

Analysis of Clinical and Imaging Characteristics of Suspected and Confirmed COVID-19 Patients

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Abstract: *Objective:* To analyze the clinical characteristics and chest CT imaging characteristics of patients with confirmed COVID-19 (COVID-19) and patients with suspected COVID-19. *Methods:* The study time span was from February 2020 to May 2020. The case samples were selected from 72 patients with confirmed covid-19 and suspected covid-19 diagnosed and treated by The First People's Hospital of Yinchuan and Yinchuan Temporary Emergency Hospital, including 38 patients with confirmed covid-19 and 34 patients with suspected covid-19. All patients underwent laboratory examination and chest CT examination, and the specific examination results were compared and analyzed. *Results:* There were significant differences in number of white blood cell, percentage of lymphocytes, creatine kinase and erythrocyte sedimentation rate between confirmed and suspected COVID-19 patients ($P < 0.05$). The CT imaging characteristics of COVID-19 patients were compared with those of suspected COVID-19 patients. The lesions of COVID-19 patients were mostly characterized by mixed ground glass density and pure ground glass density. There were vascular thickening and interstitial thickness increase, and accompanied by bronchiectasis or air bronchogram. The distribution of lesions was mostly subpleural without pleural effusion. The lesion area of suspected COVID-19 patients mostly showed solid density and mixed ground glass density. The lesion was distributed along bronchovascular and pleural effusion was observed. *Conclusion:* There are some differences in biochemical indexes and chest CT images between confirmed and suspected covid-19 patients, which can be used for differential diagnosis.

Keywords: Suspected; Diagnosis; COVID-19 biochemical indexes; Chest CT image

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1. Introduction

At the end of 2019, there were continuous cases of pneumonia of unknown cause in Wuhan, which were confirmed as novel coronavirus infection by gene sequencing test, and the epidemic spread rapidly in many regions of China^[1]. In January 2020, COVID-19 was officially named as COVID-19 by WHO, and China's National Health Commission included it into the category of Class B infectious disease, and took strict prevention and control measures. The routine protocol for clinical diagnosis of covid-19 is PCR kit nucleic acid detection, which is limited by sampling method, kit resources, false negative and other factors. This detection protocol has some defects in clinical practical application^[2]. Relevant experts believe that chest CT examination combined with clinical biochemical detection is a more effective scheme for the diagnosis

of covid-19. In this study, patients with confirmed and suspected covid-19 in The First People's Hospital of Yinchuan and Yinchuan Temporary Emergency Hospital were selected as basic samples to explore and evaluate their clinical and chest CT features.

2. Materials and methods

2.1. General information

The study time span was from February 2020 to May 2020. The case samples were selected from 72 patients with confirmed covid-19 and suspected covid-19 diagnosed and treated by The First People's Hospital of Yinchuan and Yinchuan Temporary Emergency Hospital, including 38 patients with confirmed covid-19 and 34 patients with suspected covid-19. There were 20 males and 18 females diagnosed with COVID-19.

The statistical range of age was 20-75 years, with an average of (43.62±2.79) years. There were 18 male and 16 female suspected COVID-19 patients, with a statistical age range of 14-78 years old, with an average of (43.89±2.88) years old. All patients were informed of the relevant contents of the study.

Inclusion criteria for confirmed COVID-19 patients: The nucleic acid test results were positive, which was consistent with the diagnostic criteria in COVID-19 Diagnosis and Treatment Protocol, and the clinical data and CT imaging data were complete.

Inclusion criteria for suspected COVID-19 patients: More than two nucleic acid test results were negative, which was consistent with the diagnostic criteria in COVID-19 Diagnosis and Treatment Protocol. CT signs were positive, and clinical data were complete.

2.2. Methods

All patients underwent laboratory examination, including creatine isozyme, creatine kinase, percentage and absolute value of lymphocytes, numeration of leukocyte, D-dimer, lactic dehydrogenase, high-sensitivity C-reactive protein, erythrocyte sedimentation rate, procalcitonin, aspartate aminotransferase, etc.

