

HISTOPATHOLOGICAL STUDY OF COVID-19 SEQUELAE DEATHS: A CASE SERIES

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ABSTRACT

Background: SARS-CoV-2, Severe Acute Respiratory Syndrome coronavirus 2 is a single- stranded, non-segmented, enveloped RNA virus. Coronavirus causes disease ranging from asymptomatic or mild disease with fever, shortness of breath, cough and common cold to pneumonia and severe acute respiratory distress syndrome.

Material and methods: Histopathological findings of three cases done during the month of May, 2021 who died of SARS-CoV 2 infections known to cause coronavirus disease 2019 (COVID 19) were recorded. **Results:** Two cases had lung infection. It was heterogeneous ranging from acute respiratory distress syndrome (ARDS) to pneumonia. One case had foci of acute tubular injury in kidney in addition. **Conclusion:** Lungs were the major organs affected by SAR CoV 2 virus. Other organs were less frequently involved. Though present case series has small number of cases but histopathology of post mortem viscera are valuable in finding cause of death and improving treatment modalities.

KEYWORD: Histopathology, SARS-CoV-2, COVID 19.

INTRODUCTION

SARS-CoV-2, Severe Acute Respiratory Syndrome Coronavirus 2 is a single- stranded, non- segmented enveloped RNA virus.^[1] These ubiquitous viruses cause variably severe diseases that range from the common cold to severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS).^[1,2]

On December 31, 2019, China informed the World Health Organization (WHO) about cases of pneumonia of unknown aetiology detected in Wuhan city, Hubei province of China. From December 31, 2019 to January 3, 2020, a total of 44 patients with pneumonia of unknown aetiology were reported to the WHO by the national authorities in China. During this period, the causal agent was not identified. The cases initially

identified had a history of exposure to the Huanan Seafood Wholesale Market. The most common clinical features of the early clinical cases from Wuhan, China, were fever (98.6%), fatigue (69.6%) and dry cough (59.4%). The second meeting of the Emergency Committee convened by the WHO Director-General under the International Health Regulations (2005) regarding the outbreak of novel coronavirus 2019 in the People's Republic of China on January 30, 2020, declared COVID-19 outbreak as Public Health Emergency of International Concern (PHEIC). As on February 17, 2020, except China, 25 other countries have been affected by COVID-19 outbreak with 70,635 confirmed cases and 1,772 deaths in China. Outside China, 794 cases were reported with three deaths.^[3] Since then coronavirus has spread across whole world with 177,108,695 confirmed cases and more than 3

million deaths.^[4] India confirmed its first case in Kerala on January 27, 2020.^[3] Currently, India has the largest number of confirmed cases in Asia and second highest number of confirmed cases in the world.^[4]

In India, during first wave infection rate was low and was well controlled due to nationwide lockdown in March, 2020 but during second wave around March, 2021 infection rate was high with highest number of cases reported on 9th April, 2021 (144,829) in India. Delhi, Uttar Pradesh, Maharashtra, Kerala, Karnataka, Andhra Pradesh, Tamil Nadu were the most affected states.^[5]

In Haryana, Indian Ministry of Health and Family Welfare confirmed 9216 deaths due to coronavirus as on 20/6/21.^[6] We conducted our case series of three patients during the month of May, 2021 in which more than eight million cases (8,623,999) were reported and more than one lakh (1,27,075) total deaths occurred due to coronavirus in India.^[7]

The aim of this case series is to share our observations and findings on the pathological aspects of coronavirus based on three Covid-19 positive patients in Haryana during the second wave in India, in the month of May 2021.

MATERIAL AND METHODS

Tissue processing for histopathological examination

Specimens received were fixed in 10% buffered formalin for histopathological examination. After fixation for at least 24 hours tissue processing was done. Hematoxylin and eosin stained slides of all tissue sections were microscopically examined.

