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## COVID-19 infection and changes in the kidneys

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### [B. Search History](#SearchHistory)

## A. Original Research

1. **A familial cluster, including a kidney transplant recipient, of Coronavirus Disease 2019 (COVID-19) in Wuhan, China**  
   Chen S. American Journal of Transplantation. 2020;:No page numbers.

In December 2019, an outbreak of COVID-19 occurred in Wuhan, China, and spread to the whole of China and to multiple countries worldwide. Unlike SARS and MERS, where secondary transmission mostly occurred in hospital settings, COVID-19 transmission occurs in large numbers within families. Herein we report three cases of a familial cluster with one family member being a kidney transplant recipient. The initial clinical symptoms of COVID-19 in these three patients were the same, but their progression was different. Based on the severity of clinical symptoms, chest computer tomography findings and SARS-Cov-2 RNA test results, we admitted the husband to the respiratory intensive care unit (RICU) and used a treatment consisting of immunosuppressant reduction/cessation and low dose methylprednisolone-based therapy, and his wife to the respiratory isolation ward. In contrast, the son received in-home isolation and home-based care. All three family members made a full recovery. Copyright © 2020 The American Society of Transplantation and the American Society of Transplant Surgeons

1. **A report from the Brescia Renal COVID Task Force on the clinical characteristics and short-term outcome of hemodialysis patients with SARS-CoV-2 infection**  
   Alberici F. Kidney International. 2020;:No page numbers.

The SARS-CoV-2 epidemic is pressuring healthcare systems worldwide. Disease outcomes in certain subgroups of patients are still scarce, and data are needed. Therefore, we describe here the experience of four dialysis centers of the Brescia Renal COVID Task Force. During March 2020, within an overall population of 643 hemodialysis patients, SARS-CoV-2 RNA positivity was detected in 94 (15%). At disease diagnosis, 37 of the 94 (39%) patients (group 1) were managed on an outpatient basis, whereas the remaining 57 (61%) (group 2) required hospitalization. Choices regarding management strategy were made based on disease severity. In group 1, 41% received antivirals and 76% hydroxychloroquine. Eight percent died and 5% developed acute respiratory distress syndrome (ARDS). In group 2, 79% received antivirals and 77% hydroxychloroquine. Forty two percent died and 79% developed ARDS. Overall mortality rate for the entire cohort was 29%. History of ischemic cardiac disease, fever, older age (over age 70), and dyspnea at presentation were associated with the risk of developing ARDS, whereas fever, cough and a C-reactive protein higher than 50 mg/l at disease presentation were associated with the risk of death. Thus, in our population of hemodialysis patients with SARS-CoV-2 infection, we documented a wide range of disease severity. The risk of ARDS and death is significant for patients requiring hospital admission at disease diagnosis. Copyright © 2020 International Society of Nephrology

1. **A single center observational study of the clinical characteristics and short-term outcome of 20 kidney transplant patients admitted for SARS-CoV2 pneumonia**  
   Alberici F. Kidney International 2020;97:1083-1088.

The outcome of SARS-CoV2 infection in patients who have received a kidney allograft and are being treated with immunosuppression is unclear. We describe 20 kidney transplant recipients (median age 59 years [inter quartile range 51-64 years], median age of transplant 13 years [9-20 years], baseline eGFR 36.5 [23-47.5]) with SARS-CoV2 induced pneumonia. At admission, all had immunosuppression withdrawn and were started on methylprednisolone 16 mg/day, all but one was commenced on antiviral therapy and hydroxychloroquine with doses adjusted for kidney function. At baseline, all patients presented fever but only one complained of difficulty in breathing. Half of patients showed chest radiographic evidence of bilateral infiltrates while the other half showed unilateral changes or no infiltrates. During a median follow-up of seven days, 87% experienced a radiological progression and among those 73% required escalation of oxygen therapy. Six patients developed acute kidney injury with one requiring hemodialysis. Six of 12 patients were treated with tocilizumab, a humanized monoclonal antibody to the IL-6 receptor. Overall, five kidney transplant recipients died after a median period of 15 days [15-19] from symptom onset. These preliminary findings describe a rapid clinical deterioration associated with chest radiographic deterioration and escalating oxygen requirement in renal transplant recipients with SARS-Cov2 pneumonia. Thus, in this limited cohort of long-term kidney transplant patients, SARS-CoV-2 induced pneumonia is characterized by high risk of progression and significant mortality. Copyright © 2020 The Authors

1. **ACE2 correlated with immune infiltration serves as a prognostic biomarker in endometrial carcinoma and renal papillary cell carcinoma: implication for COVID-19**  
   Yang J. Aging 2020;12:6518-6535.

Angiotensin-converting enzyme 2 (ACE2) is a member of the renin-angiotension system, however, the correlation between ACE2 and prognosis in UCEC (Uterine Corpus Endometrial Carcinoma) and KIRP (Kidney Renal Papillary Cell Carcinoma) is not clear. We analyzed the expression levels of ACE2 in the Oncomine and TIMER databases, the correlation between ACE2 and overall survival in the PrognoScan, GEPIA and Kaplan-Meier plotter databases. The correlation between ACE2 and immune infiltration level and the type markers of immune cells was investigated in TIMER database. A prognosis analysis based on the expression levels of ACE2 was further performed in related immune cells subgroup. The ACE2 promoter methylation profile was tested in the UALCAN database. In addition, we used GSE30589 and GSE52920 databases to elucidate the changes of ACE2 expression in vivo and in vitro after SARS-CoV infection. ACE2 was elevated in UCEC and KIRP, and high ACE2 had a favorable prognosis. The expression of ACE2 was positively correlated with the level of immune infiltration of macrophage in KIRP, B cell, CD4+T cell, neutrophil and dendritic cell immune infiltration levels in UCEC. ACE2 was significantly positively correlated with the type markers of B cells and neutrophils, macrophages in UCEC, while ACE2 in KIRP was positively correlated with the type markers of macrophages. High ACE2 expression level had a favorable prognosis in different enriched immune cells subgroups in UCEC and KIRP. And the promoter methylation levels of ACE2 in UCEC and KIRP were significantly reduced. What's more, we found that the expression of ACE2 decreased in vivo and in vitro after SARS-CoV infection. In conclusion, ACE2 expression increased significantly in UCEC and KIRP, elevated ACE2 was positively correlated with immune infiltration and prognosis. Moreover, tumor tissues may be more susceptible to SARS-CoV-2 infection in COVID-19 patients with UCEC and KIRP, which may worsen the prognosis.

1. **ACE2 Expression in Kidney and Testis May Cause Kidney and Testis Damage After 2019-nCoV Infection**  
   Fan Caibin medRxiv 2020;:2020.02.12.20022418.

In December 2019 and January 2020, novel coronavirus (2019-nCoV) - infected pneumonia (NCIP) occurred in Wuhan, and has already posed a serious threat to public health. ACE2 (Angiotensin Converting Enzyme 2) has been shown to be one of the major receptors that mediate the entry of 2019-nCoV into human cells, which also happens in severe acute respiratory syndrome coronavirus (SARS). Several researches have indicated that some patients have abnormal renal function or even kidney damage in addition to injury in respiratory system, and the related mechanism is unknown. This arouses our interest in whether coronavirus infection will affect the urinary and male reproductive systems. Here in this study, we used the online datasets to analyze ACE2 expression in different human organs. The results indicate that ACE2 highly expresses in renal tubular cells, Leydig cells and cells in seminiferous ducts in testis. Therefore, virus might directly bind to such ACE2 positive cells and damage the kidney and testicular tissue of patients. Our results indicate that renal function evaluation and special care should be performed in 2019-nCoV patients during clinical work, because of the kidney damage caused by virus and antiviral drugs with certain renal toxicity. In addition, due to the potential pathogenicity of the virus to testicular tissues, clinicians should pay attention to the risk of testicular lesions in patients during hospitalization and later clinical follow-up, especially the assessment and appropriate intervention in young patients' fertility.Competing Interest StatementThe authors have declared no competing interest.Funding StatementThe author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This study was supported by National Natural Science Foundation of China (81802565 and 81773014), Natural Science Foundation of Jiangsu Province (grant no. BK20180216), Key Project of the Scientific Research Project of Nanjing Medical University Affiliated Suzhou Hospital (grant no. szslyy2017005). Author DeclarationsAll relevant ethical guidelines have been followed; any necessary IRB and/or ethics committee approvals have been obtained and details of the IRB/oversight body are included in the manuscript.YesAll necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived.YesI understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance).Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable.YesIn this article, we made use of some online renal single cell RNA-seq (scRNA-seq) gene expression data sets that were publicly usable. These contained the data reported in GSE131685 and GSE107585. We used RNA and protein expression data of ACE2 in different human tissues and cancer cell lines through The Human Protein Atlas portal (Website: http://www.proteinatlas.org/) , GTEx portal (Website: https://gtexportal.org) and The Cancer Cell Line Encyclopedia (CCLE) . All data are available directly online. https://gtexportal.orghttp://www.proteinatlas.org/

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=3267b1c8c5899100e7749337a247a8c0)

1. **ACE2: The key Molecule for Understanding the Pathophysiology of Severe and Critical Conditions of COVID-19: Demon or Angel?**  
   Xiao L. Viruses 2020;12:28.

