Clinical Characteristics of 6 patients with SARS-Cov-2 infected severe pneumonia in Zunyi, China

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Research

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Abstract

Purpose

To study the clinical characteristics, laboratory examination, radiological changes and treatments of 6 patients with severe SARS-Cov-2 infected pneumonia in Zunyi City, China.

Methods

The clinical data, laboratory examination, radiological changes and clinical treatment process of 6 patients with severe SARS-Cov-2 infected pneumonia admitted to the Department of Critical Medicine of the Affiliated Hospital of Zunyi Medical University were retrospectively analyzed.

Results

Four of the six patients were older than 65 years. Two patients had a history of exposure to Wuhan, and four patients had family clustering infection. The most common symptoms at onset of illness were dry cough (4, 66%) and fever (4, 66%). Laboratory tests showed that white blood cell count, neutrophil count, C-reactive protein, IL-6, IL-10, and urea nitrogen elevated. The Total lymphocyte count and T lymphocyte count decreased. All patients received antiviral therapy, blood purification, immunomodulatory therapy, and Chinese herb treatments. One patient was discharged from the hospital, and 5 patients' condition improved significantly.

Conclusion

T lymphocyte decreased significantly, IL-6 and IL-10 elevated in severe SARS-Cov-2 infected pneumonia patients. Elderly patients with comorbidities appear to be more severe and to recover more slowly. Blood purification can be tried for severe and critically ill patients. Early identification and timely treatment of critical cases is of crucial importance.

Introduction

In December 2019, 2019-novel coronavirus (SARS-Cov-2) infected pneumonia (NICP) emerged in Wuhan[1] and spread rapidly to all areas of China, even other countries. What's more, the sharp increase of the case number caused widespread panic among the people[2]. Local governments in China have implemented the most stringent control measures and achieved good effects, which to some extent blocked the spread of the virus.

Zunyi is located in the north of Guizhou Province, about 1000 kilometers away from Wuhan. On January 21, 2020, the first patient with SARS-Cov-2 infected pneumonia was diagnosed in Guizhou Province. As of February 22, 2020, a total of 146 patients with new coronavirus pneumonia have been diagnosed in Guizhou Province, and 90 cases have been discharged. Here we report the clinical characteristics,

laboratory, radiological characteristics and treatment of 6 cases of severe SARS-Cov-2 infected pneumonia in Affiliated Hospital of Zunyi Medical University.

Methods

This study was approved by the institutional ethics board of the Affiliated Hospital of Zunyi Medical University. Oral consent was obtained from patients. All patients with NCIP enrolled in this study were diagnosed according to World Health Organization interim guidance. The clinical outcomes were monitored up to February 20, 2020. The medical records of patients were collected and analyzed by the team of the Department of Critical Care Medicine, Affiliated Hospital of Zunyi Medical University. Epidemiological, clinical, laboratory, and radiological characteristics and treatment and outcomes data were obtained with data collection forms from electronic medical records. The date of disease onset was defined as the day when the symptom was noticed. Symptoms, signs, laboratory values, chest CT scan, and treatment measures during the hospital stay were collected, as a recent study reported[3].

Results

General Information

Four of the six patients were older than 65 years old, and two patients had a history of exposure to Wuhan. The causes of these patients with SARS-Cov-2 infected pneumonia are shown in Fig. 1.

Four patients had a history of chronic diseases. The most common symptoms at onset of illness were dry cough (4, 66%), fever (4, 66%), headache (2, 33%), fatigue (1, 17%), vomiting (1, 17%), as shown in Table1. The oxygenation index of 6 patients was lower than 300 at admission, and the respiratory rate was more than 20 / min (Table 2). These 6 patients all belong to severe SARS-Cov-2 infected pneumonia.

Treatments And Outcome

All patients rest in bed and were given effective oxygen therapy. Case 1, case 5 and case 6 were received high flow nasal oxygen therapy (HFNO) and other patients were given nasal catheter (2-4L/min). All patients were given antiviral therapy. The α -interferon atomization inhalation (5 million U per time for adults in sterile injection water, Bid); lopinavir/ritonavir orally, 2 capsules each time, Bid; ribavirin 500 mg for adults each time, Bid.

Xuebijing (100 ml, bid) and Chinese herb were also used to treat patients. The patients' treatment plans are referred to the "Guidelines for the Diagnosis and Treatment of Novel Coronavirus (SARS-Cov-2) Infection by the National Health Commission (Trial Version 5)"[4]. In addition, all patients received plasmapheresis and CRRT treatment (Oxiris, CVVH).

