

Impact of Covid-19 on the pattern of HRCT findings in renal failure patients

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ABSTRACT

Objective: To evaluate the pattern of HRCT findings in Covid-19 positive renal failure patients.

Study Design: A Case Series study.

Place and Duration: From 5th October 2020 to 5th March 2021 at Department of Radiology in Ch. Pervaiz Elahi Institute of Cardiology Multan.

Methodology: The study comprises of renal failure patients with Covid-19 confirmed diagnosis. Detailed history and clinical examination, laboratory data and HRCT findings were evaluated. HRCT findings were assessed by two radiologists who were blind to the study. The parameters that were studied involve the disease laterality, distribution, and particular zone involvement.

Results: Among 15 patients, majority (73.3%) were males. The mean age (\pm Standard deviation) of the patients was 40 ± 1.47 . Most frequently observed symptoms include fever, cough, and dyspnea in 80%, 73.3%, and 26.6% respectively. 86.6% and 60% patient samples showed increased levels of CRP and creatine phosphokinase respectively. Only 13.3% patient's blood count results showed leukocytosis and leukopenia was observed in 60% patients. On the assessment of HRCT findings, 60% cases showed bilateral lung involvement and 40% showed unilateral involvement of the lung tissue. Lower lobes were found to be involved in 80% and ground-glass opacity (GGO) was observed in all patients with 80% showing consolidation. In terms of lesion distribution, the peripheral along with central involvement was shown in scans of 60% of the patients.

Conclusion: The features and findings of HRCT that were obtained in renal failure patients who were tested positive for Covid-19 are similar to the features that are being recorded in the general population.

Keywords: Covid-19, Renal failure, HRCT, Ground Glass opacity, Consolidation

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INTRODUCTION

In December 2019, the coronavirus was identified from respiratory secretions of several patients in Wuhan China. Previous outbreaks of Covid-19 include (SARS)-CoV & (MERS)-CoV¹. Coronavirus attacks the human respiratory system

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primarily². The affected patients were admitted to hospitals with pneumonia of unknown etiology³. The percentage mortality of Covid-19 is about 5%⁴. The signs and symptoms of Covid-19 take an incubation period of approximately 5 days to appear⁵. The period between the onset of symptoms to death in severe cases ranges from 6 to 41 days⁶. The disease period is related to the age and immune status of the affected individual. It has been observed that adults (especially old age) and individuals with a chronic disease or immune-compromised patients are more likely to present with severe symptoms⁷. Moreover, it results in poor prognosis and even results in fatal conditions. Immunosuppressive drugs for example long-term use of steroids is also linked with severe disease manifestations⁸.

The clinical features of the chest CT scan of Covid-19 patients reveal pneumonia, with multiple peripheral ground-glass opacities in sub pleural regions of both lungs⁹. The infiltration in the upper lobe is associated with dyspnea and hypoxemia¹⁰. Furthermore, patients infected with the coronavirus also manifest symptoms related to the GI tract e.g. diarrhea¹¹. Most of the patients with end-stage renal disease are suffering from renal diseases of autoimmune etiology¹².

The management of nephrotic syndrome involves the long-term use of immunosuppressive regimes¹³. Hence the patients with renal failure have a chronic disease and are also immune-

compromised. It is important to note that metastatic pulmonary calcification is a complication associated with end-stage renal failure¹⁴. Most of the time it is asymptomatic and benign in nature. However, in some instances, it can cause fulminant respiratory failure and death¹⁵. Currently, there is not sufficient clinical data available regarding the course of the disease, radiological findings, and consequences of Covid-19 in renal failure patients. Hereby the study was conducted with an objective to evaluate the pattern of HRCT findings in Covid-19 positive renal failure patients

METHODOLOGY

This case Series study was conducted from 5th October 2020 to 5th March 2021 at Department of Radiology in Ch Pervaiz Elahi Institute of Cardiology Multan. The study consisted of 15 patients of an end-stage renal disease which were known cases of Covid-19. The inclusion criteria was based on symptoms of Covid-19 pneumonia, positive nasopharyngeal sample for SARS-CoV- 2 (PCR based test), a CT scan indicative of covid-19, dyspnea with oxygen saturation less than 93%, respiratory rate greater than 30/min, and lymphocytopenia (lymphocyte count <1000). On admission, patients were examined and a detailed history was taken. The medical history was reviewed to gather information about the immunosuppressive therapy and to rule out other complications. The patient's samples were already taken to perform CBC, RFTs and to evaluate levels of C reactive protein.

A High-resolution CT imaging was done using a defined protocol¹⁶. Two radiologists that were blind to the study were requested to interpret the findings independently. In case of any conflict, the results were reassessed to reach a consensus. The parameters that were studied involve “the disease laterality, distribution, and particular zone involvement”. It was recorded either the disease is unilateral or bilateral, the distribution is peripheral or central, and which zone among the upper, middle or lower is predominantly involved. After assessing the pattern of involvement in lobes, the findings were categorized into “ground-glass opacity (GGO)” and “consolidation”. In cases where there was a combination, then each category was allocated accordingly. The % involvement of each lobe was scored to estimate overall lung damage. The existence of other indications on CT imaging was also taken into consideration. The follow-up was done to know the outcome of the disease.

