

## Covid-19 mimics in CT-Scan

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### Absatrcct

The chest CT plays a primary role in the early detection of COVID-19 pneumonia; however the diagnosis is essentially based on reverse transcription polymerase chain reaction (RT PCR). This is allowing the inexperienced radiologist, during this global COVID pandemic, to keep in mind a list of differential diagnosis that can mimic COVID pneumonia on CT. We retrospectively reviewed the initial chest CT data of 158 suspected SARS Cov 2 patients admitted in Hassan II University Hospital center of Fez (Morocco), from March 16, 2020, to May 25, 2020, with two consecutive negative tests at admission and five days after.

**Keywords:** COVID-19; Diagnosis; Ground glass opacity; Differential diagnosis; Mimics

### Introduction

The World Health Organization has declared on March 11, 2020, that Coronavirus disease 2019 (COVID-19) caused by SARS-CoV-2 is a pandemic and public health emergency of international concern.<sup>1</sup> Early identification and proper management of patients with COVID-19 are very important. As of May 25th, 2020, more than five million individuals have contracted the virus worldwide with more than 350.000 reported deaths, including 7500 confirmed cases in Morocco.<sup>2</sup>

The standard of reference for confirming COVID-19 relies on microbiological tests such as Reserve Transcription Polymerase Chain Reaction (RT-PCR) or sequencing. However, these tests might not be accessible in an emergency setting and their results are not immediately available. Computed tomography (CT) can be used as an important complement to RT-PCR for diagnosing COVID-19 pneumonia in the current epidemic context.<sup>3-5</sup> Features in chest computed tomography (CT) can facilitate identifying newly infected individuals. However, CT findings of some lung diseases are similar to those of COVID-19, as shown in this present article. Several studies have demonstrated that chest CT characteristics can facilitate identifying newly infected cases of COVID-19.<sup>6,7</sup> CT features of COVID-19 are diverse, including pure or mixed GGOs with a patchy to confluent or nodular shape, consolidations, and crazy-paving appearance. These features can be located in the central or peripheral areas of the posterior lungs, with peripheral lesions dominating their distribution. Current pandem-

ic is making out subtle radiological differences between COVID-19 and pneumonia of other etiology.

### Materials and Methods

We retrospectively reviewed the initial chest CT data of 158 suspected SARS Cov 2 patients admitted to Hassan II University hospital center of Fez, from March 16, 2020, to May 25, 2020 were included. All patients were imaged with 1 mm thick slices, with a Light Speed scanner (GE Medical Systems). All scans were obtained with the patient in the supine position during end-inspiration without intravenous contrast material for 97 patients and with intravenous administration of iodinated contrast material for 61 patients. All patients were negative for 2019-n Cov at laboratory testing of respiratory secretions obtained by means of nasopharyngeal swab, or oropharyngeal swab, on two consecutive direct tests at admission and after five days. Patient selection for this study is detailed in (Table 1) and no exclusion criteria were applied. Two radiologists in consensus with 5 and 10 years of thoracic imaging experience evaluated the images.

**Table 1:** Summary of patient characteristics (n=158)

Parameter	Value	
<b>Sex</b>		
Men	113	-72
Women	45	-28
<b>Age</b>		
Mean	57	
Range	16 - 88	
<b>Exposure history</b>		
Recent travel to Europe or china	4	-2.5
Exposure to infected patient	84	-53.2
Unknown exposure	70	-44.3
<b>Symptoms</b>		
Fever	121	-76.5
Headache	106	-67
Cough	52	-33
Dyspnea	98	-62
Sore throat	73	-46.2
Myalgia	46	-29.1
Fatigue	79	-50
Nausea	35	-22.1

### Discussion

#### Typical imaging features of Covid-19

A wide variety of CT findings in COVID-19 have been reported in the different studies.<sup>3,6</sup> However, all studies indicate that the main CT feature of COVID-19 pneumonia is the presence of ground glass opacities (GGO), typical-

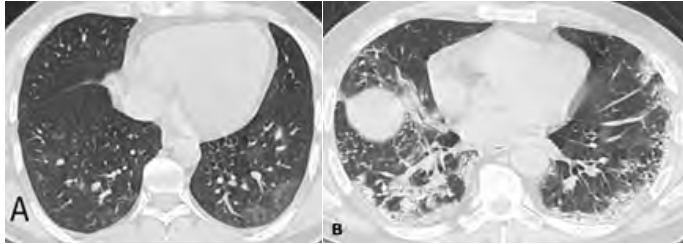
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## Mini-Review

ly with a peripheral and sub pleural distribution (Figure 1A). The involvement of multiple lobes, particularly the lower lobes is reported in the majority of patients with COVID-19.

