

Hypertension as a Manifestation of COVID-19 Pneumonia

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Case Report

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Abstract

COVID-19 has become a serious problem in the world due to its rapid spread and high mortality rate. Since the pandemic, various manifestations of COVID-19 pneumonia have been described, ranging from classic acute respiratory viral infections to thromboembolic manifestations as the first signs of the disease. However, the relationship between hypertension and its effect on the severity of COVID-19 is not studied well. Here we show the link between hypertension as one of the various manifestations of COVID-19 pneumonia. There is the hypothesis that the initial stage of infection is the penetration of SARS-CoV-2 into target cells with ACE2 receptors. However, some experimental studies have shown that ACE2 protects against lung damage. In this regard, it is logical to assume the presence in the pathogenesis of COVID - 19 conditions for an increase in blood pressure, which occurs in the early stages of the disease. Our result shows that hypertension can become the initial manifestation of the COVID-19 and it is very important to differentiate the disease patterns. Thus, this case clearly shows that any course of coronavirus infection could have a diverse nature of clinical forms and should have a personalized approach, taking into account risk factors and predictors, with the involvement of a multidisciplinary team to prevent long and post COVID-19 syndromes.

Introduction

COVID-19 has become a serious problem in the world due to its rapid spread and high mortality rate. Since the pandemic, various manifestations of COVID-19 pneumonia have been described, ranging from classic acute respiratory viral infections to thromboembolic manifestations as the first signs of the disease.

This clinical case represents an unusual manifestation of COVID-19 pneumonia which started as arterial hypertension as well as development of post viral inflammatory complications and long-covid syndrome.

Case Presentation

A 57-year-old female patient, a healthcare worker at the hospital, started feeling headache and tinnitus together with an increase in blood pressure to 160/90 mmHg. Hypertension and other chronic illness conditions were unremarkable in the past medical history. No symptoms of acute respiratory viral infection were observed at that time.

Elevated blood pressure values persisted for 2 days and were marked by resistance to antihypertensive drugs, specifically to valsartan at a dose of 80 mg 2 times a day.

On the 3rd day, chills appeared, the body temperature increased to 38.8 C.

On the 4th day – elevated blood pressure persisted without a tendency to decrease. BP was 150/90 mm Hgmm. Saturation 96%.

On the 5th day PCR for COVID-19 was obtained, which gave a positive result, and on the lung computed tomography (CT) foci of infiltration of the pulmonary parenchyma of the "ground-glass" type, measuring up to 5.2-2.6 cm, were found. The volume of the lesion was 22%. (Figure 1).

The patient was hospitalized with a diagnosis of coronavirus infection COVID-19 of moderate severity, PCR confirmed with bilateral polysegmental pneumonia.

On laboratory assessment: CBC showed neutropenia - $2.27 \cdot 10^6$ L (15 - 61), lymphopenia - $1.14 \cdot 10^6$, aneosinophilia. Biochemical analysis revealed an increased level of CRP - 0.51 mg / dl, ferritin - 373.6 mg / l, glucose - 112.58 mg / dL, increased ALT - 114.59 U / L, AST - 70.13 U / L with normal bilirubin levels. It should be noted that the patient had a history of cholecystectomy (1998) and therapy for opisthorchiasis of the bile duct 2 years ago. Immunological study showed an increase in interleukin - 6 to 22.17 pg / ml.

Based on the data obtained, therapy with low molecular weight heparins was started: enoxaparin (clexane) 0.4 ml b.i.d. The antiviral drug remdesivir was prescribed according to the following scheme: day 1 - 200 mg IV, on the following days - 100 mg IV for 10 days. Also, humidified oxygen was supplied nasally at a flow rate of 5 l/min for 7 days, due to increased oxygen consumption noted on ABG.

On the day 6 of the disease (the 2nd day of hospitalization), improvement in the patient's well-being was noted. Blood pressure reduced to 130/80 mmHg on valsartan 160 mg per day. However, despite the ongoing therapy, body temperature up to 38 C lasted for 5 days and then persisted in the evening hours for up to 37.5 C for 4 more days. Lab tests showed that decrease in neutrophils - $1.65 \cdot 10^3$ and lymphocytes to $1.22 \cdot 10^3$ and aneosinophilia persisted. In the biochemical analysis, there is a slight decrease in liver function tests compared to the previous day, but the indicators remain elevated: ALT - 94.8 U/L, AST - 61.1 U/L. Also an increase in CRP - 1.032 mg / dl and ferritin - 484.1 µg/L were observed.

In the immunological study, an increase in the level of IL-6 to 57.41 pg/mL persisted, which point to an immune inflammatory response by the body.

