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USING OF THE CARE SCALE IN MONITORING THE TREATMENT OF ACUTE CORONAVIRUS PNEUMONIA

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ABSTRACT

The mechanisms of pneumonia caused by SARS-CoV-2 appear particularly complex. In some cases, a reaction called a "cytokine storm" occurs. The effect is extensive tissue damage with dysfunctional coagulation and inflammatory response, as well as pulmonary microvascular thrombosis associated with viral lung injury.

Chest X-ray is not recommended as a first-line imaging method for COVID-19 diagnosis due to its limited sensitivity in detecting opaque glass and other early pulmonary signs of infection. He demonstrated high sensitivity, but limited individuality. The changes observed on chest X-rays of patients with COVID-19 are similar to changes on CT, and both methods usually show bilateral peripheral consolidation and opacity in the form of a dull mirror. It has been established that the severity of abnormalities on chest X-rays peaks 10-12 days after the onset of symptoms.

Chest X-ray shows better results in monitoring of treatment in COVID-19 with good sensitivity (85%) and diagnostic accuracy.

Key words: COVID-19, pneumonia, Chest – X ray, monitoring.

INTRODUCTION

COVID-19 spread rapidly to cities and countries beyond China [3, 5, 6, 8]. On January 30, 2020, the World Health Organization (WHO) declared this ongoing spread a global health emergency, and on February 28, 2020, it elevated the risk of COVID-19 to a very high level on a global scale [1,3,8]. As of March 2, 2020, a total of 88,948 COVID-19 cases and 3,043 deaths had been confirmed, with 80,174 cases in China and 8,774 cases in 64 other countries [5, 6,7,8].

COVID-19 not only caused inflammation in the lungs but also led to various degrees of pneumonia on the lung surface. In the conducted studies, the majority of patients, even after treatment for COVID-19, returned with complaints of neurological symptoms, including dizziness (18%), headache (21%), loss of taste and smell (39%), and a feeling of oxygen deficiency (8%) experienced by some patients. Almost 90% of these complications were not observed in the 1-year follow-up after treatment. Conversely, severe weakness, which some patients did not experience in the hospital, persisted among 34% of those who sought medical attention during the first year after treatment, and among 7-8% of those who sought attention after 2 years. We found that this is closely related to pulmonary fibrosis and bronchiectasis (Table 1).

Table 1

Complaints of patients with moderate and severe CEOP at the time of follow-up visit No. 608

Symptoms	3- 5 mo	6-8 mo	9-12 mo
Dry cough	11,2 %	4.5 %	1.3%
Shortness of breath	23 %	14%	1.1%
Sputum	16%	4.2%	0.3%
Dizziness	18%	3.9%	0 %
Headache	21%	2.6	0 %
Loss of taste and smell	39%	12 %	1.6%
Oxygen deficiency	5,6%	1,1 %	0,4%
Severe weakness	44 %	27%	11%

In our research, we used the CARE (COVID-19 Chest X-ray Assessment) scale for monitoring the treatment of CAP. (This scale was proposed by Borghesi and Maroldi in March 2020, specifically developed for evaluating chest radiographs of confirmed COVID-19 patients). We applied this scale to monitor the treatment of coronavirus pneumonia and obtained rapid, positive results during the course of treating patients.

Using this scale, two stages of coronavirus pneumonia chest X-Ray image analysis were employed.

In the first stage, each lung was divided into three zones in the anterior chest projection (PA or AP). For the right lung, these zones are designated by the letters

A, B, and C, while for the left lung, they are designated by the letters D, E, and F (Figure 1).

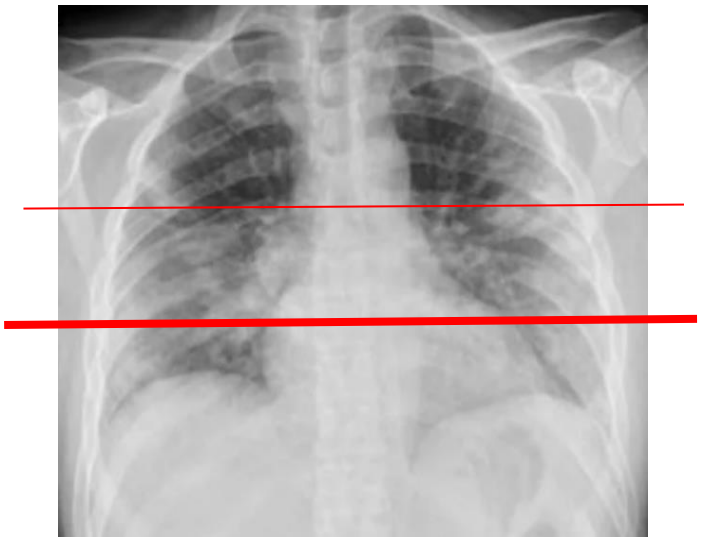


Figure 1. Patient: 65 years old man. Chest X-ray (frontal view). According to the CARE scale, both lungs were divided into 3 sections, forming 6 surfaces. The affected areas were calculated based on points, total 9 points in this image.