**Figure 1:** Unenhanced axial thin section chest CT images of (A) a 28 year old man with confirmed COVID-19 pneumonia, illustrating ground glass opacities (GGO), typically with a peripheral and subpleural distribution. (B) A 62 year old man with confirmed COVID-19 pneumonia, showing peripheral or subpleural consolidation adjacent to the chest wall.



These areas of GGO may be admixed with areas of focal consolidation and or associated with superimposed intralobular reticulations, resulting in a crazy paving pattern (Figure 1B). Linear consolidations and other signs suggesting organizing pneumonia such as the reverse halo sign (i.e., areas of ground glass surrounded by peripheral consolidation) are very frequently observed, mostly in patients several days after the onset of disease.<sup>3</sup>

### Non Covid ground glass opacities

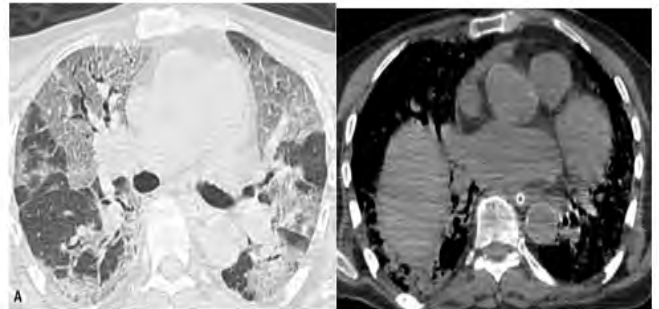
GGO is a non-specific term referring to a hazy increase in lung opacity that is not associated with obscuration of underlying vessels. This finding can reflect the presence of a number of diseases and can be seen in patients with either minimal interstitial thickening or air-space disease. Although GGO is a nonspecific finding its presence is very significant. As with consolidation, the differential diagnosis is based primarily on the duration of symptoms. In patients with acute symptoms, the presence of GGO reflects active disease such as viral pneumonias (Figure 2), pulmonary edema (Figure 3), or hemorrhage, diffuse alveolar damage, pulmonary vasculitis (Figure 4), lung contusion (Figure 5), acute interstitial pneumonia (AIP), and acute hypersensitivity pneumonitis.<sup>8</sup>

**Figure 2:** Unenhanced axial thin section chest CT images of a 36 year old woman with confirmed Influenza pneumonia, showing ground glass opacities (GGO) with a peripheral and subpleural distribution two consecutive direct test (RT-PCR) at admission and after five days were negative for COVID-19 and positive for Influenza.

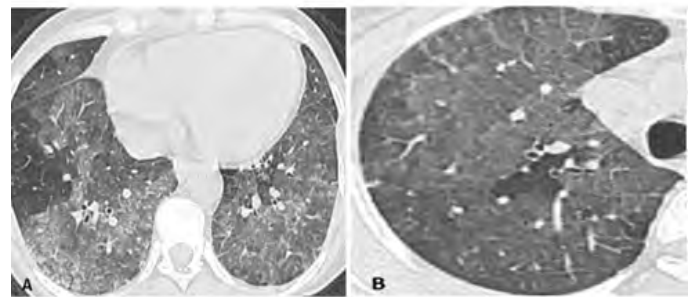


**Figure 3:** Axial thin section chest CT images of a 77 year old woman

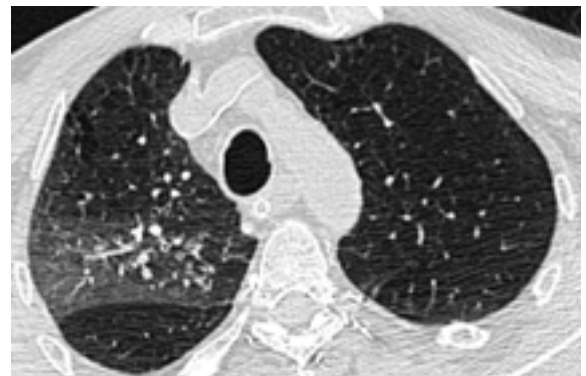
with heart failure and acute pulmonary edema shows in (A) diffuse ground glass opacity with interlobular septal thickening and in (B) cardiomegaly



**Figure 4:** Unenhanced axial thin section chest CT images of a 28 year old man with vasculitis showing in (A) Diffuse ground glass opacity with interlobular septal thickening. The smooth thickening of the interlobular septa (white arrows) is well seen in (B) (enlarged).



