INTRODUCTION OF A CLINICAL CASE OF COVID-19 SEVERE LUNG INJURY, TREATED BY CORTICOID

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ABSTRACT: *COVID-19 epidemic appeared at the end of 2019 and it became a global pandemic. That disease was caused by the SARS-CoV-2 virus. There are 20% COVID-19 patients that were hospitalized and 5% lung injury had respiratory failure. Lung injuries that appeared IIA stage were treated by corticoid to significantly improve clinical and subclinical criteria. A severe COVID-19 patient had severe pneumonia (respiratory rate 30 b/m, SpO_2 82% with room air, PaO_2 67 mmHg, P/F 319, X-ray bilateral diffused consolidated injuries), treated methylprednisolone 1.5 mg/kg/day combined with antibiotics, anticoagulant… The patient gradually recovered, improved clinical criteria, decreased lung injuries on X-ray, discharged after 14 days.*

Keywords: Corticoid treat COVID-19, lung injuries.

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1. INTRODUCTION.

Appearing in Wuhan (China) from the end of 2019 and not long after that, COVID-19 (the disease caused by the SARS-CoV-2 virus) has become a global pandemic - one of the largest epidemics in human history. Among those infected with the SARS-CoV-2 virus, up to 80% of cases were asymptomatic or have mild symptoms, 20% of cases were hospitalized, and approximately 5% of cases developed respiratory failure and were admitted to the ICU (Intensive care unit) with a mortality rate of nearly 50%. The disease progression is divided into 3 stages, including stage I corresponding to upper respiratory tract virus infection; stage II, also known as lung viral infection, if there is no hypoxemia (stage IIA) and with hypoxemia (stage IIB); Stage III is the stage of increased inflammation.

The clinical studies showed that, depending on the age of the patients, different stages have different severity, while the danger level of stage I decreases with age, stage III can be dangerous to life in young patients stage III is a strong inflammatory response, characterized by the massive release of proinflammatory cytokines into the circulation, leading to organ injuries. Therefore, this stage has the highest mortality rate [1]. Lung injuries occur early after infection with the SARS-CoV-2 virus and can make the disease worse rapidly. The early symptoms of lung injury are alveolar wall injury and diffuse alveolar injury in ARDS (Acute respiratory distress syndrome), thrombosis of small capillaries… [2].

Recently, the RECOVERY study showed that the use of dexamethasone (DXM) in severe cases improved the mortality rate [3]. Therefore, WHO *(World Health Organization*) has recommended systemic corticosteroids for severe COVID-19 patients [4]. However, in clinical practice, there are many different types of corticosteroids used, of which, methyl-prednisolone (MTP) is used more than DXM (due to its strong anti-inflammatory effect and good penetration into the lung parenchyma). The experiments by Ranjbar (2021) in animals showed that the ratio of lung parenchymal MTP/ plasma was higher than that of DXM, so MTP may have a better effect on the lungs [5].

Stemming from the above issues, we introduce a clinical case of severe COVID-19 disease with severe lung injury, treated by MTP combined with antibiotics, anticoagulants to colleagues for reference.

2. INTRODUCTION OF A CLINICAL CASE.

- Patient Pham Thi N., female, 57 years old, healthy history, has not been vaccinated against COVID-19. The place of birth: Dong Hoa, Di An, Binh Duong.

- Hospital admission with diagnosis: severe COVID-19 infection, severe pneumonia.

- Pathological development: the patient contacted with F0, initially asymptomatic, positive

rapid test for SARS-CoV-2. The patient was self-isolating and monitoring at home. After 12 days of self-isolation, the patient showed symptoms of fever 38-39°C, fever, did not chilly; dry cough, sore throat, muscle pain of whole body, fatigue, increasing dyspnea. Positive SARS-CoV-2 RT-PCR test. The patient was admitted to the hospital for monitoring and treatment in the following condition: awake, accessible, normal skin and mucous membranes; fever 38°C, hot fever, pulse 95 times/minute, blood pressure 140/85 mmHg; respiratory rate 30 cycles/min, accessory respiratory muscles contracture, SpO_2 82%.

The patient was indicated to take a chest X-ray, the results: ground-glass opacity and diffuse solidification of two lungs; Arterial blood gas test: pH 7.48, PaO_2 67 mmHg, $PaCO_2$ 50 mmHg (breathing room air with FiO_2 21%, P/F = 319 > 300, indicating severe pneumonia). Through clinical examination and test results, the disease was diagnosed: severe COVID-19 and severe pneumonia (diagnosed according to the standards of the Ministry of Health [6], [4]).