Given the presence of arterial hypertension in addition to full therapy according to the COVID-19 treatment protocol, the patient received antihypertensive treatment.

On the 11th day of hospitalization and the 16th day of illness, the patient's condition was stabilized, the laboratory data continues to increase in the previous indicators: ALT 81.2 U/L, AST 38.6 U/L, CRP 2.793 mg/dL (0 - 0.5), ferritin 473.1 µg/l. Normalization of neutrophils - $2.52 \cdot 10^3$, eosinophils - $2 \cdot 10^3$, but a sharp increase in platelets - $533 \cdot 10^9$ which could indicate the development of acute viral inflammatory syndrome. Dexamethasone 4 mg per day was added to the therapy and the patient was discharged home with a recommendation to continue treatment for 10 days. Lymphocytes in a relative amount - 41%. Immunogram: interleukin 6 - 29.70 pg / mL. PCR: RNA SARS-CoV-2 not detected (negative).

On the 22nd day in the outpatient period, the patient's blood tests showed persistence of lymphopenia ($3.31 \cdot 10^6$) and thrombocytosis ($653 \cdot 10^3$).

CT of the lungs (Fig. 2) after a month of the disease showed improvement, the number of affected foci decreased, the size of the infiltration has reduced.

Discussion

This case report once again points to the link between several risk factors and prognosis in patients with COVID-19, including hypertension, bile duct disease and age.

The following critical issues arose during the consideration of this case:

1. Is there a relationship between hypertension and its effect on the severity of COVID-19?
2. Does early therapy with the antiviral drug remdesivir affect the course and duration of COVID-19 hospitalizations?
3. Are co-factors such as liver damage specifically liver opisthorchiasis and a history of cholecystectomy worse prognosis of COVID-19 patients?
4. Which factors influence development of long-covid and post viral inflammatory syndrome?

Hypertension in adults is quite common, but due to the pandemic it is of particular interest, since there are concerns that the virus uses ACE-2 receptor to enter host cells [1].

In this clinical case, the onset of the COVID-19 began with arterial hypertension, in the absence of risk factors for arterial hypertension. It is noteworthy that the manifestation of the clinical manifestation in the form of high blood pressure proceeded during the latent period of COVID-19. This is evidenced by the data of CT examination of the lungs, performed on the third day of the development of arterial hypertension. According to the CT scans, by this time, multiple ground-glass opacities and infiltrates, which are not early signs of pneumonia, have already been found. At the same time, in the first 48 hours of the incubation period, there were no other symptoms besides arterial hypertension. This fact confirms that the detected changes in the lungs developed before or simultaneously with an increase in blood pressure. Thus, this further confirms the hypothesis that the initial stage of infection is the penetration of SARS-CoV-2 into target cells with ACE2 receptors. However, some experimental studies have shown that ACE2 protects against lung damage [2,3]. On the other hand, the development of interstitial pneumonia caused by COVID-19 contributes to the development of hypoxia, thrombotic complications and endothelial dysfunction. It is still unclear if uncontrolled blood pressure is a risk factor for contracting COVID-19 or if controlled blood pressure is a lesser risk factor. In this regard, it is logical to assume the presence in the pathogenesis of COVID - 19 conditions for an increase in blood pressure, which occur in the early stages of the disease.

Special attention should be paid to the short-term decrease in blood pressure in response to taking valsartan. At the same time, against the background of intensive treatment of pneumonia with remdesivir

and ongoing hypotensive blood pressure, blood pressure returned to normal and the course of coronavirus infection did not worsen. Although, the effectiveness of any particular antiviral drug for treating patients with severe COVID-19 has not been proven [4,5].

In addition, given the high transaminases – ALT, AST and normal indicators of other biochemical indicators of liver damage, such as bilirubin, alkaline phosphatase and gamma-glutamyltransferase in the patient, the role of the virus in liver damage remains open and requires detailed systematic study. There are studies that the virus also uses ACE2 as an entry receptor and that both liver cells and bile duct cells express ACE2. However, the expression of ACE2 in the bile duct cells is much higher than in liver cells, but is similar to the level of alveolar 2 cells. type in the lungs [6,7,8]. Currently, research on the mechanisms of liver damage caused by the SARS-CoV-2 virus is limited and remains largely unclear. For example, does SARS-CoV-2 virus infection occur directly to the liver? Do liver cells secrete infectious viral particles? Is there any possible role for viral shedding through the biliary tract in facilitating infection of intestinal cells (also expressing ACE2) from fecal-oral transmission? Does liver damage play a causal role in the pathogenesis of severe COVID-19 disease by altering the secretion of cytokines, clotting factors and other inflammatory mediators?