**Figure 5:** Axial thin section chest CT images with intravenous injection for a 36 year old man victim of a traffic accident showing lung contusion in peripheral and subpleural ground glass opacities.



### Non Covid focal patchy consolidation

Focal patchy consolidation is typical of pneumonias, or endobronchial spread of tumor such as mucinous carcinoma (w). CT may show a pattern of lobular consolidation. Centrilobular nodules are seen in some cases. Patchy consolidation is frequently seen in viral or bacterial bronchopneumonia (Figure 6). Bacterial Pneumonias are associated with this pattern (e.g., Staphylococcus, Haemophilus, and Pseudomonas). Infected secretions are typically present within the bronchi. Mycoplasma pneumonia often results in this pattern.<sup>8</sup>

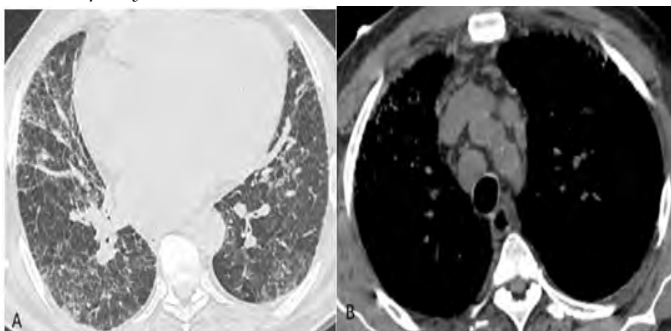
**Figure 6:** Unenhanced axial thin section chest CT images of a 24 year old woman with tuberculosis show ground glass opacities admixed with patchy areas of lobular consolidation.



### Non Covid peripheral or subpleural consolidation

Peripheral or subpleural consolidation is seen adjacent to the chest wall, with sparing of the perihilar regions. It is most often seen in patients with a chronic lung disease. It is also classically associated with eosinophilic lung diseases, particularly eosinophilic pneumonia, but may also occur with sarcoidosis (Figure 7), organizing pneumonia (Figure 8), lung contusion (Figure 9), radiation pneumonitis, or mucinous adenocarcinoma (Figure 10).

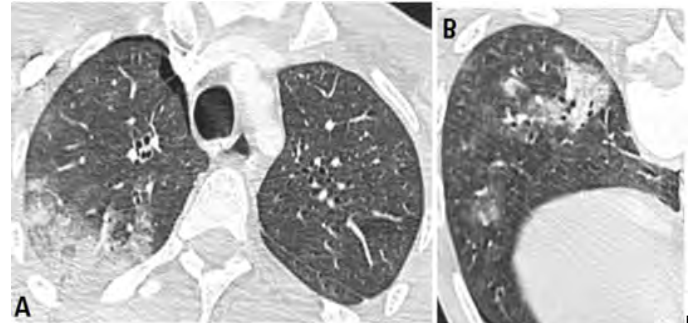
**Figure 7:** Unenhanced axial thin section chest CT images of a 55 years old patient with sarcoidosis shows in (A) pulmonary intralobular septal thickening combined to ground glass opacities and in (B) mediastinal adenopathy (white arrows)



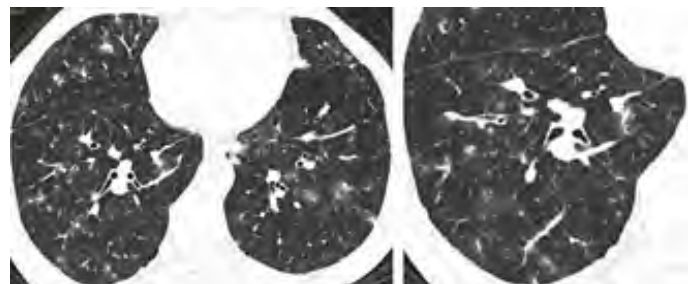
**Figure 8:** Axial thin section chest CT images of a 37 year old man with cryptogenic organizing pneumonia shows patchy consolidation associated with ground glass opacity.



**Figure 9:** Axial thin section chest CT images with intravenous injection of a 25 year old man victim of a traffic accident showing peripheral or subpleural consolidation adjacent to the chest wall (A) associated with GGO (B), and anterior small right pneumothorax is visible (black arrow).



**Figure 10:** Unenhanced axial thin section chest CT images of a 57 year old man with mucinous carcinoma shows nodular ground glass opacities (arrow), with the involvement of multiple lobes, particularly the lower lobes.



