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Correlation of Chest CT and PCR Testing for Coronavirus Disease (COVID-19) in Hail Region

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Chest CT is an essential complement to reverse-transcription Polymerase Chain Reaction (PCR) testing in the diagnosis of coronavirus Disease 2019 (COVID-19). The objective of this study was to evaluate the diagnostic usefulness and consistency of chest CT with the PCR test in COVID-19. To meet the studies objectives, a cross-sectional technique was use; data on 83 COVID-19-positive patients from both genders was collect from Hail Hospital in Saudi Arabia's Hail area. This study done in the period from January 2022 to June 2022.The results show that; the population of the study was patients who are confirm positive to SARS-COV-2 by PCR test. The average age is 58 years; most of the affected patient with COVID were above 50 years, which means that the most affected people are the elderly. PCR is the most effective test in the diagnosis of COVID as many of the patients who are positive for COVID where shown positive in PCR. PCR has a high sensitivity for diagnosis of COVID-19. PCR may be considered as a primary tool for the current COVID-19 detection in epidemic areas. Males were more affected than females with a small different percent between them, all the participant were suspected to have COVID 19 as the symptoms appeared on most of them, when they tested for PCR 85% of them were resulted positive for COVID which meat most of them had the virus. 68 % of the participants were confirm as a COVID-19 patient by examining the symptoms and making PCR test, chest X-ray and CT scan, 21 % of them were suspected for COVID-19 and the rest were post COVID. The study recommended that; more study by CT and MRI machines to show the late effects of COVID-19 in the patients**.**

Keywords: Computed Tomography (CT), Chest CT, Coronavirus Disease (COVID-19), Polymerase Chain Reaction (PCR), Chest X-ray, Positive COVID-19.

INTRODUCTION

Coronavirus Disease (COVID-19) is the pandemic of the 21st century which has been distribute over the world in just a short time after the announcement of the appearance of first China's Wuhan SARS-COV-2 is a member of the Corona family of viruses, which includes MARS, SARS, and other corona viruses (Daniel J,2020) The symptoms of the virus and severity of infection differentiated among patients according to different strains. But even when 2 patients get infected with the same strain, the matter that is discovered using PCR test; the patients possesses different symptoms and different chest CT signs (De Smet et al.2021).

A computerized tomography (CT) scan is a set of multiple X-ray images. The CT machine rotates around the patient and quickly sends X-rays through the body from multiple angles. A ring of hundreds of specialized detectors around the body traces the X-ray pattern. This is the subjected to processing by a powerful computer attached to the device to create detailed images created from very thin sections of the body, up to 0.3 mm wide, often in 3D. For a CT scan of the chest, the area of the body that is normally examine when assessing a case of COVID-19, hundreds of images are created to cover the entire chest area (Villarraga et al.2019, AKÇAY et al.2020)

Computed tomography (CT) machines are more advanced, more expensive, and not as widely available as X-ray machines. It is also more difficult to clear, Pele says, as it can take more than 20 minutes (Fleischmann D, Boas FE 20110. Computed tomography provides very detailed information, and in order to make that much information available, it uses more radiation than the X-ray generator. It should only use when appropriate for the patient (Brenner and Hall2007).

Polymerase chain reaction (PCR) test also called a molecular test, detects the genetic material of the COVID-

19 virus using a laboratory technique called polymerase chain reaction. The specialist collects a liquid sample by inserting a long swab (nasopharyngeal swab) into the nostril and taking liquid from the back of your nose, or by inserting a short nasal swab (mid-turbinate swab) to collect the sample (Tahamtan and Ardebili,2020).

In some cases, the specialist inserts a long swab into the back of your throat (oropharyngeal swab), or may ask you to spit into a tube to collect a saliva sample (Takeuchi et al.2020).

