

ACUTE KIDNEY INJURY IN COVID-19

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DISCLOSURES

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 - American Thoracic Society Unrestricted Critical Care Award: “Mitochondrial DNA in ARDS due to Sepsis”
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- **Disclosures:**
 - I have no relevant disclosures related to the content that I am going to present

WHAT IS THE RISK OF AKI IN COVID-19?

Publication	Cohort	Rate of AKI	Timing of AKI
Chen et al. Lancet	All Hospitalized	3/99 (3%)	15 days
Yang et al. Lancet Resp. Med	Critically Ill	15/52 (29%)	7 days
Hirsch et al. Kidney International	All Hospitalized	1993/5449 (37%)	4 days
Mohamed et al. Kidney 360	All Hospitalized	161/575 (28%) (14% non- critically ill, 61% critically ill)	24-48 hours (highest at time of intubation)

WHAT IS THE ETIOLOGY OF AKI IN COVID-19?

Table 4. Etiology of CoV-AKI (n = 161)

Ischemic ATI	
Hemodynamic instability	106 (66%)
Hypotension / shock	86 (53%)
Large reduction in SBP	4 (2.5%)
Rapid atrial fibrillation	2 (1.2%)
Prolonged volume depletion	14 (9%)
Toxic ATI	11 (7%)
Rhabdomyolysis (isolated)	7 (4%)
Another toxic agent [∞]	4 (2.5%)
Ischemic/Toxic	
Hemodynamic instability and rhabdomyolysis	4 (2.5%)
AKI otherwise not specified	20 (13%)
Urine sediment microscopy suggestive of ATI	11 (7%)
Overt proteinuria suggestive of glomerular lesion	3 (1.9%)
Acute interstitial nephritis	1 (0.6%)
<i>De novo</i> glomerular disease	4 (2.5%)
Collapsing glomerulopathy	3 (1.9%)
Proliferative glomerulonephritis	1 (0.6%)
Prerenal azotemia	15 (9%)

[∞] toxic agents that were identified as only potential culprit for AKI included: vancomycin (n = 3), iodinated radiocontrast (n = 1).

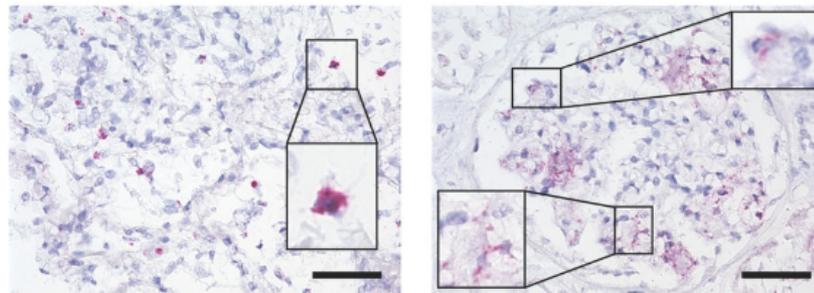
Under Toxic ATI, 5 patients were diagnosed with rhabdomyolysis based on CPK > 5000 U/L and 2 based on CPK > 2000 U/L + 2+heme dipstick and no urine RBCs.

Under Ischemic/Toxic ATI, among 4 patients with ischemic ATI, 3 patients were diagnosed with concomitant rhabdomyolysis based on CPK > 5000 U/L and 1 based on CPK > 2000 U/L + 2+heme dipstick and no urine RBCs.

AKI, acute kidney injury; CoV-AKI, AKI associated with COVID-19; ATI, acute tubular injury

Table from: Hirsch et al.,
Kidney International. 2020

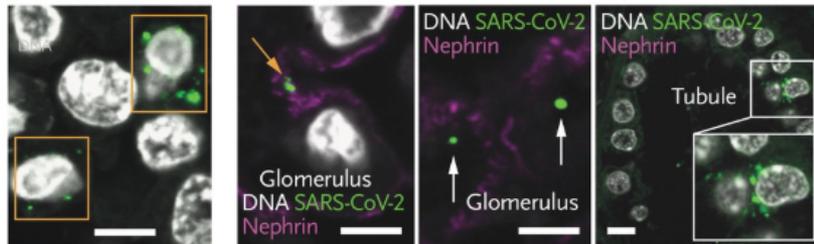
IS THERE A DISTINCT COVID-AKI?



