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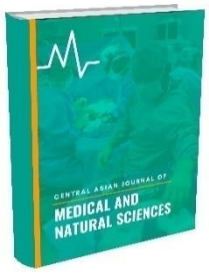

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The Role of Computed Tomography in the Diagnosis of Coronavirus Infection

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Abstract: A large amount of literature is devoted to the differential diagnosis of X-ray symptoms of COVID-19, their differences from other variants of lung damage (other viral and bacterial pneumonias), and non-pulmonary diseases. In real clinical practice, coronavirus pneumonia can develop in patients who have radiological signs of another, intercurrent disease.

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

Introduction

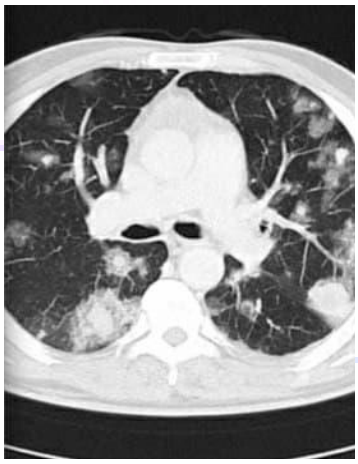
The first reports of a new coronavirus infection COVID-19 appeared at the end of December 2019 from Wuhan, Hubei, People's Republic of China. The report described 4 cases of pneumonia of unknown etiology, with no effect from standard antibacterial therapy for 3-5 days [1]. January 7, 2020. The World Health Organization published information on the identification of a new coronavirus as the cause of the disease, and also suggested a link between infection and visiting a market in Wuhan [2, 3]. Subsequently, the tropicity of the virus to the receptors was established angiotensin-converting enzyme 2 of alveolocytes, followed by cell infection and direct cytopathic action of the virus [4, 5]. Due to its clinical features, as well as its genetic relationship with the coronavirus that caused the severe acute respiratory syndrome (SARS) outbreak in 2002-2003, the virus was named SARS-CoV-2 [6]. During January-June 2020, there was an exponential increase in the incidence of diseases worldwide, the number of cases exceeded 7 million people. The first reports based on the description of individual clinical cases have already begun to arrive. early January. Cases of pneumonia associated with the novel coronavirus were described as bilateral interstitial lung damage that does not respond to standard antibacterial therapy, with an increase in respiratory failure (DN) and the formation of acute respiratory distress syndrome (ARDS). A significant increase in the number of cases allowed us to quickly gain experience in monitoring, diagnosing and treating patients with COVID-19. In the first generalizing study, conducted on the basis of observation of 1099 patients, the frequency of various clinical symptoms and changes in the course of treatment was established. computed tomography (CT) of the thoracic organs (OGC) [7]. In particular, CT changes were detected in 86.2% of the 975 patients examined. At the same time, bilateral changes were described in 51.8% of patients, and the most common symptom of "frosted glass" - in 56.4%. The key point in CT diagnostics was the separation of changes in accordance with the stages and days of the disease [8]. In the future, various options were proposed for differentiating the CT picture of COVID-

19 both according to the Internal Medicine Archive and according to the compliance criteria (bilateral lesion, symptoms of "frosted glass", " cobblestone mostovoy", etc.), and on the dynamics of development, highlighted in various literature reviews [9-11]. There is a generally accepted opinion that the sensitivity of chest X-rays is significantly lower than that of CT scans. Due to the lack of correlation of auscultative signs of pneumonia with the volume of lung damage, as well as frequent primary false-negative results of polymerase chain reaction (PCR) examination, CT has become the reference method for diagnosing COVID-19 and the severity of the disease. As a screening study, CT is also recommended in the territory of the Russian Federation.Russia [12]. The massive spread of COVID-19 has led to the regular involvement in the epidemic process of people with the presence of bronchopulmonary pathology caused by other causes, including cancer and tuberculosis [13, 14], which determined the need for differential diagnosis. In addition to COVID-19, more than 400 thousand cases of community-acquired pneumonia per 100 thousand population are registered annually in Russia, tuberculosis is widespread-44.06 per 100 thousand population [15], more than 60 thousand new cases of malignant neoplasms of the trachea and bronchi are detected annually and lungs [16], as a result of which, in the process of diagnosing coronavirus pneumonia, radiologists and clinicians need to differentiate it from other respiratory diseases, which can often be background (Table 1). A large number of publications are devoted to the differential diagnosis of X-ray symptoms of COVID-19, their specificity, frequency of occurrence in various variants of the course of coronavirus infection, differences from other variants of lung damage (other viral and bacterial pneumonias), and non-pulmonary diseases [20]. In real clinical practice coronavirus pneumonia can develop in comorbid patients who have radiological signs of another disease. In the available medical literature, we were unable to find any studies devoted to the analysis of the frequency and features of radiological manifestations of concomitant diseases in patients with coronavirus infection. Questions of differential diagnosis in patients with COVID-19 are not only of clinical, but also of epidemiological significance, since timely implementation and competent interpretation of CT data allows us to separate patient flows to different departments of medical institutions. In this regard, a number of clinical cases are interesting

