Case report

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RADIOGRAPHIC CHANGES IN ACUTE RESPIRATORY DISTRESS SYNDROME INDUCED BY COVID-19 SUCCESSFULLY TREATED WITH TOCILIZUMAB: CASE REPORT

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Acute respiratory distress syndrome (ARDS) is a possible complication of pneumonia. The prevalence of ARDS was high in severe COVID-19 pneumonia. Chest x-ray changes of ARDS are not typical. They are manifested by diffuse opacifications and consolidations. Considering that ARDS is the result of a cytokine storm, the immunomodulatory drugs are successfully used in therapy.

We presented a patient with severe COVID-19 pneumonia that rapidly progressed to ARDS. Chest x-ray showed striking bilateral inhomogeneous shadowing of the lung parenchyma, on the right complete, and on the left with relative displacement of the apex and part of the upper lung field. Progression of inflammation is manifested by a decrease in oxygen saturation and an increase in laboratory inflammatory parameters. After treatment with tocilizumab, there was rapid regression of radiographic changes and clinical improvement.

Keywords: chest X-ray, acute respiratory distress syndrome, COVID-19, tocilizumab

Prikaz bolesnika

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RADIOGRAFSKE PROMENE KOD AKUTNOG RESPIRATORNOG DISTRES SINDROMA NASTALOG ZBOG COVID-19 INFEKCIJE USPEŠNO LEČENOG TOCILIZUMABOM: PRIKAZ SLUČAJA

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Nastanak akutnog respiratornog distres sindroma (ARDS) je moguća komplikacija pneumonije. Uočena je visoka prevalenca ARDS-a kod teških COVID-19 pneumonija. Radiografske promene kod ARDS-a nisu tipične. Manifestuju se difuznim opacifikacijama i konsolidacijama. S obzirom da ARDS nastaje zbog pojave citokinske oluje, u terapiji se uspešno primenjuju imunomodulatorni lekovi.

U našem radu je prikazan pacijent sa teškom COVID-19 pneumonijom i rapidnom progresijom u ARDS. Radiografski snimak je prikazao izražena bilateralna nehomogena zasenčenja plućnog parenhima, desno kompletno, a levo uz relativnu poštedu apeksa i dela gornjeg plučnog režnja. Progresija upale manifestovana je padom kiseonične saturacije i porastom laboratorijskih upalnih parametara. Nakon terapije tocilizumabom, brzo je nastala regresija radiografskih promena i kliničko poboljšanje.

Ključne reči: radiografski nalaz, akutni respiratorni distres sindrom, COVID-19, tocilizumab

Introduction

In the first half of 2020, infection with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has converted into a global pandemic having different forms of presentation in patients, from asymptomatic cases to fatal outcomes. The most frequently described symptoms of infection were high body temperature, malaise, myalgias, cough, loss of sense of taste and smell (1).

Although the virus can cause multiorgan dysfunctions, the most common complication was pneumonia, the sequelae of which can last for several months (1, 2). COVID-19 pneumonia was most often mild. Severe pneumonia with the onset of acute respiratory distress syndrome (ARDS) has also been described (3). There are no typical radiographic changes in ARDS. The changes are seen as diffuse opacification caused by the accumulation of inflammatory contents in the alveoli (4). In the treatment of severe covid-19 pneumonia, immunosuppressive drugs, such as tocilizumab (TCZ), are used. In addition to influencing the clinical course and laboratory parameters, TCZ affects radiographic changes (5).

Case presentation

A seventy-four-year-old man was treated at the Uzice General Hospital in December 2023. The patient had a four-day history of fever up to 39°C, shortness of breath, headache, weakness and pains in muscles. Medical history indicated a ten-year history of cardiomyopathy, high blood pressure and Parkinson's disease, and diabetes mellitus for the last three years. He regularly took prescribed cardiological therapy and metformin. He was smoker for fifty years. He was not vaccinated against SARS CoV-2.

On admission to the hospital he was conscious, mobile, obese (body mass index of 34.4 kg/m2, febrile 38.5°C, with pulse rate of 110 bpm, blood pressure of 140/90 mmHg, 54 breaths/minute peripheral oxygen saturation (SpO2) 60% on room air, 94% on 15 L/minute O2 administered via a nasal cannula, cardiac compensated. On auscultation, late inspiratory crackles were audible on the lungs, basally and bilaterally. A rapid test for SARS CoV2 from a nasopharyngeal swab was negative, but polymerase chain reaction (PCR) test was positive.