All patients underwent chest CT examination, assisted by multi-slice spiral CT in The First People's Hospital of Yinchuan and Yinchuan Temporary Emergency Hospital. The CT images were judged by the chest radiologist in the hospital. The distribution, density and morphology of the lesion area were observed in detail in the mediastinal window and lung window, and the abnormalities of the bronchus and the internal blood vessels of the lesion were observed. The presence of streak lesion, interstitial thickening, pleural effusion, etc. in the lesion area were observed. 2-4 days after the first chest CT examination, CT review was performed. If the lesions were significantly enlarged or increased, or the lesion scope had no significant change from the first examination, and the density changed to solid, the evaluation was considered as progression. If the lesion shrank or became solid, it was evaluated as remission.

2.3. Exclusion criteria

The biochemical test results and chest CT image characteristics of patients with confirmed covid-19 and suspected covid-19 were compared and analyzed.

2.4. Statistical methods

Spss23.0 software is introduced to calculate and analyze the research data. The measurement data is the (\pm s) representation of normal distribution, and the t-test mode is used for comparative analysis. The counting data is the% representation, and χ^2 test is used for comparative analysis. If the test value is $P < 0.05$, there is a statistical difference in data comparison.

3. Results

3.1. Comparative analysis of biochemical test results of confirmed and suspected COVID-19 patients

There were significant differences in white blood cell count, percentage of lymphocytes, creatine kinase and erythrocyte sedimentation rate between confirmed and suspected COVID-19 patients ($P < 0.05$).

Table 1. Comparative analysis of biochemical test results of confirmed and suspected covid-19 patients (n/%)

Group	White blood cell number is elevated	The percentage of lymphocytes is normal	Creatine kinase is elevated	Erythrocyte sedimentation rate is elevated
Confirmed COVID-19 patients (n=38):	2(5.3)	30(78.9)	5(13.2)	18(47.4)
Suspected COVID-19 patients (n=34):	7(20.6)	19(55.9)	0(0.0)	24(70.6)
χ^2 value	3.853	4.391	4.807	3.980
P values	0.049	0.036	0.028	0.046

3.2. Comparative analysis of chest CT imaging characteristics of confirmed and suspected COVID-19 patients

Comparing the CT image characteristics of patients with confirmed COVID-19 and patients with suspected COVID-19, the lesion areas of patients with confirmed COVID-19 are mostly mixed ground glass density and pure ground glass density. There are thickening of blood vessels and increase of interstitial thickness, accompanied by bronchiectasis or air containing bronchial sign. The lesions are mostly located under the pleura without pleural effusion. The lesion area of suspected COVID-19 patients mostly showed solid density and mixed ground glass density. The lesion was distributed along bronchovascular and pleural effusion was observed.

38 patients diagnosed with COVID-19 underwent CT Reexamination 2-4 days after the first chest CT examination. 10 patients were evaluated as progress and 28 patients were evaluated as remission. 34 patients with suspected COVID-19 underwent CT Reexamination 2-4 days after the first chest CT examination. 8 patients were evaluated as progress and 26 patients were evaluated as remission. After follow-up examination, one patient with suspected covid-19 was diagnosed as positive, 33 patients' lesions disappeared, clinical symptoms alleviated, and nucleic acid test results were negative, which met the discharge criteria.

4. Discussion

Covid-19 is highly infectious and can be transmitted by respiratory droplets or contact. Its incubation period is about 3-7 days. The main clinical symptoms of patients are fatigue, dry cough and fever. Some patients are accompanied by diarrhea, runny nose and nasal obstruction, and some patients have no typical clinical symptoms^[3-4]. In order to effectively control the epidemic situation of COVID-19, it is necessary to adopt effective diagnostic screening scheme and take isolation measures for suspected and confirmed covid-19 patients in time.

Through clinical biochemical test, there are significant differences in the number of white blood cell, percentage of lymphocytes, creatine kinase and erythrocyte sedimentation rate between the confirmed and suspected covid-19 patients. The percentage of lymphocytes and number of white blood cell of the confirmed covid-19 patients are mostly reduced or normal, creatine kinase is mostly normal or increased, and erythrocyte sedimentation rate is mostly normal or increased. The percentage of lymphocytes in

patients with suspected covid-19 is mostly reduced or normal, the number of white blood cell and erythrocyte sedimentation rate are mostly increased, and creatine kinase is mostly normal. According to the difference of biochemical test results, covid-19 can be assisted in the diagnosis.

