

Multisystem Imaging Manifestations of COVID-19: Viral Pathogenesis and Pulmonary Complications

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ABSTRACT

Objective: To analyze multisystem imaging techniques for diagnosis of Covid-19 viral pathogenesis and pulmonary complications.

Study Design: Retrospective study.

Place and Duration of Study: Department of Pulmonology, Ghulam Muhammad Mahar Medical College, Sukkur from 1st June 2021 to 31st December 2021.

Methodology: Two hundred patients admitted due to Covid-19 positive results were enrolled. Pulmonary consolidations and pneumonia related alterations were observed due to these images. Changes which were related with acute respiratory distress syndrome in complicate Covid-19 cases were also observed. Patients with serious illness were further underwent chest computer topographic imaging scan. Pulmonary-US scan was also performed on the bedside of severe ill Covid-19 patients. In patients with acute respiratory decline and acute dyspnea were also further diagnosed through computed tomography angiography.

Results: The mean age of the patients was 41.2±6.5 years. Chest radiograph presented bilateral pneumonia opacities. In a typical progressive pneumonia could be seen through non-contrast enhanced computed tomography imaging in covid-19 patients with glass opacities and bilateral ground glass opacities. In many cases multifocal, patchy as well as distribution findings which were confluent and organizing as pneumonia were also observed. Pulmonary embolism was also identified through computed tomography imaging in Covid-19 patients.

Conclusion: Multisystem imaging techniques are significantly important and efficient in diagnosis of various manifestations of Covid-19.

Key words: Multisystem imaging manifestations, COVID-19, Viral Pathogenesis, Pulmonary complications

INTRODUCTION

Pandemics are lethal causing catastrophic changes globally. One such pandemic has been faced recently by the whole world due to novel type of coronavirus spread since December 2019. Coronavirus novel type also termed as covid-19 has killed millions of lives all over the world with bringing serious illness to countless population. It is a non-segmented enveloped single stranded positive sense RNA virus. The virus mainly effects the lungs causing acute respiratory distress syndrome resulting into pulmonary distress and failure. In addition to this the virus has also been reported for its involvement in causing multiple organ damage resulting into higher mortality risks. Covid 19 belongs to SARS viruses.¹⁻³

Covid-19 is generally diagnosed through the real time reverse transcription polymerase chain reaction (RT-PCR). The test requires nasal or throat swab sampling. There is a high chance of false negative reporting due to either insufficiency of viral load, or late test determination as well as technical issues leading into improper sampling.⁴⁻⁹

The main transmission mode of Covid-19 is through person to person transmission. The risk of infection increased in places where home shelter or another combine populate were residing. There has been other type of transmission methods implicated including droplet infection through surfaces touched by a Covid-19 patient.⁹⁻¹³

MATERIALS AND METHODS

The retrospective study was carried out at Department of Pulmonology, Ghulam Muhammad Mahar Medical College, Sukkur from 1st June 2021 to 31st December 2021. A total of 200 patients admitted due to Covid-19 positive results in the clinical setting. All patients' diagnosis was confirmed through RT-PCR in addition to their clinical symptoms and presentations. There was no age specified for enrolment. The first line of imaging performed on the Covid-19 moderate cases was chest radiography. It was conducted in primarily in posteroanterior and then in anteroposterior view. Pulmonary consolidations and pneumonia

related alteration were observed in these images. Changes which were related with ARDS in complicated Covid-19 cases were also observed. Patients with serious illness were further underwent Chest computed tomography imaging scan. Lung consolidations and ground glass opacities were observed through Chest CT examination. GGOs areas are accompany with the reticularopacities and are well presented through CT chest imaging. Pulmonary US was also performed on the bedside of severe ill Covid-19 patients. It identified irregular pleural thickness as well as B line artifacts presence. In patients with acute respiratory decline and acute dyspnea were also further diagnosed through CT angiography which applied contrast-enhanced CT of pulmonary angiography. The study was approved through ethical board. Data regarding clinical assessment of each patients was noted. Data analysis was performed using SPSS version 25.0 with Chi square tool used and p<0.05 considered as significant.

RESULTS

The mean age of the patients admitted was 41.2±6.5 years. There were 110 (55%) were males and 90 (45%) were females. The maximum age was 81 years while minimum age was 14 years of enrolled patients (Table 1). Chest X ray, CT Chest was performed in all the enrolled study participants. However, CT angiography was performed in 88 (44%) patients only (Table 2).

Chest radiograph presented bilateral pneumonia opacities. The chest radiography presented pneumonia mostly in lower lung distribution and was bilateral. Intestinal edema or and pleural thickening were observed in Covid-19 patients with subpleural-consolidations in Pulmonary US imaging (Fig. 1).

In a typical progressive pneumonia could be seen through non-contrast enhanced CT imaging in covid-19 patients with glass opacities and bilateral GGOs. In many cases multifocal, patchy as well as distribution findings which were confluent and organizing as pneumonia were also observed. The CT angiography presented pulmonary reversed halo-sign with peripheral ground glass opacities. Pulmonary embolism was also identified through CT angiography in Covid-19 patients (Fig. 2).

Table 1: Distribution of age and gender in Covid-19 patients (n=200)

Variable	No.	%
Age (years)		
14-34	29	14.5
35-64	126	63.0
65-81	45	22.5
Gender		
Male	110	55.0
Female	90	45.0

Table 2: Frequency of multisystem imaging techniques applied to Covid-19 diagnosis (n=200)

Multisystem imaging technique	No.	%
Chest X ray	200	100.0
Chest CT	200	100.0
Pulmonary US	64	32.0
Chest Angiography	88	44.0



Fig. 1: Radiological Manifestations of Covid-19 patients (A), presenting opacities (arrow head) in chest radiography and Pulmonary US imaging (B) presenting pleural thickening (red arrow head)

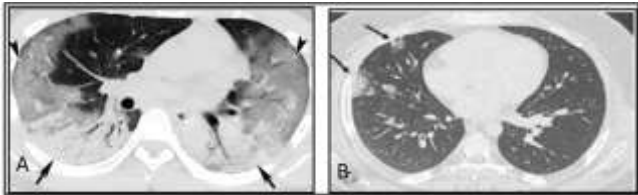


Fig. 2: Non-contrast CT scan (A) and CT angiography imaging (B) in Covid-19 patients. Where A: axial and with bilateral and multiple peripheral lower-lobe GGOs (arrow head), CT imaging showing, B: Ground glass opacities shown by arrow head

DISCUSSION

Chest radiological imaging and CT scan reports have been reported for early identification of acute respiratory distress syndrome. Super imposed pneumonia as a result of bacterial invasions as well as heart failure can be diagnosed through radiological imaging.^{15,16} It may be kept in consideration that non-specific findings are also frequent. Through the assistance chest radiographic imaging the bilateral-airspace opacities can be identified. In the present study the CT scan images demonstrated GGOs in the posterior and base areas of lungs prominently. Similar findings have been reported by other studies on moderate to severe cases of Covid-19.^{17,18}

Blood tests have a high significant role in identifying Covid-19 but in many cases the diagnosis of disease requires more specificity and early detection for timely actions and life saving strategies. In cases where pulmonary and cardiac function decline is foreseen the use of radiological imaging can provide better and efficient way of diagnosis.¹⁹ Fibrotic diagnosis as well as architectural-distortions and reticulations or traction-bronchiectasis can be observed through the radiographical images as presented in the present study as well as previous literature.²⁰

The current study also highlighted way of diagnosing various Covid-19 related complications through advanced radiological imaging techniques involving pulmonary US radiography and CT angiography. Arterial and venous thrombosis was identified through CT angiography in the present study. The similar techniques in addition to CT venography have been suggested in various studies for its efficiency in diagnosing thrombosis.^{21,22} Klok et al²³ also elaborate the fact that multiorgan defects are as also related with thrombosis activity therefore requires special attention and timely diagnosis related with various radiological imaging techniques.

CONCLUSION

Multisystem imaging techniques such as chest radiography, chest computed tomography scan, pulmonary ultrasound and computed tomography angiography are significantly important and efficient in diagnosis of various manifestations of Covid-19 due to viral pathogenesis and pulmonary complications.

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