]. The spider web sign is defined as a triangular or angular GGO in the sub-pleural lung with the internal interlobular septa thickened like a net; the adjacent pleura was pulled and formed a spider web-like shape in the corner [9]. According to Zhu et al, the spider web sign is very common among Covid-19 patients [10]. Spider web sign was also used in a different anatomic region, as liver for Budd-Chiari syndrome: one pathognomic feature on inferior cavography or hepatic veinography is the presence of multiple tiny collateral vessels forming a dense network with a spiderweb appearance [11,12].

Unenhanced chest CT is useful in early diagnosis of Covid-19 infection, in monitoring disease progression, coinfection, or disease stability [13]. Chest CT can accurately evaluate the



**Picture 4 – (a, b): Chest HRCT (third week of hospitalization) had documented the almost complete resolution of the bilateral pulmonary parenchymal pathological findings. A 3D VRT reconstruction was also made.**

type and extent of lung lesions. In our experience in our Hospital, we found that the most common CT findings were: GGO, consolidations, crazy-paving patterns, and the spider web sign. Consolidation was significantly more frequent in severe/critical patients, which indicates that the alveoli are completely filled by inflammatory exudation; this usually means that the virus diffuses into the respiratory epithelium, leading to necrotizing bronchitis and diffused alveolar damage [14,15].

Severe/critical patients showed more lymph node enlargements, pericardial effusion, and pleural effusion; these extrapulmonary lesions may indicate the occurrence of severe inflammation. CT can evaluate the severity of the disease, which is of great significance for the diagnosis and follow-up of Covid-19 pneumonia.

## Conclusions

CT findings of consolidations, linear opacities, crazy-paving patterns, bronchial wall thickenings, spider web sign, and extrapulmonary lesions may be features of severe/critical Covid-19 pneumonia. The spider web sign is a very important sign to consider and evaluate when diagnosing Covid-19 pneumonia. CT plays an important role in the diagnosis and severity evaluation of this disease, because it investigates very well the dynamic CT changes in different stages of Covid-19 pneumonia, and also in the follow-up of the patients. In conclusion, CT played an important role in the diagnosis and evaluation of this emerging global health emergency.

## Patient Consent Statement

The patient confirmed the consent for publication of our case report.

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