Recently, the SARS-CoV-2 induced disease COVID-19 has spread all over the world. Nearly 20% of the patients have severe or critical conditions. SARS-CoV-2 exploits ACE2 for host cell entry. ACE2 plays an essential role in the renin-angiotensin-aldosterone system (RAAS), which regulates blood pressure and fluid balance. ACE2 also protects organs from inflammatory injuries and regulates intestinal functions. ACE2 can be shed by two proteases, ADAM17 and TMPRSS2. TMPRSS2-cleaved ACE2 allows SARS-CoV-2 cell entry, whereas ADAM17-cleaved ACE2 offers protection to organs. SARS-CoV-2 infection-caused ACE2 dysfunction worsens COVID-19 and could initiate multi-organ failure. Here, we will explain the role of ACE2 in the pathogenesis of severe and critical conditions of COVID-19 and discuss auspicious strategies for controlling the disease.

1. **Achieving a popliteal venous access for renal replacement therapy in critically ill COVID-19 patient in prone position**  
   Adams E. Journal of Vascular Surgery Cases and Innovative Techniques 2020;6:266-268.

This patient is a 67-year-old man who initially presented to our facility with acute respiratory failure secondary to COVID-19. Soon after arrival at our facility, the patient decompensated, developing severe acute respiratory distress syndrome requiring intubation and prone positioning to maintain adequate oxygenation. During the next few days, acute kidney injury with oliguria and severe volume overload developed. The vascular surgery service was consulted to obtain central venous access for emergent continuous renal replacement therapy. On examination, the patient was sedated and paralyzed in a rotating prone-positioning bed. He could not be positioned supine without immediately becoming hypoxic and decompensating. A 50-cm Permcath (Medtronic, Santa Rosa, Calif) was inserted through the left popliteal vein. This case report outlines a possible challenging scenario that the vascular interventionist may encounter in dealing with COVID-19 patients with respiratory compromise in the prone position. Copyright © 2020

1. **Acute kidney injury associated with COVID-19: another extrapulmonary manifestation**  
   Barros Camargo L. International Urology and Nephrology. 2020;:No page numbers.

1. **Acute kidney injury at early stage as a negative prognostic indicator of patients with COVID-19: a hospital-based retrospective analysis**  
   Xu Shen medRxiv 2020;:2020.03.24.20042408.

Coronavirus disease 2019 (COVID-19) is a newly emerged infection of severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) and has been pandemic all over the world. This study described acute kidney injury (AKI) at early stage of COVID-19 and its clinical significance. Three-hundred and fifty-five COVID-19 patients with were recruited and clinical data were collected from electronic medical records. Patient's prognosis was tracked and risk factors of AKI was analyzed. Of 355 COVID-19 patients, common, severe and critical ill cases accounted for 63.1%, 16.9% and 20.0%, respectively. On admission, 56 (15.8%) patients were with AKI. Although AKI was more common in critical ill patients with COVID-19, there was no significant association between oxygenation index and renal functional indices among COVID-19 patients with AKI. By multivariate logistic regression, male, older age and comorbidity with diabetes were three important independent risk factors predicting AKI among COVID-19 patients. Among 56 COVID-19 patients with AKI, 33.9% were died on mean 10.9 day after hospitalization. Fatality rate was obviously higher among COVID-+19 patients with AKI than those without AKI (RR=7.08, P&lt;0.001). In conclusion, male elderly COVID-19 patients with diabetes are more susceptible to AKI. AKI at early stage may be a negative prognostic indicator for COVID-19.Competing Interest StatementThe authors have declared no competing interest.Funding StatementThis study was supported by National Natural Science Foundation of China (grants number: 81630084) and National Natural Science Foundation Incubation Program of the Second Affiliated Hospital of Anhui Medical University (grant number: 2019GQFY06).Author DeclarationsAll relevant ethical guidelines have been followed; any necessary IRB and/or ethics committee approvals have been obtained and details of the IRB/oversight body are included in the manuscript.YesAll necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived.YesI understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance).Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable.YesAll data used to support the findings of this study are available from the corresponding author upon request.

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=a9d63a6a1a520357538a8e5707d16ba9)

1. **Acute Kidney Injury in COVID-19 Pandemic**  
   Capuano I. Nephron. 2020;:No page numbers.

1. **Acute kidney injury in COVID-19; A review on current knowledge**  
   Aleebrahim-Dehkordi E. Journal of Nephropathology 2020;9:No page numbers.

Coronaviruses are a large family of viruses that can cause a variety of diseases in humans. Some coronaviruses cause only mild illnesses like the common cold. While, some coronaviruses such as SARS-CoV (SARS-associated coronavirus) and Middle East respiratory syndrome coronavirus (MERS-CoV) have, in recent years, been able to cause severe respiratory involvement (pneumonia), leading to death in several patients. By identifying the genomic sequence of the new human coronavirus SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2) it has been revealed that it belongs to the beta coronavirus genus. COVID-19 appears to be transmitted by a mechanism similar to the influenza virus via person to person, sneezing coughing, or contact with the secretions of infected patients. Early symptoms of these respiratory viruses include fever, cough, and shortness of breath, with an incubation period of 2-14 days. SARS-CoV-2 is an acute respiratory disease that initially causes lung damage. SARS-CoV-2 can affect other organs, including the kidneys. Kidney damage may be caused by alterations that occur during coronavirus infection. It seems that low-oxygen delivery to tissues like the kidney in the setting of this disease may lead to ischemic damage of the kidney. Considering the importance of the kidneys, as one, this review study aimed to investigate the effect of the new coronavirus on the kidneys and its role in the development of renal failure. Copyright © 2020 The Author(s); Published by Society of Diabetic Nephropathy Prevention.

1. **Acute Kidney Injury in Hospitalized Patients with COVID-19**  
   Chan Lili medRxiv 2020;:2020.05.04.20090944.

Importance: Preliminary reports indicate that acute kidney injury (AKI) is common in coronavirus disease (COVID)-19 patients and is associated with worse outcomes. AKI in hospitalized COVID-19 patients in the United States is not well-described. Objective: To provide information about frequency, outcomes and recovery associated with AKI and dialysis in hospitalized COVID-19 patients. Design: Observational, retrospective study. Setting: Admitted to hospital between February 27 and April 15, 2020. Participants: Patients aged ≥18 years with laboratory confirmed COVID-19 Exposures: AKI (peak serum creatinine increase of 0.3 mg/dL or 50% above baseline). Main Outcomes and Measures: Frequency of AKI and dialysis requirement, AKI recovery, and adjusted odds ratios (aOR) with mortality. We also trained and tested a machine learning model for predicting dialysis requirement with independent validation. Results: A total of 3,235 hospitalized patients were diagnosed with COVID-19. AKI occurred in 1406 (46%) patients overall and 280 (20%) with AKI required renal replacement therapy. The incidence of AKI (admission plus new cases) in patients admitted to the intensive care unit was 68% (553 of 815). In the entire cohort, the proportion with stages 1, 2, and 3 AKI were 35%, 20%, 45%, respectively. In those needing intensive care, the respective proportions were 20%, 17%, 63%, and 34% received acute renal replacement therapy. Independent predictors of severe AKI were chronic kidney disease, systolic blood pressure, and potassium at baseline. In-hospital mortality in patients with AKI was 41% overall and 52% in intensive care. The aOR for mortality associated with AKI was 9.6 (95% CI 7.4-12.3) overall and 20.9 (95% CI 11.7-37.3) in patients receiving intensive care. 56% of patients with AKI who were discharged alive recovered kidney function back to baseline. The area under the curve (AUC) for the machine learned predictive model using baseline features for dialysis requirement was 0.79 in a validation test. Conclusions and Relevance: AKI is common in patients hospitalized with COVID-19, associated with worse mortality, and the majority of patients that survive do not recover kidney function. A machine-learned model using admission features had good performance for dialysis prediction and could be used for resource allocation.Competing Interest StatementGNN, CH, BM, SGC receive financial compensation as consultants and advisory board members for RenalytixAI, and own equity in RenalytixAI. BM is a non-executive director of RenalytixAI. In the past 3 years, SGC has also received consulting fees from CHF Solutions, Takeda Pharmaceuticals, Relypsa, Bayer, Goldfinch Bio, Boehringer-Ingelheim, and inRegen. In the past 3 years GNN has also received consulting fees from AstraZeneca, Reata, GLG Consulting, BioVie and grant support from Goldfinch Bio. K.S.M. is supported by K23HL130648 from the National, Heart, Lung, and Blood Institute.Funding StatementGNN is supported by a career development award from the National Institutes of Health (NIH) (K23DK107908) and is also supported by R01DK108803, U01HG007278, U01HG009610, and U01DK116100. SGC is supported by the following grants: U01DK106962, R01DK115562, R01HL085757, U01OH011326, R01DK112258, and RRTI UG 2019.Author DeclarationsAll relevant ethical guidelines have been followed; any necessary IRB and/or ethics committee approvals have been obtained and details of the IRB/oversight body are included in the manuscript.YesAll necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived.YesI understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance).Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable.YesN/A

