ORIGINAL ARTICLE

Role of CT Imaging for the Management of COVID-19

SHAHZEB MASTOI[1], ANEEL KUMAR[2], TAUQEER ANJUM[3], MAHNOOR SHAHZEB[4], MEHAK GUL[5], RASHID DAUDPOTA[6]
[1-3]Consultants, Department of Radiology, Jinnah Postgraduate Medical Centre, Karachi
[4]Postgraduate Trainee, Department of Clinical Pathology, Jinnah Sindh Medical University, Karachi
[5]Sindh Medical College, Karachi
[6]Consultant, Department of Pulmonology, South City Hospital, Karachi
Correspondence to Dr. Shahzeb Mastoi, E-mail: drshahzebmastoi@gmail.com Cell: 0333-7344014

ABSTRACT

Aim: To evaluate the role of high-resolution Computer tomography imaging in the management of COVID-19.
Study design: Prospective study
Place and duration of study: Jinnah Postgraduate Medical Centre Karachi from 1st December 2021 to 31st May 2022.
Methodology: One hundred patients suspected to be suffering from COVID-19 were enrolled. All patients underwent Reverse transcriptase-based polymerase chain reaction tests (RT-PCR). The patients were divided into positive or negative depending upon their test results. A high-resolution computed tomography scan was followed in every patient and the results were compared with the reverse transcriptase-based polymerase chain reaction tests findings. The sensitivity and Specificity of the CT scan test were assessed.
Results: The mean age of the patients was 59±6.5 years. There were 60 (60%) male and 40 (40%) female patients. Around 58% of the patients were found as positive on PCR while 42% were negative. There 75% of the cases were positive for novel coronavirus on high-resolution computed tomography scan while only 25% were negative.
Conclusion: Chest HRCT-scan proved to be a better and more sensitive tool for the diagnosis of novel coronavirus and can be considered as an alternative screening tool for COVID-19 confirmation.
Keywords: SARS-CoV-2, Severity, Pulmonary, CT-scan, Serotype

INTRODUCTION

Coronavirus which belongs to the family of severe acute respiratory syndrome coronavirus-2 caused severe respiratory infections all over the globe. World Health Organization declared this novel viral infection a pandemic in March 2020. It affects people of every age and every background and race, causing mild flu-like symptoms to chronic illnesses. The average incubation period of COVID-19 was 10-14 days. The death toll remained to be very high till the formation of the vaccine and understanding of the nature and adverse effects of this virus. Novel coronavirus remained to be lethal for a majority of the population due to the change in its serotype. Every time it comes with a different shape and different outcomes which continued to be a serious challenge for both researchers and healthcare workers[1-3].

Common symptoms include influenza-like appearances such as dry cough, fatigue, fever, loss of sense of taste/smell, and sore throat. Reverse transcriptase polymerase chain reaction (RT-PCR) is currently considered the gold standard for the diagnosis of coronavirus. However, studies report sensitivity of this virus is ranging from 30-70% only in the case of initial representation through swab sampling. Furthermore, most of the patients are not diagnosed with PCR when the virus reaches the lower respiratory tract despite the coronavirus infection. This poses a major concern and risk to the population and possibly could be the cause of viral spread and transmission.[4-7] Moreover, COVID-19 is highly contagious and RT-PCR is also not able to determine the severity of the disease.

A chest CT scan proved to be a better imaging tool for the diagnosis of coronavirus which not only asses the presence of viral infection but also proved beneficial to the severity of the disease. This is also easy to perform and studies revealed the typical pulmonary characteristic radiological findings include crazy paving pattern, multiple ground glass opacities, sub-pleural and basal areas, and patchy pulmonary consolidations in coronavirus patients[8-11]. Up-till now, RT-PCR along with chest CT scans proved to be the diagnostic tools for coronavirus diagnosis and assessing the severity of the disease respectively. In the present study, the value of chest CT-scan was compared with RT-PCR value in coronavirus patients Result of the present study proved to be helpful for the consideration of a better diagnostic tool for COVID

MATERIALS AND METHODS

This prospective study was conducted at Jinnah Postgraduate Medical Centre Karachi and 100 patients suspected to be suffering

----

from COVID-19 and aged between 16-75 years were enrolled. All the cases were enrolled before ethical approval of the study from the institutional committee. Patients' informed consent was taken before their participation. A well-structured questionnaire was sued to gather demographic as well as related clinical information, signs, and symptoms details as well as biochemical, and hematological findings documentation. The sample size was calculated based on the current prevalence of the disease. WHO sample size calculator was used for calculating sample size through 80% power of the test and 95% CI. The patients who were already confirmed through CT scanning or those who were suffering from chronic respiratory complications were excluded from this study. All patients underwent Reverse transcriptase-based polymerase chain reaction tests (RT-PCR). The patients were divided into positive or negative depending upon their test results. A high-resolution computed tomography scan was followed in every patient and the results were compared with the RT-PCR findings. The sensitivity and Specificity of the CT scan test were assessed. Results of RT-PCR were kept hidden at the time of reporting for illuminating biases in the study. The low-dose non-contrast based high-resolution chest CT scanning images comprising of spiral-acquisition with 1 pitch and a rotation 0.35second and having an auto kVp as well as mA choice with an average dosage length of the product to be 149 mGy cm was used. Images having a 1.25 mm thickness of the slice were rebuilt through deep learning-image reconstruction (DLIR). It was customized at a medium level and also stored in the PACS system. Data were analyzed using SPSS version 26.0.