Diagnosis of COVID-19 has been difficult due to the difference of atypical signs of infection. Some cases have had severe symptoms like fatigue, fever, and dyspnea while some other cases with mild symptoms have possessed mild, moderate and severe signs of ground glass opacity. The study asks several questions considering the correlation between the severity of infection and the chest CT signs. The main aim of the study is to determine the correlation between the chest CT signs and features and the PCR test results for the patients infected with SARS-COV-2.

MATERIALS AND METHODS

The study was cross- sectional approach to achieve the aims of the study. The duration of study from January 2022 upto June 2022. Data of 83 of COVID-19 positively confirmed patients would gathered from Hail hospitals, in Hail region, Saudi Arabia. Approval will be obtained and written from University of Hail and Hail Hospital without any patient personal information. Participants gathered according to the inclusion criteria. The data of the patients includes age, gender, and positive PCR test for COVID-19. Chest CT report was included, in addition to the patient health record which included information about symptoms and severity of each case.

Mean and standard deviation of patients who have signs of ground Glass opacity were calculated to determine the correlation between chest CT and PCR test of SARS-COV-2.

Low-radiation-dose CT images can be obtained by using lower kilovoltage settings, iterative or more recently developed deep learning–based reconstructions for noise reduction, and spectral shaping of the x-ray beam to reduce the low-energy component of the x-ray spectrum (41,42), dependent on the local availability of these technologies. For CT examinations at risk for motion artifact, lowering the rotation time of the tube detector system with high pitch and wide collimation values may be considered (41,42). Low-radiation-dose chest CT performed on the basis of these principles has been shown to be feasible for imaging patients with COVID-19, with noninferior diagnostic quality and a radiation dose reduction of around 90% compared with those of a standard CT acquisition (42). Therefore, performing low-radiation-dose CT instead of full-radiation-dose CT as standard for the evaluation of the lung parenchyma in COVID-19 can be defended on the basis of the ALARA (as low as reasonably achievable) principle.

CT images should be acquired during a single inspiratory breath hold. Expiratory phase CT increases radiation dose, and evaluation for air trapping has not been reported to increase the suspicion for COVID-19 at chest CT. Whether expiratory phase CT has any value in the follow-up of patients with COVID-19 and prognostication remains unclear. Acquired CT data should be reconstructed by using a sharp kernel.

Population and sampling of study:

The population of the study was the patients who are confirm positive to SARS-COV-2 by PCR test. The sample of the study will be 83 patients who are tested positive by PCR test for SARS-COV-2, in Hail region, Saudi Arabia and have been performed chest CT in the period between March 2020 and December 2020.

The inclusion criteria include that Patients who are confirmed positive for SARS-COV-2 by PCR test, age range between 20 and 75 years old, Male and female patients are included in the study, Patients who have respiratory symptoms such as cough; dyspnea or hypoxia, patients who performed chest CT scan with different degrees of ground glass opacity (GGO). The excluded criteria include any patient who lack any of the inclusion criteria.

Variables of study

Independent variable: the independent variable for this study is the infection with COVID-19. Dependent variable: the dependent variables in this study are the results of PCR reaction for patients with COVID-19 and the results of CT-Chest conducted for the patients.

Most individuals with COVID-19 infection can be diagnosed with a single phase, non-contrast, low radiation dose chest CT. When there is a clinical worsening of cardiorespiratory state or suspicion of pulmonary embolism in patients with COVID-19 pneumonia, a post contrast chest CT may be useful. Without a non-contrast or native phase, and with a single arterial phase CT, such post-contrast imaging should be performed. The data will be gather and analyzed using SPSS (V.25) Program to calculate the statistical parameters needed for achieving the aim of the study.

RESULTS

The results of patient's data after analyses shows that 8.2 % of respondents below 30 years, 8.2 % of respondents from 31 to 40 years, 8.2 % of respondents from 31 to 40 years, 22.4 % of respondents from 51 to 60 and 40 % of respondents are above 60 years. The average age is 58 years; while the minimum is 16 and maximum is 95 with standard deviation of 18, which means the data has variety of ages (Table 1 and Figure 1).

