

Narrative Review Article: Covid CT Chest Finding



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ABSTRACT

The manifestations of Covid-19 in the CT scan of children with Covid-19 are very diverse and lacking in features. Some children with mild disease have normal findings on CT scan. In those patients with pulmonary disorders, the most common finding is ground glass opacities, especially in the peripheral and posterior parts of the lungs, along with involvement of the sub pleural areas. Compared to adults, ground-glass opacities in children with Covid-19 are more localized and characterized by lower attenuation and less lobular involvement. A study has shown that small nodular ground-glass opacities can be found in children with Covid-19. In addition to manifestations such as ground-glass opacities, consolidation or thickening of interlobular septa can also be seen in children. In some rare cases, diffuse consolidation of the lung occurs, which is seen as a white lung. In addition to the above-mentioned findings, in some cases, high-resolution CT scan changes are similar to bronchopneumonia and are seen as patchy opacities along the bronchial vascular bundle. In another study conducted by Steinberger et al., 30 children with Covid-19 aged 10 months to 18 years were examined. In most of these children, the CT scan did not show any specific findings, and the observed findings were opaque glass opacities with peripheral distribution, crazy paving pattern, and signs of aura and inverted aura.

Introduction

In late 2019, the outbreak of the novel human coronavirus caused respiratory disease in Wuhan [1-3], China, and the virus spread rapidly around the world. Chest tomography scan of patients suffering [4-9] from corona virus disease have shown different stages of respiratory involvement, by presenting different conditions of the lungs, the need for individual ventilation strategies in those who become seriously ill [10-15], chest physiotherapy has been proven to

improve long-term breathing in the body. It is effective. There is still no evidence about the effect of chest physiotherapy on the disease of covid-19 [16-25]. However, due to the fact that people suffering from this disease clearly suffer from respiratory problems, and as a result, symptoms such as decreased oxygen levels, shortness of breath, irritating and dry coughs, irritation of the pharynx and sputum appear [26].

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Organ damage caused by covid-19: Although covid-19 is a disease that primarily affects the lungs, it can also damage other organs. Damage to organs may increase the risk of long-term health problems [27-29].

Heart: Imaging tests done months after recovery from Covid-19 have shown permanent damage to the heart muscle, even in people who have experienced only mild symptoms of Covid-19, which may increase the risk of heart failure or other heart complications. The future will increase [30-32].

Lungs: The type of pneumonia often associated with Covid-19 can cause long-term damage to the tiny air sacs (alveoli) in the lungs. The

resulting tissue damage can lead to long-term breathing problems [33-35].

Blood clots and blood vessel problems: Covid-19 can make blood cells more likely to clot and cause heart and brain attacks, but it is believed that most of the heart damage caused by Covid-19 is from very small clots. It occurs when the small blood vessels (capillaries) in the heart muscle become blocked. Other parts of the body that are affected by blood clots include the lungs, legs, liver [36-45], and kidneys. Covid-19 can also weaken blood vessels and cause them to leak, leading to possible long-term liver and kidney problems [46].

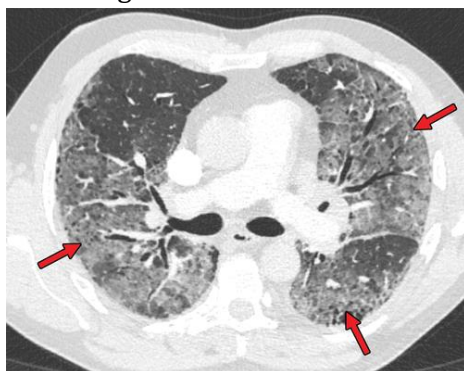


Figure 1: Chest CT in COVID-19: What the Radiologist Needs to Know

Also, these researchers showed a significant relationship between the severity of the findings and the age of the children [47-50]. In the present study, although the severity of the relationship between the severity of the findings and the age of children was not investigated, it was shown that children with pleural effusion were significantly older than children without this finding in CT scan [51-60].

Other studies conducted on children, including Lee et al.'s and Len et al.'s, were case reports and did not have enough sample size to draw definitive conclusions [61-70]. Lung involvement in studies conducted on adults also mostly indicate a much higher prevalence of lung involvement in this age group than

children. Milder symptoms of Covid-19 in children and less lung involvement in them compared to adults may be due to the difference in the receptor of angiotensin converting enzyme 2. Angiotensin 2 is an important binding receptor for the Covid-19 virus [72].

This receptor in children is not yet fully matured, and its function is also reduced compared to adults, which makes this age group less susceptible to virus attachment. In addition, children's immune systems are still growing and maturing [73-80]. Therefore, the intensity of the immune response (cytokine storm) is not as high as that of adults, which reduces damage to the body. The important point is that according to previous studies, especially in adults, lung

involvement and its extent in the initial CT scan of patients can determine their prognosis and disease progression [81-90]. Therefore, although pulmonary involvement in children is generally less than adults, diagnosing pulmonary involvement in the early stages of the disease can play a significant role in preventing long-term pulmonary complications by applying timely treatments and interventions. A new study shows that the binding affinity of ACE2 to the receptor-binding domain in SARS-CoV-2 is about 10-20 times higher than that of SARS-CoV RBD [91-100]. ACE2 has been reported to be widely expressed in various body systems, including the cardiovascular system, kidneys, lungs, and brain, which could provide an explanation for some Covid-19 patients dying from multiple organ failure.