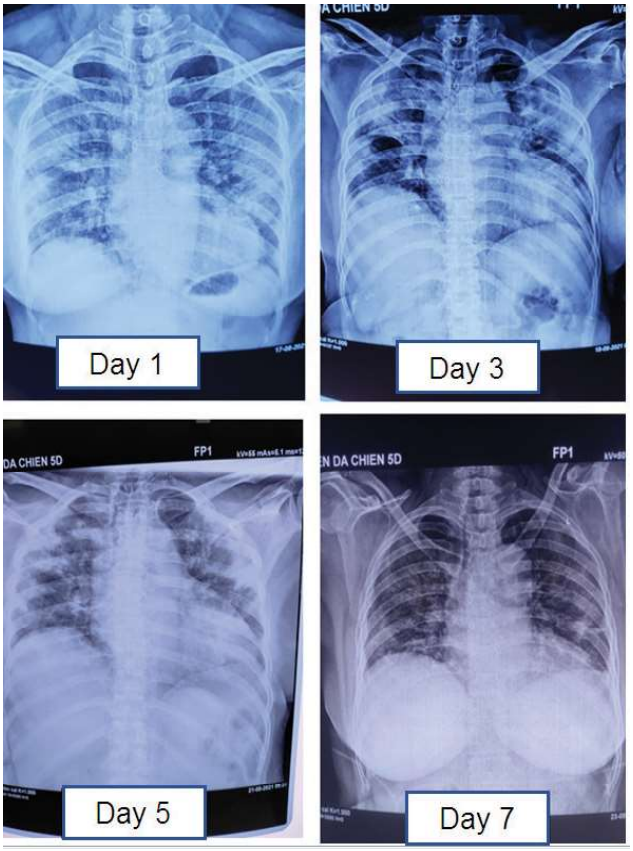

Figure 1. X-ray image of patient's heart and lung gradually improved with time of treatment.

- The patient was indicated for treatment, specifically as follows:

+ Oxygen breathing through a mask with an oxygen bag, but not effective, must switch to HFNC (high-flow oxygen breathing through a nasal cannula) with Flow = 60 L/min, FiO_2: 80%, temperature: 35°C, maintain SpO_2 88-94% [2].

+ MTP 1.5 mg/kg/day, antibiotics, anticoagulants, reduce secretions, antihistamines, vitamin C supplements, vitamin 3B, antipyretics, electrolyte supplements, cool compresses, intestinal nourishment [6]

During treatment, the patient was a closely monitored pulse, temperature, blood pressure, and SpO_2 index; chest X-ray on the 3rd, 5th, 7th day to evaluate and monitor the progression of the disease. The results showed that the clinical symptoms gradually improved, and the patient responded well to HFNC breathing and HFNC weaning. The Cardiopulmonary radiograph showed that pneumonia gradually improved with the time of treatment, arterial blood gas gradually returned to normal (Figures 1, 2). After 14 days of treatment, the patient was stable and discharged.

Figure 2. Transformation of PaO_2 and $PaCO_2$ inpatient during treatment time.

3. DISCUSSION.

The patients with severe COVID-19 and severe pneumonia, when treated in the ICU, have a high mortality rate (50%). The treatment of lung injury in patients with COVID-19 required a combination of measures, such as high-flow oxygen ventilation (maybe require assisted ventilation, mechanical ventilation), antibiotics, anticoagulant, vitamin supplements, nutrition, and physical therapy… In this article, we introduced a clinical case with severe COVID-19 diagnosis, severe pneumonia, and good response to treatment.

- The patient was ventilated according to the treatment guidelines of the Ministry of Health and the Attaway scheme: initially, the patient was indicated to breathe oxygen with support glasses; After that, the patient was given an oxygen mask with a bag. However, the symptoms of dyspnea did not improve, the patient was switched to HFNC breathing, maintaining SpO_2 88-94% (corresponding to the green square box according

to the ventilation diagram for treating COVID-19 patients with pneumonia and respiratory failure). by Amy H Attaway [2]).

