ORIGINAL ARTICLE

Accuracy of Computed Tomography for Detection of COVID-19 among Suspected Patients

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ABSTRACT

Objective: To determine the accuracy of CT chest in diagnosis of COVID-19 taking RT-PCR-testing as gold standard.

Materials and Methods: A total of 150 patients of suspicion of COVID-19 who were referred for CT Chest in Radiology Department of Nishtar Medical University Multan from June-2020 to May-2021 were included. In all patients, two RT-PCR test results were obtained with 7 days of admission in hospital. Presence of any of these positive was labelled as COVID-19 infection. CT chest was performed in all patients within 2 days of admission in hospital using 128 slices CT scan machine. The diagnosis of COVID-19 infection was made according to the recommendations by Radiological Society of North America (RSNA) protocol.

Results: Mean age was 51.3±14.7 years. 78 (52%) patients were male and 72 (48%) patients were female. RT-PCR test was positive in 89 (59.3%) patients. While the CT chest findings were suggestive of COVID-19 infection in 130 (86.7%) patients. The sensitivity of CT chest was 95.5%, specificity 26.2%, PPV wad 65.4% and NPV was 80.0%.

Conclusion: CT chest has a very good sensitivity for detection of COVID-19, it can be used as a rapid diagnostic tool especially in areas of pandemic. However, the specificity of CT chest is low, that can limit its use in low COVID-19 affected areas.

Keywords: COVID-19, Computed tomography, False Positive, True Positive, Positive Predictive Value, Negative Predictive Value.

INTRODUCTION

The corona virus infection (COVID-19) outbreak was started in December 2019 in the Wuhan province of China and within months it involved the whole world.[1] COVID-19 has now been declared as the global pandemic by WHO as the infection has caused worldwide mortalities.[2] So in regard to this, all countries have developed special precautionary measure at public as well as inside the hospitals to stop the spread of COVID-19. Still the exact source of transmission of COVID-19 has still not been recognized.[3] The clinical and radiological findings of COVID-19 patients are similar to the patients who present with other severe respiratory tract infections. The typical symptoms are cough, fever, myalgia, dyspnea, fatigue, weakness and generalized body-ache.[4] Many of the patients who develop COVID-19 infection are asymptomatic and can easily transmit disease to other people especially health care workers (HCWs).[5]

Though the worldwide mortality rate has reduced markedly. The correct and timely diagnosis is very necessary to break the infection chain, because breaking the chain is the only effective way of controlling the disease as still no standard treatment for COVID-19 infection has been developed.[6] Therefore, there is a need of definitive diagnostic tool to identify infected individuals. As the currently available serologic test have low sensitivity and are time consuming therefore, efforts are made to develop a faster and more accurate diagnostic test. The role of CT in evaluation of asymptomatic individuals have been reported to be beneficial, and comparison of CT with other diagnostic test has proved that CT has high sensitivity for evaluation of infected patients.[7, 8], In this study, we determined the accuracy of CT chest in diagnosis of COVID-19 taking RT-PCR-testing as gold standard.

METHODOLOGY

In this study, we included data of 150 patients after obtaining approval from ERC of hospital. We enrolled these COVID-19 patients referred to radiology department of Nishtar Medical University Multan from June-2020 to May-2021. All suspected cases of COVID-19 who underwent CT within 24 hours after coming to hospital and in whom one or two COVID-PCR were performed within 7 days were included. Patients with un-conclusive CT findings due to CT imaging artifacts were excluded. Patients presenting with fever, dyspnea, cough, presence of mild pneumonia symptoms or having history of contact with positive patient or having positive PRC report was labelled as suspected case of COVID-19.

In all patients, two RT-PCR test results were obtained with 7 days of admission in hospital. Presence of any of these positive was labelled as COVID-19 infection.

CT chest was performed in all patients within 2 days of admission in hospital. 128-slices CT scan was performed by consultant radiologist. Images were constructed using 1 mm slice thickness. The diagnosis of COVID-19 infection

was made according to the recommendations by RSNA protocol. Patients having typical or intermediate characteristics were labelled as positive for COVID-19, while those with atypical or negative findings were labelled as negative.