Another aspect to be explored is a genetic predisposition to an increased risk of severe SARS-CoV-2 infection and development of complications, which may be related to the ACE2 polymorphism that has been associated with diabetes, cerebral stroke and hypertension, especially in Asian populations. Summarizing this information, we can say that human sensitivity may be the result of a combination of therapy and ACE2 polymorphism [3].

This case clearly indicates that several factors such as hypertension, bile duct disease and age can effect on the duration of COVID which can lead to long COVID. Thus, this case clearly shows that any course of coronavirus infection could have a diverse nature of clinical forms and should have a personalized approach, taking into account risk factors and predictors, with the involvement of a multidisciplinary team to prevent long and post COVID-19 syndromes.

Declarations

The author states that the patient consented to participate and publish.

The authors declare no competing interests.

Author Contributions:

Makhabbat Bekbossynova - acquisition, analysis, or interpretation of data, design of the work

Tauekelova Ainur – conception, have drafted the work

References

1. Yushun, W., Jian, S., Rachel, G., Ralph, S. B., and Fang, L. Receptor Recognition by the Novel Coronavirus from Wuhan: an Analysis Based on Decade-Long Structural Studies of SARS Coronavirus. *J Virol.* **94(7)**: e00127-20.. [https://doi: 10.1128/JVI.00127-20](https://doi.org/10.1128/JVI.00127-20) (2020)
2. Haibo, Z., Josef , M. P., Yimin, L., Nanshan, Z., Arthur ,S. S. Angiotensin-converting enzyme 2 (ACE2) as a SARS-CoV-2 receptor: molecular mechanisms and potential therapeutic target. *Intensive Care Medicine.* **volume 46, pages 586–590** (2020)
3. Lei, F., George, K., Iakobis, M. R. Are patients with hypertension and diabetes mellitus at increased risk for COVID-19 infection? *The Lancet Respiratory Medicine.* **8/4, e21** (2020)
4. John David, N. Remdesivir for COVID-19: challenges of underpowered studies. *The Lancet.* [https://doi.org/10.1016/S0140-6736\(20\)31023-0](https://doi.org/10.1016/S0140-6736(20)31023-0).(2020)
5. Erin, K. McCreary, Pharm, D., Derek,C. A. Efficacy of Remdesivir in COVID-19. **324(11):1041-1042.** <https://doi:10.1001/jama.2020.16337>. (2020)
6. Hoffmann, M, Kleine-Weber, H, Krüger,N.,, et al. The novel coronavirus 2019 (2019-nCoV) uses the SARS-1 coronavirus receptor2 ACE2 and the cellular protease TMPRSS2 for entry into target cells. in press. <https://doi.org/10.1101/2020.01.31.929042>. (2020)
7. Chai, X., Hu, L., Zhang, Y., et al. Specific ACE2 expression in cholangiocytes may cause liver damage after 2019-nCoV infection. *bioRxiv.* <https://doi.org/10.1101/2020.02.03.931766>. (2020)
8. Banales, JM, Huebert, RC, Karlsen,T, Strazzabosco,M, LaRusso, NF, Gores, GJ. Cholangiocyte pathobiology. *Nat Rev Gastroenterol Hepatol.* **16(5): 269- 281.** (2019)