Chest x-ray: (AP position, lying position): bilateral inhomogeneous shadowing of the lung parenchyma, on the right complete, and on the left with relative displacement of the apex and part of the upper lung field. The hemidiaphragms are not differentiated. Costopherenic sinuses shaded (Figure 1). Based on the CXR severity score (CXR-SS), the radiographic finding corresponded to very severe pneumonia (6).

Arterial blood gas (ABG) values were: acidity level (pH) of 7.4, partial pressure of oxygen (pO2) of 54 mmHg, partial pressure of carbon dioxide (pCO2) of 60 mmHg, bicarbonate level of 20 mEq/L and oxygen saturation level of 88%. Laboratory findings at admission showed lovered WBC 3.0 × 109/L (range (4.5-11.0 × 109/L), elevated glycemia 10.4 mmol/L (range 3.9-5.6 mmol/L) and inflammatory biomarkers: lactate dehydrogenase (LDH) 420 U/L (range 140-280 U/L), C-reactive protein (CRP) 125 (up to 10 mg/L), ferritin 590 (range 30-400 ng/mL), fibrinogen 8.0 (range 2.0-4.0 g/L), D-dimer 0.73 mg/mL (normal up to 0.5 mg/L), IL-6 21.8 pg/mL (normal up to 7 pg/mL).

Treatment with methylprednisolone (0.6mg/kg/day) and empiric antibiotic therapy (ceftiriaxone, chemomycin) was started immediately.

A few hours after admission, SpO2 drops to 84%, IL6 rises to 68 pg/mL, LDH 610 U/L, ferritin 640 ng/mL, CRP 205 mg/L, fibrinogen 8.0 g/L. He was kept on High Flow Nasal Cannula (HFNC) with a flow rate of 60 L/min and FiO2 of 100%. The patient was given TCZ 800 mg/day. The day after receiving th TCZ, the patient was afebrile, pO2 68 mmHg, pCO2 49 mmHg, bicarbonate level 30 mEq/L, IL6 75 pg/mL.

X-ray on the third day of hospitalization showed the significant regression of the changes. Diffuse patchy shadowing of the lung parenchyma can be seen on both sides (Figure 2).

On the fifth day of treatment, the patient was transferred to an oxygen mask, 12 L/min, with SpO2 97%. Inflammatory parameters were decreasing. (LDH 250 U/L, CRP 34 mg/L, ferritin 410 ng/mL, D-dimer 0.5 mg/L, fibrinogen 5 g/L, IL6 12 pg/mL), WBC 7.4 × 109/L. Oxygen support was reduced daily, and was used until the 10th day of hospitalization. He was discharged home after 13 days of treatment, with normal laboratory findings and normal ABG. X-ray at discharge showed a strip-linear shadow in the projection of the upper right lung field and a wavy left hemidiaphragm (Figure 3).

