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TOMOGRAPHIC PATTERNS IN THE DIAGNOSTIC APPROACH TO COVID 19

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Abstract: Introduction: Computed axial tomography is a diagnostic imaging study in the field of medicine, it is expressed in images that show the interior of the human body structurally, through millimeter cross-sections using radiation. Objective: To identify the radiological findings in the chest computed tomography for the diagnosis of COVID - 19, through a systematic review of evidence-based medicine. **Methodology:** Non-experimental descriptive study, through a systematic review of scientific articles from the main evidence-based medicine repositories and databases, through a search prism (Pubmed, Cochrane, Elseiver, Google Scholar). It is a logical deductive method, through the literature search, the radiological parameters of computed tomography in patients diagnosed with COVID - 19 are analyzed and described. **Conclusion:** Lung computed tomography can fully show its distribution, results of changes in shape and density and dynamic changes in patients with COVID-19 in the course of the disease and important clinical manifestations. The combination of the patient's laboratory indicators can help guide early clinical diagnosis, early isolation and early rehabilitation of coronavirus, and can be used as a basis for evaluating treatment-induced adverse reactions and the time in which symptoms linked to the radiological study appear.
Keywords: Tomography, Covid 19, diagnostic imaging, coronavirus.

INTRODUCTION

Computed axial tomography (CT) is a diagnostic imaging study in the field of medicine, it is expressed in images that show the interior of the human body structurally, through millimeter cross-sections using radiation. The doctor can request a tomographic study of any part of the body, starting from the skull to the lower

extremities, in suspicion of a pathology in a specific location. (1,2)

According to the latest guidelines published by the Chinese government, the diagnosis of Covid-19 must be confirmed by PCR or gene sequencing for respiratory or blood samples. But the complementary tests that show lung involvement is Tomography, which is why the use of this study is essential for an effective diagnosis of coronaviruses. (3)

Ecuador has adhered to the standards issued by the World Health Organization in all areas, for this reason the WHO has a diagnostic plan called Algorithm for the management of patients with suspected COVID-19 infection at the first level of care and in remote areas of the Region of the Americas, where the diagnosis by means of images is carried out according to the availability of the health home with chest X-ray and chest tomography. (4)

In the new coronavirus disease, it consists of infection by the severe acute respiratory syndrome virus also called SARS. CoV-2, is the cause of COVID-19, with its numbering because the first case was in 2019 in the month of December and taxonomically it is part of the Coronaviridae family. (4)

The most common symptoms are fever and cough, and they are present in almost all patients, however, there are asymptomatic people who do not show signs of the disease, but contain the virus. The fever occurs for a long time in high degrees of temperature, which shows an unfavorable prognosis if it is not treated in time. The evolution of the cough is variable, it can be dry or productive and sometimes hemoptysis can occur. Fatigue, myalgia and headaches are common and occur in a percentage of 10 and 20% of cases. (5)

In the following bibliographic review, the radiological findings that are presented in the computed tomography associated with the symptoms of COVID-19 will be announced, in order to obtain a timely and effective diagnosis.

At the end of 2019, it became known on the Asian continent in China, Wuhan city specifically, with the appearance of a new viral microorganism, unknown at the time and called coronavirus (SARS-CoV-2). It was registered on January 31, 2020 in Spain, the first imported case for a month later on February 26, 2020, a local contagion occurred. The most important entity regarding health worldwide, the World Health Organization (WHO) established on March 12, 2020 to take sanitary measures by declaring a pandemic with a disease called COVID-19. (5)

Taking into account the massive contagion until May 10, 2020, alarming numbers of infected 3,986,119 registered cases have been disseminated, of which 278,814 have died. This new virus has affected the population regardless of their ethnic or racial characteristics and since its behavior has been little studied, it has not been possible to establish a specific treatment, taking especially the vulnerable population and with associated comorbidities, referring to the Hispanic population, with rates of high mortality. (6)