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1. **Acute kidney injury in patients hospitalized with COVID-19**  
   Hirsch J. S. Kidney International. 2020;:No page numbers.

The rate of acute kidney injury (AKI) associated with patients hospitalized with Covid-19, and associated outcomes are not well understood. This study describes the presentation, risk factors and outcomes of AKI in patients hospitalized with Covid-19. We reviewed the health records for all patients hospitalized with Covid-19 between March 1, and April 5, 2020, at 13 academic and community hospitals in metropolitan New York. Patients younger than 18 years of age, with end stage kidney disease or with a kidney transplant were excluded. AKI was defined according to KDIGO criteria. Of 5,449 patients admitted with Covid-19, AKI developed in 1,993 (36.6%). The peak stages of AKI were stage 1 in 46.5%, stage 2 in 22.4% and stage 3 in 31.1%. Of these, 14.3% required renal replacement therapy (RRT). AKI was primarily seen in Covid-19 patients with respiratory failure, with 89.7% of patients on mechanical ventilation developing AKI compared to 21.7% of non-ventilated patients. 276/285 (96.8%) of patients requiring RRT were on ventilators. Of patients who required ventilation and developed AKI, 52.2% had the onset of AKI within 24 hours of intubation. Risk factors for AKI included older age, diabetes mellitus, cardiovascular disease, black race, hypertension and need for ventilation and vasopressor medications. Among patients with AKI, 694 died (35%), 519 (26%) were discharged and 780 (39%) were still hospitalized. AKI occurs frequently among patients with Covid-19 disease. It occurs early and in temporal association with respiratory failure and is associated with a poor prognosis. Copyright © 2020 International Society of Nephrology

1. **Acute kidney injury in patients hospitalized with COVID-19 in Wuhan, China: A single-center retrospective observational study**  
   Xiao Guanhua medRxiv 2020;:2020.04.06.20055194.

Background: The kidney may be affected in coronavirus-2019 disease (COVID-19). This study assessed the predictors and outcomes of acute kidney injury (AKI) among individuals with COVID-19. Methods: This observational study, included data on all patients with clinically confirmed COVID-19 admitted to Hankou Hospital, Wuhan, China from January 5 to March 8, 2020. Data were extracted from clinical and laboratory records. Follow-up was censored on March 8, 2020. This is a single-center, retrospective, observational study. Patients clinically confirmed COVID-19 and admitted to Hankou Hospital, Wuhan, China from January 5 to March 8, 2020 were enrolled. We evaluated the association between changes in the incidence of AKI and COVID-19 disease and clinical outcomes by using logistic regression models. Results: A total of 287 patients, 55 with AKI and 232 without AKI, were included in the analysis. Compared to patients without AKI, AKI patients were older, predominantly male, and were more likely to present with hypoxia and have pre-existing hypertension and cerebrovascular disease. Moreover, AKI patients had higher levels of white blood cells, D-dimer, aspartate aminotransferase, total bilirubin, creatine kinase, lactate dehydrogenase, procalcitonin, C-reactive protein, a higher prevalence of hyperkalemia, lower lymphocyte counts, and higher chest computed tomographic scores. The incidence of stage 1 AKI was 14.3%, and the incidence of stage 2 or 3 AKI was 4.9%. Patients with AKI had substantially higher mortality. Conclusions: AKI is an important complication of COVID-19. Older age, male, multiple pre-existing comorbidities, lymphopenia, increased infection indicators, elevated D-dimer, and impaired heart and liver functions were the risk factors of AKI. AKI patients who progressed to stages 2 or 3 AKI had a higher mortality rate. Prevention of AKI and monitoring of kidney function is very important for COVID 19 patients.Competing Interest StatementThe authors have declared no competing interest.Clinical Trial NCT04316299Funding StatementThis work was supported by the Natural Science Foundation of China Grant 81871604; the Natural Science Foundation of Guangdong Province, China, Grants 2016A030310389 and 2017A030313590; the Outstanding Youths Development Scheme of Nanfang Hospital, Southern Medical University, Guangzhou, China, Grant 2016J011.Author DeclarationsAll relevant ethical guidelines have been followed; any necessary IRB and/or ethics committee approvals have been obtained and details of the IRB/oversight body are included in the manuscript.YesAll necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived.YesI understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance).Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable.YesData sharing is not applicable to this article as no datasets were generated or analysed during the current study.

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1. **Acute kidney injury in pregnant women following SARS-CoV-2 infection: A case report from Iran**  
   Taghizadieh A. Respiratory Medicine Case Reports 2020;30 (no pagination):No page numbers.

We reported a 33-year-old female case with novel coronavirus disease 2019 (COVID-19) accompanied by Acute tubular necrosis (ATN). She had a gestational age of 34 weeks. The patient referred to treatment clinic for COVID-19 in Imam Reza hospital of Tabriz (Iran) after having flu-like symptoms. In radiologic assessment, ground glass opacity (GGO) with consolidation was found in upper right lobe. Lopinavir/ritonavir (200mg/50mg) two tablet tow times, Ribavirin 200mg every 6 h, and Oseltamivir 75mg tow times were given for the treatment of COVID-19. The medications used for treatment of pneumonia were Meropenem, Ciprofloxacin, Vancomycin. All doses of medications were administrated by adjusted dose assuming the patient is anephric. Also, a few supplements were also given after ATN development including daily Rocaltrol and Nephrovit (as a multivitamin appropriate for patients with renal failure), Folic acid and Calcium carbonate. The patient is still under ventilator with a Fraction of inspired oxygen (FiO<inf>2</inf>) of 60% and Positive end-expiratory pressure (PEEP) of eight. SpO<inf>2</inf> is 94% but the patient's ATN problem has been resolved. We started weaning from mechanical ventilator. The patient is conscious with full awareness to time, person and place. The maternal well-being is achieved and her neonate was discharged. Copyright © 2020 The Authors

1. **Acute kidney injury in SARS-CoV-2 infected patients**  
   Fanelli V. Critical Care (London, England) 2020;24:155.

1. **Acute Kidney Injury in SARS-CoV-2 Infection: Direct Effect of Virus on Kidney Proximal Tubule Cells**  
   Soleimani M. International Journal of Molecular Sciences 2020;21:05.

Coronaviruses (CoVs), including Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome (MERS), and the novel coronavirus disease-2 (SARS-CoV-2) are a group of enveloped RNA viruses that cause a severe respiratory infection which is associated with a high mortality [...].

1. **Adding insult to injury: kidney replacement therapy during COVID-19 in India**  
   Ramachandran R. Kidney International. 2020;:No page numbers.

1. **Autophagy inhibition by chloroquine and hydroxychloroquine could adversely affect acute kidney injury and other organ injury in critically ill patients with COVID-19**  
   Edelstein C. L. Kidney International. 2020;:No page numbers.

1. **Caring for Nephrology Patients and Staff During the COVID-19 Pandemic: Experiences of the Northwest Kidney Centers**  
   Ulrich B. Nephrology nursing journal : journal of the American Nephrology Nurses' Association 2020;47:119-125.