Data Analysis: The data were analyzed and expressed as mean, standard deviation, and range. The percentage analysis was done to determine the most frequent symptoms and findings obtained on HRCT. The “lobar involvement” was scored using the following system:

0 = No involvement 2= 26 to 50% 4= more than 75%
1 = less than 25% 3= 51 to 75%

RESULTS

Among 15 patients, 11 were males (73.3%) and 4 (26.6%) were

females. The mean age (\pm Standard deviation) of the patients was 40 ± 1.47 with a range of 25 to 67 years. Most frequently observed symptoms include fever, cough, and dyspnea in 80%, 73.3%, and 26.6% respectively. The History of all 15 patients revealed that they have been on immunosuppressive therapy for different durations. On laboratory findings, creatinine and blood urea nitrogen were elevated in all patients as expected. While 13 (86.6%) and 9 (60%) patient samples showed increased levels of CRP and creatine phosphokinase respectively. Only 2 (13.3%) patient's blood count results showed leukocytosis and leukopenia was observed in 9 (60%) patients. On the assessment of HRCT findings, 9 (60%) cases showed bilateral lung involvement and 6 (40%) showed unilateral involvement of the lung tissue. Lower lobes were more frequently found to be damaged as shown in 12 (80%) out of 15 patients. Computed tomography features showed ground-glass opacity (GGO) in all of the patients with 12 (80%) showing consolidation. Hence a combination of consolidation and GGO was the most predominant feature assessed on the HRCT scan. In terms of lesion distribution, it was found out that peripheral along with central involvement was shown in scans of 9 (60%) of the patients.

Table-I: Frequency of features assessed on HRCT of patients (N=15)

Parameter		n (% of patients)
Lung involvement	Bilateral	9 (60%)
	Unilateral	6 (40%)
Zonal anatomy	Upper	2 (13.3%)
	Middle	4 (26.6%)
	Lower	4 (26.6%)
	Diffuse	6 (40%)
Lobar anatomy Right lobe	Upper	10 (66.67%)
	Middle	11 (73.3%)
	Lower	12 (80%)
Lobar anatomy Left lobe	Upper	10 (66.67%)
	Lower	12 (80%)
Distribution	Peripheral	6 (40%)
	Peripheral + central	9 (60%)
HRCT features	Ground glass opacity	15 (100%)
	Consolidation	12 (80%)

No cavitation, cystic changes were observed in the patients. Pleural and pericardial effusion was seen in 6 patients. Pneumomediastinum was seen in 3 patients, these patients also showed severe changes on HRCT. On follow up it was found that 6 (40%) patients died and 9 (60%) patients got discharged from hospital.

DISCUSSION

The renal failure patients are at higher risk of contracting Covid-19¹⁷. Moreover owing to the immunosuppressive therapy and long-term progression of underlying chronic disease results in a much more bad prognosis of Covid-19 as compared to immune-competent individuals¹⁸. There is no study till now that particularly focused on HRCT findings of renal failure patients who are also positive for Covid-19. Most of the studies are based on a group of patients with different underlying diseases,

therefore the results are conflicting¹⁹. As the patients included in the current study were suffering from end-stage renal disease, the clinical presentation, features on HRCT, and laboratory findings obtained were different from other studies. Although few patients showed symptoms of gastrointestinal disturbances, myalgia, headache, most of them showed typical symptoms of fever, cough. According to a case study, a patient with the history of kidney transplant and presented with vomiting and fever was later on diagnosed with Covid-19²⁰. Another result that was seen in accordance with previous studies was the white blood cells count. Most of the Covid-19 patients show lymphocytopenia (70%)²¹. In the current study, 80% of the patient's samples revealed leukopenia. So these results are in parallel to the immune-compromised state of the patients. Based on the results obtained on HRCT, it was observed that the most common pattern involved was bilateral with diffuse lesion distribution. Moreover, some obvious features suggestive of Covid-19 such as ground-glass opacity (GGO) were seen in scans. Most of the patients showed a combination pattern of GGO with consolidation. In some previous studies, it was seen that an increased percentage of patients showed bilateral involvement on HRCT and a maximum of one case of unilateral involvement. However, in our study, 40% of the patient's scans showed unilateral involvement²². Sub pleural involvement was shown in some patients who were suffering from an advanced stage of the disease. Other less frequent findings included pleural/pericardial effusion, lymphadenopathy and pneumothorax. Our study hereby revealed multi lobar patterns with ground-glass opacity and a high percentage of lung involvement. The increased damage was seen associated with complicated cases for example patients with a history of acute respiratory distress syndrome. The patients with unilateral involvement didn't show any further complications and had a shorter hospital stay. The follow-up of patients showed that the outcome was in accordance with the symptoms and features shown. The mortality rate was high in patients whose HRCT showed increased lung damage with associated complications.

CONCLUSION

The features and findings of HRCT that were obtained in renal failure patients who were tested positive for Covid-19 are similar to the features that are being recorded in the general population.

AUTHOR'S CONTRIBUTION

Bushra H: Conceived idea, Designed research methodology, Data analysis, Manuscript writing, Final critical review of manuscript, Data collection, Literature review

Kamal R: Manuscript writing, Data collection, Data analysis, Literature review

Irum R: Data analysis, Manuscript writing, Final critical review of manuscript, Data collection, Literature review

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