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Case Study

Imaging a Single COVID-19 Patient-Patterns of Pulmonary Damage

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Abstract

Covid-19 disease has exhibited devastating outreach with regards to damage to lungs and other body systems. In the course of illness with the SARS-CoV-2 virus pneumonia, patients may develop overlapping complications which can be a result of disease and/or the treatment modalities. We hereby describe the imaging features due to multiple complications in one of our fortunate patients who had developed alveolar air leak (Pneumomediastinum/Pneumopericardium), pulmonary embolism in addition to Pneumonia.

Keywords: *COVID-19; Pulmonary Damage; Pneumomediastinum; Ground Glass Opacities; Bronchiectasis*

Introduction

The world at large is presently in the grip of waves of the coronavirus disease (COVID-19) by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2 virus), since declared a pandemic as early 2020. Radiological imaging, especially the thin slice Computerised tomography (CT), has an important role in the diagnosis and management of patients with COVID-19 pneumonia. Chest CT findings can vary according to the stage of the pneumonia and its severity. It can also detect the many complications of COVID-19 pneumonia like pneumothorax, pneumomediastinum, pulmonary embolism etc.

In the course of managing the pandemic, we encountered a 48-year-old male patient who developed severe COVID-19 pneumonia. In the course of his illness, he developed a spectrum of some typical and atypical complications. In addition to a severe pneumonia he subsequently developed spontaneous emphysema, pneumomediastinum, pneumopericardium and subsequently a pulmonary embolism. He ultimately survived to tell his tale.

This document is a brief commentary on the common and uncommon imaging signs and patterns on CT scan of a that single patient. If detected early, these patterns and signs can be used to predict the etiology, pathophysiological mechanism and probably use to optimize patient management.

Ground glass opacities (GGO) and "Headcheese sign"

Ground glass opacities (GGO) are recognised as nonspecific high attenuation of the lung parenchyma in view of decrease air content or partial effacement due to exudates in the alveolar area and seen as increased whiteness but not enough to complete obscure lung mark-

ings which gives a ground glass appearance (Figure 1). In Covid-19 Pneumonia the locations can be bilateral but can also be unilateral, more often in peripheral lung fields [1].

Figure 1

The name "headcheese" derived from the European dish of meat pieces refers to heterogeneous mosaic appearance of thorax secondary to patchy infiltration of inflammatory cells in parenchyma (ground glass opacity) interspersed by normal lung (Figure 1) [2]. This sign is very specific for hypersensitivity pneumonitis; however it can also be seen in atypical infections associated with bronchiolitis [3].

"Subcutaneous-emphysema"

Subcutaneous emphysema (SE) if formed when air enters into the tissues underneath the skin and soft tissues (Figure 2). This condition is usually seen in the soft tissues of the chest wall/neck however can also be found in other areas/parts of the body surface. It usually results from many varied conditions like trauma- blunt or penetrating, pneumothorax, barotrauma, atypical infections, malignancy, a complication of surgical procedure or even in some cases spontaneous [4].

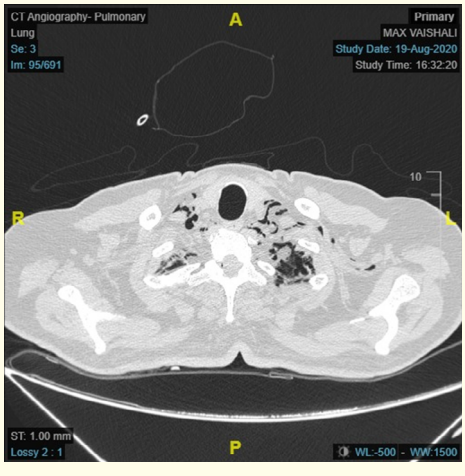

Figure 2

Pneumorachis

Pneumorrhachis, a phenomenon of air within the spinal canal, in the extradural space; in the intradural space; or in the subarachnoid space is a rare benign condition following traumatic, non-traumatic and iatrogenic causes (Figure 3). It is usually incidentally detected during radiological investigations [5]. There are very rare reports of the combined occurrence of pneumomediastinum and extradural pneumorrhachis not associated with thoracic injury in the published literature and never been described in the ongoing COVID-19 pandemic [6].

