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Calcifications found in the chest CT of a Patient suffering from 2019 Novel Coronavirus (2019-nCoV) Pneumonia: a case report

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Abstract*: Since December 2019, the world is facing a panpidemic novel coronavirus disease named COVID-19 causing a worldwild health problem. The non-enhanced chest computed tomography (CT) was proven to be a very sensitive tool to an early diagnosis, for monitoring the abnormalities evolution and predicting complications in patients with coronavirus disease 2019 (COVID-19). We're reporting the case of a 62 years old man with a recent history of traveling from an endemic country, who presented cough, asthenia and a high grade fever. The real-time polymerase chain reaction (RT-PCR) test was posistive and the chest CT at admission showed bilateral and patchy consolidation with a prominent peripherally subpleural distribution, and preferred posterior and lower lobe predilection, which was suggestive of COVID-19 infection, it also showed calcifications within the pathological area which is very uncommon. The patient were treated with hydroxychloroquine in combination with Azithromycin, with a very satisfying evolution. We present this case to discuss the possible theories explaining the association of calcifications with the virus-induced pulmonary injuries and highlight the possibility that the virus tends to graft on a pathological parenchyma.*

Keywords: COVID 19, Imaging, CT, calcifications, pandemic.

Introduction :

On December 2019, many cases of an unknown pneumonia emmerged in the provence of Hubei. After epidemiologic researches and deep sequencing analysis from lower respiratory tract samples, the results lead to a novel coronavirus, which was named 2019 Novel Coronavirus (2019-nCoV).

In a short amount of time and due to globalization, a pandemic was declared and by April 15 th, there were 1 914 916 confirmed cases with 2019-nCoV (COVID-19) pneumonia worldwild and 123 010 deaths [1].

All the researches were into finding the most sensitive tool to an early diagnosis to facilitate clinical decisions and treatment.

Even if the Real time polymerase chain reaction (RT-PCR) test is still considered as the reference in the diagnosis of COVID-19 [2,3], non-enhanced chest CT imaging may be a more sensitive, practical, and rapid tool to diagnose COVID-19 [3-5]. The most common CT findings are ground-glass opacity (GGO) , reticulations, crazing paving , and consolidations [4-9], with multifocal, bilateral, patchy and peripheral sub-pleural distribution and a posterior predilection at the lower lung lobes [5,7,9, 10].

Observation :

We are reporting the case of a 62-year-old man with a history of chronic smoking wand recent traveling from an endemic country , who was admitted to our emergency department for a fever (temperatures over 39.5°C), cough, and asthenia for 13 days.
The patient has no history of respiratory desease, of professional or environmental allergen exposure.

On presentation, the patient's vital signs were stable, his blood pressure was 125/66 mmHg, pulse was 95/min, respiratory rate was 15/min, oxygen saturation was 98% on room air.

Results of his physical examination included bilateral coarse breath sounds with wet rales distributed at the bases of both lungs were heard on auscultation. The remaining examination was inconspicuous.

Laboratory studies showed a normal white blood cell count, 7.5 103 /mL) , lymphopenia (lymphocyte cell count 0. 59 10^3/L) and a high rate of C-reactive protein (84 mg/L; normal range, 0–10 mg/L). All the additional laboratory tests were normal . Real time polymerase chain reaction (RT-PCR) of the patient's sputum was positive for the 2019-nCoV nucleic acid.

Chest computed tomography (CT) with multi-planar reconstruction was done immediatly after his admission, and showed bilateral and patchy consolidation with a prominent peripherally subpleural distribution, and preferred posterior and lower lobe predilection (figure 2) and a mild involvment (25-50% of total parenchyma). This abnormalities were associated with reticulations and bronchiolectasia in the pathological areas (figure 3). A close analysis to the mediastinal window showed calcifications within

the pathological area with no calcifications in the normal parenchyma (figure 1b). To our knowledge, no other case of calcifications in covid patients chest CT was reported.

The treatment consisted on the association of choloquine 500 g x 2/ day and azithromycine 250 mg.

Within the next 4 days, the evolution was satisfying with a total regression of the symptoms.

