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Systematic Review Article

Lung autopsy findings post-Covid19

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Abstract
There are studies available whereby autopsy findings in the lungs were noted. Present review was conducted to compile all autopsy findings and to have the knowledge of common lung autopsy findings in the in the patient where the cause of death was COVID-19.
Keywords: COVID-19, Lung, Autopsy

Introduction

Coronavirus disease 2019 (COVID-19) was first recognized in Wuhan, China, in December 2019. An exponential rise has been seen in the cases of COVID -19 since December 2019. Second wave of COVID 19 had widely affected all over the world. Almost more than thirty eight lacks death has been reported till 22nd June 2021. (1)

As per WHO, severity definitions are critical COVID 19, severe COVID 19 and non-severe COVID 19. Severe pneumonia is seen in severe COVID 19 and critical disease is characterized by development of adult respiratory distress syndrome. These are the important cause of death in COVID-19 patients. (2)

Role of cytokines have elaborated in the lung damage. Various cytokines involved are interleukin (IL)-6, IL-10, granulocyte-colony stimulating factor (G-CSF), monocyte chemoattractant protein 1 (MCP1), macrophage inflammatory protein (MIP)1α, and tumor necrosis factor (TNF)-α. Besides this role angiotensin converting enzyme -2 receptor has been elaborated. All these mechanism aids in systemic inflammatory response which affect lung. This inflammatory response is considered to cause death in severe and critical covid-19 patients.(3)

Autopsy finding helps us know how that particular organ was affected. This review was conducted to collect autopsy findings in lungs depending on the available data till date.

Method

The electronic search of the various studies available from the electronic database of PUBMED and google scholar were collected. The search term used were COVID-19, Autopsy findings and lungs. All authors selected the relevant papers. Based on relevant papers, review were done. Only English papers were included in the study. Based on screening, about following studies were included in the study.

Following were the important studies

Carsana L et al (4) analysed lung tissue samples from 38 patients. Mean age was 69 years (SD 12; range 32–86). Macroscopic examination as well as histopathological study was done.

Predominant findings in all cases were

- exudative and proliferative phases of diffuse alveolar damage
- capillary congestion
- necrosis of pneumocyte
- Type 2 pneumocyte hyperplasia
- Infiltratory infiltrate

In majority of the case, findings were-

- Hyaline membranes (33 cases)
- Interstitial and intra-alveolar oedema (37 cases)
- Platelet fibrin thrombi (33 cases)
- Macrophage in alveolar lumina (24 cases)
- Lymphocyte in interstitium (31 cases)

Bradley BT et al (5) had done autopsy study in 14 people who died with COVID-19, Mean age was 73·5 years (range 42-84; IQR 67·5-77·25). Predominant findings in the lungs were diffuse alveolar damage in the acute or organising phases, and pulmonary microthrombi were observed in 5 patients.

Fox et al (6) had done autopsies in ten people aged 44-78 years. Findings evident were the presence of thrombosis and microangiopathy in the small vessels and capillaries of the lungs, with associated haemorrhage. Features of diffuse alveolar damage including hyaline membranes were seen.

Copin et al (7) had conducted autopsies in 6 patients at different stages of disease. They describe a type L characterized by a low elastance, a low ventilation to perfusion ratio, a low lung weight and a low lung recruitability. Worsening patients are supposed to progress from type L to type H. Type H is characterized by a high elastance, a high right-to-left shunt, a high lung weight and a high lung recruitability.

Joob et al **(8)** had observed the pulmonary pathology of early phase 2019 novel Coronavirus Pneumonia. He observed edema, proteinaceous exudate, focal reactive hyperplasia of pneumocytes with patchy inflammatory cellular infiltration, and multinucleated giant cells. These represent an early phase of the lung pathology of COVID-19 pneumonia

Schaller et al (9) had done autopsies in 10 patients with mean age of 79 years (range 64 to 90 years). Diffuse alveolar damage was reported in middle and lower lobe.

Aguiar et al (10) heavy lung with haemorrhagic oedema in female patient of 31 years of age. Microscopic findings was diffuse alveolar damage with oedema, focal intra alveolar haemorrhage. CD3 + T cell and megakaryocytes was seen in in the interstitium.

Dolhnikoff et al (11) had done autopsy study in 10 patients in the age group of 33 to 83 years, 67.8 mean age. Main microscopic finding reported were

- Diffuse exudative and proliferative Diffuse alveolar damage
- Foci of alveolar haemorrhage,
- Lymphocytic infiltration,
- Viral cytopathic damage of epithelium of alveoli and small airways,
- Fibrin microthrombi in small pulmonary arterioles with a large number of megakaryocytes within pulmonary capillaries.