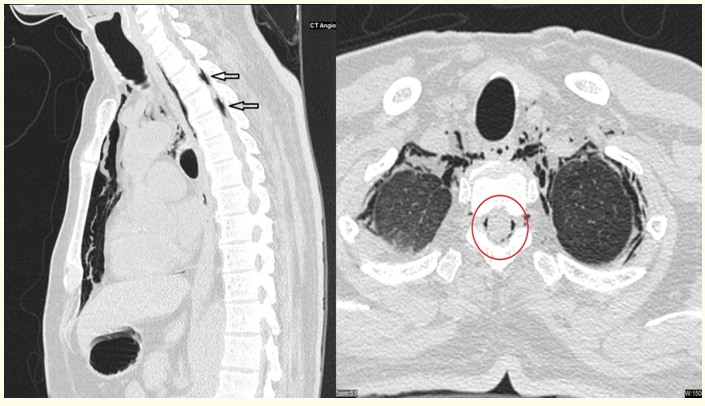

Figure 3

Pneumopericardium- Continuous diaphragm sign

Pneumopericardium is usually manifested as a single band of gas which may outline both the right atrium and the left ventricle and the right atrium. The band is curved and sharply marginates the pericardial sac and may completely surround the heart. If large enough it forms a lucency overlying the ascending aorta and pulmonary artery and can be seen in the base as a "continuous diaphragm sign" (Figure 4) [7].

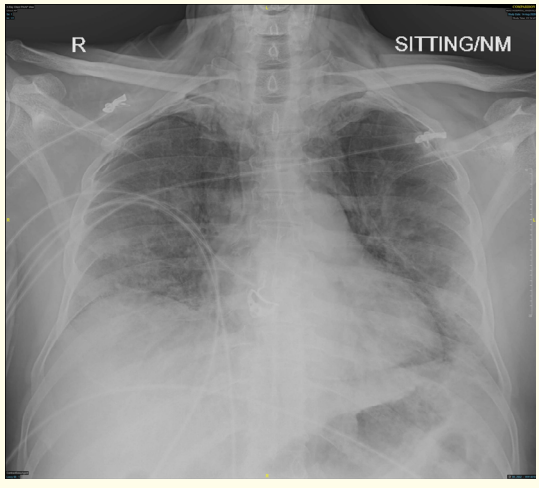

Figure 4

Flying eagle sign

In cases of pericardial effusion, the area between ascending aorta and Pulmonary trunk gets bulging giving rise to Bikini sign or Bikini Bottom, however in our case presence of air in the same recess looked like flying bird and therefore we propose it to be labelled as "Flying eagle sign" (Figure 5).

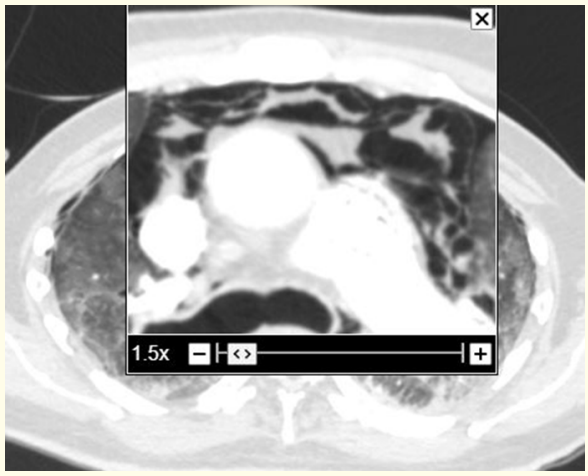

Figure 5

Arcade sign

It refers to the "arch" like pattern made by perilobular fibrosis seen in more than half of patients in cryptogenic organizing pneumonia. It is seen as curved or arched bands of consolidation dispersed around structures surrounding the secondary pulmonary lobules. This similar pattern was seen in our patient as part of organizing pneumonia following recovery from COVID-ARDS as demonstrated in figure 6.

