

Acute kidney injury and end stage kidney disease in severe COVID-19

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This transmission electron microscope image shows SARS-CoV-2 -- also known as 2019-nCoV, the virus that causes COVID-19 -- isolated from a patient in the US. Virus particles are shown emerging from the surface of cells cultured in the

lab. The spikes on the outer edge of the virus particles give coronaviruses their name, crown-like. Credit: NIAID-RML

Germany was not hit as hard by the SARS-CoV-2 pandemic as many other European countries. The reason for this is that the wave of infection reached Germany later, that the authorities were warned by the situation in Italy and Spain and at an early stage ordered a lockdown and conducted extensive testing. Up to June 2, 2020, there were 182,028 cases of COVID-19 and 8,522 deaths. As in other countries, dialysis patients were at high risk, due to the fact that they often are of older age, have more comorbidities and, of course, suffer from an impaired immune system. A practical problem which adds to the risk is that they cannot stop their treatment and they have to go to a dialysis unit 3 times a week, this means: strict home isolation is not possible for these patients at risk.

A registry has been created in Germany to investigate the prevalence and outcome of SARS-CoV-2 infected dialysis patients. By the end of May, about 2% of the registered [dialysis patients](#) (about 300 people out of 14,000) had been tested positive for SARS-CoV-2, and, as it turned out, these patients had a [poor prognosis](#): The mortality rate was around 20%. Phase 2 of the Registry will also include patients with [acute kidney injury](#) and [chronic kidney disease](#), and will investigate outcomes and prognostic factors.

However, not only are patients with [kidney disease](#) at a higher risk of becoming infected with the coronavirus and have a more severe course of COVID-19—data also suggest, that the kidneys might be a target organ of this viral disease.

Early data from China on COVID-19 included some startling

revelations: Kidney involvement seems to be frequent in people who have been tested positive and have developed symptoms. A consecutive cohort study of COVID-19 patients admitted in a tertiary teaching hospital with 3 branches following a major outbreak in Wuhan in 2020 analysed hematuria, proteinuria, serum creatinine concentration and other clinical parameters as well as the incidence rate for acute kidney injury (AKI). On admission, 44% of the patients had proteinuria and 26.7% had hematuria. AKI occurred in 5.1% patients. After adjustment for confounders, all kidney impairment indicators were associated with higher risk of in-hospital death. The authors recommended already in February that clinicians should increase their awareness of kidney impairment in hospitalized COVID-19 patients.

Indeed, one other study showed that the incidence of AKI is significantly increased among hospitalized patients: Of 4259 patients not requiring mechanical ventilation, 925 had AKI (any stage) and nine needed kidney replacement therapy. The rate was significantly higher among ventilated patients—of 1190 patients, 276 (23.2%) needed dialysis treatment. The main conclusion drawn by the authors is that "AKI occurs frequently among patients with COVID-19. It occurs early and in temporal association with respiratory failure and is associated with a poor prognosis."

It is obvious that the COVID-19 causes kidney injury. In an autopsy study conducted in Hamburg, samples from different organ tissues of 27 autopsied COVID-19 patients were analyzed for viral load. It was found that, although the lungs are worst affected by the novel virus, other organs and especially the kidneys are also affected. The samples from seven patients were also used to investigate which renal compartments are particularly affected, and it was shown that the renal tubules and especially the glomerular cells had a high viral load. "These findings are consistent with clinical observations. The glomeruli perform the filtration function of the kidneys and the tubules are responsible for

reabsorption. It has been found that, early in the course of Covid-19, many patients had abnormalities in their urine, in particular proteinuria", explained Dr. Hoxha at the press conference to launch the ERA EDTA Congress. "The question is how these findings can be used."

A study group from Göttingen, which cooperates closely with groups in Hamburg, Cologne and Aachen, is currently investigating whether early signs of kidney involvement, such as proteinuria, hypoproteinemia and antithrombin III deficiency allow early risk assessment and stratification of patients. Such patients would be at higher risk for developing complications such as lung oedema and thrombembolisms, such as the dreaded pulmonary embolisms. Both could then be treated prophylactically in patients at risk. A recently launched study is now being conducted to investigate the prognostic significance of [kidney](#) parameters.

More information: Yichun Cheng et al. Kidney impairment is associated with in-hospital death of COVID-19 patients, (2020). [DOI: 10.1101/2020.02.18.20023242](https://doi.org/10.1101/2020.02.18.20023242)

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