Table 1: Age Groups

Valid	Age	Frequency	Percent
	below 30	7	8.2
	31-40	7	8.2
	41-50	16	18.8
	51-60	19	22.4
	Above 60	34	40.0
	Total	83	97.6

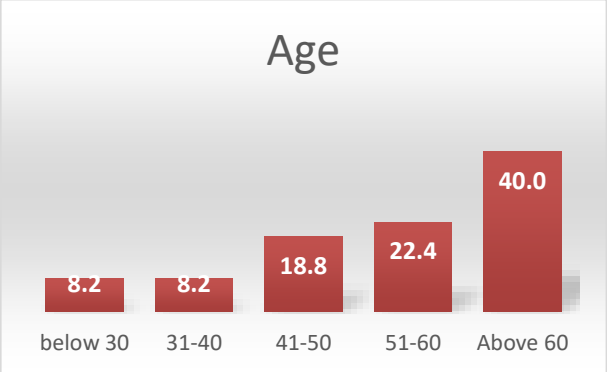

Figure 1: Age Groups

54.1 % are males and 44.7% are females as the exclusion of the respondents was randomly and including males and females (Figure 2).

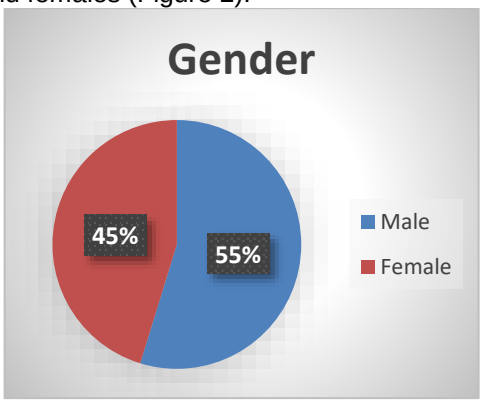

Figure 2:Gender Groups

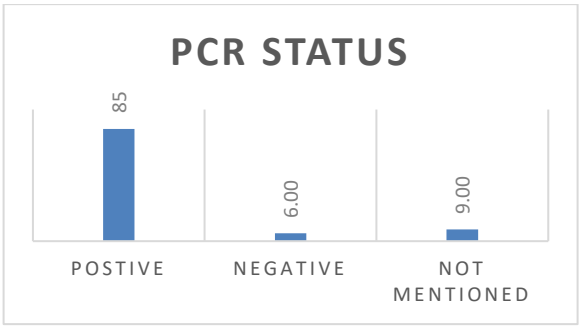

Figure 3: PCR Results of the patients.

85 % of the respondents got positive PCR, while 6 % of them got negative PCR and then 9 % of them the results are not mentioned (Figure 3).

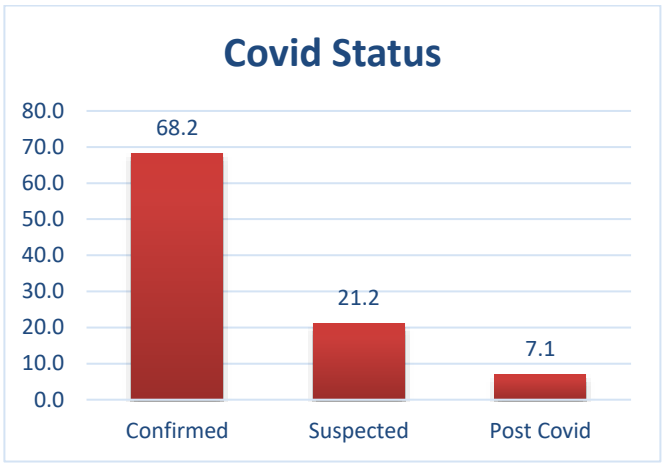

Figure 4: Covid status

68.2 % of the respondents of confirmed Covid 19, 21.2 % of respondents are suspected Covid 19 and then 7.1 %, as shown in figure 4.