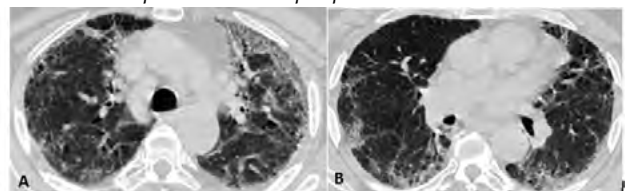
### Non Covid diffuse patchy consolidation

Diffuse patchy consolidation may be seen with any pneumonia (bacterial, mycobacterial, fungal, viral). Even in pulmonary edema, acute respiratory distress syndrome (ARDS), pulmonary hemorrhage syndromes, inhalational diseases, eosinophilic diseases, and invasive mucinous adenocarcinoma. The patchy opacities may correspond to consolidation of lobules, sub segments, or segments.

### Non Covid crazy paving appearance

The combination of GGO and interlobular septal thickening is termed crazy paving. This appearance is nonspecific and may be seen with a variety of acute lung diseases such as pneumocystis or viral pneumonia, edema, hemorrhage, and acute lung injury. Among patients with chronic lung disease, it is a classic finding for PAP, although it may be seen in any chronic infiltrative lung disease characterized by GGO (Figure 11).

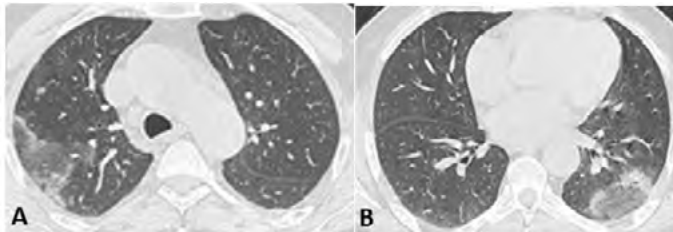
**Figure 11:** Unenhanced axial thin section chest CT images of a 62 year old man shows in A and B ground glass opacity and patchy consolidation, with superimposed fine reticulation and traction bronchiectasis. Abnormalities predominate in peripheral and basal areas.



## Non Covid reverse halo sign

A finding termed the reversed-halo sign or atoll sign, in which ring-shaped or crescentic opacities are seen, often with GGO in the center of the ring (resembling the opposite of the halo sign), may be seen with organizing pneumonia (Figure 12) or angioinvasive aspergillosis.<sup>9</sup>

**Figure 12 :** Unenhanced axial thin section chest CT images of a 40 year old man shows in A and B Atoll or reversed halo sign which consist in patchy ground glass opacities surrounded by irregular and thin areas of consolidation



## Conclusion

When faced with a suspected case of COVID-19, radiologists should analyze the exposure history, clinical manifestations, CT findings, and laboratory test results. Because, lot of pulmonary pathologies can appear with the same typical features of COVID-19 in CT scan and to properly categorize the situation if the initial RT-PCR test results are negative, radiologist must be careful before making the final diagnosis.

## Conflict of interest

None

## Acknowledgment

None

## References

1. WHO DG. WHO Director-General's opening remarks at the media briefing on COVID-19-11 March 2020.
2. COVID-19 Pandemic World Meter Updates.
3. Hania C, Trieua NH, Saaba I, et al. COVID-19 pneumonia: A review of typical CT findings and differential diagnosis. *Diagn Interv Imaging* 2020; 101(5):263-268.
4. Fang Y, Zhang H, Xie J, et al. Sensitivity of chest CT for COVID-19: comparison to RT-PCR. *Radiology* 2020; 296(2):E115-E117
5. Ai T, Yang Z, Hou H, et al. Correlation of chest CT and RT-PCR testing in coronavirus disease 2019 (COVID-19) in China: a report of 1014 cases. *Radiology* 2020; 296(2):E32-E40.
6. Chung M, Bernheim A, Mei X, et al. CT Imaging Features of 2019 Novel Coronavirus (2019-nCoV). *Radiology* 2020; 295(1):202-207.
7. Huang C, Wang Y, Li X. Chest CT Findings in Coronavirus Disease-19 (COVID-19): relationship to duration of infection. *Radiology* 2020; 295(3):200-463.
8. Salehi S, Abedi A, Balakrishnan S, et al. Coronavirus disease 2019 (COVID-19): A systematic review of imaging findings in 919 Patients. *AJR Am J Roentgenol* 2020; 215(1):87-93.
9. Webb R, Heggins CB. *Thoracic imaging Pulmonary and cardiovascular radiology* 3rd ed. Wolters Kluwer 2017.