



Case Report

IMAGING CHANGES IN A PATIENT WITH COVID-19 PNEUMONIA AND EARLY COMPLICATIONS: CASE REPORT

M. Mitev^{1,2*}

¹Department of Medical Physics, Biophysics, Roentgenology and Radiology, Faculty of Medicine, Trakia University, Stara Zagora,

²Department of Diagnostic Imaging, University Hospital 'Prof. Dr. Stoyan Kirkovich', Stara Zagora, Bulgaria

ABSTRACT

BACKGROUND: Imaging changes from the Covid-19 pandemic are important and interesting for the diagnostic workup in clinical practice. **AIMS:** We present a case of rapidly occurring early complications in a patient with Covid-19, type SARS-CoV-2, followed by a progressive deterioration with comorbidities. **METHODS:** The subject, a 59-year-old Covid-19 man, also presented with astheno-adynamic, febrile intoxication, and broncho-pulmonary syndrome. Imaging changes were monitored by performing radiographs and CT. **RESULTS:** As a result of the diagnostic imaging study, we established progressive infiltrative-inflammatory changes, accompanied by bilateral massive consolidation areas affecting approximately 75% of the lung parenchyma. Interstitial and alveolar components were also observed, corresponding to the 4th stage of COVID-19 infection. **CONCLUSIONS:** Low-dose CT protocols are recommended for diagnosing early manifestations of the disease, staging in later phases, and detecting both early and late complications.

Keywords: CT, hypertension, pericardial effusion, pneumothorax, SARS-CoV-2

INTRODUCTION

SARS-CoV-2 has affected millions of people worldwide. The infection and its subsequent early and rapid complications have posed a serious challenge in diagnostic and clinical practice. These complications were also the subject of numerous studies (1-3, 4-10, etc.). Despite significant advances in experiential knowledge, there is still a need and interest in developing diagnostic studies of both short-term and long-term resulting pathologies (1). Spontaneous pneumothorax has been reported as a specific and potentially life-threatening complication in patients with SARS (2). Computed tomography (CT) of the chest and CT pulmonary angiography (CTPA) are established as highly sensitive methods for

determining the pulmonary characteristics and complications of Covid-19 (10).

The aim of this study is to describe a case of rapidly occurring early complications in a patient with Covid-19, caused by SARS-CoV-2. His progressively deteriorating condition with comorbidities was diagnosed with radiographs and computed tomography (CT).

CASE REPORT

A 59-year-old man was identified with Covid-19, type SARS-CoV-2 and admitted to the Clinic of Infectious Diseases with pronounced astheno-adynamic, febrile-intoxication and broncho-pulmonary syndrome. For the diagnostic process, radiographs and subsequent CT examinations were prescribed and performed. The radiographs were taken with a mobile X-ray system for imaging "ARMAN" 10 L5. CT examinations were conducted using a 64-MDCT Siemens model Definition AS with subsequent post-processing reconstructions in coronal and sagittal views. The images were interpreted on a Singo.via VB60 workstation.

***Correspondence to:** Assoc. Prof. Dr. Mitko Mitev, DM, Department of Medical Physics, Biophysics, Roentgenology and Radiology, Faculty of Medicine, Trakia University – Stara Zagora, Department of Diagnostic Imaging, University Hospital "Prof. Dr. Stoyan Kirkovich", 11 Armejska Str., 6000 Stara Zagora, Bulgaria, Mobile: +359 887 706 079, E-mail: mitev.mitko69@gmail.com

The first radiograph (**Figure 1**) shows an enhanced striated-reticular pattern with changes more pronounced peripherally and in the right lung in apical and basal positions. Bilateral “ground glass” changes are found in the parietal and basal positions. The costophrenic sinuses are

free. The cardiovascular shadow exhibits an elongated left ventricular arch and an elongated ascending aortic arch, characterised by a pronounced cardiac waist. A characteristic configuration for a hypertensive heart is registered.