5 days after the baseline CT, another chest CT was realised, and showed a healing of the consolidations was replaced by ground-glass opacities with the percistency of the calcifications (figure 4)

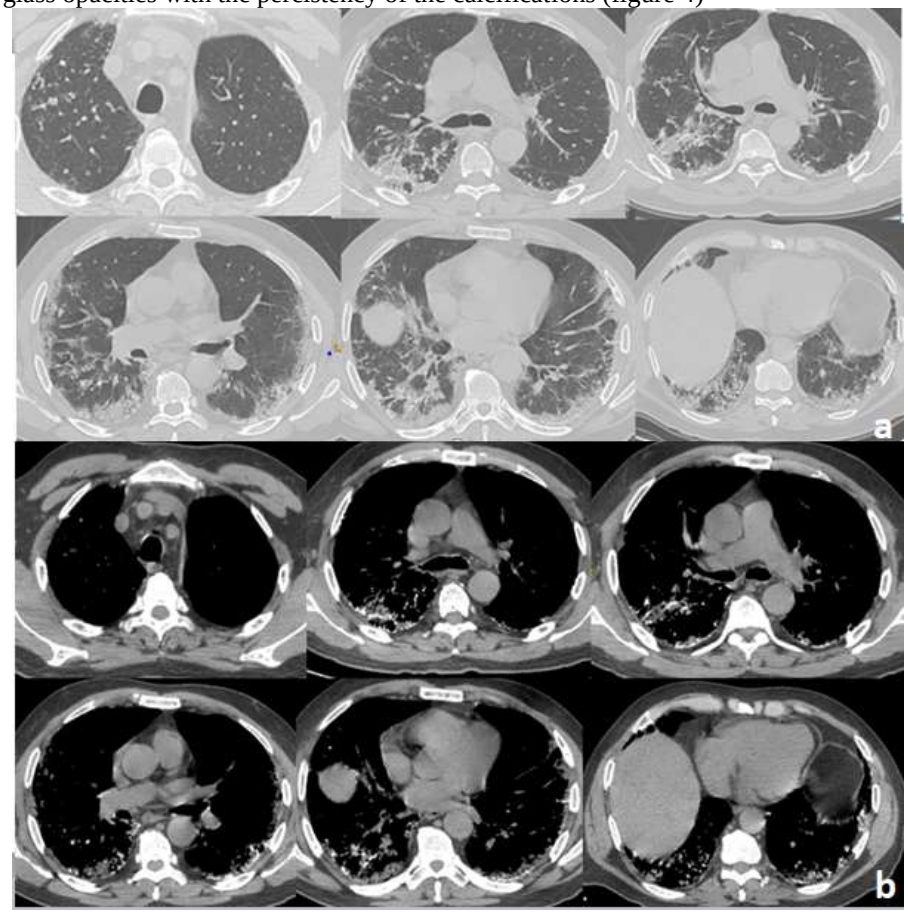

Figure 1 : Axial thin-section unenhanced baseline CT scan(a) axial parenchymal window showed bilateral and patchy consolidation with a prominent peripherally subpleural distribution associated to reticulations in the lower lobes, (b) mediastinal window showing the calcifications within the pathologic area.