Figures

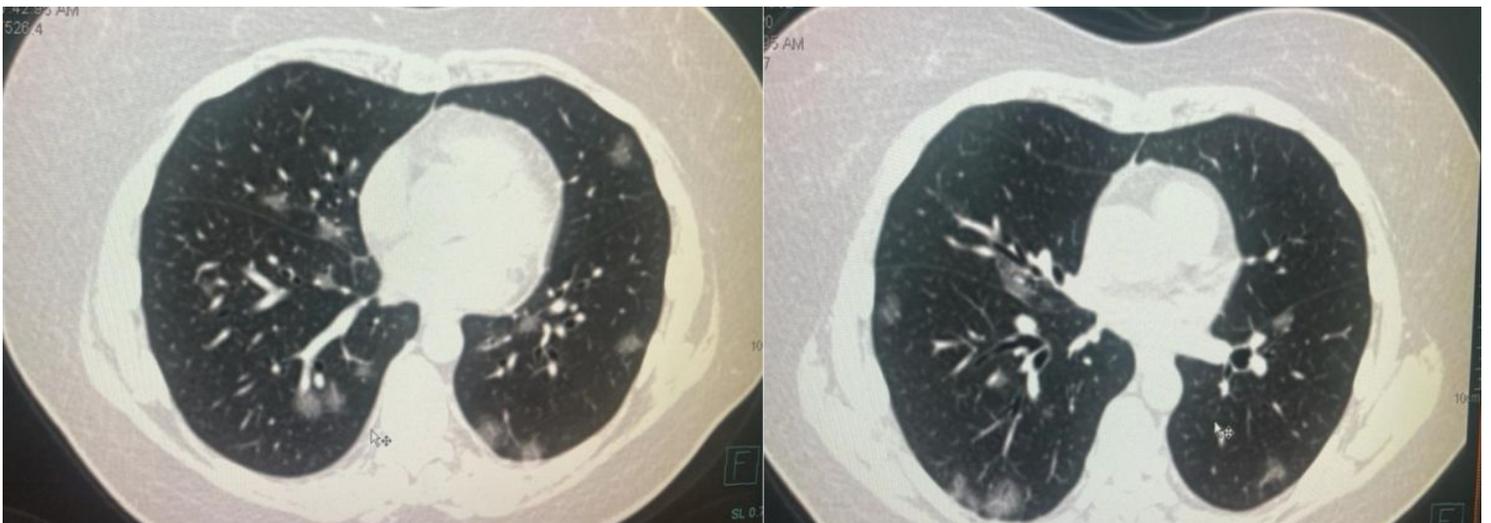


Figure 1

Lungs CT scan

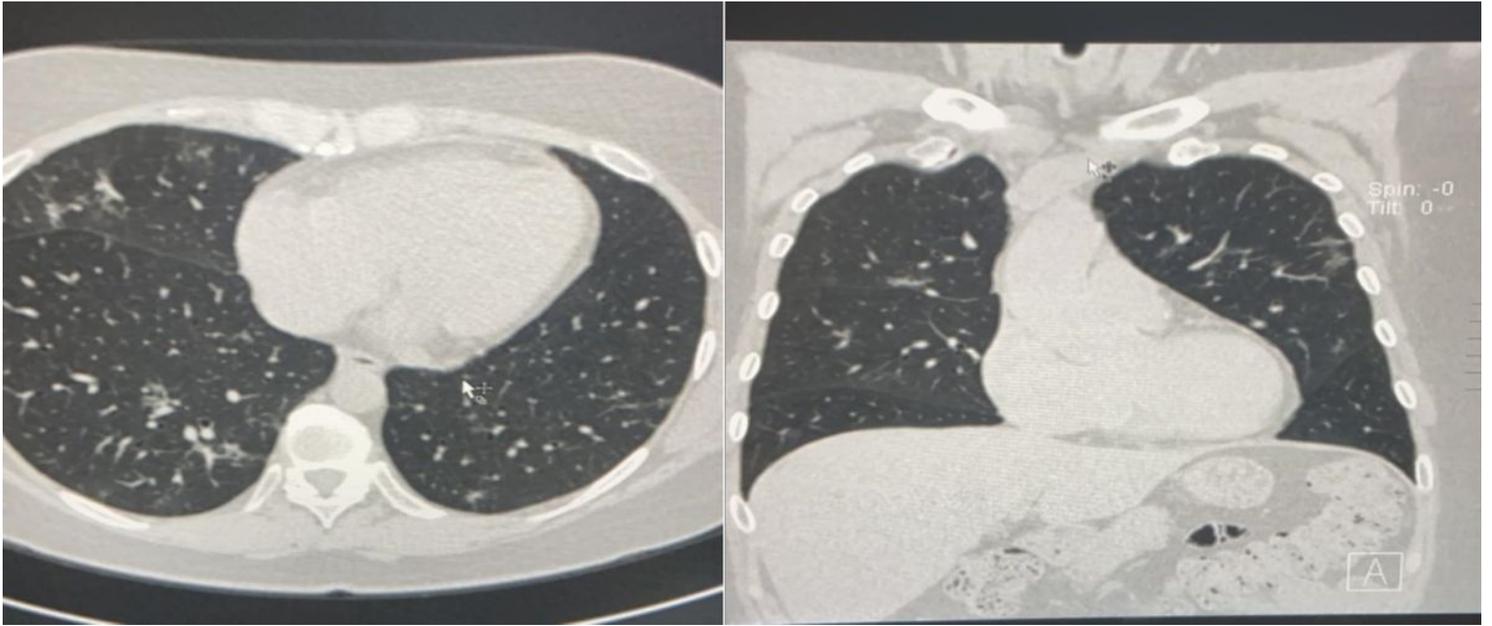


Figure 2

CT after a month of the disease.