This Pneumonia (SARS-CoV-2) is highly contagious, adequate isolation to reduce the spread, early clinical diagnosis and establishing differentiation of its symptoms from other diseases, which is of great importance, must be a priority. Laboratory studies using swab tests exemplify the presence or absence of viral load and imaging studies play a leading role in detecting potential damage in the lower respiratory tract and avoiding irreversible damage. (7)

RADIOLOGICAL FINDINGS OF THE COMPUTED TOMOGRAPHY WITH THE SYMPTOMATOLOGY OF PATIENTS WITH COVID-19

RADIOLOGICAL PATTERN	SYMPTOMS
Opacity on ground or frosted glass	Asymptomatic patients Fever Sore throat Dry cough mild dyspnea headache, fatigue
Patchy atelectasis and/ or hyperinflation and/ or thickening of the bronchial wall	Fever Dry cough Fatigue Muscle pain Diarrhea headache Conjunctivitis
Focal alveolar consolidation involving no more than one segment or one lobe	Fever Dry cough Dyspnea or hypoxemia
Multifocal consolidation	Fever Dry cough Dyspnea or hypoxemia
Diffuse alveolar consolidation.	Fever Dry coughDyspnea or hypoxemia

Table I. Relationship of radiological findings with symptoms in Covid-19.

Elaborated: Authors.

Source: Fonseca EKUN, Ferreira LC, Loureiro BMC, Strabelli DG, Farias LPG, Queiroz GA, Garcia JVR, Teixeira RF, Gama VAA, Chate RC, Assunção Júnior AN, Sawamura MVY, Nomura CH. Chest computed tomography in the diagnosis of COVID-19 in patients with false negative RT-PCR. Einstein (Sao Paulo). 2021 Nov 5;19:eAO6363. doi: 10.31744/einstein_journal/2021AO6363. PMID: 34755810; PMCID: PMC8555875.

The typical imaging features of patients with COVID-19 have differed multiple manifestations at different stages of the disease. We can assess the disease severity of COVID-19 and treatment efficacy through dynamic observation of computed tomography images to guide clinical management. Ground glass opacity is the most typical imaging feature of COVID-19. (12)

In a retrospective study, analysis of computed tomography images of 21 patients showed that the majority of patients had single or multiple ground-glass opacities in the early stages of the disease, and the extent of ground-glass opacity patterns it continued to expand with the progression of the disease. (13) In the late stages of COVID-19, ground-glass opacity is often combined with other imaging features, such as lung consolidation, pavement appearance, etc. (14)

In the current case reports, the CT images of these patients showed the same pattern of change. One of the most representative cases is the change of CT scan in a 44-year-old transport station of the Huanan Seafood Market in Wuhan. (15) On admission, multiple patterns of bilateral ground-glass opacities appeared in the subpleural region of the lungs, and as the disease progressed, CT scans showed a muddy pavement appearance, and the number and range ground glass opacity gradually expanded to the entire lung. (16)

We can speculate that, in the initial stages of the disease, the single or multiple ground-glass opacity pattern is the most common symptom, distributed mainly unilaterally or bilaterally in the posterior aspect and periphery of the lungs, the distribution being more common. bilateral. Lung consolidation is also one of the features of CT scans in patients with COVID-19, which is considered a sign of disease progression. bread and cabbage found that lung consolidation is rare in the early stages of COVID-19. (17)

With disease progression, pulmonary consolidation gradually appears, and the range of lesions continues to expand. In the later stages of COVID-19, the range of lung consolidation becomes larger and more

diffuse. This pattern is clearly shown in current case reports of some COVID-19 patients. (18) Notably, in a study by Song, CT images of a 75-year-old man on admission clearly showed no pulmonary consolidation, whereas CT images on day 3 after admission showed more consolidations. (19)

In addition, in the clinical case of a 32-year-old man, as the condition improved, the lung consolidation in the patient. The CT scan image gradually disappeared. According to these reports, larger consolidation indicated disease progression, while smaller size and absorption of these lesions indicated improvement. Therefore, we can define that, in the early stages of the disease, pulmonary consolidation is rare. (twenty)