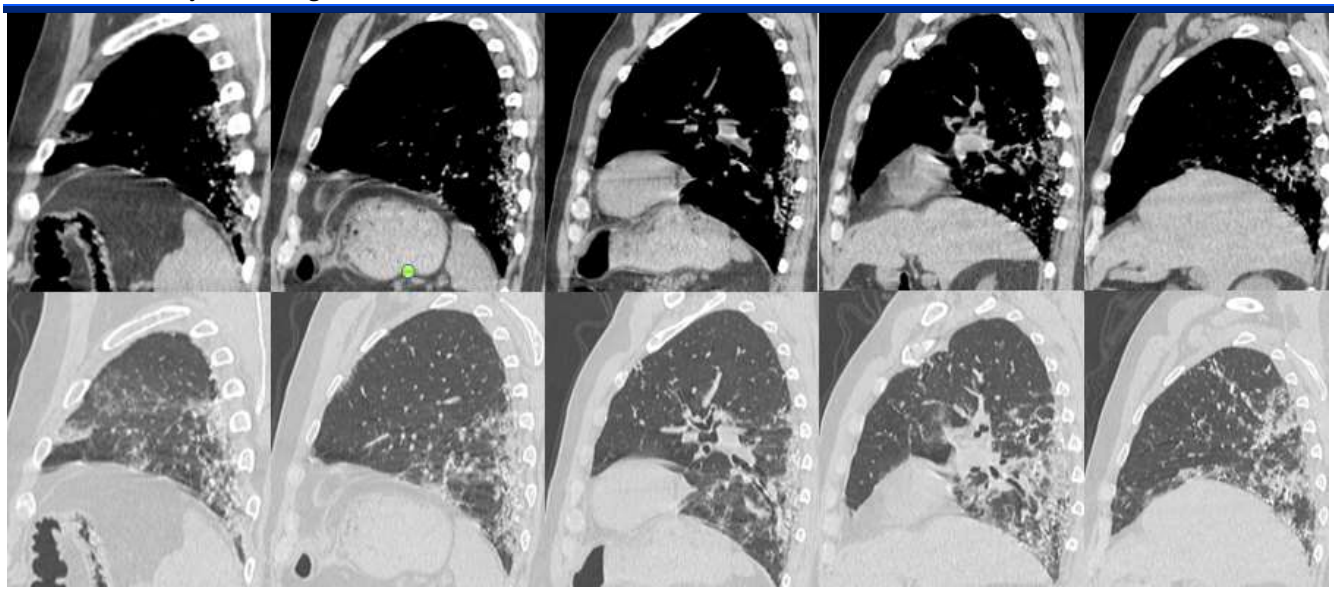

Figure 2 : sagital thin-section unenhanced baseline CT scan showed bilateral and patchy consolidation with a prominent peripherally subpleural distribution, and preferred posterior and lower lobe.

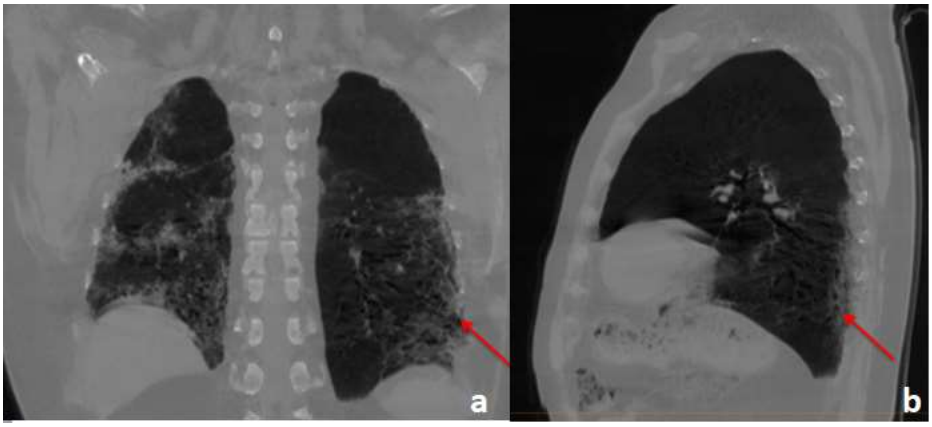

Figure 3. Coronal (a) and sagital (b) thin-section unenhanced baseline CT with minimum intensity projection (MinIP) showing bronchiolectasia in the pathological areas (red arrows)