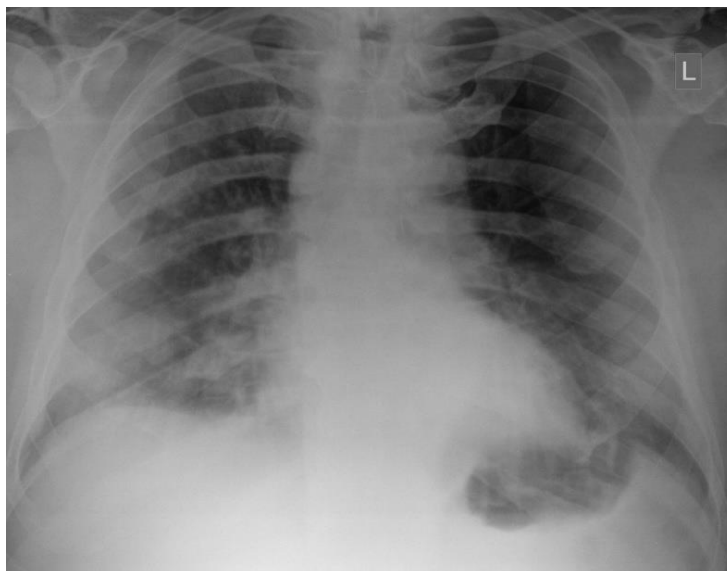


Figure 1. Frontal radiograph – frontal chest radiograph.
Streaky reticular changes in Covid-19 SARS-CoV-2. Hypertensive CVS.

A subsequent control radiograph (**Figure 2**) shows progression of the changes with bilateral small and medium-spotted shadows likely to converge, and the presence of an enhanced reticular interstitial pattern. The hila are enlarged and hypervolemic. The changes resemble those of bilateral pneumonic infiltrates associated with COVID-19 infection in progress. More intense

“ground glass” type changes with particularly pronounced medium and small spotty confounding shadows is found. In the left parietal region, a weak shadow is visible without any air content type structures. The mediastinal shadow is slightly shifted to the right which indicates partial pneumothorax and bilateral progressive infiltrative inflammatory changes.

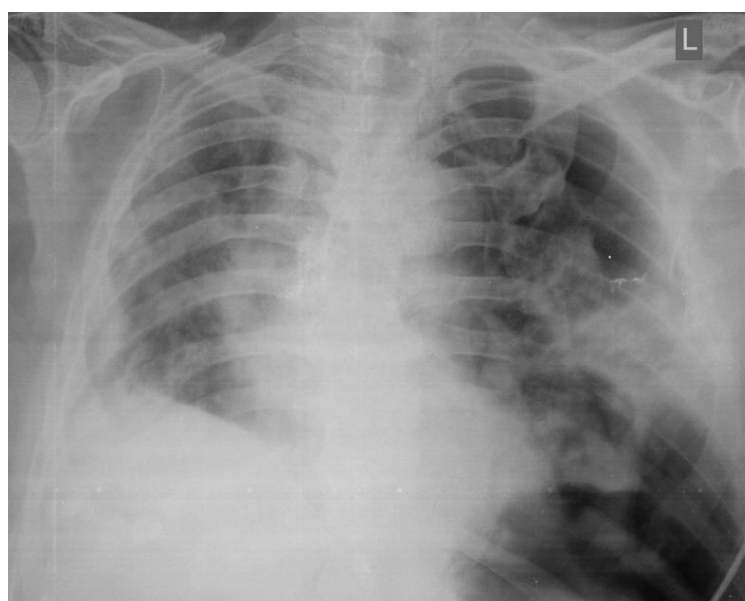


Figure 2. Frontal chest radiograph.
Progression of infiltrative inflammatory changes in COVID-19 SARS CoV-2 with the presence of a partial pneumothorax on the left.

As a result of the identified changes, computed tomography is preferred as a higher resolution method for the comprehensive assessment of the chest condition (**Figures 3-7**). The performed study shows bilateral massive areas of consolidation of the parenchyma in places with a visible bronchogram, peribronchial and perivascular opacities with fuzzy outlines and physomatous changes in the few preserved areas with normal parenchyma. There are pronounced changes of the “ground glass” type and an interstitial pattern enhanced with deformed architectonics, forming a pattern with indistinct outlines. In the left parietal and basal area, a detachment of more than 3 cm of the visceral from the parietal pleura and a structureless zone with air equivalent content are visible. The mediastinum is displaced to the right. Single significantly enlarged paratracheal lymph nodes sized up to 11-13 mm are visible.