Materials and methods

A retrospective analysis of medical records and computed tomograms of patients was carried out, with a description of individual clinical cases, and therefore statistical methods were used sparsely. We observed 354 patients (age 59 (IQR: 49-70) years, 56% women) admitted to the hospital with suspected COVID-19. Patients were hospitalized from day 1 to day 56 from the onset of symptoms (8 (IQR:6-11) days), in 5 (1.4%) patients due to the inability of verbal contact, the timing of the onset of the disease could not be determined. Every patient admitted to the clinic with suspicion for COVID-19, it was scanned by the same 64-section scanner (Discovery CT750HD; GE Healthcare) located in the "red zone" of the tomography department. Most of the research was conducted natively. The operating parameters of the X-ray tube of the tomograph were as follows: voltage-100 mA, current - 100 kV, the maximum field of view during scanning (up to 50 cm), the time of one rotation of the tube is 0.6 seconds and the spiral pitch is 1.375: 1. The thickness of image slices is 1.25 mm, with a 40-cm field of view and a 512-512 matrix. In addition, two series of images with different factors were obtained from the reconstruction results stiffness — in the pulmonary and mediastinal windows. Subsequent post-processing and detailed analysis of thin image scans with the construction of multiplanar reconstructions, minimum (MinIP) and maximum intensity (MIP) modes was performed remotely via a local network by a radiologist in the" green zone " of the department, on the Advantage Workstation 4.6 tomograph workstation (GE Healthcare, USA). When assessing changes in the pulmonary parenchyma in patients, the department's doctors relied on temporary guidelines for the prevention, diagnosis and treatment of a new coronavirus infection (COVID-19) of the Ministry of Health Russian Federation, relevant at the time of the study [12]. Based on these data, the severity

scale of the disease was evaluated, taking into account the volume of lesion (in%) of the lung parenchyma. Also, the CO-RADS classification developed by the Dutch Radiological Society's COVID-19 working group was used for structured assessment of the specificity of detected changes in lung tissue [21]. Statistical data processing was performed in the SPSS Statistics program. The data are presented as median and interquartile range (IQR), with 95% confidence interval values for the fractions (95%CI). Clinical examples Patient T., 53 years old, Debuts with fever up to 39.5°C for 5 days, dry cough, shortness of breath. A coronavirus swab was taken on an outpatient basis, and SARS-CoV-2 RNA was detected. Symptomatic treatment was performed, with no effect. He was hospitalized in an emergency on the 5th day of the disease. Upon admission: Serious condition. Body temperature: 39.5°C. Conscious, adequate. BDD 25 min. Saturation is 93%. Heart rate 90 beats / min - 6 points. CT scan on admission: in the parenchyma of both lungs, there are multiple areas of frosted glass, combined with minimal reticular changes (CO-RADS 5, CT-2). Treatment started (hydroxychloroquine, azithromycin, amoxicillin), oxygen therapy. On the 8th day of the disease due to an increase in DN, a decrease in saturation up to 89%, increased shortness of breath up to 30 beats. in min, he was transferred to the intensive care unit, intubated, ventilator was started, and later tracheostomy was performed. On the 18th day of the disease, due to a sharp decrease in oxygenation, CT was performed, a left-sided pneumothorax was detected (Figure 1), and therefore the pleural cavity *was drained.*



Against the background of" frosted glass " in the lower lobe of the right lung, there is consolidation with the air cavity (arrow), as well as left-sided pneumothorax (arrow).

During the treatment, the patient's condition improved, the patient was transferred to independent breathing, decanulated, and transferred to the department. The subsequent recovery period was uncomplicated, and the patient was discharged home in a satisfactory condition on the 51st day after the onset of the disease. In this clinical observation, CT allowed us to track the dynamics of changes in the lungs of a patient who was in the intensive care unit for a long time due to a severe coronavirus infection complicated by pneumonia, with bacterial superinfection with destruction of lung tissue, pneumothorax, most likely associated with mechanical ventilation.

Patient A., 74 years old In early April 2020 was treated for community-acquired pneumonia in a hospital (not LRC), SARS-CoV-2 RNA was not detected twice in oropharyngeal and nasopharyngeal smears. Concomitant diseases: Hypertension stage III. Degree of arterial hypertension 2. Risk 4 (very high). Targeted ADV therefore hospitalized in the LRC. At admission, the condition is moderate, the position is forced due to limited mobility. In the lungs, wheezing is not heard. SpO2 –94%. SARS-CoV-2 RNA was detected in the oropharyngeal smear. OGC CT data for p-bluntness: in the parenchyma both lungs are visualized diffuse multiple areas of reduced airiness of the lung tissue like "frosted glass" with basal and subpleural localization, the largest size in S6 of the right lung (up to 55x32mm) (CO-RADS 5, CT-2). Over the next few days, there was a deterioration in health, an increase in the volume of lung damage to CT-3 (Figure 5B). After stabilization and partial regression of inflammation, she was discharged home on the 21st day of hospitalization. Thus, according to the assessment of the patient's data ., it can be assumed that the first episode of pneumonia (probably hypostatic) was associated with a bacterial infection, and the second — with infection with coronavirus.

Conclusion

In the context of a new coronavirus infection pandemic, one of the main tasks solved by CT is to diagnose COVID-19 in the context of an inaccessible or negative SARS-CoV-2 RNA test. Equally important is the ability to track the dynamics of changes in lung tissue using CT scans in patients with COVID-19 for timely correction of management tactics. In clinical practice, in addition to determining typical changes in COVID-19, the CT method allows for differential diagnosis of pulmonary and extrapulmonary pathology in comorbid patients. Our experience shows that the combination of coronavirus pneumonia with another pathology of the chest cavity occurs in 10.2% of patients, and only X-ray symptoms of other diseases are detected in 0.6% without signs of infection with coronavirus infection. It is advisable to conduct an initial CT scan in all patients with suspected COVID-19, and repeat it if there is no clinical improvement during treatment for 7 days or if the clinical and laboratory parameters worsen.

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