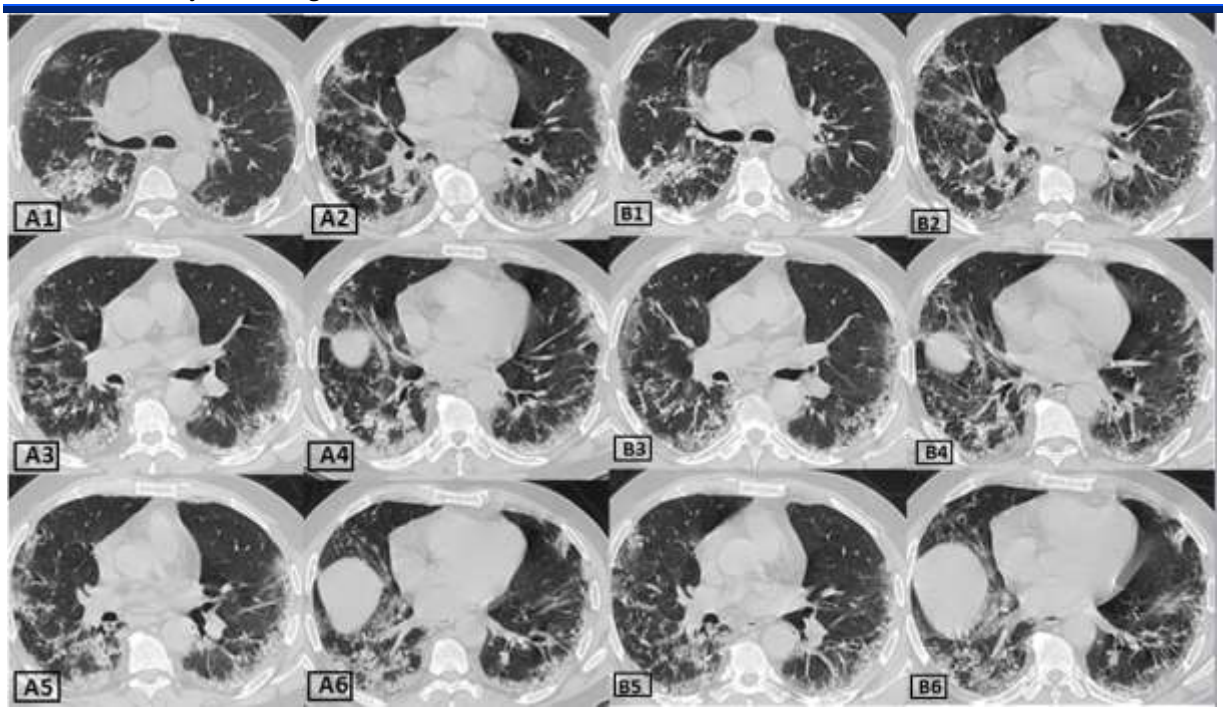

Figure 4 : Baseline Scan obtained on illness days 13 in (A1, A2, A3, A4, A5 A6) comparing to , Scan obtained on illness days 19 in (B1, B2, B3, B4, B5, B6) all images have the same window level and window width: showing a partial absorption of abnormalities, with ground-glass opacity replacing consolidation.

Tableau 1: Etiologies of pulmonary ossifications.

Primary injury	Idiopathic pulmonary ossification
Pre-existing lung injury	- Idiopathic pulmonary fibrosis -usual interstitial pneumonia - nonspecific interstitial pneumonia - Asbestosis - Interstitial lung fibrosis following busulfan therapy - Respiratory distress syndrome - Sarcoidosis - Silicosis - Histoplasmosis - Tuberculosis - Amyloidosis - Metastasis(melanoma, breast cancer, osteogenic sarcoma colorectal, adenocarcinoma
Pre-existing heart diseas	- Mitral stenosis - Chronic left ventricular stenosis - Idiopatic hypertrophic subartic stenosis
Pre-existing noncardiopulmonary conditions	- Chronic kidney failure - Hemodialysis - Hyperparathyroidism - Diabetes mellitus - Rheumatism arthritis - Congenital protein C deficiency disorders - Hypervitaminosis - Calcitonin producing tumors

	- Myeloblastic leukemia - Hypercalcemia - Acromegaly

Discussion:

With the growth of the new cases of COVID-19 every day, the number of chest CTs in those suspected of infection are increasing. In fact, even if RT-PCR test is still considered as the reference in the diagnosis of COVID-19 [2,3], many papers showed that its sensitivity was pretty low, especially at the early stages [2,3]. This means that many patients may be misdiagnosed and may not be treated in the right time and even be a threat to the community. In this perspective, many studies showed that Compared to RT-PCR, chest CT imaging may be a more sensitive, practical, and rapid to diagnose COVID-19 [3-5].

In the literature, the most common CT findings were ground-glass opacity (GGO) , reticulations, crazing paving , and consolidations [4-9], which are multifocal, bilateral, patchy with a peripheral sub-pleural distribution and a posterior predilection at the lower lung lobes [5,7,9, 10], which is similar to our presented case.

