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In the Early Period (first 1 month) of the Covid 19-SARS-CoV-2 Pandemic, the Guidance of Computerized Tomography in Patient Diagnosis and Its Correlation With PCR Test in Emergency Services

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Abstract: The first identification in our country for the COVID-19 disease was in March. Quick and valuable diagnostic methods for this disease are critical in the management of covid and non-covid patients. With this study, we arranged to investigate the compatibility of the utilized of computed thorax tomography as a scanning and diagnostic tool with PCR tests in the primary period (first 1 month) of the Covid 19 pandemic. Patients over the age of 18 whose chest CT scans were taken from feasible and positive Covid 19 cases who admitted to Ankara Etimesgut Şehit Sait Ertürk Hospital Emergency Department in the primary period of the Covid 19 pandemic (first 1 month) were included in the study. The study started on 15.05.2021 and finished on 30.05.2021 and a retrospective analysis was made. Statistical analysis of the study was performed with SPSS Version 20.0 program. The study was managed with a total of 393 patients. Of these, 259 were male and 134 were female. Between the radiological detections, the results with the highest sensitivity were GGO, atelectasis, presence of nodules, fibrosis, nodule formation and interlobular thickening. Thickness of interlobules and pleural effusion were had the high rise PPV. There are radiological detections that can be used in the identification of Covid 19: Thickness of interlobules and pleural effusion.©2025 NTMS.

Keywords: Covid 19; PCR; Torax CT; Ground Glass Opacity; Thickness of Interlobules.

1. Introduction

The first coronavirus disease case in Turkey occurred for the first time in our country in March and it was in connection with the Wuhan outbreak that began on December 31, 2019. As of March 11, 2020, the WHO had declared the viral infection a world pandemic and that became the turning point on the healthcare systems all over the globe. For the management of the patients with and without COVID-19, effective and rapid diagnostic techniques are of extreme importance.

According to the guidelines for diagnosis and treatment of COVID-19, the 'gold standard' for diagnosis is RT-PCR tests. However, RT-PCR is susceptible to false negative outcomes in certain instances. In addition, these tests were not cheap and there was often a delay in receiving test results in the first phase of the epidemic. These difficulties triggered the investigation of additional diagnostic methods such as chest CT scan as it was thought to help in differential diagnosis. For

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instance, systematic review and meta-analysis by Kim et al. demonstrated that chest CT had sensitivity of 94% (95% CI: 91%-96%) but only 37% (95% CI: 26%-50%) for specificity.

Not only are there cases of symptomatic disease, there are also many asymptomatic people who exhibit high transmission potential during the pandemic. Therefore, a screening methods such as chest CT should be used to complement RT-PCR tests to control the spread of the virus. Early detection through chest CT in individuals traced to confirmed COVID cases may identify a higher number of infections than RT-PCR.

The common symptoms of COVID-19 are fever as well as cough and shortness of breath. Patients may also experience diarrhea, muscle pain, and headaches. Laboratory markers such as lymphopenia, increased CRP, increased D-dimer and procalcitonin all good biomarkers for prognosis. Chest CT is the most useful technique for diagnosis of disease, with identified findings such as multiple plaque-like opacities, interstitial changes in the lungs, and bilateral ground-glass opacities. All these findings have a definite peripheral and subpleural distribution. Moreover, a chest CT could be very useful for monitoring a patient's progress of treatment. It was also benefical impact on patients who were RT-PCR negative in following period. However, worsening symptoms, with subsequent chest CT scans that aided in their management and long-term physiological monitoring. They can also be assessed with chest CT after the Resolution of COVID: Acute Respiratory Distress Syndrome (ARDS) and Pulmonary Embolism (PE).

The purpose of this study was to assess the effectiveness of chest CT as a diagnostic and screening tool comparing with PCR testing in emergency settings. Furthermore, we aimed to study the reduction of false-negative results in patients tested negative by RT-PCR.

2. Material and Methods

The study involved patients aged 18 and older who underwent chest CT scans for suspected or confirmed COVID-19 cases at the Emergency Department of XXX Hospital during the primary period of the COVID-19-SARS-CoV-2 pandemic.

The COVID-19 clinic was integrated into the emergency department at the hospital where the study was conducted. The patient's management and treatment plans was coordinated by the emergency medicine, chest diseases, and infectious diseases specialists. Throughout the pandemic, between 1,500 and 2,000 patients was admitted the hospital daily. 98% of whom were considered at risk for COVID-19, excluding those in the red-zone triage or needing resuscitation.

This study started on May 15, 2021, and ended on May 30, 2021. All data were retrospective. Data were collected by individually reviewing patient files through the hospital's information management system. Ethics committee acceptance was acquired from Ankara Dışkapı Training and Research Hospital (decision number 113/03, dated June 14, 2021).