The Northwest Kidney Center (NWC) in Seattle, Washington, has been a leader in nephrology care for almost 60 years, opening the first hemodialysis unit in the United States in 1962. In February 2020, one of their patients was the first reported death from COVID-19 in the United States. On April 6, 2020, as a part of NNJ Extra - the Nephrology Nursing Journal's podcast series, Beth Ulrich, EdD, RN, FACHE, FAONL, FAAN, Editor-in-Chief of the Nephrology Nursing Journal, talked with the leaders of the Northwest Kidney Centers - Suzanne Watnick, MD, the Chief Medical Officer, and Liz McNamara, MN, RN, Vice President of Patient Care Services and the Chief Nursing Officer, who discussed dealing with the onset of COVID-19 at NWC, how their team worked together to provide care for their patients and support for their staff members, and the lessons they learned that can benefit others. Copyright© by the American Nephrology Nurses Association.

1. **Case 17-2020: A 68-year-old man with Covid-19 and acute kidney injury**  
   Sise M. E. New England Journal of Medicine 2020;382:2147-2156.

1. **Case report of COVID-19 in a kidney transplant recipient: Does immunosuppression alter the clinical presentation?**  
   Guillen E. American Journal of Transplantation. 2020;:No page numbers.

COVID-19 is novel infectious disease with an evolving understanding of its epidemiology and clinical manifestations. Immunocompromised patients often present atypical presentations of viral diseases. Herein we report a case of a COVID-19 infection in a solid organ transplant recipient, in which the first clinical symptoms were of gastrointestinal viral disease and fever, which further progressed to respiratory symptoms in 48 hours. In these high risk populations, protocols for screening for SARS-Cov2 may be needed to be re-evaluated. Copyright © 2020 The American Society of Transplantation and the American Society of Transplant Surgeons

1. **Caution on Kidney Dysfunctions of COVID-19 Patients**  
   Li Zhen medRxiv 2020;:2020.02.08.20021212.

Summary Background: To date, large amounts of epidemiological and case study data have been available for the Coronavirus Disease 2019 (COVID-19), which suggested that the mortality was related to not just respiratory complications. Here, we specifically analyzed kidney functions in COVID-19 patients and their relations to mortality. Methods: In this multi-centered, retrospective, observational study, we included 193 adult patients with laboratory-confirmed COVID-19 from 2 hospitals in Wuhan, 1 hospital in Huangshi (Hubei province, 83 km from Wuhan) and 1 hospital in Chongqing (754 km from Wuhan). Demographic data, symptoms, laboratory values, comorbidities, treatments, and clinical outcomes were all collected, including data regarding to kidney functions. Data were compared among three groups: non-severe COVID-19 patients (128), severe COVID-19 patients (65) and a control group of other pneumonia (28). For the data from computed tomographic (CT) scans, we also included a control group of healthy subjects (110 cases, without abnormalities in the lung and without kidney diseases). The primary outcome was a common presence of kidney dysfunctions in COVID-19 patients and the occurrence of acute kidney injury (AKI) in a fraction of COVID-19 patients. Secondary outcomes included a survival analysis of COVID-19 patients in conditions of AKI or comorbid chronic illnesses. Findings: We included 193 COVID-19 patients (128 non-severe, 65 severe (including 32 non-survivors), between January 6th and February 21th,2020; the final date of follow-up was March 4th, 2020) and 28 patients of other pneumonia (15 of viral pneumonia, 13 of mycoplasma pneumonia) before the COVID-19 outbreak. On hospital admission, a remarkable fraction of patients had signs of kidney dysfunctions, including 59% with proteinuria, 44% with hematuria, 14% with increased levels of blood urea nitrogen, and 10% with increased levels of serum creatinine, although mild but worse than that in cases with other pneumonia. While these kidney dysfunctions might not be readily diagnosed as AKI at admission, over the progress during hospitalization they could be gradually worsened and diagnosed as AKI. A univariate Cox regression analysis showed that proteinuria, hematuria, and elevated levels of blood urea nitrogen, serum creatinine, uric acid as well as D-dimer were significantly associated with the death of COVID-19 patients respectively. Importantly, the Cox regression analysis also suggested that COVID-19 patients that developed AKI had a ~5.3-times mortality risk of those without AKI, much higher than that of comorbid chronic illnesses (~1.5 times risk of those without comorbid chronic illnesses). Interpretation: To prevent fatality in such conditions, we suggested a high degree of caution in monitoring the kidney functions of severe COVID-19 patients regardless of the past disease history. In addition, upon day-by-day monitoring, clinicians should consider any potential interventions to protect kidney functions at the early stage of the disease and renal replacement therapies in severely ill patients, particularly for those with strong inflammatory reactions or a cytokine storm. Funding: None.Competing Interest StatementThe authors have declared no competing interest.Funding StatementThis study was supported by grants from the "1000-Talents Program for Young Scholars" of China (X. Chen) and the "100-Talents Program for Elite Engineers" of the CAS (H. Jia).Author DeclarationsAll relevant ethical guidelines have been followed; any necessary IRB and/or ethics committee approvals have been obtained and details of the IRB/oversight body are included in the manuscript.YesAll necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived.YesI understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provide (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance).Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable.YesPlease find all data at the following link (code: 7hjn ):https://pan.baidu.com/s/1yDg\_jwSv1RckHuVa6\_dhYA

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1. **Characterisation of Acute Kidney Injury in Critically Ill Patients with Severe Coronavirus Disease-2019 (COVID-19)**  
   RUBIN Sebastien medRxiv 2020;:2020.05.06.20069872.

Background: COVID19-associated acute kidney injury frequency, severity and characterisation in critically ill patients has not been reported. Methods: Single-center cohort performed from March 3, 2020, to April 14, 2020 in 4 intensive care units in Bordeaux University Hospital, France. All patients with COVID19 and pulmonary severity criteria were included. AKI was defined using KDIGO criteria. A systematic urinary analysis was performed. The incidence, severity, clinical presentation, biological characterisation (transient vs. persistent acute kidney injury; proteinuria, hematuria and glycosuria), and short-term outcomes was evaluated. Results: 71 patients were included, with basal serum creatinine of 69 +/- 21 micromol/L. At admission, AKI was present in 8/71 (11%) patients. Median follow-up was 17 [12-23] days. AKI developed in a total of 57/71 (80%) patients with 35% Stage 1, 35% Stage 2, and 30% Stage 3 acute kidney injury; 10/57 (18%) required renal replacement therapy. Transient AKI was present in only 4/55 (7%) patients and persistent AKI was observed in 51/55 (93%). Patients with persistent AKI developed a median urine protein/creatinine of 82 [54-140] (mg/mmol) with an albuminuria/proteinuria ratio of 0.23 +/- 20 indicating predominant tubulo-interstitial injury. Only 2 (4%) patients had glycosuria. At Day 7 onset of after AKI, six (11%) patients remained dependent on renal replacement therapy, nine (16%) had SCr &gt; 200 micromol/L, and four (7%) died. Day 7 and day 14 renal recovery occurred in 28% and 52 % respectively. Conclusion: COVID19 associated AKI is frequent, persistent severe and characterised by an almost exclusive tubulo-interstitial injury without glycosuriaCompeting Interest StatementSebastien Rubin discloses support by Sanofi. Alexandre Boyer discloses support by Gilead and Basilea. Olivier Joannes-Boyau is consultant for Baxter and BBraun. Arthur Orieux, Renaud Prevel, Antoine Garric, Marie-Lise Bats, Sandrine Dabernat, Nahema Issa, Gaelle Mourrissoux, Fabrice Camou, Olivier Guisset, Catherine Fleureau, Hadrien Rozé, Cédric Carrié, Laurent Petit, Benjamin Clouzeau, Charline Sazio, Hoang-Nam Bui, Odile Pillet, Frederic Vargas, Claire Rigothier, Christian Combe, Antoine Dewitte, Matthieu Biais, Didier Gruson disclose no conflict of interest.Funding StatementNoneAuthor DeclarationsAll relevant ethical guidelines have been followed; any necessary IRB and/or ethics committee approvals have been obtained and details of the IRB/oversight body are included in the manuscript.YesAll necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived.YesI understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance).Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable.YesN/A

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1. **Continues renal replacement therapy (CRRT) with disposable hemoperfusion cartridge: A promising option for severe COVID-19**  
   Dastan F. Journal of Global Antimicrobial Resistance 2020;21:340-341.

Cytokine release syndrome is prevalent in severe cases of COVID-19. In this syndrome, an uncontrolled response of immune system occurs. Extracorporeal blood purification has been proven to effectively remove the released inflammatory cytokines. Here, we reported a successful case to represent our experience of extracorporeal blood purification in a patient with severe COVID-19. Copyright © 2020 The Authors

1. **Corona, COVID and kidney transplantation**  
   Sahay M. Indian Journal of Transplantation 2020;14:1-4.