In Case 1, the patient switched from high flow nasal oxygen therapy to a nasal catheter after three days of treatment. The patient was discharged on February 17, 2020.

In Case 2 and Case 3, the RT-PCR of SARS-Cov-2 on February 18 was negative. The oxygenation index was greater than 300 on February 18. On February 19, they were transferred to Jiangshan Hospital of Guizhou Province for centralized treatment.

In Case 4, 5 and 6, their oxygenation index was also higher than 300 on February 19. On February 20, they also were transferred to Jiangshan Hospital of Guizhou Province for centralized treatment. On February 26, the Case 4 was discharged.

Laboratory examination

The white blood cell (Fig. 1A) and neutrophil counts (Fig. 1B) increased in 4 patients, and the lymphocytes counts (Fig. 1C) decreased in all patients. Further laboratory examination showed that both T helper cell count (Fig. 2D) and T suppressor cell count (Fig. 2F) decreased significantly. Creatine kinase (CK) did not increase significantly, only one patient was higher at admission, but it recovered to normal level after treatment (Fig. 1D). CK-MB was in normal range in all patients (Fig. 1E).

C-reactive protein (CRP) was significantly increased in all patients (Fig. 1F). We further examined the changes of inflammatory factors, and the results showed that IL-6 (Fig. 3C), IL-10 (Fig. 3D) and TNF- α (Fig. 3E) were significantly increased, and IL-2 (Fig. 3A), IL-4 (Fig. 3B) and IFN- γ (Fig. 3F) were not markedly changed.

There was no significant change in ALT in all patients, and AST was slightly elevated in 4 patients (Fig. 4A and 4B). Total bilirubin was elevated in cases 2 and 5 (Fig. 4C). In case 4 and case 5, creatinine was higher than normal value at admission, and then returned to normal level (Fig. 4D). All patients had a slight increase in urea nitrogen (Fig. 4E) and no significant increase in uric acid (Fig. 4F).

Ct Images

In Case 1, ground glass shadows appeared in the lateral basal segment of the lower lobe of the right lung and anteromedial basal segment of the lower lobe of the left lung on admission (Fig. 6, 2020.01.31). The ground glass shadow faded when the patient was discharged. In Case 2, ground glass shadows appeared in the lateral basal segment and posterior basal segment of right lower lobe. After treatment, the patient's oxygenation improved, but the lung lesions did not change significantly. The ground glass shadow was peripheral distribution in Case 3. After treatment, the lung lesions of the patient were better than that at admission.

The lungs of Case 4 were ground-glass attenuation. There were opacities in the right lung middle lobe of Case 5 at admission. After treatment, the patient's oxygenation improved, but multiple fibrosis appears in the lungs. The ground glass opacities appeared in right inferior lobe and left inferior lobe of Case 6. On

February 8, the patient developed pneumothorax. On February 17, On February 17, pneumothorax and lung lesions were absorbed.

Discussion

This report focuses on the clinical and radiological characteristics of 6 patients with severe 2019 novel coronavirus (SARS-Cov-2)-infected pneumonia (NCIP). Huang et al first reported 41 patients with NCIP, in which most patients had a history of exposure to Huanan Seafood Wholesale Market[5]. Subsequently, Wang et al reported 138 Hospitalized Patients with NCIP in Wuhan[3]. In this report, the 6 patients were in critical condition at the time of admission, but they all improved significantly, without deterioration after treatments. As recent study reported[6], the most common symptoms at onset of illness were dry cough and fever.

The rapid person-to-person transmission of SARS-Cov-2 has occurred in China. The present study showed that the basic reproductive number (R_0) is 2.2, which means that, on average, each patient has been spreading infection to 2.2 other people[7]. Two of the six patients in this report had a history of exposure to Wuhan. The other four cases were infected by close contact with patients with a history of exposure to Wuhan. As a result, Guizhou province immediately initiated strict quarantine measures to prevent the spread of SARS-Cov-2.

A present study found that about half of patients infected by 2019nCoV had chronic underlying diseases, mainly cardiovascular disease and diabetes[8]. This found is similar to MERS-CoV[9]. Four of the six patients in our study were older than 65 years, and four patients had comorbidities. Therefore, 2019nCoV appears to infect older adults with chronic comorbidities as a result of the weaker immune functions of patients [3, 8].

