ORIGINAL ARTICLE

Diagnostic Accuracy of HRCT Chest in Detection of Covid-19 Infection Taking PCR as Gold Standard

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ABSTRACT

Objective: To determine the diagnostic accuracy of High-resolution computed tomography (HRCT) chest in detection of covid-19 infection taking PCR as gold standard.

Study Design: Cross-sectional study

Setting: Radiology department of Tabba Hospital, Karachi.

Duration: From March 2019 to September 2020

Material and Methods: All the clinically suspected patients of covid-19, of any age, both genders and those referred to radiology for High-resolution computed tomography (HRCT) chest to detect the covid-19 infection were included. After two days, patients' PCR reports were collected from the ward, after taking informed consent and permission from head of department. The diagnostic accuracy of HRCT was established with respect to sensitivity, PPV, NPV, and specificity by taking PCR as gold standard. All the information was collected via study proforma.

Results: Total 70 patients suspected for COVID-19 were studied, and the patients' mean age was 58.23±9.52 years. Males were in majority 54(77.1%). As per HRCT findings, COVID-19 infection was positive in 46 patients, however, 48 patients were detected positive for COVID-19 infection as per PCR findings. In the detection of COVID-19 infection, HRCT chest showed sensitivity of 91%, specificity of 90%, PPV of 83%, NPV of 84% and diagnostic accuracy of 94%; by taking PCR as gold standard.

Conclusion: High-resolution computed tomography (HRCT) is a reliable diagnostic approach in promptly detecting the COVID-19; with 91% sensitivity, 90% specificity, 83% positive predictive value, 84% negative predictive value and 94% diagnostic accuracy.

Keywords: Accuracy, HRCT, COVID-19

INTRODUCTION

The coronavirus disease 19 (COVID-19) is an extremely pathogenic and contagious viral infection transmitted by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which first appeared in Wuhan city of China, and has since spread throughout the world.[1] The majority of COVID-19 victims have mild symptoms and have a strong prognosis, but some extreme patients experience acute respiratory dysfunction, acute respiratory distress syndrome (ARDS), and other potential complications rapidly, leading to severe outcomes.[2,3] Given the high infectiousness, detecting COVID-19 at an initial stage of exposure is critical for isolating infected individuals from healthy individuals and preventing further spread of virus. Imaging approaches are useful in diagnosing as well as assessing COVID19.[4,5] The number of false positive results of PCR is increasing as genetically mutated strains of SARS-COV-2 are emerging, causing the epidemic to spread faster because of poor early detection and isolation. For nations such as Pakistan, there are several limitations such as sample collection, financial burden, transportation, and kit performance.[6] In COVID-19, though, chest computed tomography (CT) was being commonly used to evaluate pulmonary activity. A recent series of studies sheds light on the discrepancies between using chest computed tomography (CT) and Real Time Reverse Transcriptase-Polymerase Chain Reaction (RT-PCR) in terms of sensitivity and specificity.[7] It was deemed necessary to see if HRCT could help diagnose pandemic COVID-19 pneumonia in the face of insufficient testing, poor sensitivity of the COVID-19-PCR assay, restricted accessibility of test kits, and a poor detection rate.[8] Therefore, this study has been conducted to assess the diagnostic accuracy of High-resolution chest computed tomography (HRCT) in detecting covid-19 infection, by taking PCR as gold standard.

MATERIAL & METHODS

Settings: This study was conducted in Radiology department of Tabba Hospital, Karachi.

Duration: From March 2019 to September 2020.

Study Design: Cross-sectional study.

Inclusion Criteria: All the clinically suspected patients of covid-19, of any age, both genders and referred to radiology for High-resolution computed tomography (HRCT) chest to detect the covid-19 infection were included.

Exclusion Criteria: All the patients who were not agree to participate in the study and those whose PCR reports were not seen were excluded from the study.

Data Collection Procedure: Study was done on patients who were referred to the Radiology department of Tabba Hospital, Karachi for HRCT scan chest for the assessment of COVID-19. Purpose and procedure including the risks and benefits of study were explained to the patients and their attendants. After taking an informed consent, HRCT

scan chest was performed at Radiology department Civil Hospital Karachi by senior radiologist with experience of at least 5 years. After two days, patients' PCR reports were collected from the ward, after taking informed consent and permission from head of department. The HRCT, diagnostic accuracy was established in terms of sensitivity, specificity, PPV, and NPV by taking PCR as gold standard. All the information was collected via study proforma. Data analysis was performed via SPSS version 20. Mean±SD were calculated for quantitative data and frequency and percentages were computed for categorical data. A 2x2 table was constructed and sensitivity, specificity, PPV, NPV and accuracy of HRCT of abdomen and pelvis was assessed in the detection of COVID-19, by using PCR as gold standard.