Severe acute respiratory syndrome corona virus 2 (SARS CoV2) is responsible for corona virus disease (COVID-19). Many organizations have given guidelines for the prevention of COVID-19. Other societies have given updates regarding living and deceased donor transplantation during the pandemic. This article reviews the literature available on corona virus and its impact on living and deceased donor transplantation. Copyright © 2020 Indian Journal of Transplantation Published by Wolters Kluwer - Medknow.

1. **Coronavirus Disease 19 Infection Does Not Result in Acute Kidney Injury: An Analysis of 116 Hospitalized Patients from Wuhan, China**  
   Wang L. American Journal of Nephrology 2020;51:343-348.

BACKGROUND: Whether the patients with coronavirus disease 19 (COVID-19) infected by severe acute respiratory syndrome (SARS)-CoV-2 would commonly develop acute kidney injury (AKI) is an important issue worthy of clinical attention. This study aimed to explore the effects of SARS-CoV-2 infection on renal function through analyzing the clinical data of 116 hospitalized COVID-19-confirmed patients.

1. **Coronavirus Disease 2019 Pneumonia in Immunosuppressed Renal Transplant Recipients: A Summary of 10 Confirmed Cases in Wuhan, China**  
   Zhu L. European Urology. 2020;:No page numbers.

Background: Previous studies on coronavirus disease 2019 (COVID-19) have focused on populations with normal immunity, but lack data on immunocompromised populations. Objective(s): To evaluate the clinical features and outcomes of COVID-19 pneumonia in kidney transplant recipients. Design, setting, and participants: A total of 10 renal transplant recipients with laboratory-confirmed COVID-19 pneumonia were enrolled in this retrospective study. In addition, 10 of their family members diagnosed with COVID-19 pneumonia were included in the control group. Intervention(s): Immunosuppressant reduction and low-dose methylprednisolone therapy. Outcome measurements and statistical analysis: The clinical outcomes (the severity of pneumonia, recovery rate, time of virus shedding, and length of illness) were compared with the control group by statistical analysis. Results and limitations: The clinical symptomatic, laboratory, and radiological characteristics of COVID-19 pneumonia in the renal transplant recipients were similar to those of severe COVID-19 pneumonia in the general population. The severity of COVID-19 pneumonia was greater in the transplant recipients than in the control group (five severe/three critical cases vs one severe case). Five patients developed transient renal allograft damage. After a longer time of virus shedding (28.4 +/- 9.3 vs 12.2 +/- 4.6 d in the control group) and a longer course of illness (35.3 +/- 8.3 vs 18.8 +/- 10.5 d in the control group), nine of the 10 transplant patients recovered successfully after treatment. One patient developed acute renal graft failure and died of progressive respiratory failure. Conclusion(s): Kidney transplant recipients had more severe COVID-19 pneumonia than the general population, but most of them recovered after a prolonged clinical course and virus shedding. Findings from this small group of cases may have important implications for the treatment of COVID-19 pneumonia in immunosuppressed populations. Patient Summary: Immunosuppressed transplant recipients with coronavirus disease 2019 infection had more severe pneumonia, but most of them still achieved a good prognosis after appropriate treatment. Immunosuppressed renal transplant recipients with coronavirus disease 2019 infection had more severe pneumonia than the general population. Most patients could recover following a treatment regimen consisting of reduced immunosuppressant use, low-dose methylprednisolone therapy, and protection of renal graft function. Copyright © 2020 European Association of Urology

1. **Covid-19 and acute kidney injury in hospital: Summary of NICE guidelines**  
   Selby N. M. The BMJ 2020;369 (no pagination):No page numbers.

1. **COVID-19 and Acute Kidney Injury requiring Kidney Replacement Therapy: A Bad Prognostic Sign**  
   Shekhar Rahul medRxiv 2020;:2020.05.08.20096040.

The development of acute kidney injury in patients with COVID-19 is estimated to about 0.5% from earlier studies from China. The incidence of AKI in patients with COIVID-19 in the largest inpatient series in the United States is 22.2%3. Development of AKI requiring kidney replacement therapy in hospitalized patients is a bad prognostic sign. Out of Fifty patients admitted to our hospital with COVID-19 13/50(26%) developed AKI. All patients required hospitalization in intensive care unit care and 12/13 required initiation of kidney replacement therapy. The median age was 41 years (31-85 years) and 50% were men. Common comorbidities were obesity (83%), diabetes (42%), and hypertension (25%). 10/12 (83%) patients were hypoxemic and required oxygen therapy. 11/12 (92%) patients required invasive ventilation. Majority of patients had elevated neutrophils counts (81.8%) and low lymphocyte counts (81.8%). All patients had chest x-ray findings suggestive of pneumonia. 11/12(91.6%) developed septic shock requiring vasopressors. Review of UA showed all patient (9/9) had active urine sediments with blood but 7/9 of them have sterile pyuria. At the end of study period, 1 patient remained hospitalized. 10/11(90%) patients died and one patient was discharged home with resolution of AKI. Median length of stay was 13 days. The exact mechanism of AKI is not well understood in COVID-19 but can be due to acute tubular necrosis due to septic shock because of cytokine storm in severe COVID-19 or direct invasion by SARS-CoV-2 on podocytes and proximal renal tubular cells. Our findings suggest poor prognosis despite continuous kidney replacement therapies in patients who develop AKI with COVID-19.Competing Interest StatementThe authors have declared no competing interest.Funding StatementNon Funded studyAuthor DeclarationsAll relevant ethical guidelines have been followed; any necessary IRB and/or ethics committee approvals have been obtained and details of the IRB/oversight body are included in the manuscript.YesAll necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived.YesI understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance).Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable.YesData is collect by two independent MD RS, SU and stored in redcap in deidentified format

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1. **COVID-19 and cardiovascular and kidney disease: Where are we? Where are we going?. [Spanish]**  
   Pallares Carratala V. Semergen. 2020;11:No page numbers.

1. **COVID-19 and kidney transplantation: an Italian Survey and Consensus**  
   Vistoli F. Journal of nephrology. 2020;03:No page numbers.

Italy was the first Western country to face the COVID-19 pandemic. Here we report the results of a national survey on kidney transplantation activity in February and March 2020, and the results of a three-round Delphi consensus promoted by four scientific societies: the Italian Society of Organ Transplantation, the Italian Society of Nephrology, the Italian Society of Anesthesia and Intensive Care, and the Italian Group on Antimicrobial Stewardship. All 41 Italian transplant centers were invited to express their opinion in the Delphi rounds along with a group of seven experts. The survey revealed that, starting from March 2020, there was a decline in kidney transplantation activity in Italy, especially for living-related transplants. Overall, 60 recipients tested positive for SARS-CoV2 infection, 57 required hospitalization, 17 were admitted to the ICU, and 11 died. The online consensus had high response rates at each round (95.8%, 95.8%, and 89.5%, respectively). Eventually, 27 of 31 proposed statements were approved (87.1%), 12 at the first or second round (38.7%), and 3 at the third (9.7%). Based on the Italian experience, we discuss the reasons for the changes in kidney transplantation activity during the COVID-19 pandemic in Western countries. We also provide working recommendations for the organization and management of kidney transplantation under these conditions.

1. **Covid-19 and long term conditions: what if you have cancer, diabetes, or chronic kidney disease?**  
   Extance A. BMJ 2020;368:m1174.

1. **COVID-19 from the nephrologist's point of view. [French]**  
   Kissling S. Revue medicale suisse 2020;16:842-844.

1. **COVID-19 in a Kidney Transplant Patient**  
   Wang J. European Urology 2020;77:769-770.

1. **COVID-19 in an HIV-positive Kidney Transplant Recipient**  
   Kumar R. N. Transplant infectious disease : an official journal of the Transplantation Society 2020;:e13338.

We report a case of a 50-year-old male with a history of HIV and kidney transplant who presented with SARS-CoV-2. We also present a review of COVID-19 cases in kidney transplant recipients. Copyright This article is protected by copyright. All rights reserved.

1. **COVID-19 in elderly kidney transplant recipients**  
   Crespo M. American journal of transplantation : official journal of the American Society of Transplantation and the American Society of Transplant Surgeons. 2020;29:No page numbers.