RESULTS

The mean age of the patients was 59±6.5 years. There were 60 male and 40 female patients. Around 58% of the patients were found as positive on PCR while 42% were negative (Table 1).

The values of the CT scan showed a higher number of positive results for coronavirus than RT-PCR results. There were 75% of the cases were positive for novel coronavirus while only 25% were negative (Fig. 1). The diagnostic efficiency of the CT scan of Covid 19 patients presented a sensitivity of upto 100% with a confidence interval of 95% (Table 2).

The CT scan reports in various patients presented with multiple focal-ground glass opacities which were associated with linear inter as well as intra-lobular thickening of septa presented n the upper lobular region. Other cases showed bilateral, predominant consolidation patterns in lower lobes. Presentation of subpleural ground glass was also common in the lower as well as upper lobes. Patients also presented CT imaging with diffuse consolidations (Fig 2).

Table 1: Demographic information of the patients (n=100)

Variable	No.	%
Age (years)	59±6.5	
Gender		
Male	60	60.0
Female	40	40.0
PCR positive	58	58.0
PCR negative	42	42.0

Table 2: CT test performance through sensitivity analysis (n=100)

RT-PCR	CT		Total
	Positive	Negative	
Positive	45	42	87
Negative	-	13	13
Total	45	55	100

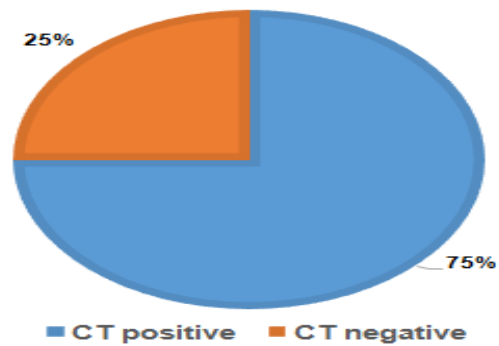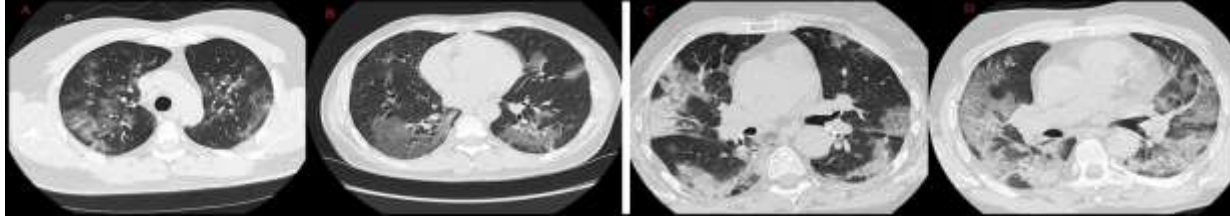Sensitivity = 100%   Specificity = 28% PPV = 68%,NPV = 100%, Accuracy = 72%

Fig. 1: Positivity of patients on CT scan

Fig. 2: CT scan imaging presenting focal ground glass opacities (A), intra lobular thickening (B), predominant consolidation (C), and diffused consolidation

DISCUSSION

Coronavirus cause catastrophic effects in recent years in almost every corner of the world. It is declared the pandemic of the 22nd century and poses a serious burden on human health and the economy. Despite the advancement in the medical world, it was the major death cause in last year. Various testing methods developed for quick, rapid, and accurate diagnosis of coronavirus. Out of which, RT-PCR and chest CT-scan proved to be the standard diagnostic tools in various clinical settings. Studies showed that PCR testing is not enough to indicate the level of severity of the disease and its damage. This tool lacks diagnostic sensitivity which could lead to an epidemic in infections site.[12-17] This study is mainly designed to determine the role of CT scans in COVID-19 management and early diagnosis. Ct-scan also helps to evaluate the treatment response.

In the present study, the majority of the study participants had positive chest CT-scan despite the negative RT-PCR result. A large number of patients had abnormal CT findings (common in viral pneumonia) which proved to be positive CT-scan for the coronavirus. In the present analysis, sensitivity and specificity was very high and diagnostic performance following the already available data.[5] Other various studies also showed similar findings with higher sensitivity results as compared to RT-PCR performance[18-21]. This proved to be better sensitivity and confirmation of coronavirus through chest CT-scan.

Care should be taken while evaluating and interpreting the results of CT imaging in asymptomatic patients of the coronavirus. Results can be made further better through modification in the study module. This study needs to be conducted on a larger population and by comparing the results with symptomatic and asymptomatic populations. Only patients with respiratory distress were included in the present study.