Stage 1 - Assigning scores to each zone based on identified lung changes (from 0 to 3 points): 0 - no lung changes; 1 - interstitial infiltrates (Figure 2);

2 - interstitial and alveolar infiltrates (with interstitial infiltrates predominating);

3 - interstitial and alveolar infiltrates (with alveolar infiltrates predominating). The total score consisted of the sum of points accumulated across all zones, ranging from 0 to 18 (Table 2).

Table 2

Severity levels on the Care scale in points

Severity	**18-44**	**45-60**	**60-75**	**≥ 75**
Mild (2-5 ball)	6,85%	4,75%	2.35 %	1,05%
Moderate (6-9 ball)	5,1%	7,4%	15,9 %	12,6%
Severy (≥ 10 ball)	1,4 %	9,7%	17.6 %	15.3%

2 - figure.

Figure 2. Patient E., 47 years old. Mild course of the disease: subtle, ill-defined peripheral opacities in the lower lobes

In moderate COVID-19, radiological changes appeared in the form of interstitial and alveolar infiltrates, with interstitial infiltrates predominating (Figure 3).;

3 -figure.

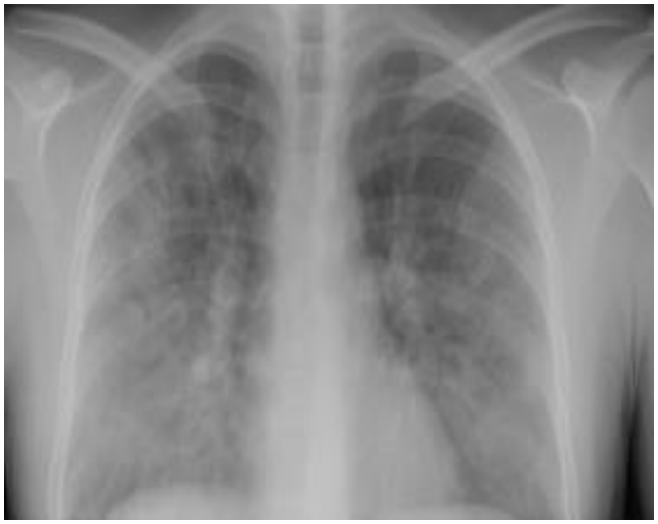


Figure 3. Patient E., 47 years old. PCR (+). Stage of shadow dissemination (absorption) - clearly defined shadows visible in all areas.

Based on the identified lung changes, CARE demonstrated the best predictive results in terms of accuracy, sensitivity, and specificity even at the time of admission. This evidence highlights the importance of correctly assessing the severity of COVID-19 infection. CARE indicators were significantly higher in

patients who were initially in COVID-19 wards and subsequently required transfer to the intensive care unit, compared to patients who were treated exclusively in COVID-19 wards.

The most severe CARE indicators were observed in the lower regions of both survivors and deceased patients (Fig. 4). In each of the studied deceased patients, the CARE indicators were significantly higher. High scores were noted in the lower areas, and significantly elevated indicators were observed across all regions ($p<0.05$).

The most severe score scales were found in the lungs of the deceased patients.

4 -figure.