The SARS-Cov-2 infection disease (COVID-19) pandemic has posed at risk the kidney transplant (KT) population, particularly the elderly recipients. From March-12th until April-4th 2020, we diagnosed COVID-19 in 16 of our 324 KT patients aged >=65 years old (4.9%). Many of them had had contact with healthcare facilities in the month prior to infection. Median time of symptom onset to admission was 7 days. All presented with fever and all but one with pneumonia. Up to 33% showed renal graft dysfunction. At infection diagnosis, mTOR inhibitors or mycophenolate were withdrawn. Tacrolimus was withdrawn in 70%. The main treatment combination was hydroxychloroquine and azithromycin. A subset of patients was treated with anti-retroviral and tocilizumab. Short-term fatality rate was 50% at a median time since admission of 3 days. Those who died were more frequently obese, frail and had underlying heart disease. Although a higher respiratory rate was observed at admission in nonsurvivors, symptoms at presentation were similar between both groups. Patients who died were more anemic, lymphopenic and showed higher D-dimer, C-reactive protein, and IL-6 at their first tests. COVID-19 is frequent among the elderly KT population and associates a very early and high mortality rate. Copyright This article is protected by copyright. All rights reserved.

1. **COVID-19 in kidney transplant recipients**  
   Nair V. American Journal of Transplantation. 2020;:No page numbers.

There is minimal information on coronavirus disease 2019 (COVID-19) in immunocompromised individuals. We have studied 10 patients treated at 12 adult care hospitals. Ten kidney transplant recipients tested positive for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) by polymerase chain reaction, and 9 were admitted. The median age was 57 (interquartile range [IQR] 47-67), 60% were male, 40% Caucasian, and 30% Black/African American. Median time from transplant to COVID-19 testing was 2822 days (IQR 1272-4592). The most common symptom was fever, followed by cough, myalgia, chills, and fatigue. The most common chest X-ray and computed tomography abnormality was multifocal patchy opacities. Three patients had no abnormal findings. Leukopenia was seen in 20% of patients, and allograft function was stable in 50% of patients. Nine patients were on tacrolimus and a mycophenolic antimetabolite, and 70% were on prednisone. Hospitalized patients had their antimetabolite agent stopped. All hospitalized patients received hydroxychloroquine and azithromycin. Three patients died (30%), and 5 (50%) developed acute kidney injury. Kidney transplant recipients infected with COVID-19 should be monitored closely in the setting of lowered immunosuppression. Most individuals required hospitalization and presenting symptoms were similar to those of nontransplant individuals. Copyright © 2020 The American Society of Transplantation and the American Society of Transplant Surgeons

1. **Covid-19 in solid organ transplant recipients: A single center experience**  
   Hoek R. A. S. Transplant international : official journal of the European Society for Organ Transplantation. 2020;27:No page numbers.

BACKGROUND: Solid organ transplant (SOT) recipients may be at risk for severe COVID-19. Data on the clinical course of COVID-19 in immunosuppressed patients are limited and the effective treatment strategy for these patients is unknown. METHOD(S): We describe our institutional experience with COVID-19 in SOT. Demographic, clinical and treatment data were extracted from the electronic patient files. RESULT(S): A total of 23 SOT transplant recipients suffering from COVID-19 were identified (n = 3 heart; n =15 kidney; n = 1 kidney-after-heart; n = 3 lung and n = 1 liver transplant recipient). The presenting symptoms were similar to non-immunocompromised patients Eighty-three percent (19/23) of the patients required hospitalization but only two of these were transferred to the intensive care unit. Five patients died from COVID-19; all had high Clinical Frailty scores. In four of these patients, mechanical ventilation was deemed futile. In 57% of patients, the immunosuppressive therapy was not changed and only 3 patients were treated with chloroquine. Most patients recovered without experimental anti-viral therapy. CONCLUSION(S): Modification of the immunosuppressive regimen alone could be a therapeutic option for SOT recipients suffering from moderate to severe COVID-19. Pre-existent frailty is associated with death from COVID-19. Copyright This article is protected by copyright. All rights reserved.

1. **COVID-19 Infection in a Patient with End-Stage Kidney Disease**  
   Fu D. Nephron 2020;144:245-247.

Since December 2019, the epidemic of coronavirus disease 2019 (COVID-19) has spread very rapidly in China and worldwide. In this article, we report on a 75-year-old man infected with 2019 novel coronavirus who has end-stage kidney disease (ESKD). COVID-19 patients with ESKD need isolation dialysis, but most of them cannot be handled in time due to limited continuous renal replacement therapy (CRRT) machines. CRRT provided benefits for this patient by removing potentially damaging toxins and stabilizing his metabolic and hemodynamic status. With the control of uremia and fluid status, this patient ended up with an uneventful post-CRRT course, absence of clinical symptoms, and negative PCR tests. Greater efforts are needed to decrease the mortality of COVID-19-infected ESKD patients.

1. **Covid-19 nephropathy; probable mechanisms of kidney failure**  
   Khouchlaa A. Journal of Nephropathology 2020;9:No page numbers.

The mechanistic understanding of signaling pathways that contributes to the kidney involvement by coronavirus disease 2019 (COVID-19) is an extremely critical point for improving therapeutic options. These pathways consist of the production of pro-inflammatory factors, the infiltration of pro-inflammatory cells into the renal interstitium, the activation of C5b-9 complexes, and receptorangiotensin converting enzyme 2 (ACE2). Cytopathogenic effects and invasion into renal tubular cells have been confirmed. Copyright © 2020, Society of Diabetic Nephropathy Prevention. All rights reserved.

1. **COVID-19 pneumonia in a dual heart-kidney recipient**  
   Stachel M. W. Journal of Heart and Lung Transplantation 2020;39:612-614.

1. **COVID-19 pneumonia in kidney transplant recipients-Where we are?**  
   Machado D. J. D. B. Transplant Infectious Disease. 2020;:No page numbers.

In late December 2019, China reported cases of respiratory illness in humans that involved a novel coronavirus SARS-CoV-2. On March 20, 2020, the first coronavirus disease 2019 (COVID-19) in Brazil was diagnosed, and by now, we present the report on the first case of COVID among transplant recipients in our country. A liver and kidney transplant patient with SARS-CoV-2 pneumonia without respiratory failure was treated in a clinical multimodal strategy consisting of symptomatic support therapy, immunosuppression reduction, use of anti-coronavirus drugs and heparin leading to a progressive improvement of patient symptoms till discharge. The authors also present a comprehensive review of published cases. Copyright © 2020 John Wiley & Sons A/S. Published by John Wiley & Sons Ltd

1. **Covid-19 rapid guideline in kidney transplant recipients**  
   Samavat S. Iranian Journal of Kidney Diseases 2020;14:231-234.

Since in the reports presented about COVID-19, patients receiving kidney transplantation have not been specifically studied and based on national flowchart, this population is classified as high-risk group, thus it is necessary to be aware of the step-by-step treatment approach of these patients. Suspicious cases included patients with a history of dry cough, chills or sore throat accompanying by shortness of breath with or without fever, patients with upper/lower respiratory symptoms with radiological manifestations as single or double-sided multi-lobular infiltrations on CT scan or plain chest radiography, any one that has a history of close contact with a definite COVID-19 case within the last 14 days, any one with a history of presence in COVID-19 epidemic regions within the last 14 days and patient with pneumonia that despite of proper treatment has an inappropriate clinical response and clinical condition becomes more severe in an unusual way or unexpectedly. Copyright © 2020, Iranian Society of Nephrology. All rights reserved.

1. **COVID-19 Rapid Guideline in Kidney Transplant Recipients**  
   Samavat S. Iranian journal of Kidney Diseases 2020;14:231-234.

in the reports presented about COVID-19, patients receiving kidney transplantation have not been specifically studied and based on national flowchart, this population is classified as highrisk group, thus it is necessary to be aware of the step-by-step treatment approach of these patients. Suspicious cases included patients with a history of dry cough, chills or sore throat accompanying by shortness of breath with or without fever, patients with upper/lower respiratory symptoms with radiological manifestations as single or double-sided multilobular infiltrations on CT scan or plain chest radiography, any one that has a history of close contact with a definite COVID-19 case within the last 14 days, any one with a history of presence in COVID-19 epidemic regions within the last 14 days and patient with pneumonia that despite of proper treatment has an inappropriate clinical response and clinical condition becomes more severe in an unusual way or unexpectedly.

1. **COVID-19: Nephrology preparedness checklist**  
   Geara A. S. Clinical nephrology. 2020;26:No page numbers.

1. **Diabetic Kidney Disease and COVID-19: The Crash of Two Pandemics**  
   D'Marco L. Frontiers in Medicine 2020;7 (no pagination):No page numbers.