CONCLUSION

Chest CT-scan proved to be a better and more sensitive tool for the diagnosis of novel coronavirus and can be considered as an alternative screening tool for COVID-19 confirmation. This also reduces the risk of virus transmission through reliable diagnosis if interpretations are made according to the set criteria.

Conflict of interest: Nil

REFERENCES

1. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet 2020;395(10223):497-506.
2. Coronavirus disease 2019 2020. https://www.who.int/emergencies/diseases/novel-coronavirus-2019. Accessed 13 June 2020.
3. Control EC for DP and COVID-19 situation update worldwide, as of 4 July 2020. https://www.ecdc.europa.eu/en/geographical-distribution-2019-ncov-cases. Accessed 4 July 2020.
4. Corman VM, Landt O, Kaiser M, Molenkamp R, Meijer A, Chu DK, et al. Detection of 2019 novel coronavirus (2019-nCoV) by real-time RT-PCR. Euro Surveill 2020;25(3):2000045.
5. Ai T, Yang Z, Hou H, Zhan C, Chen C, Lv W, et al. Correlation of chest CT and RT-PCR testing in coronavirus disease 2019 (COVID-19) in China: a report of 1014 cases. Radiology 2020; 296(2):E32-40/
6. Yang Y, Yang M, Shen C, Wang F, Yuan J, Li J, et al. Evaluating the accuracy of different respiratory specimens in the laboratory diagnosis and monitoring the viral shedding of 2019-nCoV infections. medRxiv 2020.
7. Fang Y, Zhang H, Xie J, Lin M, Ying L, Pang P, et al. Sensitivity of chest CT for COVID-19: comparison to RT-PCR. Radiology 2020; 296(2): E115-7.
8. Ng M-Y, Lee EY, Yang J, Yang F, Li X, Wang H, et al. Imaging profile of the COVID-19 infection: radiologic findings and literature review. Radiol Cardiothorac Imaging 2020;2(1):e200034.
9. Bollineni VR, Nieboer KH, Döring S, Buls N, de Mey J. The role of CT imaging for the management of COVID-19 in the epidemic area: early experience from a University Hospital. Insights Imaging 2021;12(1):10.
10. Garg M, Prabhakar N, Bhalla AS, Irodi A, Sehgal I, Debi U, et al. Computed tomography chest in COVID-19: when & why? Indian J Med Res 2021;153(1 & 2):86-92.
11. Worldometer. Coronavirus update (Live): 79,331,141 cases and 1,743,079 deaths from the COVID-19 virus pandemic. [accessed on December 24, 2020]. Available from: https://www.worldometers.info/coronavirus/.
12. Long C, Xu H, Shen Q, Zhang X, Fan B, Wang C, et al. Diagnosis of the coronavirus disease (COVID-19): rRT-PCR or CT? Eur J Radiol 2020;126:108961.
13. Xie X, Zhong Z, Zhao W, Zheng C, Wang F, Liu J. Chest CT for typical 2019-nCoV pneumonia: relationship to negative RT-PCR testing. Radiology 2020
14. Kanne JP. Chest CT findings in 2019 novel coronavirus (2019-NCoV) infections from Wuhan, China: key points for the radiologist. Radiology 2020;295:16-7.
15. Pan Y, Guan H, Zhou S, et al. Initial CT findings and temporal changes in patients with the novel coronavirus pneumonia (2019-nCoV): a study of 63 patients in Wuhan, China. Eur Radiol 2020;30:3306-9.
16. Zhao W, Zhong Z, Xie X, Yu Q, Liu J. CT scans of patients with 2019 novel coronavirus (covid-19) pneumonia. Theranostics 2020;10:4606-13.
17. Chua F, Armstrong-James D, Desai SR, Barnett J, Kouranos V, Kon OM, et al. The role of CT in case ascertainment and management of COVID-19 pneumonia in the UK: insights from high-incidence regions. Lancet Respir Med 2020; 8(5):438-40.
18. Caruso D, Zerunian M, Polici M, Pucciarelli F, Polidon T, Rucci C, et al. Chest CT features of COVID-19 in Rome, Italy. Radiology 2020; 296(2): E79-85.
19. Adams HJA, Kwee TC, Yakar D, Hope MD, Kwee RM. Systematic review and meta-analysis on the value of chest CT in the diagnosis of coronavirus disease (COVID-19): Sol Scientiae, Illustra Nos. Am J Roentgenol 2020
20. Xu B, Xing Y, Peng J, Zheng Z, Tang W, Sun Y, et al. Chest CT for detecting COVID-19: a systematic review and meta-analysis of diagnostic accuracy. Eur Radiol 2020; 30(10): 5720-7.
21. Kim H, Hong H, Yoon SH. Diagnostic performance of CT and reverse transcriptase-polymerase chain reaction for coronavirus disease 2019: a meta-analysis. Radiology 2020;19(1):22402.