Data was analyzed with SPSS v25. Sensitivity, Specificity, positive predictive value (PPV), negative predictive value (NPV) of CT was calculated taking RT-PCR findings as gold standard.

RESULTS

A total of 150 patients with mean age of 51.3±14.7 years were included. Majority of the patients were in age range 41-60 years. Regarding gender 78 (52%) patients were male and 72 (48%) patients were female (Table 1).

RT-PCR test was positive in 89 (59.3%) patients. While the CT chest findings were suggestive of COVID-19 infection in 130 (86.7%) patients. There were 85 (56.7%) true positive cases (TP), 16 (10.7%) true negative (TN) cases, 45 (30.0%) false positive (FP) and 04 (2.6%) false negative (FN) cases. The sensitivity of CT chest was 95.5%, specificity 26.2%, PPV wad 65.4% and NPV was 80.0% (Table 2).

Table 1. Study Patients Characteristics.

Mean Age (Y)	51.3±14.7
< 20 years	5 (3.3%)
21-40 years	47 (31.3%)
41-60 years	75 (50%)
>60 years	23 (15.3%)
Male/Female Gender	78 (52%)/72 (48%)

Table 2. Accuracy of CT Chest.

RT-PCR Results	
Positive	89 (59.3%)
Negative	61 (40.7%)
CT Chest Findings positive for COVID	
Yes	130 (86.7%)
No	20 (13.3%)
Accuracy Parameters	
TP	85 (56.7%)
TN	16 (10.7%)
FP	45 (30.0%)
FN	04 (02.6%)
Sensitivity	95.5%
Specificity	26.2%
PPV	65.4%
NPV	80.0%

DISCUSSION

Early diagnosis of COVID-19 is a crucial step for management and controlling the spread of infection. At initial stages of pandemic, WHO recommended RT-PCR test as the gold standard for diagnosis of COVID-19 infection.[9,10] This RT-PCR technique detects different antibodies for determining the presence of virus in different ways for detection of COVID-19. This RT-PCR is effective even for detection of cases with even mild symptoms and in asymptomatic subjects.[11, 12] However, RT-PCR is time consuming and is limited by longer results times. On the other hand, CT scan can provide a definite diagnosis of COVID-19 with good accuracy.[13]

In this study of 150 subjects of suspected COVID-19, the sensitivity of CT chest was 95.5%, specificity 26.2%, PPV 65.4% and NPV 80.0%. In this study, the specificity of CT chest was higher in comparison to RT-PCR which was used as reference in comparison to some other internationally conducted studies.

Ai et al. in a study of 1014 suspected COVID-19 patients on accuracy of CT chest reported that CT has a good sensitivity of 97%, but lacks specificity of 25.0% for diagnosis of COVID-19 infection. The results of present study are comparable to this study.[14]

A recent meta-analysis by Xu et al. including 16 studies comprising total of 3186 patients reported sensitivity of 92% and a low specificity of 25%. The authors reported that the sensitivity of CT even varies among different regions like in China only the reported sensitivity of CT chest varied from 61% to 98%. While in Wuhan region the sensitivity was closer among different studies.[15]

Another meta-analysis by Kim et al. reported a pooled sensitivity of 94%.[16] The sensitivity in current study is near to the sensitivity reported by meta-analysis reported by the above mentioned meta-analysis reports.

A study by Falaschi et al. including 773 patients of suspected COVID-19 reported that CT chest is 90.7% sensitive, 78.8% specific with PPV of 86.4% and NPV of 85.1%. The authors reported COVID-19 in 62.7% patients on CT chest and in 59.8% patients using RT-PCR.[17]

CONCLUSION

CT chest has a very good sensitivity for detection of COVID-19, it can be used as a rapid diagnostic tool especially in areas of pandemic. However, the specificity of CT chest is low, that can limit its use in low COVID-19 affected areas.

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