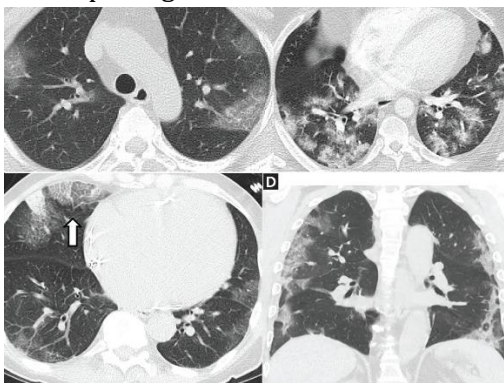


Figure 2. Thoracic imaging in COVID-19

In the rapid transmission of the virus between people and the lack of specific treatment for this disease, it is very important to identify infected people in the early stages in order to quarantine them. Molecular testing has been introduced as a confirmatory test for this disease. Recently,

there have been reports of false negative results in the initial molecular test of affected patients. Some of the reasons that can cause false negative results in the RT-PCR test include problems in sampling and transfer of samples, the efficiency of the kits used, and the quality of the test performed by the operator. On the other hand, CT scan is used as a routine imaging tool for the diagnosis of lung pneumonia, which according to some common findings in the lungs of people infected with the Corona virus, its use can provide quick results. The increase in mortality observed in people with older age is in accordance with past studies [101-109].

Of course, it should be noted that the mortality rate reported in this study was calculated based on hospitalized patients and cannot represent the exact mortality rate due to the disease. The Covid-19 disease has a high speed of transmission between people, and it is necessary to identify it in the early stages in order to control, quarantine and prevent its widespread transmission [110-114]. RT-PCR test is currently used as a confirmatory test for Covid-19. In this study, by placing the RT-PCR test results as a reference, the sensitivity and accuracy of CT scan to diagnose this disease was measured. In the present study, 185 patients had positive results before confirmation by RT-PCR, of which 135 were confirmed by RT-PCR test. Of course, one of the limitations of this study is the lack of secondary RT-PCR for symptomatic individuals, which can show the sensitivity of the primary test well.

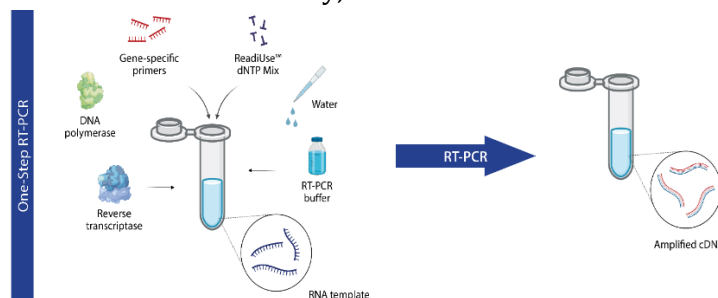


Figure 3. Reverse Transcription PCR (RT-PCR)

In another study conducted by Moradi et al., by estimating and evaluating based on the GAM model parameters of time-dependent transmission rate, time-dependent recovery rate and time-dependent mortality rate of the outbreak of Covid-19 in China and using the number Covid-19 infections in Iran, the number of patients for the next month in Iran was estimated. The value and importance predicted and estimated in this study is to emphasize the peak time of the epidemic, hospital preparedness, government measures and public preparedness to reduce social contacts.

In a study conducted by Eshrati and his colleagues, the factors affecting the mortality rate of Covid-19 patients admitted to the ICU were investigated. Based on the findings of this study, the mortality rate in Covid-19 patients admitted to the intensive care unit with underlying diseases such as chronic obstructive pulmonary disease, diabetes and kidney diseases is higher than other patients. Therefore, in order to reduce the death rate, more attention should be paid to these patients and people who have underlying diseases.

In a study conducted by Nikoubakht and his colleagues, the importance of designing remote counseling services in the field of Covid-19 disease has been pointed out. In this way, by minimizing the presence of specialist doctors and other colleagues in the field of treatment in the face of high-risk conditions, the possibility of infection for the treatment staff on the one hand and the waiting period and the need for protective equipment on the other hand will be minimized. In a study that was conducted at the request of the Medical Care Monitoring Center of the Ministry of Health, Treatment and Medical Education of Iran, all hospitals were required to register hospitalized patients with a confirmed or suspected diagnosis of Covid-19.

In this study conducted by Jalili et al., the characteristics and mortality rate of people

infected with this virus in Iran were investigated and analyzed. The high mortality rate corresponds to the hospitalized population. In accordance with other studies, hypoxemia, fever, and cough were common symptoms recorded as common complications in these patients.

In another study conducted by Huang and his colleagues, it was found that in nine pregnant women with Covid-19 infection, symptoms included fever (in seven of nine patients), cough (in four of nine patients), muscle pain (in three 1 out of 9 patients), sore throat (in 2 out of 9 patients), diarrhea (in 1 out of 9 patients) and shortness of breath (in 2 out of 9 patients). When their babies were sampled and examined, the babies had no symptoms of the Corona virus, indicating no evidence of direct mother-to-child transmission of the infection.

Another study, in 41 hospitalized patients in Wuhan with confirmed Covid-19 infection, showed that 32% of the patients had underlying diseases such as diabetes, hypertension and cardiovascular diseases, and clinical symptoms such as fever (98%), cough (76%), fatigue (44%), sputum production (28%), headache (8%), bloody sputum (5%) and diarrhea (3%). In addition, the results of examining the clinical symptoms of four Covid-19 patients who visited the China Public Health Clinic and were confirmed to be infected with Covid-19 showed that most of them had fever, fatigue and dry cough, and some of them had nasal congestion. They had a runny nose and diarrhea. In another study conducted by Zhang and his colleagues on 138 hospitalized patients with confirmed cases of Covid-19 in a Wuhan hospital, it shows that the most common symptoms of infected patients are fever, fatigue, dry cough, anorexia, and runny nose, shortness of breath, phlegm, diarrhea, nausea, dizziness, headache, vomiting and abdominal pain.

The limited role of CT scan and X-ray in Corona diagnosis

The American College of Radiology (ACR), which represents approximately 40,000 radiologists in

the United States, has issued a guideline that CT and X-rays should not be used as first-line tools for diagnosing or screening for Corona virus.

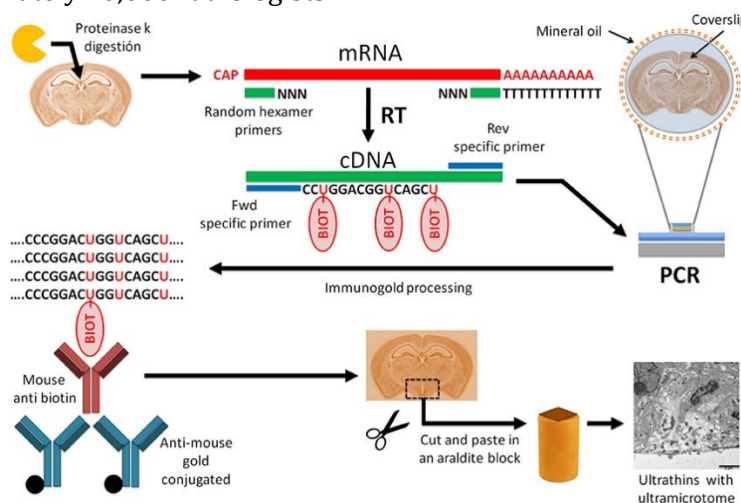


Figure 4. In situ RT-PCR Optimized for Electron Microscopy

Conclusion

The amount of white blood cells and neutrophils in these patients increased and the amount of lymphocytes and platelets decreased. Also, an increase in D-dimer, keratin kinase, keratin and LDH was seen in the blood factors of these patients. The study, on the blood samples of 24 asymptomatic carriers with confirmed Covid-19, showed that in 16.7% of patients, the number of lymphocytes was reduced, and in most of the patients, the amount of ALT, AST, CPR, D-dimer and keratin kinase was increased. The study on 41 patients showed that 63% of them had the number of lymphocytes below the normal level and their ALT, AST, D-dimer, bilirubin, creatinine and LDH increased. These studies show that the first way to diagnose this disease is to check changes in cells and blood factors. Nowadays, serum CRP value is determined and measured by different methods such as capillary tube precipitation, hemagglutination immunodiffusion and latex agglutination method. But among them, the latex-agglutination method is more common than other methods. To measure lactate dehydrogenase in blood samples, kinetic

methods such as "Lactate to pyruvate" or "Pyruvate to lactate" conversion are usually used. Different iso enzymes of lactate dehydrogenase are also separated using electrophoresis method. Also, changes of ALT and AST enzymes in blood samples can be measured using chemiluminescence, chromatography, ultraviolet light absorption and fluorescence methods. In order to measure CK enzyme, various methods such as immunoelectrophoretic and chromatography can be used; But these methods are time-consuming and are not useful for quick and emergency diagnosis. Other methods that are used are immunological methods such as the use of anti-enzyme labeled antibody, which is also a bit time-consuming. Another method that is preferred over other methods is the safety harness method.

For serological analysis of Covid-19, ELISA kits containing viral nucleoproteins can also be used to detect immunoglobulins such as IgM and IgG. In Zhang et al.'s study, on patients with Covid-19, the amount of antibodies was low or undetectable in the first days, but in the following days, the infection caused by this

disease leads to an increase in the amount of IgM and IgG antibodies, which can be useful in diagnosing the infection. Apart from the designed methods and kits based on ELISA, turbidometry, nephelometry,

immunoelectrophoresis, chemiluminescence, ELFA, CLIA IFA and RIA serology methods are another application to measure IgM and IgG produced in this disease.

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