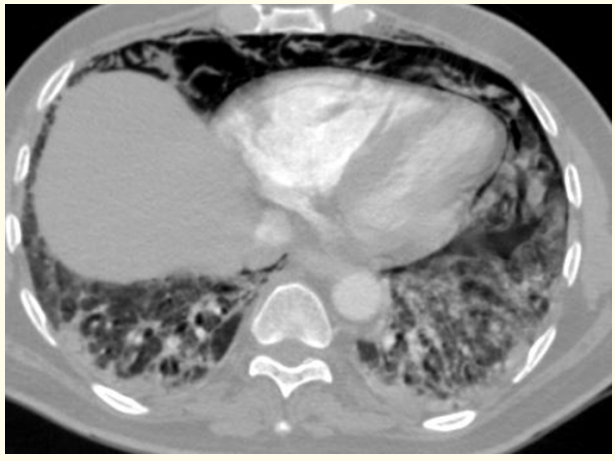

Figure 6

Interface sign

The interface sign usually encountered in fibrosing interstitial lung disease such as Usual interstitial pneumonia, Non-Specific interstitial lung disease and chronic hypersensitivity pneumonitis. In usual conditions the interface between the subpleural/mediastinal fat and pulmonary parenchyma appears linear and regular however in the case of an interstitial disease with a fibrous component, interstitial thickening with focal retractions of the pulmonary parenchyma can develop which can create irregularity of profiles in between lung parenchyma, bronchi, vessels or visceral pleura (Figure 7) [8]. COVID-19 pneumonia has been seen to developed fibrous component in healing stage and hence this sign can be observed also.

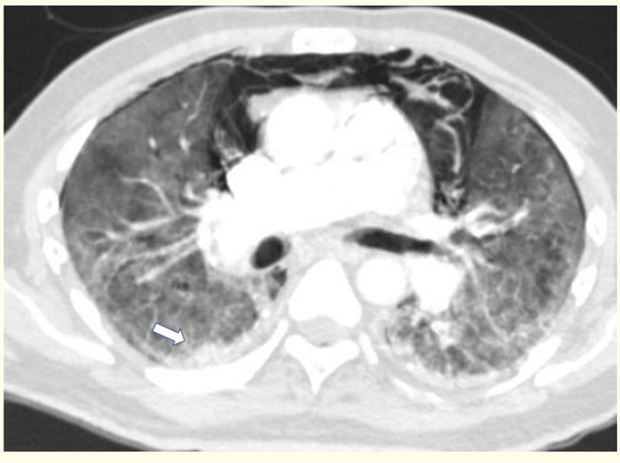

Figure 7

Tractional bronchiectasis

Tractional Bronchiectasis is typically a finding of usual interstitial pneumonitis/Pulmonary fibrosis but may also be seen in architectural destruction secondary to chronic infections like Pulmonary tuberculosis. Pulmonary parenchymal destruction and organizing pneumonia, interstitial fibrosis following COVID- ARDS can also culminate to traction bronchiectasis (Figure 8) [9].

Figure 8

Polo mint sign

The "polo mint sign" seen in acute pulmonary embolism, formed when the thrombosed vessel is seen on the axial plane was first described by Wittram., *et al*. in 2004. It is seen as contrast material surrounding a central filling defect giving an appearance of a "polo" candy in a contrast-enhanced CT examination (Figure 9) [10].

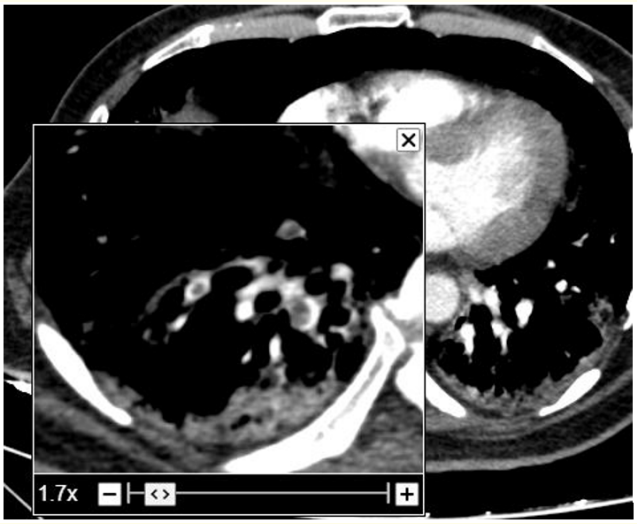

Figure 9

Conclusion

CT scan plays a pivotal role in the early diagnosis and management of COVID-19 pneumonia. A COVID-19 pneumonia patient can have a gamut of complications in the course of the disease in view of the inflammatory and thromboembolic nature of the disease. The purpose of this article is to describe common and uncommon imaging signs and patterns in a single COVID-ARDS patient and highlight the varying damage caused by COVID illness.

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Presentation at a Meeting

None.

Conflicting Interest

None.

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