Specimens of brain, heart, lungs, liver, spleen, kidneys were assessed. Two examinations were limited to heart and both lungs.

RESULTS

Clinical findings

Case 1: 46 years old male with history of covid infection detected by Rapid antigen test.

Case 2: 73 years old male with history of covid infection detected by RT PCR.

Case 3: 28 years old female with history of covid infection detected by RT PCR.

Macroscopy findings

Case 1: Both lungs were firm to hard in consistency with areas of consolidation at places. Cut sections were congested. Other viscera were unremarkable.

Case 2: Both lungs were congested and oedematous.

Case 3: Both lungs were congested.



Figure 1: Macroscopy findings.

Serial sections of lungs showing congestion.

Microscopy findings

Case 1:

Sections from both lungs show features of Acute Respiratory Distress Syndrome (ARDS) with marked thickening of alveolar septa with intra-alveolar fibrosis and proliferation of pneumocytes. Many of alveoli are distended and contain desquamated cells, proteinaceous debris and hyaline membrane. Sections from brain, heart, liver and spleen do not show any significant pathological changes. Kidneys show foci of tubular necrosis and interstitial inflammatory infiltrate.

Case 2:

Sections from both pieces of lungs showed features of pneumonitis consisting of dense inflammatory infiltrate in interstitium as well as in alveolar spaces. Sections from heart showed features of chronic ischemic heart disease with moderate atherosclerosis.

Case 3:

Sections from both pieces of lungs showed edema and congestion. Sections from heart do not show any significant pathological change.

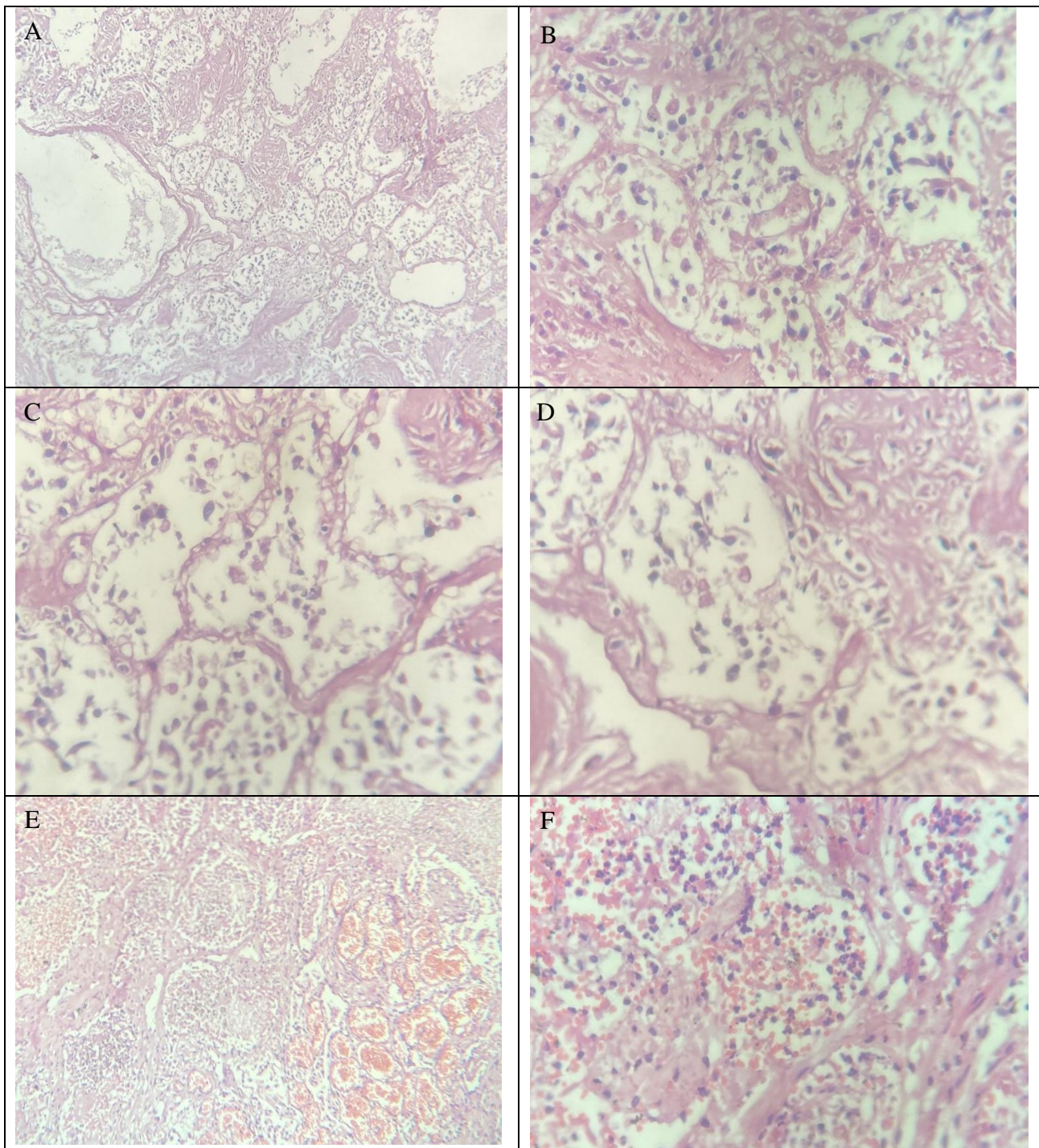


Figure 2: Microscopy findings.

(All H&E) A. Lung: Diffuse alveolar damage (100x). B,C,D. Lung: Marked thickening of alveolar septa, alveoli are distended and contain desquamated cells, proteinaceous debris and hyaline membrane (400x). E. Lung: Pneumonitis (100x). F. Lung: Areas of congestion and inflammatory infiltrate comprising predominantly of neutrophils and lymphocytes in alveolar spaces (400x)

DISCUSSION

Novel coronavirus, SARS-CoV 2 was first detected in Wuhan, China in 2019 when several cases of pneumonia

were reported.^[5] Later, it rapidly spread around the world causing more than 170 million infections and more than 3 million deaths.^[4] The present case series was conducted from 1st May to 31st May, 2021 during which we received post-mortem viscera of three patients who died of SARS-CoV 2.

SAR-CoV 2 virus gain entry through angiotensin-converting enzyme 2 (ACE2). This protein (ACE2) is present in various human organs, including respiratory system, liver, kidney, spleen, and brain. Coronavirus is

believed to be more virulent as it affects multiple organ systems in human.^[8]

In our case series, lung infection was the major factor of death. On histology, the lung infection was heterogeneous ranging from acute respiratory distress syndrome (ARDS) to pneumonia according to severity of infection. Our findings were in agreement with other studies published on coronavirus histology findings.^[9,10]

The most common histopathologic correlate of ARDS is diffuse alveolar damage (DAD) characterised by hyaline membrane in alveoli in acute stages, interstitial oedema and fibroblast proliferation in organising stage. DAD is caused by variable pathological agents including infection, oxygen toxicity, sepsis, drug toxicity and acute exacerbation of usual interstitial pneumonia.^[2]

One case had foci of acute tubular injury in kidney. These findings were also recorded in study done by SF Lax et al.^[11]

None of our cases had thromboembolic event.

CONCLUSION

In conclusion, lungs are the major organs affected by SAR CoV 2 virus. Other organs such as kidney, liver, heart are less frequently involved. Though present case series has small number of cases but histopathology of post mortem viscera are valuable in finding the cause of death and improving treatment modalities in COVID-19 pandemic as autopsies provide adequate tissue sampling from multiple organs thereby reducing sampling error. Thus further research and studies are needed to confirm the findings of spectrum of infection caused by SAR CoV 2 virus.

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