During the progression of the disease, pulmonary consolidation begins to appear and gradually becomes the main imaging feature. In the later stages of the disease, the range of pulmonary consolidations is more extensive, with some severe cases even showing a "white lung" appearance. (twenty-one)

The most common symptoms in 83 patients with COVID-19 pneumonia were fever, cough, expectoration, and myalgia. The least frequent symptoms were headache, dyspnea, abdominal pain, diarrhea, pharyngeal discomfort, and chest pain.(22) Of these, twenty-five (30.1%) were severe or critical cases and 58 (69.9%) were ordinary cases. Compared with the ordinary group, severe/critical patients were significantly older (mean age, 53.7 years vs 41.9 years) and had more comorbidities of diabetes mellitus and chronic obstructive pulmonary disease.(23)

Compared with normal patients, critically ill patients had a higher body temperature and a higher incidence of cough, expectoration, dyspnea, and chest pain. No significant differences in heart rate, respiratory rate, and blood pressure were found between the 2 groups. There was no difference in the proportion of men and women between the 2 groups, indicating that gender was not a risk factor for disease severity. (24)

Compared with the ordinary group, the critical group had a higher incidence of chest pain and dyspnea. Chest pain can result from an inflammatory condition of the pleura. Dyspnea is related to severe damage to the alveoli in the critical group. High body temperature may indicate that the immune system of seriously or critically ill patients was highly activated. The appearance of these symptoms could help clinicians to identify the severity of the disease in clinical practice. (23)

EFFECTIVENESS OF COMPUTED TOMOGRAPHY IN COVID-19

According to the established bibliography, the effectiveness of computed tomography can be verified both in asymptomatic patients and in patients with mild symptoms of the Covid-19 disease, taking into account the radiological patterns according to the location of the lesions and the intensity of the concomitant affectation over time. in which the appearance of symptoms could be evidenced. (24)

In radiological studies, a certain group of patients is complemented with laboratory examinations, mainly with PCR tests, which constituted an important prognostic factor in the recovery of patients and in the administration of the most appropriate and early treatment. (25)

The characteristics of computed tomography images in patients with COVID-19, as the first sign lung consolidation and ground-glass opacity, located mainly in the posterior and peripheral part of the lungs.(26) Computed tomography shows an efficacy than 90%, classified as a very sensitive diagnostic method for lesions that occur in COVID-19, it is also irreplaceable, since it expresses the reality of lung tissue, for correct

follow-up to provide timely treatment and reduce complications of the patient and thus have a good prognosis of this disease. (27)

CHARACTERISTICS	SYMPTOMATIC PATIENTS	ASYMPTOMATIC PATIENTS
VITAL SIGNS	- Respiratory rate of 30 rpm or more -Oxygen saturation of 93% or less at rest -FiO2 of 300mg or less (1mmHg)	- Oxygen saturation of 95% in some patients undergoing study
SIGNIFICANT CRITERIA	--Respiratory failure requiring mechanical ventilation -Shock -Treatment in Intensive Care Unit	- Elevated erythrocyte sedimentation rate
ASSOCIATED CHRONIC DISEASES	- Mellitus diabetes -COPD -Arterial hypertension -Heart disease	- Autoimmune diseases (Lupus, Rheumatoid Arthritis) -Neurological disorders
IGG TEST	-POSITIVE	-NEGATIVE
IGM TEST	-POSITIVE	-POSITIVE

Table II. Differences between asymptomatic and symptomatic patients diagnosed with Covid 19.

Elaborated: Authors

Source: Macias Gil R, Marcelin JR, Zuniga-Blanco B, Marquez C, Mathew T, Piggott DA. (2020). COVID-19 Pandemic: Disparate Health Impact on the Hispanic/Latinx Population in the United States. J Infect Dis. 2020 October 13;222(10):1592-1595. doi: 10.1093/infdis/jiaa474. PMID: 32729903; PMCID: PMC7454709.

Previous studies have shown that the sensitivity of computed tomography among symptomatic patients was high (73% to 97%), although the specificity differed widely (24% to 100%). The clinical performance of computed tomography may vary based on differences in patient populations, disease severity, and accessibility of chest tomography in each country. (28) In the present study, chest CT showed higher sensitivity than assay, but the sensitivity was only 73.3% among symptomatic patients who tested positive for SARS-CoV2 by RT-qPCR. (29).