Regarding the evolution of the infection and its radiological expression, the changes of the chest CT manifestations were proved to follow a specific pattern, which might predict the progression, the risk of potential complications or the recovery of the illness [5-8]. In fact, some papers described 4 stages. An Early stage (0-4 days) with GGO as the main radiological demonstration distributed subpleurally in the lower lobes unilaterally or bilaterally. Then, A progressive stage (5-8 days after the initial symptom) with an extension of the lesions to a bilateral multi-lobe distribution with diffuse GGO, crazy-paving pattern and consolidation. Then, a peak stage (9-13 days) in which dense consolidations became more prevalent in association to crazy-paving pattern, consolidation, and residual parenchymal bands.

The last stage called the absorption stage (≥ 14 days after the onset of the initial symptom) during which consolidation is gradually absorbed and extensive GGO is observed as a result of consolidation absorption

According to this staging, our patient baseline CT scan match the peak stage since consolidations and reticulations are the most prevalent patterns and the time limit of CT realization was 13 days after the initial symptom, while the second CT scan correspond to the absorption stage since the consolidation was disappearing.

In addition to the common patterns described above, a close analysis at the mediastinal window in our patient CT showed an uncommon pattern which is calcifications within the pathological area (figure 1b), which lead us to look for some similar cases in the literature. But to our knowledge, no other similar case was reported.

Since this virus is an emerging health problem, the pulmonary sequella and consequences on the pulmonary parenchyma are not clear yet. Thus, many papers showed a great evolution with vanishing pulmonary pattern on CT [6,7,12], some had predicted a high risk of evolution towards fibrosis for patients with a severe acute respiratory syndrome (SARD) [13-16].

With regard to this finding, 2 hypothesis were made.

1- Our patient may have had preexisting calcifications due to an underlying disease. In fact, pulmonary ossification can be found in much pathology, like tuberculosis, fibrosing interstitial lung diseases and heart diseases (tableau 1) [17, 18, 19]. Its pathogenesis is unclear, but may be associated with chronic inflammation and resulting anoxia, which leads to an acidic environment that produces free radical propagation, inducing fibroblastic proliferation, followed by metaplastic osseous formation within the pulmonary interstitium [17, 20]

   Thinking about the range of differential diagnosis, the preferential superimposition of nodules on the background of fibrosing in our case eliminates pulmonary tuberculosis and other granulomatous diseases. Heart diseases had also been eliminated since a Doppler echocardiography was done and turned out to be normal.

   On the other hand, the presence of calcifications in the bibasilar lung periphery superimposed on predominantly sub pleural pulmonary of reticulations and bronchiolectasia in the pathological area, may lead us to think that this pulmonary ossification may be related to a fibrosing interstitial lung disease like usual interstitial pneumonia (UIP) [17, 19] even if our patient is asymptomatic.

   Thus, if we consider reticulations and calcifications as pre-existing abnormalities, the superimposed covid induced consolidations is no coincidence. It may simply indicate that covid 19 tends to graft on a pathological parenchyma.

2- The second hypothesis is that reticulations and calcifications are new appearing patterns. In fact, viral pneumonia can often be responsible of pulmonary fibrosis. Since The Covid 19 virus has many similarities with the Severe Acute Respiratory Syndrome Virus(SARS), sharing 79,5% of the same genetic sequencing [13], many papers are predicting a possible evolution towards fibrosis [13,15,16], especially in patient who develop acute respiratory distress syndrome (ARDS) [13,15], which is not our patient case. This was as a result to the aberrant and excessive immune responses and the cytokine storm leading to long-term lung damage then fibrosis [13-16]. By analogy to the SARS complications, the timeline for the fibrosis development is 3 to 6 months and at least 1 month for some severe cases [13]. Regarding our patient clinical history, this hypothesis is very unlikely to be true since reticulations and calcifications were already present in the very early stages.

Conclusion:

The non-enhanced chest computed tomography (CT) was proven to be a very sensitive tool to an early diagnosis, for monitoring the abnormalities evolution and predicting complications in patients with coronavirus disease 2019 (COVID-19). With regard to our case, what can be concluded is that the virus can be more aggressive and may tend to graft on a pathological parenchyma. However, clinical and radiological data on COVID-19 infection evolution are still very limited and the pulmonary sequella and consequences on the pulmonary parenchyma are not clear yet.

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