The heart has a dilated left ventricle and an elongated ascending aorta. A small amount of fluid-equivalent collection could be seen between the pericardial sheets with axial dimensions in the right recess of 6 mm. The examination shows progressive infiltrative-inflammatory changes accompanied by bilateral massive areas of consolidation of the parenchyma. The changes have interstitial and alveolar components, involving about 75% of the lung parenchyma and correlating with the 4th stage of Covid-19 infection. Compensatory emphysematous changes are present in the preserved areas. They are in progress compared to the previous radiographs. The presence of secondary spontaneous partial pneumothorax on the left and a small pericardial effusion is also established. The heart has a hypertensive configuration.

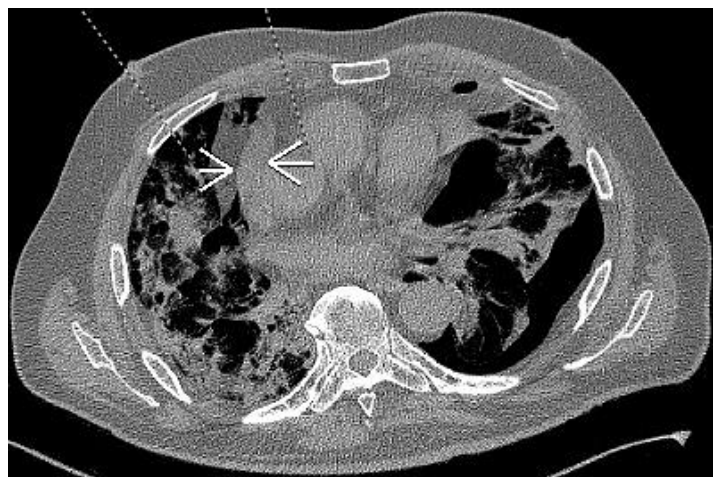


Figure 3. CT axial image.

Covid-19, four stages, partial pneumothorax on the left and pericardial effusion.

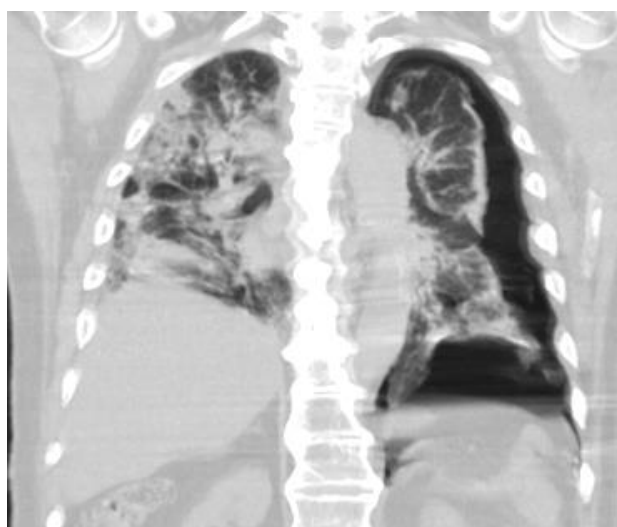


Figure 4. CT reconstruction in the coronal plane.

Bilateral massive areas of parenchymal consolidation - Covid-19, four stages, partial pneumothorax on the left