Bernheim et al reported that the sensitivity of chest computed tomography was low (44%) in the acute phase (0 to 2 days after onset) but high (91%) in the intermediate phase (3 to 5 days). The low sensitivity of chest CT may reflect the short time between symptom onset and hospitalization in the symptomatic patients examined in this study. (30) Diagnostic sensitivity was improved by combining the immunochromatography assay and chest computed tomography (81.3%). When RT-qPCR is not available or practical, the combination may be useful in diagnosing COVID-19. Identification of asymptomatic patients with COVID-19 is important to prevent nosocomial infection. The average incubation period for COVID-19 is 5.2 days, but ranges from 0-24 days. Hospitalized patients with other illnesses who did not show respiratory symptoms have also been reported to develop symptomatic COVID-19 and spread SARS-CoV2 to other patients and medical workers. Furthermore, transmission of SARS-CoV2 from patients without respiratory symptoms has been reported in several countries. (31) In the present study, chest CT showed higher sensitivity than immunochromatography assay (57.9% vs. 39.5%, respectively), but chest CT is not practical for all hospitalized patients. due to the risk of radiation exposure and limited medical resources. (32) Although the assay alone may not be useful as a test for asymptomatic COVID-19 due to its low

sensitivity, it may contribute to the prevention of nosocomial infection.

CO-RADS	SUSPICION LEVEL	INTERPRETATION
CO-RADS 0	NOT INTERPRETABLE	Technically insufficient scan
CO-RADS 1	VERY LOW	Normal or non-infectious
CO-RADS 2	LOW	Typical of other disease / Non-Covid -19
CO-RADS 3	WRONG/ UNSAFE	Characteristics compatible with COVID-19 + Other disease
CO-RADS 4	HIGH	Covid-19 suspect
CO-RADS 5	VERY HIGH	Typical of Covid-19
CO-RADS 6	TRIED	RT-PCR positive for Covid-19

Table III. Overview of CO-RADS categories and level of suspicion with lung involvement in COVID-19.

Source: PProkop M, van Everdingen W, van Rees Vellinga T, Quarles van Ufford H, Stöger L, Beenen L, Geurts B, Gietema H, Krdzalic J, Schaefer-Prokop C, van Ginneken B, Brink M; COVID-19 Standardized Reporting Working Group of the Dutch Radiological Society. CO-RADS: A Categorical CT Assessment Scheme for Patients Suspected of Having COVID-19-Definition and Evaluation. Radiology. 2020 Aug;296(2):E97-E104. doi: 10.1148/radiol.2020201473. Epub 2020 Apr 27. PMID: 32339082; PMCID: PMC7233402.

