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Histopathologic Autopsy Findings of Target Organs, Lung, Heart, Kidney and Spleen of 12 Patients died as a result of the Novel COVID-19 in Baghdad, Iraq

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ABSTRACT

Demonstration of the disease hallmarks of COVID infection 2019 (Coronavirus disease-19) caused by respiratory SARS-CoV-2 (Severe acute respiratory syndrome coronavirus 2) in tissue biopsies and some autopsy examinations confined to the pulmonary system and selective target tissues. Entire corpse dissection investigation was limited. To characterize the extent of pathological changes resulted by COVID-19 infection, examinations carried out on twelve (12) cases with SARS-CoV-2 (Nine '9' were healthy & Three '3' unhealthy) some passed out in home and others in hospitals at Baghdad. Specimens from the pulmonary, cardiac, hepatic, renal systems with splenic samples only have been inspected both grossly and microscopically. SARS-CoV-2 resulted in multiple organs illness, lungs with circulatory association was predominant. Extra-pulmonary signs include liver, kidney and spleen contribution, and microvascular injury was obvious. These results were documented both in patients with or without previous clinical history of diseases. SARS-CoV-2 resulted in multiple organs illness & critical disease in many systems regardless of previous medical background.

1. INTRODUCTION

In Iraq, the 1ST registered case of SARS-CoV-2, reported at Al Najaf governorate on end of October 2020, for an Iranian tourist who was a male 29 years old healthy without any morbid history who passed later on in Iran after his return. Later on cases were discovered in many spots in the country and the disease became more obvious [1], [2].

Wide spread reports have revealed that SARS-CoV-2 acts as a wide era of signs and symptoms, non–symptomatic and simple (60-90% of patients), intermediate (10-30 % of patients), extreme or complex (10-15 % of patients). Fatality rates were peaked in older candidates (≥65 years of age) and those with history of medical problems [2], [3].

2. MATERIALS AND METHODS

Entire body examinations were limited and performed at the medico-legal directorate, Baghdad, Iraq. Autopsy

was under high infection control legislations and within the high risk group protocol. Reports of 12 cases of SARS-CoV-2 examined were analyzed. Postmortems have been undergone in particular SARS-CoV-2 assigned postmortem examination halls supplied by wind stream and disease control techniques.

SARS-CoV-2 PCR for specimens was performed on tissue samples from pulmonary, cardiac, hepatic, renal, and splenic tissues were reserved in formaldehyde at 25C^{o} for 3 days for histopathological assessment. Samples were stained with HE stain as the main staining technique.

3. RESULTS

3.1 Patient Specificities

The characters of 12 SARS-CoV-2 corpses were autopsy examination was performed, were summarized in (Table 1). Of those, 9 had other medical illnesses (category I) and three patients were without any complain before hospitalization with insignificant history (category II).

Table 1: Characteristics of the patients

Character	Category I healthy	Category II unhealthy
No. of patients	9	3
Age in years	30-80	30-60
Median $\pm$ SD	60 $\pm$ 12.5	45 $\pm$ 11.03
Men	7 (78%)	2 (67%)
Women	2 (22%)	1 (33%)
Chronic pulmonary diseases	7 (78%)	0
Circulatory diseases	7 (78%)	0
Cancers	5 (56%)	0
Diabetes Mellitus	4 (44%)	0
Renal disease	4 (44%)	0
Neurocerebral diseases	3 (33 %)	0

3.2 Postmortem and Microscopical Findings

3.2.1 Pulmonary System

Grossly. Lungs were expanded and big size, rubbery, congested with pleurisy and thickened pleural membranes. Dissection reveals both solidification & hepatization regions, with hardening of intervening septa and pneumonic changes.

Microscopically. Alveolar exudation and proliferation (Figure 1A), hyalo-fibrin membranes (Figure 1B) and alveolar spaces breakdown (Table 2). Pneumonic changes such as sclerosis and type 2 pneumocytes proliferation, active cytoplasm, and dark nucleoli, all demonstrative of viral intracytoplasmic proliferation (Fig 1C).