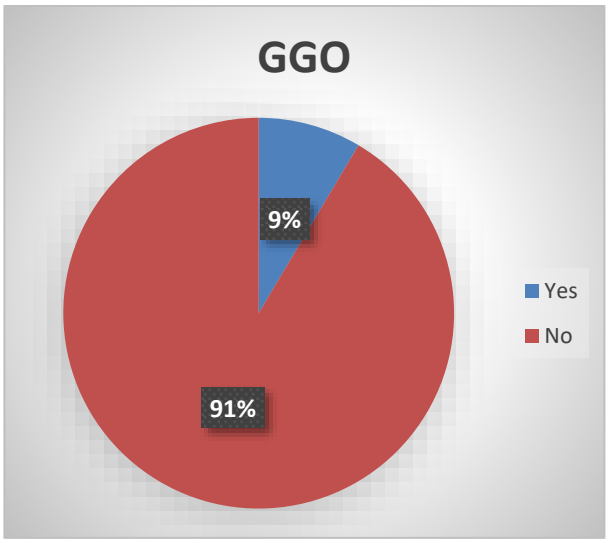

Figure 5: ground glass opacity (GGO) of the patients

9 % of respondents with GGO while 91 % with no GGO, as shown in figure 5. Only 7 cases with GGO, 2 of them of Positive PCR and confirmed Covid, 2 of them with negative PCR and suspected Covid status while 2 of them with post Covid symptoms and 1 suspected Covid case but not confirmed PCR.

The correlation between the study variables

The correlation coefficient (Pearson) is use to determine the relationship between the study variables. The statistical analysis that was conduct using the Pearson correlation coefficient showed the results of this relationship as shown in the table 2.

Table 2: Table of the correlation matrix among the study variables

Correlations						
		gender	PCR status	Covid Status	GGO	Age 2
Gender	Pearson Correlation	1	.167	.188	.010	.221*
	Sig. (2-tailed)		.177	.093	.931	.044
	N	84	67	81	81	83
PCR status	Pearson Correlation	.167	1	.897**	-.398**	.215
	Sig. (2-tailed)	.177		.000	.001	.083
	N	67	68	68	68	66
Covid Status	Pearson Correlation	.188	.897**	1	-.173	.082
	Sig. (2-tailed)	.093	.000		.120	.467
	N	81	68	82	82	80
GGO	Pearson Correlation	.010	-.398**	-.173	1	-.018
	Sig. (2-tailed)	.931	.001	.120		.871
	N	81	68	82	82	80
Age 2	Pearson Correlation	.221*	.215	.082	-.018	1
	Sig. (2-tailed)	.044	.083	.467	.871	
	N	83	66	80	80	83
*. Correlation is significant at the 0.05 level (2-tailed).						
**. Correlation is significant at the 0.01 level (2-tailed).						

DISCUSSION

There is no significant correlation between gender And PCR status, because the level of significance is equal to ***0.177***, which is greater than the level of significance 0.0***5***, and the correlation coefficient is ***0.167***. There is no significant correlation between genders And Coved Status, because the level of significance is equal to ***0.093*** , which is greater than the level of significance 0.0***5***, and the correlation coefficient is ***0.188***, as shown in table 2.

There is no significant correlation between genders and GGO***,*** because the level of significance is equal to ***0.931***, which is greater than the level of significance 0.0***5***, and the correlation coefficient is ***0.010***.

There is significant correlation between gender And Age***,*** because the level of significance is equal to ***,0.044*** which is greater than the level of significance 0.0***5***, and the correlation coefficient is ***0.221***. There is significant correlation between PCR statuses And Coved Status***,*** because the level of significance is equal to ***,0.000*** which is greater than the level of significance 0.0***5***, and the correlation coefficient is ***0.897***. There is significant inverse correlation between PCR statuses And GGO***,*** because the level of significance is equal to ***0.00***1***,*** which is greater than the level of significance 0.0***5***, and the correlation coefficient is - ***0.398*** .