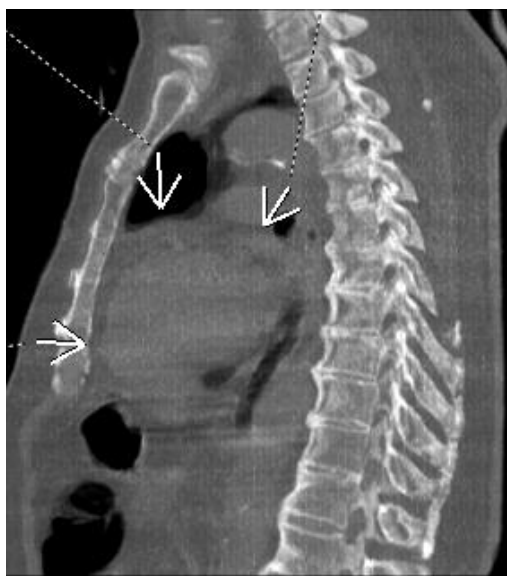


Figure 5. sagittal reconstruction.
Pericardial effusion in Covid-19 SARS-CoV-2

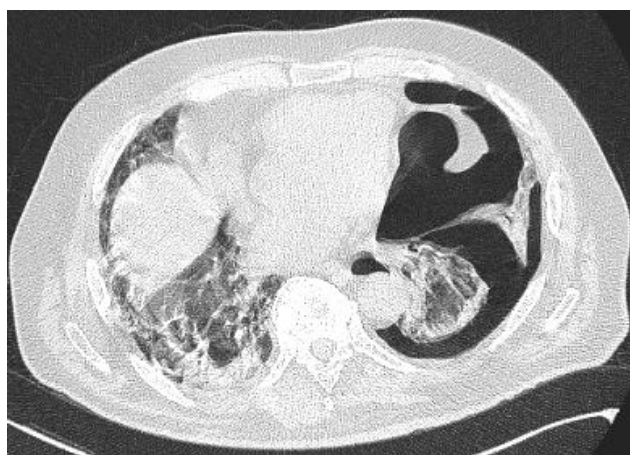


Figure 6. CT, axial image.
Covid-19, stage 4, left pneumothorax in progress.

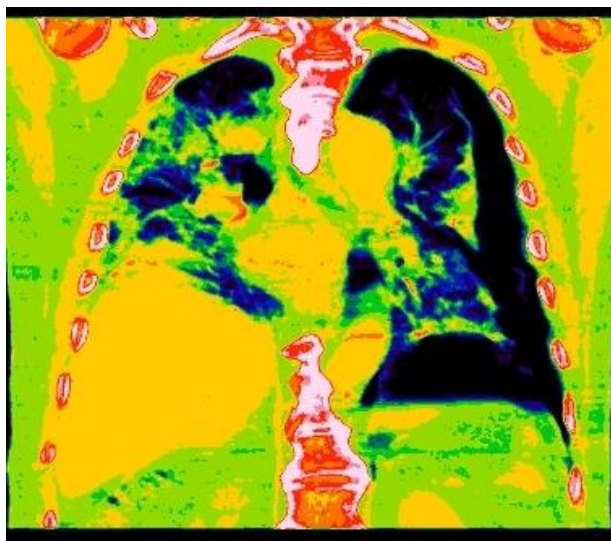


Figure 7. Colour coronary reconstruction.
Bilateral massive areas of parenchymal consolidation - Covid-19, stage 4, left partial pneumothorax.
Compensatory emphysema

DISCUSSION

Imaging studies, radiographs and CT scans reveal rapid progression of the patient's disease. Rapidly occurring complications, such as pneumothorax and reactive pericardial effusion are identified. Pneumothorax is caused by an increase in tension pressure with rupture of the alveoli from infiltrative-inflammatory changes and interstitial emphysema. This leads to a rapid deterioration of the patient's condition and the development of severe acute respiratory syndrome from alveolar hypoventilation and developing hypoxemia.

The complication is reported as very rare, occurring in 1–1.7% of cases, and also serves as a negative marker for survival (2). In some cases, it is observed in up to 2% of all patients (3). The complication is reported in both non-intubated and mechanically ventilated subjects (11). Other studies report pneumothorax in 15% of mechanically ventilated patients (12). Martinellii et al. have found a higher incidence of pneumothorax in men over 50 years of age and a more common right-sided pneumothorax (6). More in-depth investigation of pneumothorax as a serious complication after Covid-19 has been initiated by Hadzhiminev (7). In the present study, a left-sided pneumothorax has been described.