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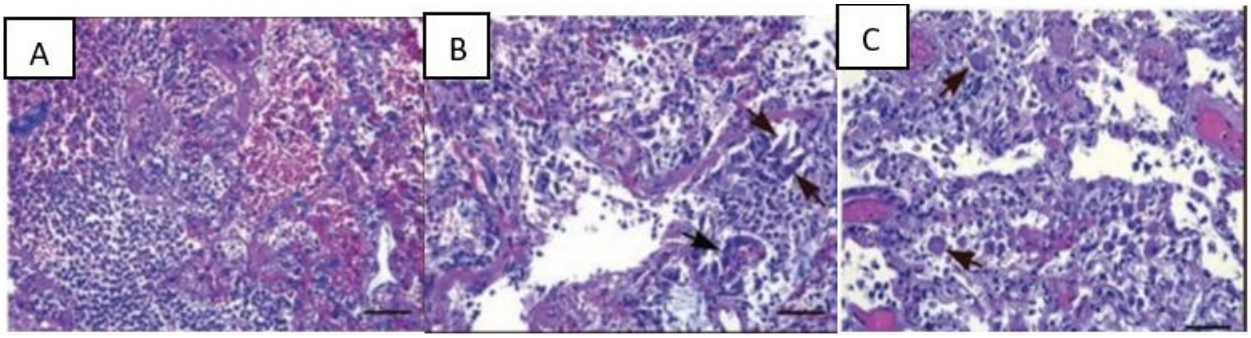

Figure 1: A and B, under microscope shows diffuse matrix breakdown with diffuse alveolar damage. B and C, showed proliferation of type 2 pneumocytes, revealed active cytoplasm, big nuclei, and dark nucleoli, *HE stain* x 10.

Table 2: Organs morph-pathological findings

Heart	**Category I no. and %**	**Group II no. and %**
Myocarditis	9 (100%)	3 (100%)
Vasculitis	5 (55%)	3 (100%)
Inflammatory infiltrate	3 (33%)	3 (100%)
Focal necrosis	5 (56%)	2 (67%)
Pericarditis	4 (44%)	1 (33%)
Vascular fibrosis	3 (33%)	1(33%)
Liver		
Inflammatory infiltrate	6 (67%)	3 (100%)
Congestion	7 (78%)	2 (67%)
Steatosis	3 (33%)	3 (100%)
Kidney		
Inflammatory infiltrate	9 (100%)	3 (100%)
Glomerulosclerosis	9 (100%)	3 (100%)
Interstitial fibrosis	9 (100%)	3 (100%)
Spleen		
Congested red pulp	6 (67%)	3(100%)
Lymphoid hypoplasia	5 (56%)	3 (100%)

3.2.2 Heart System

Grossly. The heart in category I and II victims was big, hypertrophied, with dilation of its four chambers. The muscular layer seemed scanty in blood contents and heavy, and the endothelial layer presented with tiny bleedings.

Microscpoically. Increase in size of cardiac muscle cells with spots of sclerosis (Figure 2, A & B). Monocytes invading outermost protective connective tissue layer. Myocarditis manifested by mononuclear and lymphocytic infiltrates together with areas of necrosis, transudation, bleeding and pericarditis were seen obviously in category II patients.

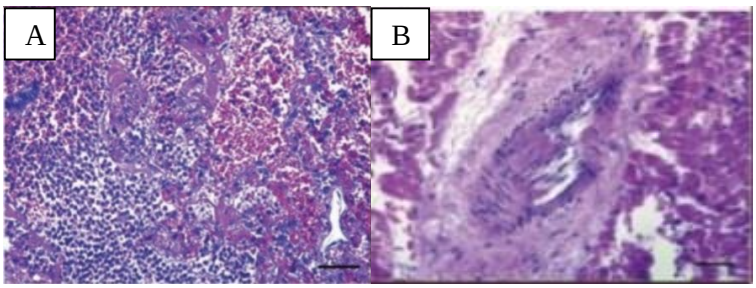

Figure 2: Histological changes A and B in heart tissue showimg increase in size of myocytes with some degree of fibrosis with monocytes infiltration, HE stain x 10.

