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The characteristics and clinical value of chest CT images of novel corona virus pneumonia: An update

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Abstract

Aim: To investigate the characteristics of chest Computed Tomography (CT) images of corona virus pneumonia in India.

Materials and methods: Clinical data and CT images of 1000 cases of NCP were collected. Lesions were scored and characterized. The clinical manifestations and laboratory test results of the patients were analysed.

Results: The main clinical manifestations were fever, dry cough, and fatigue. A total of 15000 scored lesions were found in the first chest CT images of patients. The lesions were located mainly in the subpleural area of the lungs (90%). Most of the lesions were ground-glass opacity. Pulmonary consolidation accounted for 40% of all of the lesions. Of the 1000 cases, 900 patients (90%) had bilateral lung disease, 100 (1%) patients had unilateral lung disease

Conclusion: The chest CT of NCP patients is characterized by bilateral ground-glass lesions located in the subpleural area of the lung, and progressive consolidation with no migratory lesions. Pleural effusions and mediastinal lymphadenopathy are rare. As patients can have a negative early nucleic acid test, chest CT, in combination with epidemiological and laboratory tests, is a useful examination to evaluate the disease and curative effect.

Introduction

In 2019-2021, a viral pneumonia caused by severe acute respiratory syndrome corona virus 2 (SARS-CoV-2) infections swept across the world [5]. As of late 2021, >240 million patients have been diagnosed with this corona virus disease (COVID-19), with more than [5] million Deaths.

The World Health Organization (WHO) characterized COVID-19 as a pandemic.

SARS-CoV-2 nucleic acid is a single positive-stranded RNA [6]. The diagnosis of COVID-19 depends on Polymerase Chain Reaction (PCR) for quantitative detection of nucleic acid [3].

COVID-19 causes inflammatory lesions in the lungs denoted novel corona virus pneumonia. Chest Computed Tomography (CT) is the main examination for lung lesions and plays a vital role in the clinical diagnosis, observation of curative effect, and prognostic evaluation of this disease. The present study was

under taken to analyse the chest CT images of 1000 patients, combined with clinical data and related literature, to further our understanding of NCP.

Materials and methods

Clinical data

1000 patients (600 male and 400 female patients; age 1 to 96 years; average age 48 years) with confirmed disease were diagnosed at our department from July 2020 to June 2021. PCR of the patient's sputum was positive for n COV nucleic acid.

Diagnostic criteria

The diagnosis of COVID-19 is based on PCR detection of SARS-CoV-2 nucleic acid or viral gene sequencing of respiratory specimens [4]. The epidemiological history includes travel history, contact with people with fever or respiratory symptoms. There is an epidemiological link to viral infection. Laboratory tests have shown normal or decreased white blood cell counts, reduced lymphocyte counts, and some with elevated C-Reactive Protein (CRP) and D-dimer.

Image inspection method

HRCT examinations were under taken at various hospitals in India. The number of spiral CT detectors varied from 1 to 256 rows. Experienced radiologists evaluated the CT images visually and recorded image manifestations, lesion distribution and extent, and image characteristics. The lesions were divided into ground-glass opacification and consolidation. Subpleural lesions were defined as those lesions where the margin of the lesion was within 1.

Table 1: Patient clinical data, laboratory tests, and Computed Tomography (CT) results.

Index	Result
Number of cases	1000
Age (year)	48
Male sex	60% (600/1000)
Fever	70% (700/1000)
Dry cough or a little white sputum	50% (500/1000)
Decreased white blood cell count	50% (500/1000)
Increased white blood cell count	40% (400/1000)
Decreased lymphocyte count	70% (700/1000)
C-reactive protein increase	40% (400/1000)
Erythrocytese dimentation rate	10% (100/1000)
On set of bilateral lung lesions	90% (900/1000)
Subpleural lesions	90% (900/1000)
Ground-glassopacity	70% (700/1000)
Consolidation	20% (200/1000)
Pleural effusion	1% (10/1000)
Mediastinal lymphadenopathy	1% (10/1000)
CT follow-up of absorption and progression	20% (200/1000)

Statistical analysis

Continuous variables are represented by Standard Deviation (SD). Percentages were used for categorical variables.

Results

Clinical manifestations

70% had a fever with a body temperature above 39.5°C. Many patients (50%) had weakness and dry cough. Symptoms of upper respiratory infection, such as headache, stuffy nose, and runny nose, were rare. Most patients had a history of residence, travel, or contact with respiratory infections in the affected area.

Laboratory inspections

Leukocyte counts were decreased in 50% patients, lymphocyte counts were decreased in 70% patients. CRP was increased in 40% patients, erythrocytese dimentation rate was increased in 10% patients. All of the cases tested positive on PCR tests.

Imaging examination

All of the patients underwent HRCT of the lungs, and 200 patients under went follow-up CT within 2 Weeks.

A total of 15000 scored lesions were found in the first chest CT of the 1000 patients. The lesions were located mainly in the subpleural area (90%, 900/1000).

The lesions were mainly ground-glass opacities scattered in the subpleural area (90) in the first CT examinations. The ground-glass shadow was accompanied by thickening of the interlobular septum, showing a "pavingstone-like" change.

Pulmonary consolidation was present in 20% of patients. One patient had pleural effusion. One patient had enlarged mediastinal lymph nodes.

200 patients underwent follow-up chest CT 125 patients progressed, showing increased ground-glass lesions, increased range, or consolidation within the ground-glass lesions. In 50 cases of lesions absorption, the CT images showed reduction in ground-glass lesions or consolidation, reduced lesion density, and some lesions began to be absorbed from the inside showing a "reverse halosign".

Discussion

NCP is a wide spread disease of the lungs. In this article, the pathological principles of viral pneumonia were used to explore the CT imaging manifestations of NCP.

Regarding pathological changes, the virus enters the human respiratory system through the respiratory tract or mucous membrane, and enters the alveolar stroma along the bronchi and bronchioles. Because the bronchi and bronchiolar cilia have a filtering and cleaning effect, particles >2 mm in diameter can be removed; however, particles or microorganisms <2 mm in diameter cannot be removed [9]. The subpleural area is the structure of respiratory bronchioles, alveolar ducts, alveolar sacs, and alveoli. There is no ciliated tissue in this area, and the virus cannot be removed. Therefore, the subpleural area is the most easily colonised area. The basic lesion of viral pneumo-

nia is interstitial pneumonia [10]. Virus invasion into the body initially causes alveolar septal capillaries to dilate and congest, and a small amount of fluid is seen in the alveolar cavity. The lesion is centred on the secondary lung lobules with lobular septal oedema. As the virus multiplies in the body, the alveolar interstitial phase of pneumonia occurs caused by further expansion of the blood vessels and increasing exudate in the alveolar cavity, cellulose exudation is seen in the lungs, and the lesion area increases. During the dissipative period, there is reduction in the oedema of the alveolar capillaries and lobular septum, alveolar exudation and absorption, the remaining lobular septum is thickened, and the bronchial wall is thickened or appears twisted into a cord.

Because the disease is highly contagious, the available data should be summarised and shared rapidly. The limitations of this study were the small number of cases and short observation time; thus, the disease outcome needs to be studied in the future.

Conclusion

In conclusion, the performance of NCP on CT has certain characteristics, and the clinical diagnosis should be made in combination with clinical and laboratory tests. Although the nucleicacid test can confirm the diagnosis, according to current clinical experience, some patients may still have a negative nucleicacid test after inflammatory lesions are seen at lung CT. Therefore, chest CT and follow-up have a clear role in assessing the severity of disease and curative effect.

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