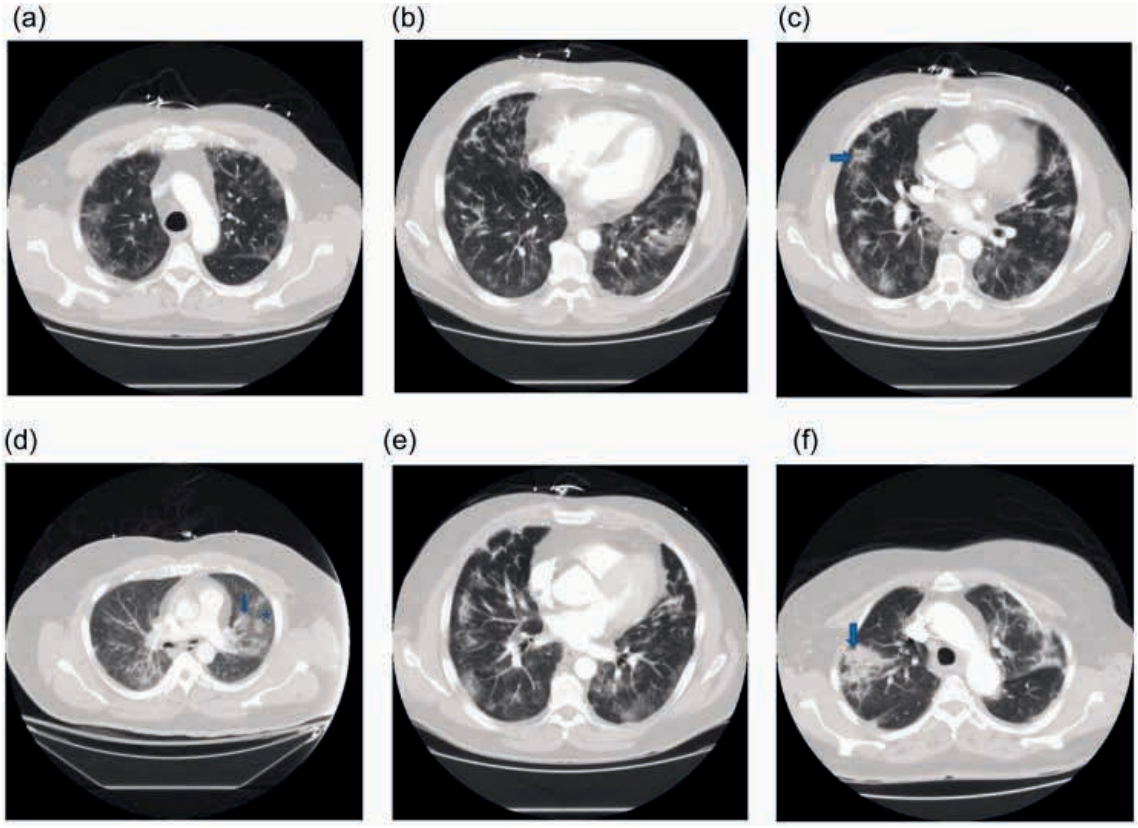

Fig. 1. Chest CT images of patients with COVID-19, demonstrating disease progression: (a) mild alveolar infiltrates, (b) linear opacities, (c) reverse halo sign (blue arrow), (d) consolidation (blue arrow), (e) crazy paving pattern (GGO with interstitial changes) and (f) consolidation (blue arrow).

Source: Wong MD, Thai T, Li Y, Liu H. The role of chest computed tomography in the management of COVID-19: A review of results and recommendations. Exp Biol Med (Maywood). 2020 Jul;245(13):1096-1103. doi: 10.1177/1535370220938315. Epub 2020 Jun 26. PMID: 32588660; PMCID: PMC7400724

CONCLUSION

Lung CT can fully show its distribution, results of shape and density changes and dynamic changes, COVID-19 patients in the course of the disease, and important clinical manifestations. The combination of the patient's laboratory indicators can help guide early clinical diagnosis, early isolation and early rehabilitation of coronavirus, and can be used as a basis for evaluating treatment-induced adverse reactions and the time in which symptoms linked to the radiological study appear. Much reference is made to imaging characteristics such as ground or ground glass opacification, diffuse, focal, or multifocal alveolar consolidation, which extend beyond the posterior parts of the lungs and affect the peripheries in different radiological patterns.

At different stages of COVID-19 we can predict the intensification and emergence of signs of consolidation that are related to its diagnostic value and the progression of the disease. In the different stages of COVID-19, we can speculate that the appearance and exacerbation of the signs of pulmonary consolidation may be related to the progression of the disease and the diagnostic value of the patients. Although positive nucleic acid test remains the gold standard diagnosis, relative to typical clinical diagnosis, Wuhan exposure, or close contact history, CT features can be used for clinical diagnosis of COVID-19 infection. despite negative nucleic acid test results. CT is highly sensitive for COVID-19 lesions and currently has an irreplaceable role in screening, diagnosis, and treatment monitoring.

For the diagnostic report of the imaging area, it is necessary to specify all the radiological findings exposed in this bibliographic review, since it can guide an opportune diagnosis that together with the complementary examinations will be determined on time and a better prognosis will be guaranteed.

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