Lung, PCR (+)

Kidney, PCR (+)

In Situ Hybridization



Lung, PCR (+)

Kidney, PCR (+)

Immunofluorescence

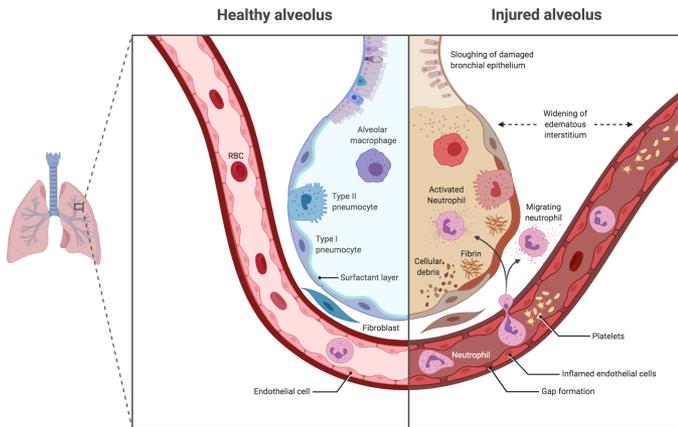
- The receptor for SARS-CoV-2, ACE2, is well expressed in kidney, particularly podocytes and renal tubule cells
- Viral RNA has been discovered in glomerulus and renal tubules
- High incidence of proteinuria and hematuria on admission in COVID-19 patients
- **However, link between viral RNA and disease has not been established, and AKI incidence and outcomes are consistent with other critical illnesses.**

Image from: Puelles et al.,
NEJM. 2020

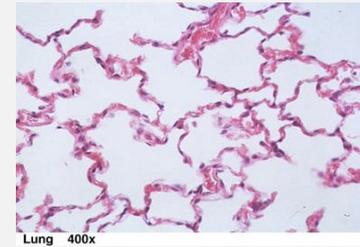
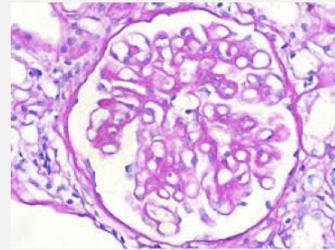
WHAT ARE THE MECHANISMS OF AKI IN COVID-19?

Mechanisms are multifactorial and typical of other critical illnesses, particularly ARDS, including hemodynamic instability, systemic inflammation, and disseminated intravascular coagulation

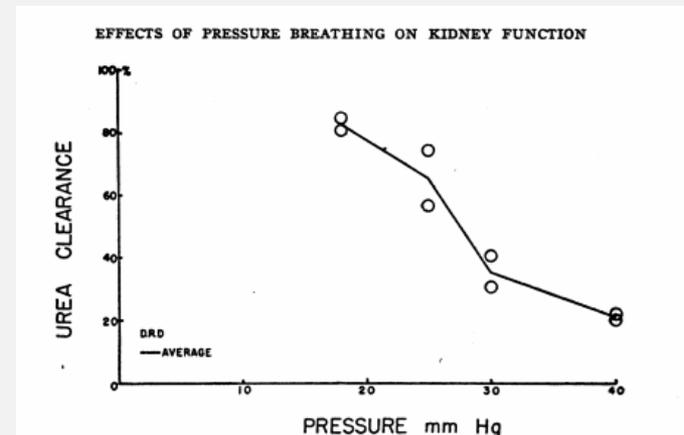
“Cytokine Storm”



Lung-Kidney Crosstalk



Ventilator Induced Kidney Injury



Drury et al., J Clin Invest. 1947

WHAT ARE THE CONSEQUENCES OF AKI IN COVID-19?

- Mortality of patients with AKI is 35-45% compared to 5-7% in patients without AKI
- AKI is an independent risk factor for mortality, though there are several confounders
- Limited data exist regarding other important long-term endpoints (i.e. progression to CKD)
- **Mortality data for AKI in COVID-19 are consistent with non-COVID critical illnesses (i.e. sepsis and ARDS)**