The management of pandemic by the Ministry of Health has defined risk groups concerning Covid 19 infection with some criteria from the first days of the pandemic. These criteria are: 1. Any of the following symptoms: Fever, joint and muscle pain, cough, shortness of breath, headache, nausea/vomiting, or diarrhea; 2. Travel from a pandemic country; 3. Contact with a possible or diagnosed case of Covid infection. These serve as the criteria for determining patients who have been assessed for admission and discharge with thoracic CT scan via the emergency room and outpatient clinics for Covid 19.

During the first month of initiating the study, 419 patients presented to the emergency department with a COVID diagnosis. Among these patients were 7 younger than 18, leaving 412 eligible for study participation. Of these, 19 had no thoracic CT imaging performed, resulting in a final study cohort of 393 patients. The case diagram for the study is presented in Figure 1.

Figure 1: The case diagram of the study.

2.1. Statistical Analysis

SPSS Version 20.0 program (SPSS Inc, Chicago, Illinois, USA) was applied for Statistical survey. Percentage frequency evaluation was performed for categorical data of demographic features such as age and gender. Chi-square (x2) test was used to differantiate categorical data. A P value of <0.05 was noted statistically significant.

3. Results

The mean age of patients in the study was 46 with an age range between the ages of 18 to 91. Out of them, 259 were males while 134 females. The PCR positivity rates, in male patients were 45.42% and in female patients were 46.47%. The differences were statistically insignificant (p=0.672). Lung involvement (AC) in PCR-positive patients was observed bilaterally in 53.7% of cases. The right lung alone was in 14.1%, and the left lung alone was in 11.9%, 20.3% of cases' images showed no infiltration.

In patients with negative PCR test, 47.2% demonstrated bilateral lung infiltration while 12% of them did not (p=0.009). Meningitis affecting just one side was mainly the right axilla in 19.8%, while lower lobe involvement was often reported at 18.6%. There were also bilateral infections were in 50.1% (Figure 2). Bilateral consolidated area, were observed in 43%, whereas no consolidation was found in 61.8%.

Additional radiological findings commonly observed in viral pneumonias and useful in diagnosing COVID-19 are abstracted in Table 1. The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of these radiological indicators are detailed in Table 2.

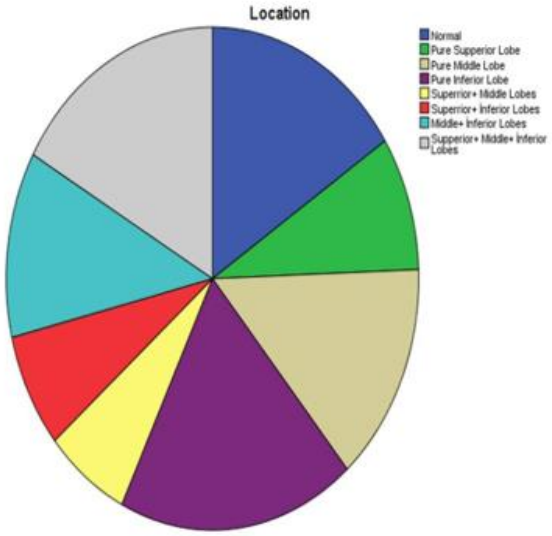

Figure 2: Lung location of infiltrations.

Table 1: Frequency of radiological definitions in cases.

Radiological sign	Single involvement (%)	Multiple involvement (%)
Interlobular septal thickening	1.3	1.5
Reticular pattern	3.3	1.8
Crazy paving	0.5	1
Air bronchograms	3.6	2.8
Bronchial wall thickening	4.1	4.8
Bronchiectasis	1.5	1.3
Pleural thickening	2.3	1.3
Pleural effusion	1.3	0.3
Nodule	8.1	15
Pericardial effusion	1	-
Budding tree view	3.6	0.3
Fibrotic changes	4.3	12
Ground glass opacity	12	43
Atelectasis	3.8	12.2

Table 2: Sensitivite, spesifite, positive predictive value (PPV) and negative predictive value (NPV) of the radiologic definitions (BCO; Ground Glass Opacity-GGO).

		PCR Results					
		Positive	Negative	Sensitivite	Spesifite	PPV	NPV
BCO Results	exist	114	102	64.4%	52.8%	52.8%	64.4%
	NON	63	114				
Consolidation	exist	68	82	38.4%	62.0%	45.3%	55.1%
	NON	109	134				
Thickness of Interlobules	exist	6	5	3.4%	97.7%	54.5%	55.2%
	NON	171	211				
Reticular Pattern	exist	4	16	2.3%	92.6%	20.0%	53.6%
	NON	173	200				
CrazyPaving	exist	4	2	2.3%	99.1%	66.7%	55.3%
	NON	173	214				
Air bronchogams	exist	5	20	2.8%	90.7%	20.0%	53.3%
	NON	172	196				
Thickness of Bronchial Walls	exist	11	24	6.2%	88.9%	31.4%	53.6%
	NON	166	192				
Bronchiectasis	exist	3	8	1.7%	96.3%	27.3%	54.5%
	NON	174	208				
Thickness of Pleura	exist	3	11	1.7%	94.9%	21.4%	54.1%
	NON	174	205				
Pleural Effusion	exist	1	5	0.6%	97.7%	16.7%	54.5%
	NON	176	211				
Nodule	exist	25	66	14.1%	69.4%	27.5%	49.7%
	NON	152	150				
Pericardial Effusion	exist	1	3	0.6%	98.6%	25.0%	54.8%
	NON	176	213				
Honeycomb	exist	4	11	2.3%	94.9%	26.7%	54.2%
	NON	173	205				
Fibrozis	exist	22	42	12.4%	80.6%	34.4%	52.9%
	NON	155	174				
Atelectasia	exist	23	40	13.0%	81.5%	36.5%	53.3%
	NON	154	176				