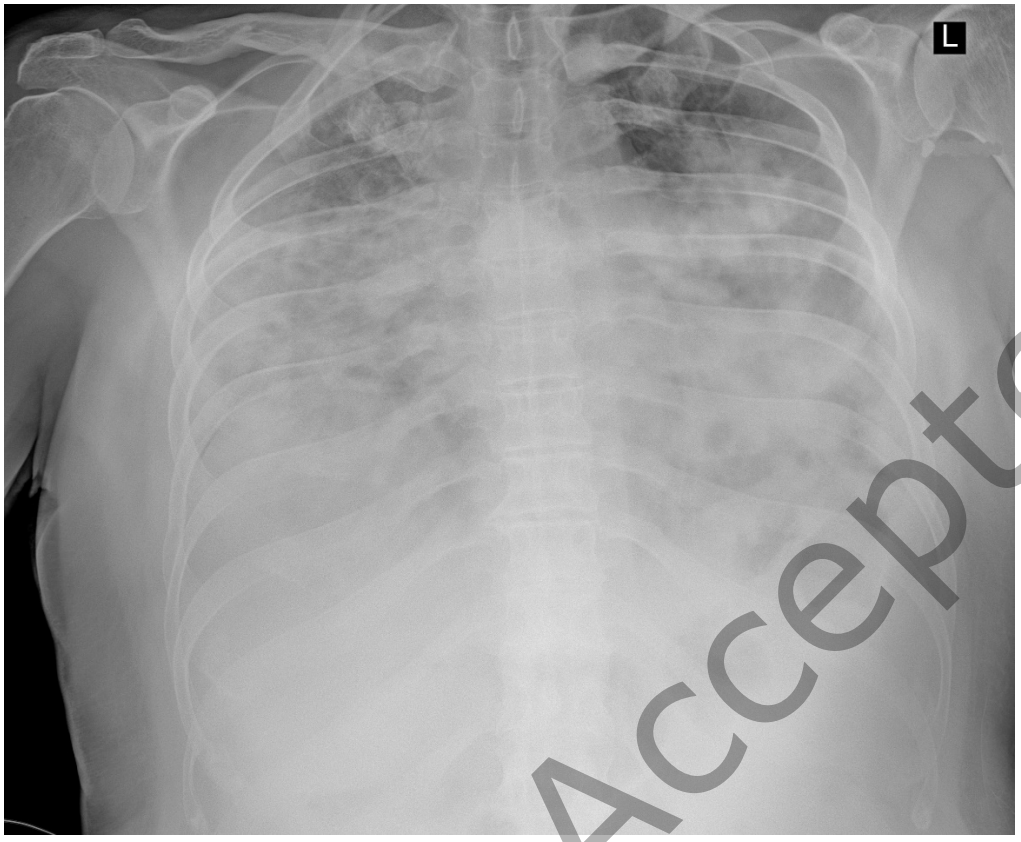

Figure 1. X-ray before tocilizumab therapy

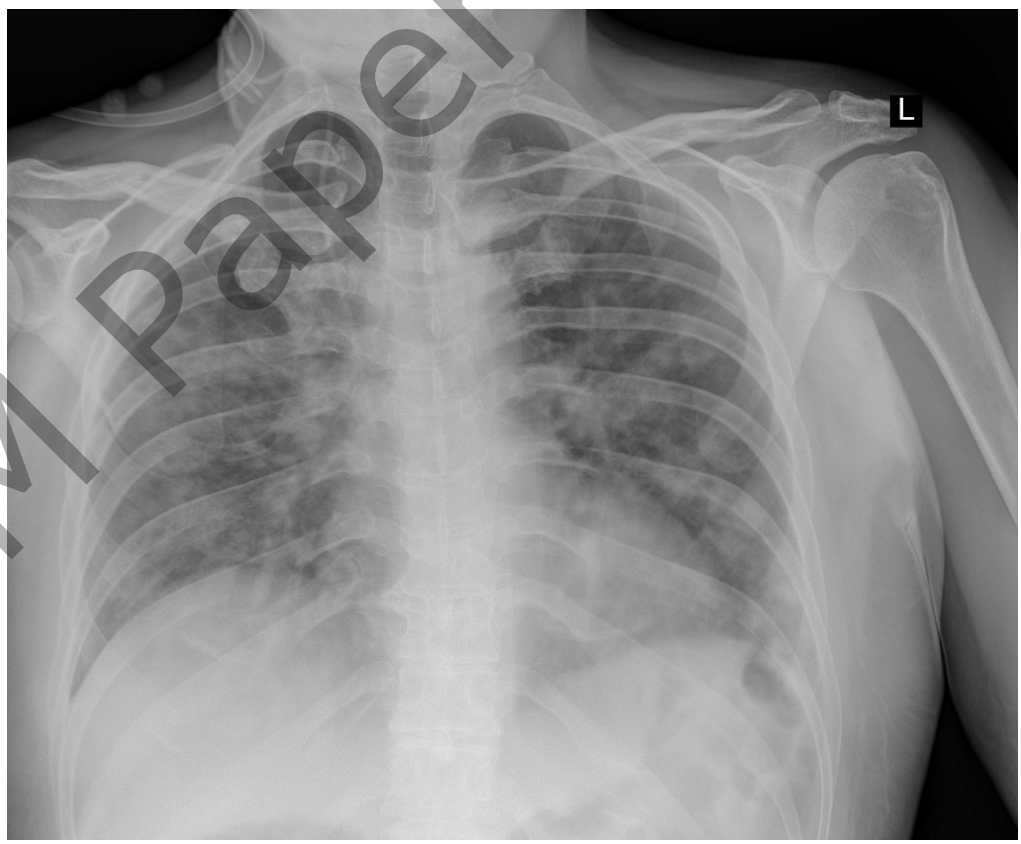

Figure 2. X-ray on the third day of tocilizumab therapy

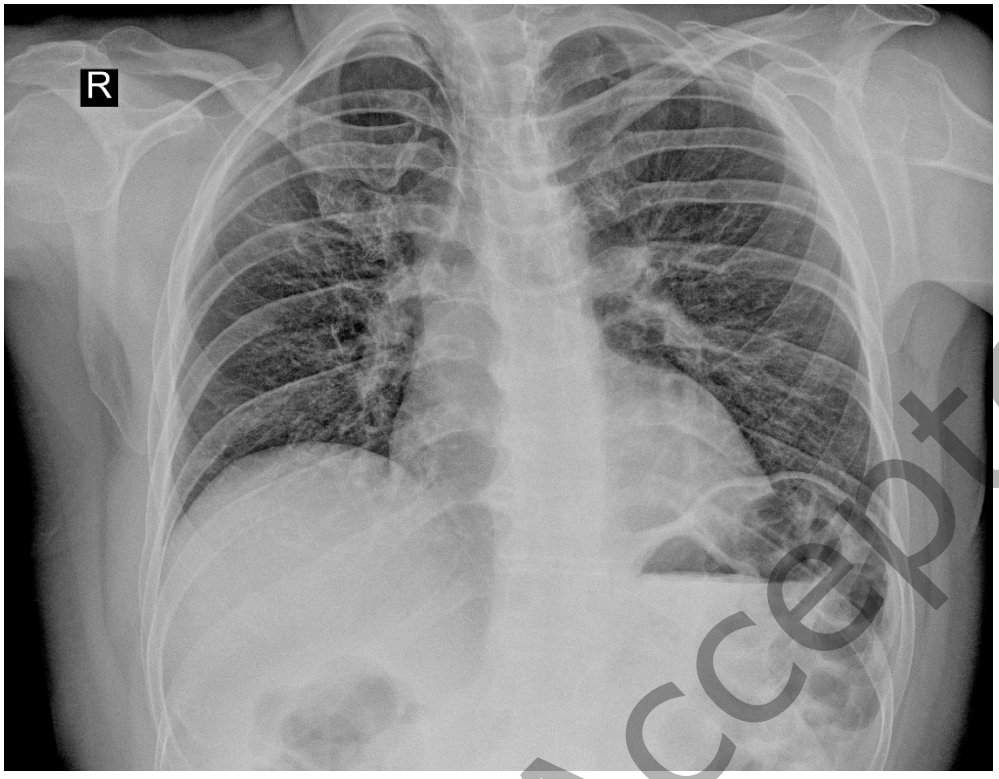

Figure 3. X-ray on the thirteenth day of tocilizumab therapy

Discussion

Chest radiography is an easily available and widely used method of diagnosing pneumonia and its further monitoring. It was especially widely applied during follow-up of COVID-19 patients due to the large number of patients who needed evaluation of pulmonary changes as quickly as possible.
The occurrence of COVID-19 induced ARDS during the COVID-19 pandemic had a high prevalence (7). The progression of COVID-19 pneumonia and the emergence of ARDS is caused by the onset of a cytokine storm, which is caused by the release of a large number of cytokines (8). This strong inflammatory reaction is due to the action of hypoxia-inducible factor-1α (HIF1α). IL6 plays a key role in this process. The binding of this interleukin to its receptor leads to the activation of HIF1α (9).

We present a case of a patient with severe COVID-19 pneumonia and ARDS. In addition to older age, the risk factors for disease progression were associated diseases and smoking. These factors have already been observed as important for the progression of the disease (10, 11). The X-ray changes seen in our patient correspond to changes associated with a high mortality rate (12). Laboratory findings and ABG also indicated severe lung damage with rapid progression. The described examples

have shown reduction of lung damage and mortality rate of COVID-19 induced ARDS treated with tocilizumab (13). In addition to tocilizumab, other immunomodulatory drugs, such as baricitinib and sarilumab, have been successfully used in the treatment of COVID-19 pneumonia (14, 15).

Tocilizumab is a monoclonal antibody that prevents the action of the pro-inflammatory interleukin 6 (IL6), primarily used in the treatment of rheumatoid arthritis and juvenile idiopathic arthritis (13).

For us, the X-ray was the most important indicator for the application of TCZ, which proved to be timely. Significant regression of our patient's X-ray changes was already seen on the third day. Other authors have shown a reduction of interstitial lung changes and consolidations after the use of TCZ, even in the case of a fatal outcome. This fact indicates a positive effect of TCZ in limiting the inflammatory process. The risk factors for a fatal outcome in their research were pronounced radiographic changes. The changes were described as interstitial or consolidation (5). Kaja et al also proved the regression of X-ray changes after TCZ administration in severe pneumonia (16). Computed tomography was not performed on our patient, but this imaging technique confirms significant regression of lung changes after TCZ administration (17). Computed tomography was most often necessary in the diagnosis of pneumonia, given that the changes, especially less pronounced, could not be detected by radiography of the lungs.