3.3 Liver, Kidney and Spleen Findings

3.3.1 Liver

Grossly no change in size and shape with smooth surface. Histology showing parenchymal congestion, impacted red blood cells within sinusoids and in the space of Disse, those were the fundamental histological findings, obstruction and blockade of micro-veins with red blood cells and liver cells breakdown were seen in some cases (Figure 3, A). Macro-vacuolar and micro-vacuolar steatosis were seen.

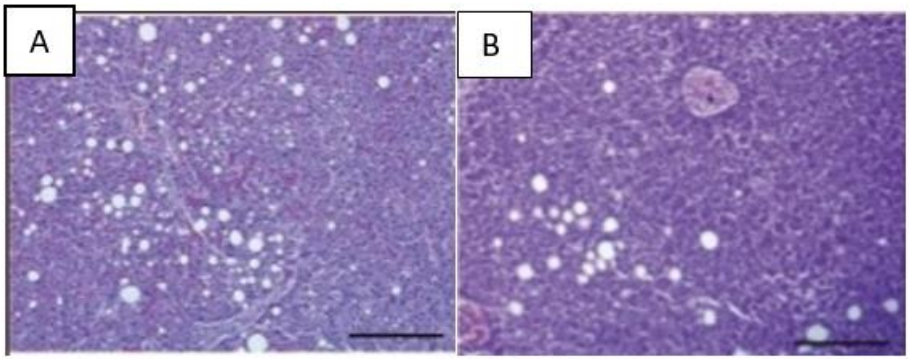

Figure 3: A, sinusoids impacted with red blood cells in the space of Disse (B). Macro-vascular and micro-vacuolar steatosis was observed, *H E stain* x 10.

3.4 Kidney

Grossly no change in outlines but looking smaller. Appearance showing rosy pits. Microscopically reveals parenchymal sclerosis (Figure 4, A), with enlarged renal cells. The stores of fibrin were rich under the capsule of Bowman (Figure 4, B).

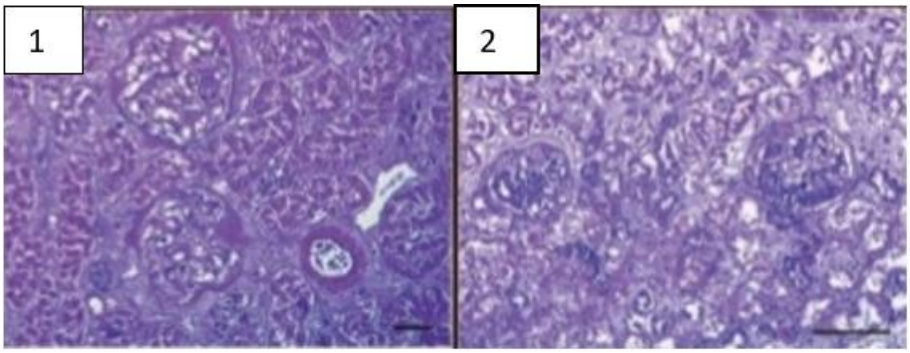

Figure 4: A, Renal cells looking big in size. B, Fibrin is rich under the capsule of Bowman, *HE stain* x 10.

Spleen. Grossly presented with typical outline, however, somewhat demolishment in weight.

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Microscopically, white cores of spleens of every one in category II showed lymphoid hypoplasia (Figure 5, A and, B).

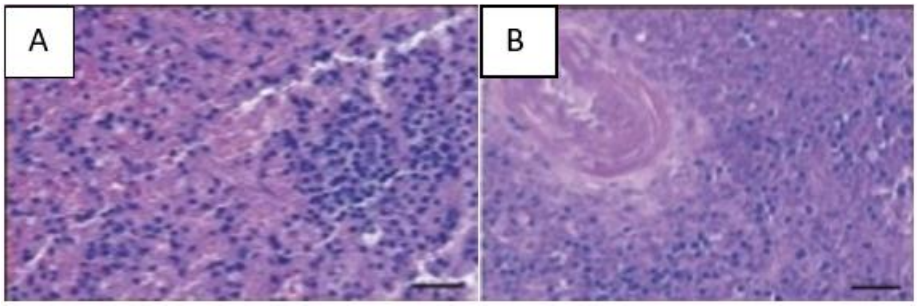

Figure 5: A and B, hypo-plastic changes are seen in the white cores of spleen, HE stain x 10.