1. **Diagnosis and treatment of COVID-19: acute kidney injury cannot be ignored. [Chinese]**  
   Yang X. H. Zhonghua yi xue za zhi 2020;100:1205-1208.

1. **Dialysis Care for Undocumented Immigrants With Kidney Failure in the COVID-19 Era: Public Health Implications and Policy Recommendations**  
   Rizzolo K. American Journal of Kidney Diseases. 2020;:No page numbers.

1. **Early Description of Coronavirus 2019 Disease in Kidney Transplant Recipients in New York**  
   Anon. Journal of the American Society of Nephrology : JASN. 2020;21:No page numbers.

BACKGROUND: The novel SARS-CoV-2 virus has caused a global pandemic of coronavirus disease 2019 (COVID-19). Although immunosuppressed individuals are thought to be at an increased risk of severe disease, little is known about their clinical presentation, disease course, or outcomes. METHOD(S): We report 15 kidney transplant recipients from the Columbia University kidney transplant program who required hospitalization for confirmed COVID-19, and describe their management, clinical course, and outcomes. RESULT(S): Patients presented most often with a fever (87%) and/or cough (67%). Initial chest x-ray most commonly showed bilateral infiltrates, but 33% had no acute radiographic findings. Patients were managed with immunosuppression reduction and the addition of hydroxychloroquine and azithromycin. Although 27% of our patients needed mechanical ventilation, over half were discharged home by the end of follow-up. CONCLUSION(S): Kidney transplant recipients with COVID-19 have presentations that are similar to that of the general population. Our current treatment protocol appears to be associated with favorable outcomes, but longer follow-up of a larger cohort of patients is needed. Copyright © 2020 by the American Society of Nephrology.

1. **Early experience with COVID-19 in kidney transplantation**  
   Coates P. T. Kidney International 2020;97:1074-1075.

1. **First case of COVID-19 in a kidney transplant recipient treated with belatacept**  
   Marx D. American Journal of Transplantation. 2020;:No page numbers.

Coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is an ongoing public health emergency of international concern. Acute respiratory distress syndrome (ARDS) develops in 3-30% of patients with COVID-19 (1,2), because of direct virus-induced cytopathic effects in the respiratory tract or cytokine storms triggered by the host's immune response. Comorbidities are known to increase the risk of ARDS in SARS-CoV-2-infected patients (1). Copyright This article is protected by copyright. All rights reserved.

1. **Focus on kidney disease among the coronavirus disease 2019 patients: A comparative perspective between China, Italy and the United States**  
   Chen L. International journal of clinical practice. 2020;27:No page numbers.

Coronavirus disease 2019 (COVID-19) has rapidly spread to more than 200 countries and areas. As of May 11, 2020, more than 4 million cases have been confirmed globally and more than 280000 deaths have been recorded. In China, Italy and America, the mortality was 5.5% (4644/84451), 14.0% (30739/219814) and 6.1% (78652/1298287), respectively.1. Copyright This article is protected by copyright. All rights reserved.

1. **Histopathology and Ultrastructural Findings of Fatal COVID-19 Infections**  
   Bradley Benjamin T. medRxiv 2020;:2020.04.17.20058545.

Background SARS-CoV-2 is the cause of an ongoing pandemic with a projected 100,000 to 240,000 U.S. deaths. To date, documentation of histopathologic features in fatal cases of COVID-19 has been limited due to small sample size and incomplete organ sampling. Methods Post-mortem examinations were performed on 12 fatal COVID-19 cases in Washington State during February-March 2020. Clinical and laboratory data were reviewed. Tissue examination of all major organs was performed by light microscopy and electron microscopy. The presence of viral RNA in sampled tissues was tested by RT-PCR. Results All 12 patients were older with significant preexisting comorbidities. The major pulmonary finding was diffuse alveolar damage in the acute and/or organizing phases with virus identified in type I and II pneumocytes by electron microscopy. The kidney demonstrated viral particles in the tubular epithelium, endothelium, and podocytes without significant inflammation. Viral particles were also observed in the trachea and large intestines. SARS-CoV-2 RNA was detected in the cardiac tissue of a patient with lymphocytic myocarditis. RT-PCR also detected viral RNA in the subcarinal lymph nodes, liver, spleen, and large intestines. Conclusion SARS-CoV-2 represents the third novel coronavirus to cause widespread human disease since 2002. Similar to SARS and MERS, the primary pathology was diffuse alveolar damage with virus located in the pneumocytes. However, other major organs including the heart and kidneys may be susceptible to viral replication and damage leading to increased mortality in those with disseminated disease. Understanding the pathology of SARS-CoV-2 will be essential to design effective therapies.Competing Interest StatementThe authors have declared no competing interest.Funding StatementThis work was not supported by any institution or grant.Author DeclarationsAll relevant ethical guidelines have been followed; any necessary IRB and/or ethics committee approvals have been obtained and details of the IRB/oversight body are included in the manuscript.YesAll necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived.YesI understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance).Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable.YesAll data will be made available by request to the corresponding author.

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1. **Human Kidney is a Target for Novel Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Infection**  
   Diao Bo medRxiv 2020;:2020.03.04.20031120.

BACKGROUND The outbreak of a novel coronavirus (SARS-CoV-2, previously provisionally named 2019 novel coronavirus or 2019-nCoV) since December 2019 in Wuhan, China, has become an emergency of major international concern. Apart from the respiratory system, it is unclear whether SARS-CoV-2 can also directly infect other tissues such as the kidney or induce acute renal failure. METHODS We conducted a retrospective analysis of estimated glomerular filtration rate (eGFR) along with other clinical parameters from 85 patients with laboratory-confirmed COVID-19 admitted to a hospital in Wuhan from January 17, 2020 to March 3, 2020. Kidney tissues from six patients with postmortem examinations were analyzed by Hematoxylin and Eosin (H&amp;E) and in situ expression of viral nucleocaspid protein (NP) antigen, immune cell markers (CD8, CD68 and CD56) and the complement C5b-9 was detected by immunohistochemistry. Moreover, the viral particles in kidneys were also investigated by transmission electronic microscope (EM). RESULTS 27.06% (23/85) patients exhibited acute renal failure (ARF). The eldery patients and cases with comorbidities such as hypertension and heart failure more easily developed ARF (65.22% vs 24.19%, p&lt; 0.001; 69.57% vs 11.29%, p&lt; 0.001, respectively). H&amp;E staining demonstrated kidney tissues from postmortems have severe acute tubular necrosis and lymphocyte infiltration. Immunohistochemistry showed that SARS-CoV-2 NP antigen was accumulated in kidney tubules. EM observation also demonstrated that viruses- like particles are visible in the kidneys. Viral infection not only induces CD68+ macrophages infiltrated into tubulointerstitium, but also enhances complement C5b-9 deposition on tubules. CONCLUSIONS SARS-CoV-2 induces ARF in COVID-19 patients. Viruses directly infect human kidney tubules to induce acute tubular damage. The viruses not only have direct cytotoxicity, but also initiate CD68+ macrophage together with complement C5b-9 deposition to mediate tubular pathogenesis.Competing Interest StatementThe authors have declared no competing interest.Funding StatementThe funding agencies did not participate in study design, data collection, data analysis, or manuscript writing.Author DeclarationsAll relevant ethical guidelines have been followed; any necessary IRB and/or ethics committee approvals have been obtained and details of the IRB/oversight body are included in the manuscript.YesAll necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived.YesI understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance).Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable.YesFor protection of patients' privacy, all data used during the study are only be provided with anonymized version.

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1. **Hyperglycemia and the novel Covid-19 infection: Possible pathophysiologic mechanisms**  
   Ilias I. Medical Hypotheses 2020;139:109699.

1. **Hyperreninemia and low total body water may contribute to acute kidney injury in corona virus disease 2019 patients in intensive care**  
   Hultstom M. Journal of hypertension. 2020;28:No page numbers.

1. **Immune dysfunction leads to mortality and organ injury in patients with COVID-19 in China: insights from ERS-COVID-19 study**  
   Li D. Signal Transduction and Targeted Therapy 2020;5:62.

1. **Impact of Nutrition and Diet on COVID-19 Infection and Implications for Kidney Health and Kidney Disease Management**  
   Kalantar-Zadeh K. Journal of Renal Nutrition 2020;30:179-181.

1. **Incidence and risk factors of kidney impairment on patients with COVID-19: a systematic review and meta-analysis**  
   Yang Qixin medRxiv 2020;:2020.05.28.20116400.