The most common laboratory abnormalities observed in this study were depressed total lymphocytes and elevated CRP. The decrease of total lymphocytes may be associated with cellular immune deficiency caused by SARS-Cov-2 infection. Some studies showed that a decrease in total lymphocytes indicates that SARS-Cov-2 consumes many immune cells and inhibits the patient's cellular immune function[8]. We further examined changes in T cell subsets, and the results showed that T lymphocytes counts, T helper cells and T suppressor cells counts all decreased. Hence, damage to T lymphocytes may be an important factor leading to exacerbations of patients.[10] Few studies have been reported the changes in T cells caused by SARS-Cov-2, so the mechanism for the reduction in T lymphocytes remains unknown.

In Wang's study, CK and CK-MB levels were higher in ICU patients than that in non-ICU patients³. In our study, CK and CK-MB were not significantly increased, and only 1 patient was higher than normal when admitted to hospital, and returned to normal levels after treatments. We speculate that this may be related to the timely and standardized treatments of these patients. The urea nitrogen of ICU patients was higher than that of non-ICU patients, and patients with persistently elevated urea nitrogen have a higher

mortality rate³. Although all of the six patients had increased urea nitrogen, it returned to normal level after treatment. We believe that blood purification may play a certain role.

The leukocyte count and neutrophil count increased in 4 patients, and CPR increased in 6 patients. CRP is a superior biomarker for more complex acute-phase characteristics, e.g., leukocytosis and fever[11]. These changes may be related to cytokine storm induced by virus invasion. However, a single elevated CRP is not very informative. For this reason, CRP is not specific enough to diagnose nosocomial pneumonia. Therefore, we further examined the levels of plasma inflammatory cytokines. Our results showed that IL-6, IL-10 and TNF- α were significantly elevated. IL-6 is a pro-inflammatory cytokine and is involved in a variety of immune and inflammatory responses by enhancing T-cell differentiation through the induction of IL-2[12]. The response time of IL-6 to infection is better than CRP[13]. IL-10 is an anti-inflammatory cytokine, which plays a crucial role in maintaining immune homeostasis, preventing immune mediated inflammatory diseases and exuberant immune responses to pathogens[14, 15]. Therefore, the pro-inflammatory and anti-inflammatory systems of these patients coexist and co-regulate immunity.

Although the six patients were seriously ill at admission, the therapeutic effect was satisfactory after timely treatments. The recovery rate of 2 young patients was significantly faster than 4 old patients. In addition, lesions in chest CTs were absorbed more quickly in two young patients. Therefore, the patient's autoimmunity may be a key factor affecting the patient's outcome. At present, there is no specific medicine for SARS-Cov-2 infection, and the clinical effect of blood purification is not clear. In our study, we performed blood purification for all patients. The Oxygenation improved significantly in all patients and none of them experienced deterioration. Therefore, blood purification can be tried for severe and critically ill patients.

Limitations Of This Study

This study has the following limitations. First, RT-PCR of pharynx swabs was used to diagnose NCIP and we didn't measure the viral load. Second, Five patients were transferred to Jiangjunshan hospital after their condition was obviously alleviated. We were unable to follow up the clinical data of the patients. After telephone follow-up, the 5 patients were in stable condition and were about to be discharged. Third, there are fewer severe cases outside Hubei, so only six patients were included in this study.

Conclusion

T lymphocyte decreased significantly, IL-6 and IL-10 elevated in patients with severe SARS-Cov-2-infected pneumonia. Elderly patients with comorbidities appear to be more severe and to recover more slowly. Blood purification can be tried for severe and critically ill patients. Early identification and timely treatment of critical cases is of crucial importance.

Declarations

Ethics approval and consent to participate

Written consent from the patient was waived, because of entirely anonymized images from which the individual cannot be identified.

Consent to publish

All authors have read and approved the manuscript version, and agree to submit for consideration for publication in the journal. We confirm that we have read the Journal's position on issues involved in ethical publication and affirm that this report is consistent with those guidelines.

Availability of data and materials

We stated that all the data and materials were true and available in the study.

Competing interests

All authors have read and approved the final version of the manuscript and agree to submit it for consideration for publication in the journal. There are no ethical/legal conflicts involved in the article.

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Disclosure

Neither of the authors has any conflict of interest to disclose.

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Tables

Due to technical limitations, all tables are only available for download from the Supplementary Files section.

Figures

Figure 1

Changes of blood cells, myocardial enzymes and CRP in 6 patients.

Figure 3

Changes of T lymphocyte subsets in 6 patients.

Figure 5

Changes of inflammatory mediators in 6 patients.

Figure 7

Changes of liver and kidney function in 6 patients.

Figure 9

Characteristics of chest CT changes in cases 1, 2, and 3.

Figure 11

Characteristics of chest CT changes in cases 4, 5, and 6.

Supplementary Files

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