CONCLUSION

Among the imaging modalities used, radiography produces a summation image with lower spatial resolution. Due to the dynamic development of the disease, and to expand the diagnostic algorithm, the patient was referred for computed tomography - a method with higher resolution and higher diagnostic value, allowing for a comprehensive assessment. The progression of the disease and the additional complications, i.e. the pericardial effusion and the degree of pneumothorax were determined. They do not appear with greater accuracy on the radiographs due to the superposition of the structures. Radiographs cannot visualise the initial changes in the lung parenchyma in the earliest stages of the disease. Therefore, it is appropriate to use CT with low-dose protocols, which favours the diagnosis of early manifestations of the disease, staging in later phases and the early and late complications that have occurred. Secondary comorbidities, the body's individual response, and rapid complications can explain the fast progression of the disease and are a poor prognostic sign.

REFERENCES

- Desai, A.D., Lavelle, M., Boursiquot, B.C. and Wan, E.Y., Long-term complications of COVID-19. *American Journal of Physiology-Cell Physiology*, 322(1):C1-C11, 2021.
- Sihoe, A.D.L., Wong, R.H.L., Lee, A.T.H., Lau, L.S., Leung, N.Y.Y., Law, K.I. and Yim, A.P.S., Severe acute respiratory syndrome complicated by spontaneous pneumothorax. *Chest*, 125:2345-2351, 2004.
- Xu, Z., Shi, L., Wang, Y., Zhang, J., Huang, L., Zhang, C., Liu, S., Zhao, P., Liu, H., Zhu, L., Tai, Y., Bai, C., Gao, T., Song, J., Xia, P., Dong, J., Zhao, J., and Wang, F-S., Pathological findings of COVID-19 associated with acute respiratory distress syndrome. *Lancet. Respir. Med.*, 8:420-422, 2020.
- Murayama, S. and Gobo, S., Spontaneous pneumomediastinum and Macklin effect. Overview and appearance on computed tomography. *World L. Radiol.*, 6:850-854, 2024.
- Hadzhiminev, V D., Secondary spontaneous pneumothorax – a study on diagnostic and therapeutic behaviour. PhD Thesis, Plovdiv, 2022.
- Azer, S.A., COVID-19: pathophysiology, diagnosis, complications and investigational therapies. *New Microbes and New Infections*, 37:100738, 2020.
- Coelho-Oliveira, A.C., Taiar, R., Jaques-Albuquerque, L.T., Valerio-Penha, A.G., Reis-Silva, A., Ferreira-Sonza, L.F., de Sa-Caputo, D., Barbardo-Filho, M., SPECT/CT Scan Images to Evaluate COVID-19 Pulmonary Complications: A Systematic Review. *Int. J. Environ. Res. Public Health*, 22(2):308, 2025.
- Yoon, S.H., Kanne, J. P., Albusawa, K., Biederer, J., Castaner, E., Fan, L., Frauenfelder, T., Chaye, B., Henry, T.S., Huang, Y-S., Jeong, Y.J., Kay, F.U., Kligerman, S., Ko, J.P., Parkar, A.P., Piyavisetpat, N., Plosch, H., Raptis, C.A., Simpson, S., Tanaka, N., Brown, K., Inone, Y., Sandbo, N. Risheldi, L. and Larici, A.R., Best Practice: International Multisociety Consensus Statement for Post-COVID-19 Residual Abnormalities on Chest CT Scan. *Radiology*, 316(1):e243374, 2025.
- Lin, H., Zhao, M., She, C., Peng, H., Lin, M. and Li, B., Classification of CT scan and X-ray dataset based on deep learning and

- practice swarm optimisation. *PLOS ONE*, 20(1):e0317450, 2025.
10. Manyika, T., Mahomed, N. and Buthelezi, T., Computed tomography chest findings in hospitalised COVID-19 patients presenting with pulmonary complications. *Wits J. of Clinical Medicine*, 7(1):9-14, 2025.
 11. Chen, N., Zhou, M., Dong, H., Qu, J., Gong, F., Han, Y., Qiu, Y., Wang, J., Liu, Y., Wei, MITEV M. Y., Xia, J., Yu, T., Zhang, X. and Zhang, L., Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *Lancet*, 395:507-513, 2020.
 12. Yang, F., Shi, S., Zhu, J., Shi, J., Dai, K. and Chen, X., Analysis of 92 deceased patients with COVID-19. *J. Med. Virol.*, 92:2511-2515, 2020.