The chest CT image of suspected covid-19 patients is characterized by the distribution of lesions along the blood vascular bundle, mostly mixed ground glass or solid density, and pleural effusion is existed. The chest CT imaging features of confirmed COVID-19 patients were compared with those of suspected COVID-19 patients as follows:

- (1) Affected by the lung parenchyma around respiratory bronchioles and terminal bronchiole involved in viral pneumonia, the lesions are mostly distributed below the pleura, and the pleura is parallel to the long axis of the lesions.
- (2) The diagnosis of COVID-19 patients mostly showed mixed or pure ground glass density, which can produce solidity with the progression of the disease. It can be considered that the early lesions of COVID-19 patients are mostly the exudation of inflammatory substances in the alveolar cavity, and advanced stage can lead to pulmonary parenchymal lesions ^[5].
- (3) Patients diagnosed with COVID-19 were affected by inflammation in areas such as alveolar septum or alveolar wall. Interstitial thickness was increased, interlobular septum was grid-like thickening, and paving stone-like lesions were seen under the shadow of ground glass.
- (4) Due to the effectiveness of factors such as inflammatory stimulation, vascular interstitial disease and so on, the majority of confirmed COVID-19 patients have congestion and vasodilatation of blood vessel, with ground glass shadow as the lesions, and their internal blood vessels are clear as well as there was vascular thickening shadow.
- (5) Affected by inflammatory stimulating factors, it is confirmed that the bronchial lumen of covid-19 patients is not completely occluded. CT examination shows that the lumen is dilated or normal, and there are signs of bronchial air, which are specific signs of virus invasion of pulmonary interstitium ^[6-7].
- (6) In inflammatory lesions of lung tissue, fiber components replace cell components during hyperplasia and repair. The early stage of the lesion produces a streak shadow. Local traction can lead to bronchiectasis, and most of them does not have pleural effusion.
- (7) Lesions of suspected and confirmed COVID-19 patients are mostly patchy, and confirmed COVID-19 patients are mostly round or oval ^[8].

To sum up, there are certain differences in biochemical indexes and chest CT images between confirmed and suspected covid-19 patients, which can be used for differential diagnosis. At the same time, the sample size of this study is insufficient and the duration angle is short, so the clinical and CT image characteristics of confirmed and suspected COVID-19 patients still need to be analyzed continuously.

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References

- [1] Hou KK, Zhang N, Li T, et al., 2020, CT Findings and Changes of Neutrophil/ Lymphocyte Ratio and

- T Lymphocyte Subsets at Different Stages of COVID-19. *Radiologic Practice*, 35(3): 272-276.
- [2] Chen T, Jiang ZY, Xu W, et al., 2020, Clinical and CT Imaging Features of 76 Patients with COVID 19. *Journal of Jinan University (Natural Science and Medicine)*, 41(2): 157-162.
- [3] Wu JL, Shen J, 2020, The Importance and Scientific Evaluation of CT in the Diagnosis and Treatment of COVID-19. *Journal of Dalian Medical University*, 42(1): 1-4.
- [4] Cheng YL, Zheng SF, Shi MG, et al., 2020, Analysis of the Disinfection Effect of Different Disinfection Methods on Special CT Machine for Pneumonia during COVID-19 Epidemic Period. *China Medical Devices*, 35(6): 16-18, 30.
- [5] Xia M, Yan LJ, Xiong MC, et al., 2020, Analysis of Chest CT Findings in 30 Patients with COVID-19 in Ezhou city, Hubei Province. *Shandong Medical Journal*, 60(5): 48-50.
- [6] Zhang N, Zou MY, Zhou S, 2020, Application of LOW-dose CT Scanning Combined with AI-assisted Diagnostic System in COVID-19 Examination. *Chinese Medical Equipment Journal*, 41(5): 9-11, 15.
- [7] Wei MQ, Li N, Shi MG, et al., 2020, Application Value of MPR Reconstruction Technique in CT Diagnosis of Early COVID-19 Patients. *China Medical Devices*, 35(6): 13-15.
- [8] Zhu ZX, Zhang Q, Xu W, et al., 2020, Analysis of CT Findings in 82 Cases of COVID-19 in Wuhan Area. *Journal of Southwest University (Social Sciences Edition)*, 42(5): 36-41.

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