Conclusion

ARDS can be a rapid complication of severe COVID-19 pneumonia. Rapid diagnosis and monitoring of the course of the disease is possible based on radiographic changes.

Timely application of tocilizumab can lead to the control of the inflammatory process, which is visible on the basis of the regression of chest X-ray alterations.

REFERENCES

1. Vadász I, Husain-Syed F, Dorfmüller P, Roller FC, Tello K, Hecker M, et al. Severe organising pneumonia following COVID-19. Thorax. 2021;76(2):201-4.
2. Singh SJ, Baldwin MM, Daynes E, Evans RA, Greening NJ, Jenkins RG, et al. Respiratory sequelae of COVID-19: pulmonary and extrapulmonary origins, and approaches to clinical care and rehabilitation. Lancet Respir Med. 2023;11(8):709-25.
3. Wu Z, McGoogan JM. Characteristics of and Important Lessons From the Coronavirus Disease 2019 (COVID-19) Outbreak in China: Summary of a Report of 72 314 Cases From the Chinese Center for Disease Control and Prevention. JAMA. 2020;323(13):1239-42.
4. Bos LDJ, Ware LB. Acute respiratory distress syndrome: causes, pathophysiology, and phenotypes. Lancet. 2022;400(10358):1145-56.
5. Anghel AM, Niculae CM, Manea ED, Lazar M, Popescu M, Damalan AC, et al. The Impact of Tocilizumab on Radiological Changes Assessed by Quantitative Chest CT in Severe COVID-19 Patients. J Clin Med. 2022;11(5):1247.
6. Warren MA, Zhao Z, Koyama T, Bastarache JA, Shaver CM, Semler MW, et al. Severity scoring of lung oedema on the chest radiograph is associated with clinical outcomes in ARDS. Thorax 2018;73(9):840-6.
7. Azagew AW, Beko ZW, Ferede YM, Mekonnen HS, Abate HK, Mekonnen CK. Global prevalence of COVID-19-induced acute respiratory distress syndrome: systematic review and meta-analysis. Syst Rev. 2023;12(1):212.
8. Džopalić T, Veljković M, Bjelaković M, Jovanović B. Features of the innate immune response during the SARS-CoV-2 infection. Acta Medica Medianae 2023;62(3):47-53.
9. Kang S, Onishi S, Ling Z, Inoue H, Zhang Y, Chang H, et al. Gp130-HIF1α axis-induced vascular damage is prevented by the short-term inhibition of IL-6 receptor signaling. Proc Natl Acad Sci U S A. 2024;121(2):e2315898120.
10. Zhang JJ, Dong X, Cao YY, Yuan YD, Yang YB, Yan YQ, et al. Clinical characteristics of 140 patients infected with SARS-CoV-2 in Wuhan, China. Allergy. 2020;75(7):1730-41.
11. Zhang L, Xu J, Li Y, Meng F, Wang W. Smoking on the risk of acute respiratory distress syndrome: a systematic review and meta-analysis. Critical Care. 2024;28:122.
12. Iwamoto S, Muhar BK, Chen H, Chu H, Johnstone M, Sidhu A, et al. Different COVID-19 treatments' impact on hospital length of stay. Eur J Med Res 2023;28(1):218.

13. Rezaei S, Fatemi B, Karimi Majd Z, Minaei H, Peikanpour M, Anjidani N, et al. Efficacy and safety of Tocilizumab in severe and critical COVID-19: A Systematic Review and Meta-Analysis. Expert Rev Clin Immunol. 2021;17(5):499-511.
14. Sweeney DA, Tuyishimire B, Ahuja N, Beigel JH, Beresnev T, Cantos VD, et al. Baricitinib Treatment of Coronavirus Disease 2019 Is Associated With a Reduction in Secondary Infections. Open Forum Infect Dis. 2023;10(5):ofad205.
15. Lescure FX, Honda H, Fowler RA, Lazar JS, Shi G, Wung P, Patel N, et al. Sarilumab in patients admitted to hospital with severe or critical COVID-19: A randomised, double-blind, placebo-controlled, phase 3 trial. Lancet Respir. Med. 2021;9:522–32.
16. Kaya H, Öksüzler Kızılbay G, Ilgazlı AH, Özgür EG. Tocilizumab in hospitalized patients with severe COVID-19 pneumonia: A single-center observational study. Eurasian J Pulmonol 2024;26(1):41-50.
17. Lacedonia D, Tondo P, Scioscia G, Fuso P, De Pace CC, Sassani EV, et al. Imaging Profile After Treatment with Tocilizumab in COVID-19: A Case Series. Curr Med Imaging. 2023;19(8):939–44.