Background: The novel coronavirus is pandemic around the world. Several researchers have given the evidence of impacts of COVID-19 on the respiratory, cardiovascular and gastrointestinal system. Studies still have debated on kidney injury of COVID-19 patients. The purpose of the meta-analysis was to evaluate the association of kidney impairment with the development of COVID-19. Methods: The PubMed, Embase and MedRxiv databases were searched until April 1, 2020. We extracted data from eligible studies to summarize the clinical manifestations and laboratory indexes of kidney injury on COVID-19 infection patients and further compared the prevalence of acute kidney injury (AKI) and the mean differences of three biomarkers between in ICU/severe and non-ICU/non-severe cases. Heterogeneity was evaluated using the I2 method. Results: In the sum of 19 studies with 4375 patients were included in this analysis. The pooled prevalence of AKI, increased serum creatinine (Scr), increased blood urea nitrogen (BUN), increased D-dimer, proteinuria and hematuria in patients with COVID-19 were 7.7%, 6.6%, 6.2%, 49.8%, 42% and 30.3% respectively. Moreover, the means of Scr, BUN and D-dimer were shown 6-folds, 1.8-folds and 0.68-folds, respectively, higher in ICU/severe cases than in corresponding non-ICU/non-severe patients. The prevalence of AKI was about 17 folds higher in ICU/severe patients compared with the non-ICU/non-severe cases. Conclusions: Overall, we assessed the incidences of the clinic and laboratory features of kidney injury in COVID-19 patients. And kidney dysfunction may be a risk factor for COVID-19 patients developing into the severe condition. In reverse, COVID-19 can also cause damage to the kidney.Competing Interest StatementThe authors have declared no competing interest.Funding StatementChinese Government Scholarship (University Graduate Program) in Central South University 31801-160170002Author DeclarationsI confirm all relevant ethical guidelines have been followed, and any necessary IRB and/or ethics committee approvals have been obtained.YesThe details of the IRB/oversight body that provided approval or exemption for the research described are given below:This study is a meta-analysis and system review, so we do not need IRB and/or ethics committee approvals.All necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived.YesI understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance).Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable.YesAll data generated or analysed during this study are included in this published article (and its supplementary information files).

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1. **Kidney Allograft Recipients Diagnosed with Coronavirus Disease-2019: A Single Center Report**  
   Lubetzky Michelle medRxiv 2020;:2020.04.30.20086462.

Background: Organ graft recipients receiving immunosuppressive therapy are likely to be at heighted risk for the Coronavirus Disease 2019 (Covid-19) and adverse outcomes including death. It is therefore important to characterize the clinical course and outcome of Covid-19 in this vulnerable population and identify therapeutic strategies that are safe. Methods: We performed a retrospective chart review of 54 adult kidney transplant patients diagnosed with Covid-19 and managed in New York State, the epicenter of Covid-19 pandemic. The patients were evaluated by video visits, phone interviews, or in the Emergency Room for respiratory illness symptoms consistent with Covid-19 from March 13, 2020 to April 20, 2020. Characteristics of the patients were stratified by hospitalization status and disease severity. Clinical course including alterations in immunosuppressive therapy were retrieved from their electronic medical records. Primary outcomes included recovery from Covid-19 symptoms, acute kidney injury, graft failure, and case fatality rate. Results: Of the 54 SARS-Cov-2 positive kidney transplant recipients, 39 with moderate to severe symptoms were admitted and 15 with mild symptoms were managed at home. Hospitalized patients compared to non-hospitalized patients were more likely to be male, of Hispanic ethnicity, and to have cardiovascular disease. At baseline, all but 2 were receiving tacrolimus, mycophenolate mofetil (MMF) and 32 were on a steroid free immunosuppression regimen. Tacrolimus dosage was reduced in 46% of hospitalized patients and maintained at baseline level in the non-hospitalized cohort. Mycophenolate mofetil (MMF) dosage was maintained at the baseline dosage in 11% of hospitalized patients and 64% of non-hospitalized patients, and was stopped in 61% hospitalized patients and 0% in the non-hospitalized cohort. Azithromycin or doxycycline were prescribed at a similar rate among hospitalized and non-hospitalized patients (38% vs. 40%). Hydroxychloroquine was prescribed in 79% of hospitalized patients and only one of 15 non-hospitalized patients. Acute kidney injury occurred in 51% of hospitalized patients. Patients with severe disease were more likely to have elevations in inflammatory biomarkers at presentation. At a median of 21 days follow up, 67% of patients have had their symptoms resolved or improved and 33% have persistent symptoms. Graft failure requiring hemodialysis occurred in 3 of 39 hospitalized patients (8%). Three of 39 (8%) hospitalized patients expired and none of the 15 non-hospitalized patients expired. Conclusions: Clinical presentation of Covid-19 in kidney transplant recipients was similar to what has been described in the general population. The case fatality rate in our entire cohort of 54 kidney transplant recipients was reassuringly low and patients with mild symptomology could be successfully managed at home. Data from the pilot study suggest that a strategy of systematic screening and triage to inpatient or outpatient care, close monitoring, and judicious use of immunosuppressive drugs rather than cessation is beneficial.Competing Interest StatementJ.R.L. receives research funding support from BioFire Diagnostics, LLC.Funding StatementThe study was supported by internal divisional funds.Author DeclarationsAll relevant ethical guidelines have been followed; any necessary IRB and/or ethics committee approvals have been obtained and details of the IRB/oversight body are included in the manuscript.YesAll necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived.YesI understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance).Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable.YesThe data included is clinical data on patients and could be further de-identified if needed but is not currently available

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1. **Kidney disease is associated with in-hospital death of patients with COVID-19**  
   Cheng Y. Kidney International 2020;97:829-838.

In December 2019, a coronavirus 2019 (COVID-19) disease outbreak occurred in Wuhan, Hubei Province, China, and rapidly spread to other areas worldwide. Although diffuse alveolar damage and acute respiratory failure were the main features, the involvement of other organs needs to be explored. Since information on kidney disease in patients with COVID-19 is limited, we determined the prevalence of acute kidney injury (AKI) in patients with COVID-19. Further, we evaluated the association between markers of abnormal kidney function and death in patients with COVID-19. This was a prospective cohort study of 701 patients with COVID-19 admitted in a tertiary teaching hospital that also encompassed three affiliates following this major outbreak in Wuhan in 2020 of whom 113 (16.1%) died in hospital. Median age of the patients was 63 years (interquartile range, 50-71), including 367 men and 334 women. On admission, 43.9% of patients had proteinuria and 26.7% had hematuria. The prevalence of elevated serum creatinine, elevated blood urea nitrogen and estimated glomerular filtration under 60 ml/min/1.73m<sup>2</sup> were 14.4, 13.1 and 13.1%, respectively. During the study period, AKI occurred in 5.1% patients. Kaplan-Meier analysis demonstrated that patients with kidney disease had a significantly higher risk for in-hospital death. Cox proportional hazard regression confirmed that elevated baseline serum creatinine (hazard ratio: 2.10, 95% confidence interval: 1.36-3.26), elevated baseline blood urea nitrogen (3.97, 2.57-6.14), AKI stage 1 (1.90, 0.76-4.76), stage 2 (3.51, 1.49-8.26), stage 3 (4.38, 2.31-8.31), proteinuria 1+ (1.80, 0.81-4.00), 2+~3+ (4.84, 2.00-11.70), and hematuria 1+ (2.99, 1.39-6.42), 2+~3+ (5.56,2.58- 12.01) were independent risk factors for in-hospital death after adjusting for age, sex, disease severity, comorbidity and leukocyte count. Thus, our findings show the prevalence of kidney disease on admission and the development of AKI during hospitalization in patients with COVID-19 is high and is associated with in-hospital mortality. Hence, clinicians should increase their awareness of kidney disease in patients with severe COVID-19.

1. **Kidney impairment is associated with in-hospital death of COVID-19 patients**  
   Cheng Yichun medRxiv 2020;:2020.02.18.20023242.

Background: Information on kidney impairment in patients with coronavirus disease 2019 (COVID-19) is limited. This study aims to assess the prevalence and impact of abnormal urine analysis and kidney dysfunction in hospitalized COVID-19 patients in Wuhan. Method: We conducted 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. Hematuria, proteinuria, serum creatinine concentration and other clinical parameters were extracted from the electronic hospitalization databases and laboratory databases. Incidence rate for acute kidney injury (AKI) was examined during the study period. Association between kidney impairment and in-hospital death was analyzed. