World Bulletin of Public Health (WBPH)
Available Online at: https://www.scholarexpress.net
Volume-10, MAY 2022
ISSN: 2749-3644

THE DIAGNOSTIC VALUE OF COMPUTED TOMOGRAPHY IN THE DIAGNOSIS OF COVID-19 DISEASE

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Article history:

Received: March 10th 2022
Accepted: April 10th 2022
Published: May 22nd 2022

Abstract:

A new coronavirus infection (COVID-19) has caused a pandemic, which not only caused a revision of approaches to diagnosis and treatment of infectious diseases, but also required a reassessment of the role of diagnostic radiology in detecting COVID-19 and its complications, assessing the effectiveness of current treatment, and verifying manifestations of postvaccination syndrome. Undoubtedly, special attention at primary diagnosis of the disease is paid to the state of lungs, and more and more data indicate the involvement of gastrointestinal tract organs, other target organs. Obviously, it is computed tomography (CT) that forms the basis of the radiotherapy diagnosis of COVID-19. However, the need to control the radiation load on the patient's body, the relative focus of chest CT assessment on changes in the lungs only, insufficient use of quantitative criteria of lung and abdominal organs examination are the reasons for optimizing algorithms of disease diagnosis, CT technique and assessment of obtained results.

Keywords: COVID-19, coronavirus pneumonia, multislice computed tomography, differential diagnosis.

INTRODUCTION.

Until 2002, humanity had treated coronaviruses as seasonal influenza viruses that did not cause serious complications. In November 2002, in rural areas of Guangdong Province, China, there was an outbreak of a new, previously unknown disease called Severe Acute Respiratory Syndrome (SARS, SARS) with a case fatality rate of 11%, caused by a coronavirus. The causative agent of this disease was named SARS-CoV and was subsequently incorporated into a type of betacoronavirus resulting from a new type of coronavirus associated with severe acute respiratory syndrome [5]. In September 2012, another previously unknown coronavirus (MERS-CoV), classified as a new species within the betacoronavirus type (Middle East respiratory syndrome associated coronavirus), began to be reported in countries of the Middle East, causing severe cases of respiratory illness called Middle East respiratory syndrome (MERS). [1,2]. By the end of May 2020, 6.1 million people had been registered worldwide. Patients with more than SARS-CoV-1 infection have been identified, of which more than 370 000 have ended up deadly. An outbreak of the new infection was first reported among indigenous people in Wuhan, China, in late 2019. Mortality rates in the current COVID-19 epidemic are significantly lower than those in Severe Acute Respiratory Syndrome (SARS) or Middle East Respiratory Syndrome (MERS). However, the SARS-CoV-2 virus spreads much more rapidly and has a relatively more lethal outcome than SARS and MERS viruses. Genetic studies have demonstrated that the etiologic agent of COVID-19 is SARS-CoV(2002-2003), which is closely related to betacoronavirus (Betacoronavirus) and causes severe acute respiratory

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Volume-10, MAY 2022
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syndrome. Consequently, this virus is SARS-CoV-2. New coronaviruses have spread around the world, causing some problems in the organization of emergency services. The world economy was in crisis. Researchers from different countries have therefore found that the development of viral rejection pathways, diagnostic tests, preventive vaccines and the creation of drugs are the main factors preventing the development of the disease. Studies in Uganda showed that the main clinical signs of COVID-19 were fever, cough, shortness of breath and wheezing. Less common symptoms of COVID-19 include phlegm, headache, haemoptysis and gastrointestinal symptoms. Community-acquired pneumonia is considered one of the major and most urgent public health problems, and is associated with high morbidity and mortality. Currently, the pandemic of a new coronavirus infection, COVID-19, brings a renewed focus on this topic, as it is crucial to diagnose pneumonia and lung damage seen with SARS-CoV-2 and to analyse treatment issues. In this regard, it should be noted that, according to the World Health Organization, more than 3 million people die each year from pneumonia and influenza. These are usually elderly patients with chronic obstructive pulmonary disease (COPD), malignancies, diabetes and other comorbidities [3,4]. A new coronavirus infection, COVID-19, has killed more than half a million people and increased the number of people infected worldwide by more than 10 million [6,7]. Coronavirus pneumonia has several stages: 1. Viremia. The course of the disease is similar to that of the common cold, with a period of 7 days to 9 days. 2. Breakdown of the disease occurs from 9 days to 14 days. Caused by damage to the respiratory epithelial cells, with the addition of a bacterial infection. 3. If pneumonia is not detected early, breathing provokes distress syndrome. The person cannot breathe without the aid of a ventilator (ventilator). Immunosuppression stage. If the disease is not stopped early, there is increased and congenital loss of immunity. 4. In coronavirus pneumonia, the pathogenic flora and fungal infection are most often added to the underlying pathogen of viral nature. Typical normal dyspnoea is the main difference between coronavirus pneumonia and other types of pneumonia.

Pneumonia with coronavirus infection is classified as atypical community-acquired pneumonia. In this disease, a non-bacterial agent is added to the lung virus and typical members of the hospital microflora. A major step in the pathogenesis of any infection is the colonisation of human pathogen biotopes and opportunistic pathogens. Analysis of opportunistic pathogens on the invasive feature of the nasal ring is important in developing a disease profile. The upper respiratory tract microbiome, as an integral part of the macrobiota, is an 'organ' that is actively involved in the protection and formation of the pathological process in the lungs [7,8,9,10].

The disease can also cause pneumonia and death accompanied by respiratory failure, ranging from mild to severe, depending on the severity (Covid-19). The significant increase in the number of patients with COVID-19 has led to an accumulation of experience in the surveillance, diagnosis and treatment of patients with COVID-19. In the first synthesis study, based on the follow-up of 1099 patients during the first period of the COVID-19 pandemic, the frequency of various clinical signs and changes on computed tomography (CT) of the chest organs was determined [7,12]. In particular, 86.2 per cent of the 975 patients examined had changes on computed tomography (CT) scan. At the same time, 51.8 per cent of patients described bilateral changes, and the most frequent "pale mirror" symptom was 56.4 per cent. The main point in CT diagnosis was the division of changes into stages according to days of illness (8,13).

Later, various scientific publications have proposed different variations in the differentiation of CT findings (bilateral "opaque glass", "stone coating" and others [9, 11]), depending on the stage of disease in COVID-19 and the progression of the disease. During the COVID-19 pandemic, studies have found that plain chest X-rays are less sensitive than CT scans. Because of the lack of association between the auscultatory symptoms of pneumonia and the degree of lung damage, and the false-negative results of polymerase chain reaction (PZR) studies, CT scanning became the basic diagnostic test for COVID-19 disease. During the COVID-19 disease pandemic, bronchopulmonary pathology, including cancer, tuberculosis [12, 13], and the natural involvement of patients from another group in the epidemic process are observed, indicating the need for differential diagnosis of these patients. As a result, in the diagnosis of coronavirus pneumonia, radiologists and clinicians must distinguish it from other respiratory diseases, which can often be a background. Numerous scientific publications are devoted to differential diagnosis of radiological signs in COVID-19 disease, their specificity, frequency of different variants of coronavirus infection, peculiarities of lung damage in other viral and bacterial pneumonias. In real clinical practice, even concomitant patients with radiological signs of other diseases can develop coronavirus pneumonia. In current scientific publications, data

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analysing the incidence and characteristics of the radiological manifestations of COVID-19 are very rare. In patients with COVID-19, diagnosis and comparative diagnosis of the disease are not only of clinical but also of epidemiological importance, as timely skilled interpretation of CT scans allows patients to be referred to different medical departments.

Purpose of the study: To determine the importance and place of computed tomography in patients with COVID-19.

MATERIALS AND METHODS.

The material for the study was the results of computed tomography performed in a certain group of patients in Samarkand city and their protocols on the history of the disease. The blood, urine and feces were taken as a test material, and blood, urine and feces analyses, virological methods, PCR, coagulogram, D-dimer determination, ferritin, procalcitonin, CIC were carried out. Computed tomography was performed with 128 slices on a GEOptima-CT660 diagnostic apparatus. The results were analysed by in-depth statistics without retrospective.

Study discussion: based on an analysis of the clinical and laboratory findings of patients with COVID-19 in Samarkand city. During follow-up, this allowed the division of patients into several unequal groups based on the radiological symptoms found in patients with COVID-19: Patients with only signs of coronavirus pneumonia, patients with a combination of COVID-19 disease and different types of comorbidities, patients with symptoms of COVID-19 and its complications (pleurisy, secondary bacterial pneumonia, decompression, pneumothorax), patients with other pathologies or patients diagnosed with COVID-19, Clinical examples are presented showing The Role Of CT Scan In The Examination Of The Chest For Its Complications And Joint Diseases.

1-clinical example.

H. Patient, 23 years old. On the 8th day of illness he was admitted to hospital with the following diagnosis: "New coronavirus infection. Bilateral polysegmental pneumonia, not grade 2". Co-morbid: Grade II arterial hypertension. Obesity II degree.

Conclusion of computed tomography at the time of admission of the patient: a large number of individual or combined "pale glass" foci, which were located almost symmetrically, scattered peribronchovascularly and sublobally in all regions of the lungs. Combined openings were (up to 6-8 cm) apical, medially, and in the lower basal segments of both lungs. A reticular component and linear adhesion were identified in their background, and no consolidation was observed. The lesion volume is 50-75% (interim recommendation for transfer and treatment of patients with COVID-19, according to homa10, corresponds to KT-3 weighting). A polymerase chain reaction (PCR) test was positive for SARS-CoV-2 RNA. Due to intoxication and respiratory failure (nE), Kuchai's patient was transferred to the intensive care unit. High-precision oxygen therapy was administered and treatment measures based on the protocol were carried out. However, despite the therapeutic measures, the patient was transferred to artificial pulmonary ventilation (APV) on day 11 of the illness.

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1-table.
To determine the severity of the disease according to changes in the CT scan

Level of disease severity	Changes in CT	Size of changes
Level of illumination	Changes in the appearance of the 'frosted glass'	Maximum diameter 3 cm pathological changes up to
Moderate form	Changes in the appearance of "frosted glass"	Maximal diameter 3 cm.ob than 3 pathological chan older
Moderate to severe form	There are solitary foci of consolidation in the form of "frosted glass".	Lung parenchyma

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Volume-10, MAY 2022
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There are multiple foci of consolidation in the form of "pale glass" changes, reticular changes and lung parenchyma architectonics abnormalities	25-50% infiltrative lesions

2-table.
Classifying them according to changes in CT

Rate of change	Major changes in CT scans	Size of changes
Level Gt - 0	No CT changes consistent with the epidemiological and clinical picture of viral pneumonia	
	Changes in the "frosted glass" appearance without observing other signs	Less than 25% of the lung parenchyma is involved
Gt-1	Changes in the "frosted glass" appearance without observing other signs	Addition of more than 25-50% of the lung parenchyma to the process
illumination level	Changes in the appearance of the "frosted glass" with consolidation ovens	50-75% of the lung parenchyma is involved
Gt-2	Observation of foci of thickening with diffuse density and "pale glass" reticular changes	More than 75% of the lung parenchyma is involved

2-Clinical Example.

Patient T., 55 years old. The patient had a dry cough, sneezing, body temperature of 39.5°C for 5 days. Outpatient SARS-CoV-2 RNA si test result was positive. Symptomatic treatment was given, but there was no effect of the treatment. On day 6 of the illness, he was rushed to hospital. The condition is severe when the patient is admitted to hospital. Body temperature: 39.5 °C. As for the mind itself, it gives an adequate response. NS22 min. Saturation 93%. Heart rate 90 beats per minute. CT findings on admission: both pulmonary parenchyma had multiple "pale glass" foci with minimal reticular changes (CO-RADS 5, CT-2). Treatment was started based on the moma19 version, which is an interim guideline for the management and treatment of patients with COVID-10. Oxygen therapy was given. On the 8th day of illness, the patient was transferred to the intensive care unit with an 89% increase in saturation and an increase in breaths up to 30 times. The patient was intubated and ventilated. On the 18th day of the disease a CT scan was performed due to a sharp decrease in oxygenation and a left-sided pneumothorax was detected. In this regard, a pleural cavity drainage was performed. An air gap was visible against a 'pale glass' in the lower part of the right lung as well as a compaction with a left-sided pneumothorax. Partially compressed lung parenchyma in the left pleural cavity shows pale glass. The patient's general condition improved with treatment, he started breathing on his own and was transferred to the ward. The next recovery period was without complications and the patient was taken home in a satisfactory condition on day 51 from the onset of the disease. In this clinical example, CT scanning allowed us to observe the dynamics of lung changes in a patient who had been in the ICU for a long time due to a severe coronavirus infection complicated by pneumonia, bacterial superinfection with destruction of lung tissue and pneumothorax.

3-Clinical Example

Patient A., 68 years old. He was treated in a hospital in early January 2020 with a diagnosis of community-acquired pneumonia. Co-morbidities: Stage III arterial hypertension. Impaired cerebral blood circulation. Parkinson's disease. Obesity degree II. Re-diagnosed with community-acquired pneumonia in September 2020. SARS-CoV-2 RNA was not detected in the nasal and oral smear twice. According to a computed tomography scan, there was a large infiltration in the root of the left lung, which is characteristic of bacterial pneumonia. During the course of treatment there was a complete regression of the infiltration of the left lung. As the patient's general condition improved, the house was responded to. But the next day the patient was found to have a body temperature of up to 38 C. Due to this, the patient was admitted to hospital on several occasions. On admission the patient's condition was of moderate severity, occupying a mandatory position due to limited mobility. No auscultatory rales were heard in the lungs. SpO2 -94%.

SARS-CoV-2 RNA was detected in the oral ring lubricant.

Thoracic computed tomography findings: pulmonary tissue oxygen saturation has decreased in the parenchyma of both lungs, it is diffuse in many places, has taken root as "pale glass" and is located in subplanar areas. In the last few days there has been a deterioration of the patient's well-being and an

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Volume-10, MAY 2022
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increase in the volume of the lung lesion on CT-3. On the 21st day of hospitalization he was sent home after stabilization of the general condition and partial regression. Thus, patient A. according to the history, the first episode of pneumonia (most likely having an oedematous nature) is a bacterial infection, while the second episode is thought to be related to a coronavirus infection.

4-Clinical Example

Patient S., 58 years old. In 2005 he underwent radical mastectomy for breast cancer with removal of lymph nodes on the left side, followed by polychimotomy and light therapy. On 30.04.2020 he was admitted to hospital due to mild physical exertion from a hangover. The patient was diagnosed with cardiomyopathy. Patient was diagnosed with 1st degree left bundle branch GISA atrioventricular block. Decreased left ventricular ejection fraction (26%). Chronic heart failure grade III. Bilateral hydrothorax. Pleural fluid is detected. The patient receives treatment on a standard basis. In a satisfactory condition, the patient responded to Dom. A week after the patient was given an answer, fever appeared and the Hangover began to increase again. A computed tomography scan was carried out on the recommendation of the outpatient clinic doctor, which revealed multiple foci of "pale glass" in both lungs on the background of cardiomegaly. A peripherally located polysegmental thickening was found on the right side at 50-75% and on the left side at 25-50%. The patient was admitted to hospital in a severe condition with a hangover at rest. On admission the patient had a body temperature of 36.1°C. Diffuse cyanosis. NS 1 min 22-24. SpO2 94%, on oxygen therapy 98-100%. Blood pressure 100/60 mm.sim.ust.ga just the same, heart rate 125 beats per minute, tachycardia with QRS complex on ECG. This condition was resolved by medical treatment of the tumour, no hepatomegaly was detected. SARS-CoV-2 RNA was detected in the oral ring lubricant.

Chest CT findings on admission: diffuse thickening of the interdollicular spaces in both pulmonary parenchyma (interstitial tumour) as well as "pale glass" foci. In the parenchyma, foci in the form of "pale glass" were found predominantly on the basal and right side (right side 50-75%, Chapa 25-50%, CT-3, CORADS 4). There are also areas of infiltration about 14 mm in size. The thickness of the pleural fluid layer is 3 cm in the cup, 1.3 cm on the right. Cardiomegaly is observed.

Given the severe cardiac abnormalities, an examination by a cardiologist, a pulmonologist, a general practitioner was prescribed and treatment was recommended. On the 11th day of illness, a repeat chest CT scan revealed a 35% reduction in the volume and amount of air masses in both lungs in the form of thickening/"pale glass" (CT-2). At the same time, due to lower lung fibrosis, a reduction in the size of the sublung area was detected. The patient was treated (diuretic therapy, intravenous albumin given hypoalbuminemia). On day 18 of illness, a repeat chest radiograph showed a 25% reduction in the volume and number of areas of thickening/"dull glass" in both lungs. Within the small circulation there was a reduction of diminished dimples but there was a slight increase in the amount of fluid in the pleural cavities. There was a significant reduction in heart rate (SpO2 98%), stable haemodynamics (ECG - 78 per minute heart rate, sinus rhythm, AQB 90/60 mm wired ust.ga equivalent), C-reactive protein (SRP) level of 49.9 to 1.6 mg/l. SARS-CoV-2 pneumonia. RNA analysis gave a double negative result. The patient was subsequently treated with cardiac resynchronisation therapy as planned.

In this clinical case, computed tomography enabled a comparative diagnosis of pulmonary parenchymal infiltration symptoms in coronavirus infection with severe heart failure due to pulmonary circulatory failure.

Thus, given the duration of the patient's complaints, the negative SARS-CoV-2 RNA test and the CT scan data, it can be assumed that the patient was diagnosed with coronavirus more than a month ago and the disease was asymptomatic. When the patient was hospitalised, the replication had already stopped. However, the changes in the lungs caused by the coronavirus infection detected by the CT scan were still present. A preliminary CT scan is recommended in all patients with suspected COVID-19; if there is no clinical improvement within 7 days during treatment, or if the clinical laboratory values deteriorate, re-injection is recommended (Table 2).

CONCLUSION:

It must be said that the primary importance of CT in the new pandemic of coronavirus infection is very important in the diagnosis of COVID-2 in circumstances where SARS-CoV-19 RNA testing is impossible or negative and to determine the severity of the disease. In the case of COVID-19, the monitoring of pulmonary tissue by CT scan is important for the correction of therapy. In clinical practice, CT scanning allows the differential diagnosis of pulmonary and extracellular pathologies in patients with comorbidities, in addition to detecting changes specific to COVID-19.

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Volume-10, MAY 2022
ISSN: 2749-3644

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