There is no significant correlation between PCR status and age, because the level of significance is equal to ***0.***083, which is greater than the level of significance 0.0***5***, and the correlation coefficient is ***0.***215. There is no significant correlation between Coved Status and GGO, because the level of significance is equal to ***0.***120, which is greater than the level of significance 0.0***5***, and the correlation coefficient is – 0.173.

There is no significant correlation between Covid Status and Age, because the level of significance is equal to ***0***.467, which is greater than the level of significance 0.0***5***, and the correlation coefficient is ***0.***082. There is no significant correlation between GGO and Age, because the level of significance is equal to ***0***.871, which is greater than the level of significance 0.0***5***, and the correlation coefficient is - 0.018.

In absence of specific therapeutic drugs for novel coronavirus disease (COVID-19), it is essential to detect the diseases at an early stage, and immediately isolate the infected person from the healthy population.

This study shows the correlation of Chest CT and PCR Testing for Coronavirus Disease, this study participant's age were mostly above 50 years those people who were affect badly with the disease, patients above 50 years have a very low immunity so their case must be study very carefully.

Males were more affected than females with a small different percent between them, all the participant were suspected to have COVID 19 as the symptoms appeared on most of them, when they tested for PCR 85% of them were resulted positive for COVID which meat most of them had the virus.

68 % of the participants were confirm as a COVID-19 patient by examining the symptoms and making PCR test,

chest X-ray and CT scan, 21 % of them were suspected for COVID-19 and the rest were post COVID. Only 7 cases with GGO, 2 of them of Positive PCR and confirmed Covid, 2 of them with negative PCR and suspected Covid status while 2 of them with post Covid symptoms and 1 suspected Covid case but not confirmed PCR. Early detection of COVID-19, a novel coronavirus disease that emerged in 2019, is critical for disease treatment and control. Chest CT imaging, as opposed to RT-PCR, may be a more reliable, feasible, and quick way of diagnosing and assessing COVID-19, particularly in epidemic areas.

In this study, the study population percentage is 22.4 % of respondents from 51 to 60 and 40 % of respondents are above 60 years. The viral nucleic acid test by RT-PCR assay, according to current diagnostic criteria, is crucial in determining hospitalization and isolation for individual individuals. Its lack of sensitivity, poor stability, and relatively long processing time, on the other hand, were adverse to disease control. In our research, the RT-PCR assay for throat swab samples had a high positive rate was 85%.

Chest CT is a conventional, non-invasive imaging modality with high accuracy and speed. Based on available data published in recent literature, almost all patients with COVID-19 had characteristic CT features in the disease process; in the chest CT 91 % of respondents with GGO while 91 % with no GGO.

CONCLUSION

In conclusion, PCR has high sensitivity for diagnosis of COVID-19. Our data and analysis suggest that PCR should considered for the COVID-19 screening, comprehensive evaluation, and following-up, especially in epidemic areas with high pre-test probability for disease.
Early diagnosis of coronavirus disease 2019 (COVID-19) is crucial for disease treatment and control. Compared with re-verse-transcription polymerase chain reaction (RT-PCR). Early diagnosis of coronavirus disease 2019 (COVID-19) is crucial for disease treatment and control. Compared with re-verse-transcription polymerase chain reaction (RT-PCR).

Recommendations

The study recommended that; more study by CT and MRI machines to show the late effects of COVID-19 in the patients.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

ACKNOWLEDGEMENT

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AUTHOR CONTRIBUTIONS

BAE. Write and perform the measurements, RKA and FAQ. were involved in planning and supervised the work, AMA and ASA were Collect data, performed the analysis, drafted the manuscript and designed the figures. Professor QTA aided in interpreting the results and worked on the manuscript. All authors discussed the results and commented on the manuscript.All authors read and approved the final version.

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