4. DISCUSSION

Entire body dissections offer benefits over restricted biopsies and tissues specimens since autopsy still the gold standard. Entire body dissection investigations of COVID-19 patients were few because of issues of disease control. Entire body dissection permits better assessment and to characterize the degree of SARS-CoV-2 organs involvement, furthermore permits reservoir specimens required for additional pathological assessment and future studies [4- 7]. They also permit a precise finding and limit odds of misleading exact conclusion by avoiding errors. It is difficult where and when to decide the degree of organ association by full postmortem assessment or direct selective organ dissection [8- 13].

A preliminary report from PRC (public Republic of China) studied morph-pathological findings in two victims with cancer had SARS-CoV-2 and the autopsy focused on lungs, which showed a few vague unspecified histopathological findings [4]. An autopsy record, additionally from PCR studied postmortem biopsy examples from lungs also but with more COVID-19 patients and majorities were healthy, which revealed widespread alveolar breakdown and parenchymal monocytes invasion [5], [7- 11]. The current postmortem examination study illustrated that SARS-CoV-2 prevalently induces acute pulmonary harm and widespread alveolar breakdown; it is related with multiple systems association and huge disease process in almost all systems in patients regardless associated morbid illness. Almost all deaths were because of heart-lungs dysfunction and disease manifestations outside the lungs were seen in all patients. Small vessels harm and thrombus formation have been widely recognized. More young victims with no previous ailments had comparable and similar findings withstanding with patients who have previous morbid history and showing all signs of broad vessels harm, with hepatic, renal, and splenic injury [13- 18].

In the present study, the pulmonary system examination showed findings were like those found in an investigation of autopsy lung tissues from an Italian study of thirty three men and five women, with an age range of fifty five years (ranged in between thirty–eighty years) [17], [18]. Curiously, all the signs of parenchymal pneumonitis were noticeable in the twelve COVID-19 cases in the current study, with lymphatic cells being conspicuous in vessels invasion and parenchymal damage.

Autopsy examinations and histopathological findings have demonstrated that intense respiratory upsets and different organ involvements are highlights of extreme patterns of COVID-19. These are believed to be supported by uncontrolled excess immune reaction [19- 23].

Many studies have shown a relationship of the seriousness of the clinical manifestations of COVID-19 with the previous history of diseases. Cardiovascular entity in seriousness of COVID-19 pathological sequences

was recorded [24], and cardiovascular liability agents were distinguished as hazard agents for high rates of fatality due to SARS-CoV-2 [25]. The present study showed a lot of contrasts among victims regarding previous illnesses. The three healthy victims showed acute pericardial and adventitial inflammation, demonstrating that the cardiac component can be affected regardless past cardiovascular problems. Renal injury has been encountered in almost 40% of SARS-CoV-2 victims; illustrating that intense renal injury was seen in healthy victims more than those who are unhealthy presented with positive past medical history [25-27]. Patients without disease history showed more prominent hepatic injury, liver or kidney harm caused straight by COVID-19 itself or as sequel of the outcomes of extreme immuo-inflammatory reactions, remains a question [26]. Studies of other diseases of viral background of the pulmonary tract suggest that hepatic system harm might be immunologically interceded or an aftereffect of direct viral harm injuring the liver cells. The current study showed that spleen was impacted in all of patients without significant medical history and 6 patients with positive history.

Microvascular harm and thrombus formation were a noticeable element in all cases regardless any morbid history, ascertains that anti-coagulants therapy can decrease fatality in SARS-CoV-2 [27- 29].

Further evaluation of neurological entity should be studied extensively using intracellular viral staining, immunohistochemistry, and electron microscopy assessment that might reveal further information into the cerebrovascular components of SARS-CoV-2 [29]. Postmortem assessment studies are crucial and extremely important, entire body examinations and study reports from all over extent of different world regions regarding age, ethnicity and associated diseases are expected to outline the disease progress and clarify the scope and extent of changes in SARS-CoV-2 [10], [12], [13], [16], [25- 29].

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