4. Discussion

In the initial stage of the COVID-19 pandemic, the diagnostic process became really important both for clinical and public health [1]. The purpose of the research is to provide sample contributions focusing on the diagnostic utility of chest CT on suspected COVID-19 cases and its correlation with PCR testing [2,3].

Our research revealed that chest CT has a very high sensitivity for diagnosing COVID-19 for all suspected patients. Particularly in the early stages of the disease, when RT-PCR tests can yield false-negative results, the use of chest CT as an additional diagnostic tool becomes crucial [4-7]. The role of chest CT, especially in the emergency and rapid diagnosis setting is supportted by some researches [8,9].

The characteristic radiological findings of COVID-19 on chest CT include ground-glass opacity (GGO) at 43%, nodules at 15%, atelectasis at 12.2%, and fibrotic changes at 12%. These findings provide important clues in diagnosing the disease. GGO is particularly considered a highly specific finding for COVID-19, usually presenting bilaterally and predominantly in peripheral and subpleural regions. Infiltration and atelectasis become more pronounced in the later stages of the disease [10,11]. Additionally, findings such as air bronchograms indicate significant changes in the lung parenchyma [12,13].

The involvement regions in the lungs also play an importand role in the radiological diagnosis. The lower lobes of the lungs are affected, with bilateral

involvement being common. Subpleural region involvement and peripheral distribution are typical radiological appearances for COVID-19. These characteristics enhance the diagnostic accuracy of chest CT and provide valuable information to clinicians about the severity and distribution of the disease.

However, despite the high sensitivity of chest CT, its specificity is not as high as that of RT-PCR. This limitation can lead to confusion with other viral or bacterial pneumonias and result in false-positive findings [14]. Therefore, it is not recommended to use chest CT alone for diagnosing COVID-19; instead, it should be used in conjunction with PCR testing to enhance diagnostic accuracy [15].

In our study, the RT-PCR test is considered the gold standard and compared with chest CT to evaluate the effectiveness of current diagnostic methods. The advantages of the RT-PCR test include its high specificity and accuracy. However, the sensitivity of the test can vary depending on sample collection and laboratory conditions. Therefore, using chest CT as an auxiliary diagnostic tool in patients with negative PCR results but clinical and radiological findings consistent with COVID-19 can reduce false-negative rates and support early isolation and treatment decisions.

The most sensitive among radiological findings were ground-glass opacity (GGO), atelectasis, nodules, fibrosis, nodule formation, as well as interlobular thickening (Table 2). The interlobular thickening and pleural effusion had the highest positive predictive value (PPV). Therefore, interlobular thickening and pleural effusion are the critical radiological markers which assist to the diagnosis of COVID-19 [14,16,17].

One of the main goals of healthcare services is to overcome pandemics worldwide with the most reliable, rapid and high survival rates in patient management, care, treatment and follow-up [18,19]. The Covid 19 pandemic was primarily a viral infection table where respiratory pathologies were at the forefront. We hope that the use of management algorithms accompanied by clinical, laboratory and imaging methods in patient management in similar or other tables with high mortality will pave the way for better prognostic survival.

5. Conclusion

In conclusion, the combined use of chest CT and PCR testing during the early stages of the COVID-19 pandemic improves diagnostic accuracy and reliability. Future studies should further examine the effectiveness and outcomes of this combination in different patient groups. Additionally, the development of new diagnostic methods and the optimization of existing ones will play a crucial role in combating pandemic diseases like COVID-19.

Limitations of the Study

The limited number of cases and the single-center nature of the study constitute the limitations of this study.

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Conflict of Interests

No conflict of interest was declared by the authors.

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Author Contributions

A.Ç Surgical and Medical Practises, Consept, Data Collection or Processing, Literature Search, Writing; G.Ç Analysis or Interpretation; Z.K.E Design, Data Collection or Processing; A.B Design, Analysis or Interpretation, Writing.

Ethical Approval

This study does not contain any experiments with human participants or animals conducted by the authors. Ethics committee acceptance was acquired from Ankara Dışkapı Training and Research Hospital (decision number 113/03, dated June 14, 2021).

Data sharing statement

The data that support the detections of this study are accessible from the corresponding author upon feasible request.

Consent to participate

Consent was obtained from the patients participating in the study.

Informed Statement

Informed consent was obtained from all subjects involved in the study.

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