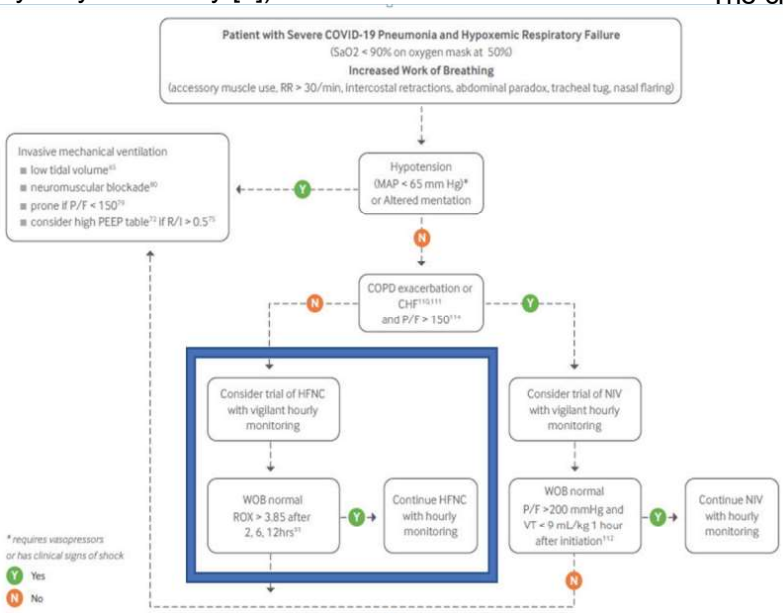

Figure 3. Ventilation diagram for treatment of COVID-19 with pneumonia and respiratory failure (according to Amy H Attaway [2]).

- Respiratory: the patient's condition when hospital admission showed severe respiratory distress (respiratory rate 30 cycles/min, contraction of accessory respiratory muscles, SpO_2 82%. Chest X-ray showed ground-glass opacity and diffuse solidification of two lungs). Therefore, we started with MTP at a dose of 1.5 mg/kg/24 hours. This is the best dose of medicine that will penetrate the lungs, reducing the inflammatory process in the lungs [4]. The results of treatment showed that the patient responded to the above dose of corticoids (the patient was breathing more comfortably, the respiratory rate was reduced, the SpO_2 remained stable, the PaO_2 improved) and have no unwanted effects. In particular, on the 3rd day of treatment, a chest X-ray was performed to monitor the progress of lung parenchymal lesions, and the right lung lower lobe lesions were found to be improved compared to the first day of admission; on the 5th day, the lesions to the upper lobe of the right lung and the lower lobe of the left lung decreased more than on the 3rd day; on the 7th day, the lung lesions were greatly reduced, the lungs were bright on both sides.

- Blood gas: at the time of the hospital admission, the patient was breathing room air with PaO_2 67 mmHg (P/F = 319). After treatment, the blood gas results gradually improved. However, on the 3rd day after the hospital admission, the PaO_2 decreased (55 mmHg), which was the time when the patient was switched to ventilation support to HFNC breathing. The results showed that the patient responded well, SpO_2 maintained 88-94%, PaO_2 gradually increased over time, clinically stable and HFNC was withdrawn.

The clinical case presented above was consistent with several studies around the world in the treatment of COVID-19 patients with severe pneumonia with MTP. Miguel treated COVID-19 stage III patients with MTP 1.5 mg/kg/day for 3-5 days. The authors concluded that a dose of MTP of 1.5 mg/kg/day improved survival in COVID-19 patients with a strong inflammatory response (stage III [1]). However, high-dose MTP was also effective in treating lung lesions in patients with SARS-CoV-2 infection. The *European Respiratory Journal* published a single-blind, randomized controlled clinical trial of Edalatifard on the effects of high-dose MTP. The author selected patients with a confirmed diagnosis of SARS-CoV-2 infection by RT-PCR test positive nasopharyngeal fluid, lung lesions on chest CT scan, SpO_2 < 93% at rest, mild dyspnea.

The selected patients were randomly divided into two groups: group 1 was treated with high-dose MTP (250 mg/day x 3 days), group 2 was treated with a standard regimen but without MTP or any glucocorticoids. The anthropometric and clinical characteristics were not different between the two groups, but there was a big difference in treatment results. Specifically, group 1 had a faster time to improve symptoms than group 2 (11.84 ± 4.88 days compared with 16.44 ± 6.93 days, the difference with p = 0.011), especially, group 1 had mortality rate was much lower than group 2 (5.9% vs 42.9%, p < 0.001). The authors concluded that high-dose MTP in the treatment of severe COVID-19 patients in the early pulmonary phase can improve the clinical symptoms and reduce mortality [7].