Barton et al (12) had done the autopsy in 2 male patients. Lungs were heavy, red to maroon in colour, oedematous parenchyma that had diffusely firm consistency without focal lesions. Findings were

- Diffuse alveolar damage in the acute stage with numerous hyaline membranes and without interstitial organization
- thrombi within a few small pulmonary artery branches
- congestion and edema fluid focally
- mucosal edema within the bronchial mucosa
- Foci of acute bronchopneumonia along with rare aspirated food particles
- CD3-, CD4 and CD8-positive T-lymphocyte

Lacy et al (13) had studied the autopsy in female patient of 58 years of age. Heavy, firm, and oedematous lungs were noted. Airways was blocked with mucus. Microscopic findings showed oedema, hyaline membranes, mild mononuclear infiltrates of the septae, desquamated hyperplastic pneumocytes alongside multinucleated cells. No viral inclusion or cytopathic changes were noted.

Prilutskiy et al (14) had conducted a study 4 patients in the age group of 64 to 91 years. Diffuse alveolar damage was observed and mediastinal lymph nodes were enlarged.

Yan et al (15) had studied the autopsy in female patient of 44 years of age. Heavy lungs with enlarged parabronchial lymphnodes were observed. Pulmonary edema and infarction areas were observed. Acute lung injury with lymphocytic infiltrates and hyaline membranes diffuse alveolar damage was seen. Cytopathic damage of pneumocytes alongside viral particles, perivascular lymohocytic cuffing, few lymphocytic infiltrations of the vessel wall and fibrin aggregates within blood vessels were observed.

Fitzek et al (16) had studied the autopsy in male patient of 59 years of age. Firm, odamatous lung with grayish yellow mutifocal areas were observed. Diffuse alveolar damage with microthrombi, lymphocytic infiltration were observed.

Edler et al (17) studied autopsy finding in 80 patients in the age group of 52 to 96 years with the mean age 79.2 years. Heavy lung with mosaic like pattern was observed. Diffuse alveolar damage with lymphocyte and plasma cell infiltration were observed. Thromboembolism was also observed.

Bryce et al (18) autopsy finding in 80 patients in the age group of 34 to 94 years with the mean age 69 years. Lung parenchyma appearance ranged from patchy to diffusely consolidated, cavitatory lesion and pulmonary emboli were observed. Lungs were heavy. Major findings are as follows-

- diffuse alveolar damage (DAD) in the acute/exudative or early proliferative phase (22 cases)
- Diffuse Hyaline membranes with type 2 pneumocyte hyperplasia (9 cases)
- Multinucleated cell with pneumocyte atypia with intranuclear inclusion (2 cases)
- Capillary inflammation (14 cases)
- Emboli and thrombi (23)
- Extensive and necrotising pneumonia (2 cases)

Menter et al (19) had studied the autopsy findings in 21 patients with mean age of 76 years in the range of 53 to 96 years. Following were the main findings

- Heavy, firm and congested lungs
- diffuse alveolar damage (DAD) exudative type mainly
- diffuse alveolar damage (DAD) proliferative type (8 cases)
- Bacterial bronchopneumonia (10 cases)
- capillary congestion; oedema; alveolar haemorrhage (5 cases)
- Microthrombi in alveolar capillaries

Remmelink et al (20) had studied the autopsy findings in 17 patients with mean age of 72 years in the range of 62 to 77 years. Following were the main findings.

- Heavy, firm lung with haemorrhagic areas
- Thrombi in pulmonary artery
- Diffuse alveolar damage (DAD) exudative type (15 cases)
- Microthrombi in small arteries with microthrombi (11 cases)
- Lung infarct (4 cases)

Wichmann et al (21) had studied the autopsy findings in 12 patients with mean age of 73 years in the range of 52 to 87 years. Following were the main findings.

- Heavy, firm and congested lungs with pleurisy and patchy pattern
- Diffuse alveolar damage (DAD)
- Microvascular thromboemboli,
- Capillary congestion
- Granulocytic infiltration when bacterial bronchopneumonia

Thus to summarize

Common macroscopic findings seen are-

- Heavy lung with oedema
- Lung infarct
- Pathy lungs with haemorrhagic area
- Thromboembolism in pulmonary artery

Common microscopic findings observed are-

- Diffuse alveolar damage which may be exudative or proliferative type
- Microthrombi in small arteries with microthrombi
- Bacterial bronchopneumonia
- Hyaline membranes with diffuse alveolar damage
- Extensive and necrotising pneumonia
- Focal reactive hyperplasia of pneumocytes with patchy inflammatory cellular infiltration
- Necrosis of pneumocyte
- Type 2 pneumocyte hyperplasia
- Infiltratory infiltrate

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