RESULTS

Total 70 suspected COVID-19 patients were studied, and the patients' mean age was 58.23±9.52 years. Out of all study participants, males were in majority 54(77.1%) and females were 16(22.9%). Table.1

Out of all, 46 patients were found with positive COVID-19 infection as per HRCT findings, while 48 patients were detected on PCR findings. Table.2

HRCT chest showed 91% sensitivity, 90% specificity, 83% PPV, 84% NPV and 94% diagnostic accuracy in the detection of COVID-19 infection by taking PCR as gold standard; as presented in **Table-2.**

Table 1: Descriptive statistics of age and gender (n=70)

Variables		Statistics
Age	(mean+SD)	58.23±9.52 years
Gender	Females	16(22.9%)
	Males	54(77.1%)

Table 2: Diagnostic Accuracy of HRCT by Taken PCR as Gold Standard (n=331)

	PCR			P-value
HRCT	Positive	Negative	Total	
Present	44	02	46	0.0001
Absent	04	20	24	
TOTAL	48	22	70	
Sensitivity	Specificity	PPV	NPV	Accuracy
91%	90%	83%	84%	94%

DISCUSSION

It is important to diagnose COVID-19 early in order to treat and prevent the disease. Chest CT seems to be a more effective, realistic, and rapid system of diagnosing and assessing COVID-19 than reverse-transcription polymerase chain reaction (RT-PCR), particularly in epidemic-affected areas. In this study, the median age of study subjects was 58.23±9.52 years, which is consistent with other studies reported by Guan et al[9] (47 years of mean age), Wang et al[10] found (56 years of mean age), Zhou et al[11] reported (56 years of mean age), and Zhang et al[12] who reported (57 years of mean age).

In this study, HRCT chest showed 91% sensitivity, 90% specificity, 83% PPV, 84% NPV and 94% diagnostic accuracy in the detection of COVID-19 infection by taking PCR as gold standard. In comparison to our results, study conducted by Ai T et al[13] reported that for the diagnosis of COVID-19 disease, chest CT seems to have a high

sensitivity. Depending on positive RT-PCR findings, the sensitivity of chest CT in predicting COVID-19 was 97% (detected 580 out of 601 patients) (95 % CI: 95-98%). In epidemic regions, chest CT can be deemed a primary method for COVID-19 identification. Chest CT is indeed a noninvasive imaging technique with a high degree of speed and accuracy. According to available evidence reported in current literature, nearly all COVID-19 infected patients had distinctive CT characteristics in the infection phase; [14,15] for example, various level ground-glass opacities without and/or with crazy-paving sign, architectural disfigurement in peripheral distribution, and multifocal localizing pneumonia. Fang Y et al [16] also documented that with a sensitivity of above 97% and a specificity of around 25%, chest CT can reliably diagnose COVID-19. Dangis A et al [17] stated that In COVID-19 diagnosis, chest CT showed excellent specificity (93.6%), sensitivity (86.7%), negative predictive value (90.3%), positive predictive value (91.1%), and accuracy (90.2%). Another study conducted by Taha et al[18] also reported that chest CT scan showed positive finding in 2714 out of 3130 scanned patients. The Chest CT scan's sensitivity in the diagnosis of COVID-19 could be extracted from all studies ranging from 0.61%-0.99%.Moreover, these studies found that chest CT scan can provide a speedy and effective approach to promptly detect suspected COVID-19 cases, contributing to reduction of cross infection due to its great sensitivity. Study conducted by Caruso D et al [19] also reported that in detecting suspected COVID-19 cases, CT had a sensitivity of 97% (detected 60 out of 62) (with 95% CI: 88-99%), specificity of 56% (detected 54 out of 96) (with 95% CI: 45-66%), and accuracy of 72% (detected 114 out of 158) (with 95% CI: 64-78%). They concluded that in their study Chest CT showed a high sensitivity of up to 97%, with a lower specificity of up to 56%.

CONCLUSION

As per conclusion, the High-resolution computed tomography (HRCT) is a reliable diagnostic approach for early detection of COVID-19, with sensitivity of 91%, specificity of 90%, positive predictive value of 83%, negative predictive value of 84% and diagnostic accuracy of 94%. This was a small sample size and single center study. Therefore, more large-scale studies are recommended for further accurate observations.
Conflict of Interest: No conflict of interest

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