To compare the effectiveness of corticoids, Pinzon conducted a comparison between COVID-19 patients with severe pneumonia treated with high-dose DXM and MTP. The Study patients were divided into two groups (group 1 was treated with DXM 6 mg/day x 7-10 days; group 2 was treated with high dose MTP 250-500 mg/day x 3 days, then changed to prednisone 50 mg) /day x 14 days). The results showed that the MTP group had a faster recovery time (p < 0.0001), a higher 30-day survival rate (92.6% compared to 63.1%, the difference with p < 0.0001), the rate of patients requiring endotracheal intubation and mechanical ventilation was lower (4.8% compared to 14.4%, the difference with p < 0.05), the lower mortality rate (9.5% compared to 17.1%, but the difference was not significant with p > 0.01) [8]. Like the Pinzon study, the Justine study

compared the effects of MTP and DXM. The author divided COVID-19 patients with severe pneumonia into two groups, group 1 used MTP 1 mg/kg/day ≥ 3 days, group 2 used DXM 6 mg/day ≥ 7 days, then compared mortality outcomes in 50 days. The study showed that the mortality rate in group 1 (16.4%) decreased statistically significantly compared with group 2 (26.5%) [3].

Similarly, Ranjbar carried out a triple-blind controlled study in COVID-19 patients with lung lesions between one group treated with MTP 2 mg/kg/day Intravenously 60 min and reduced 1/2 dose after five days; the other group was treated with DXM 6 mg, intravenously for ten days. The results showed that the MTP group had a shorter hospital stay (7.43 ± 3.64 days compared with 10.52 ± 5.47 days, $p < 0.05$), the proportion of patients requiring artificial ventilation less (18.2% compared to 38.1%, $p < 0.05$) than the group using DXM. The Mortality rate was lower in the MTP group than in the DXM group (18.6% compared to 37.5%), but the difference was not significant with $p = 0.076$. The author concluded that the COVID-19 patients with hypoxic pneumonia treated with MTP 2 mg/kg/day intravenously reduced the length of hospital stay, reduced the rate of need for ventilation create and improved clinical status at day 5, 10 compared with COVID-19 patients treated with DXM 6 mg/day [5].

Although there are many studies on the therapeutic effects of MTP in COVID-19 patients, there were not many studies on the effectiveness of high-dose and standard-dose of MTP treatment. Monreal conducted a single-center clinical trial, published in the European Journal of Infectious Diseases and Clinical Molecular Biology, comparing the effects of high-dose and standard-dose corticosteroid therapy in patients with severe COVID-19 with lung lesions progressing to ARDS. These patients were randomly divided into two groups: group 1 (n = 396) received high-dose MTP (250-1000 mg/day) for 1 day or more; group 2 (n = 177) received MTP 0.5-1.5 mg/kg/day [9].

Other treatments, such as ventilation, feeding, and breathing exercises, were the same. Comparing the results between the two groups, the author concluded, group 1 treated with high dose MTP had a higher rate of mechanical ventilation and mortality rate than group 2, the difference was statistically significant ($p = 0.001$) and there was no difference between the two groups in terms of risk of developing severe ARDS [9].

4. CONCLUSION.

Some information about the clinical case of COVID-19 and the results of treatment with MTP:

- Based on the diagnosis of severe COVID-19 and severe pneumonia in patients: patient in Binh Duong (where the COVID-19 epidemic occurred), contacted with F0, after 12 days had symptoms of fever, cough, body aches, fatigue, increasing dyspnea, rapid test positive SARS-CoV-2, positive SARS-CoV-2 RT-PCR test. The patient was admitted to the hospital with the following conditions: fever 38°C, hot fever, pulse 95 cycles/min, blood pressure 140/85 mmHg. Severe dyspnea (respiratory rate 30 cycles/min, accessory respiratory muscle contractures, room ventilation measuring SpO_2 82%). Chest X-ray (taken on admission): diffuse solidifying lesions in 2 lungs. Blood gas (time of admission) PaO_2 67 mmHg in room air (FiO_2 21%), P/F = 319.

- Treatment progress: The patient was treated with a standard dose of MTP (1.5 mg/kg/day), antibiotics, anticoagulants, secretory suppressants, antihistamines, vitamin C, vitamin 3B supplements, antipyretics, and supplements electrolytes, cool compresses, intestinal nourishment. The result showed that the disease responded well to treatment, especially the MTP dose of 1.5 mg/kg/day was highly effective, helping to improve the clinical symptoms and reduce lesions on chest radiographs. After 14 days of treatment, the patient was stable and discharged from the hospital.

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