



## Pulmonary thrombosis in post-mortem findings of COVID-19 – Autopsy Review

Journal Articles, Original articles

Carsana et al. BMJ April 2020; Wichmann et al. Ann Intern Med May 2020; Lax SF et al. Ann Intern Med May 2020; Duarte-Neto AN et al. Histopathology May 2020; Ackermann M et al. NEJM June 2020.

### Summary

#### Methods

- Recently published autopsy series highlight pulmonary arterial thrombosis as one of the key findings in severe lung injury caused by COVID-19.
- Complete autopsies were performed in accordance with standard international guidelines with the use of proper PPE and donning–doffing precautions. All the cases were confirmed SARS-CoV-2 by RT-PCR on nasopharyngeal swabs.
- Duarte-Neto AN et al used MIA-US (ultrasound-based minimally invasive autopsy), a suitable alternative to complete autopsy.
- Ackermann et al compared lung findings from autopsies of COVID-19 patients with those obtained from patients who died from ARDS secondary to influenza A (H1N1) infection and age-matched uninfected control lungs.

#### Results

- All cases showed varying degree of exudative/proliferative DAD (diffuse alveolar damage) distinctive of ARDS
- Of note were fibrin thrombi observed in small and mid-sized arteries in a high proportion of cases in all the cited studies. Associated changes of pulmonary embolism, infarction, endothelial damage and angiogenesis were also observed. (Wichmann et al, Lax et al, Ackermann et al)
- There was no evidence of thrombo-embolism in central vessels at autopsy or prior to death in any of the cases.
- Compared with influenza lungs, COVID-19 lungs had a 9-fold more pulmonary alveolar capillary thrombosis and 2.7 times more angiogenesis. Endothelial cell injury with intracellular SARS-CoV-2 was observed. Moreover 69 angiogenesis-related genes were seen as differentially regulated in the COVID-19 lungs compared with 26 genes in influenza lungs (Ackermann et al).

Author/Place of study	Journal/ Month of publication	Cases	Procedure for obtaining lung tissue	Key findings	Thrombosis
1. Carsana et al, Italy	BMJ, April 2020	38	Autopsy	DAD (38/38)	Fibrin thrombi in small arteries (33/38)
2. Wichmann et al, Germany	Ann Intern Med, May 2020	12	Autopsy	DAD (8/12)	Pulmonary embolism (4/12), DVT (7/12)
3. Duarte-Neto AN et al, Brazil	Histopathology, May 2020	10	MIA-US	DAD (10/10)	Fibrin thrombi in small arteries (8/10). Small thrombi in glomeruli, spleen, heart, liver, dermis and testis
4. Lax SF et al, Austria	Ann Intern Med, May 2020	10	Autopsy	DAD (11/11), bronchopneumonia (6/11)	Fibrin thrombi (11/11), Pulmonary infarction (8/11)
5. Ackerman et al, U.S.A	N Engl J Med, June 2020	7	Autopsy	DAD (7/7)	Thrombosis, severe endothelial injury and angiogenesis (4/7)

### Conclusion

- Vascular and thrombotic events play a role as drivers of pathological changes leading to severe lung injury and death in COVID-19.

### Appraisal:

- Strength
  - Few of the first series on pulmonary autopsy findings in COVID-19 highlight the thrombotic and vascular changes in small arteries.
- Weakness
  - Small number of cases studied.
  - Limited data on effect on other organs

### Opinion:

Autopsies are gold standard to identify the cause of death and study pathophysiology of novel diseases. Though the studies are less as compared to number of deaths worldwide, findings of pulmonary artery thrombosis and thromboembolism in these studies underpin and parallel the recent clinical findings of coagulopathy induced complications and potential beneficial role of anticoagulants in treatment of severe COVID-19.

### Appraisers

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