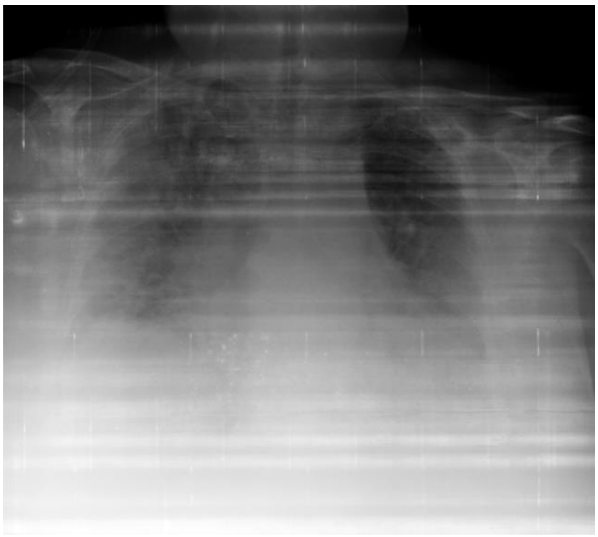
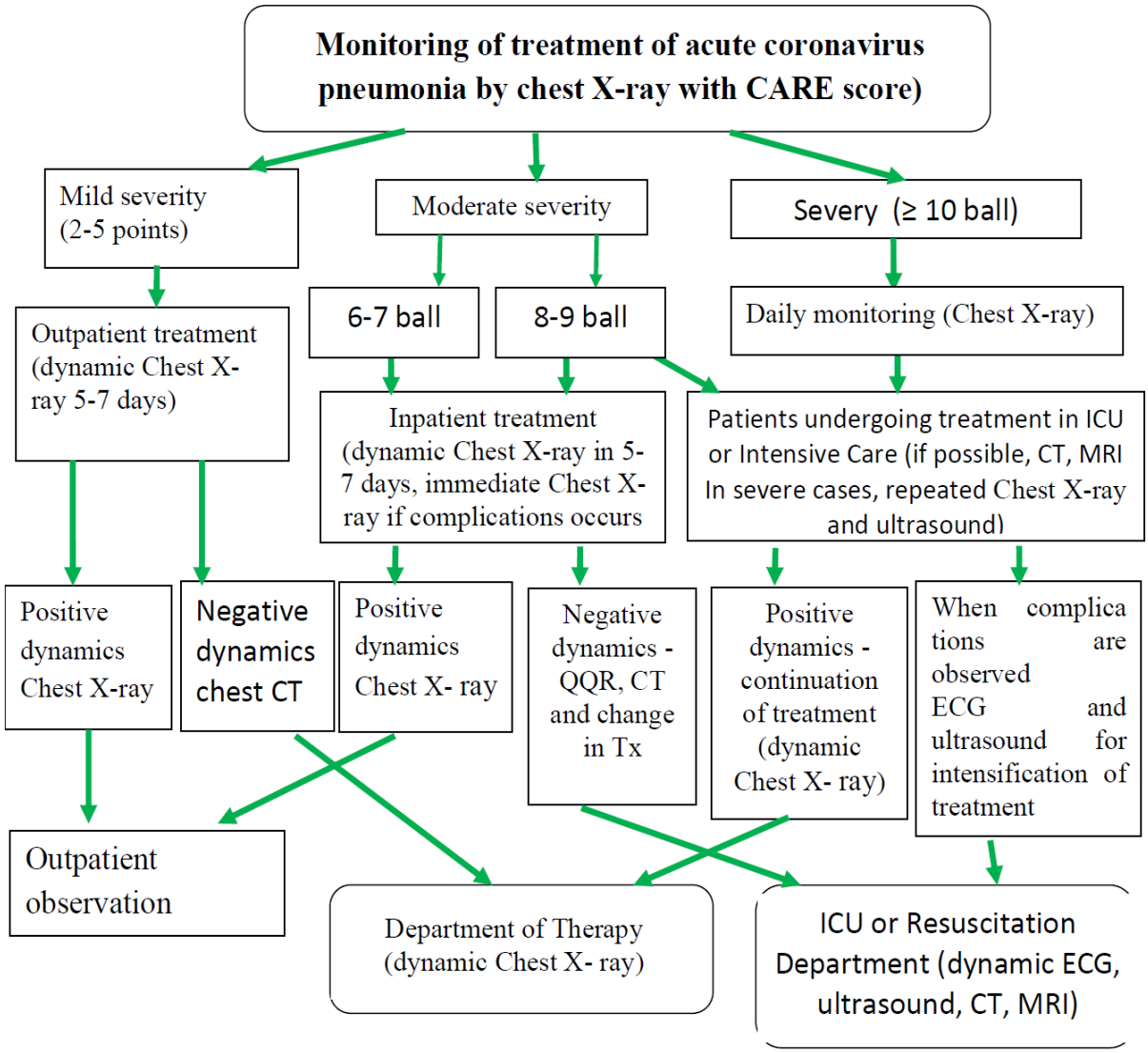


Figure 4. AP chest X-ray. Patient A, 63 years old, with a history of chronic renal failure. Increased opacity is observed in the lower, middle, and upper zones of the right lung and in the lower zone of the left lung. In the upper zone of the left lung, low-density opacities are detected. Fluid accumulation is noted in the pleural cavity, occupying the lower zones of both lungs along with the costophrenic angles.

Thus, CARE demonstrated that chest X-ray is a reliable tool for assessing the severity of lung damage and has good prognostic value at the time of hospitalization and during the treatment process. Furthermore, this scale allows for a semi-quantitative assessment of the degree of lung involvement and the dynamics of changes in acute COVID-19 pneumonia. It also aids in predicting disease outcomes and adapting treatment methods.

Based on the analysis of our above-mentioned examinations, the following summarizes the algorithmic steps for conducting radiation diagnostic monitoring of CEOP treatment (Algorithm):

Algorithm



Monitoring the treatment of acute coronavirus pneumonia with radiologic methods

In conclusion, routine chest imaging is not recommended for regular COVID-19 screening in ordinary clinical situations. However, it still plays a crucial role in disease detection and staging, especially in assessing complications or disease progression. In such cases, based on X-ray examination results, it is important to either refer patients for observation or conduct further tests. Radiological examination results have proven highly effective in predicting the course of COVID-19 and are appropriate for monitoring long-term outcomes. Compared to CT, chest X-ray is less expensive and more convenient, allowing for a reduction in

the risk of cross-infection. Nevertheless, it still has certain limitations in terms of early diagnosis, differential diagnosis, and precise diagnosis, and cannot replace the identification of the pathogen.

It is advisable to perform repeated MSCT examinations on patients with a high risk of inevitable clinical decompensation. Currently, the availability of numerous advanced CT systems and classifications facilitates this task and, thus, contributes to the improvement of treatment and outcomes for COVID-19.

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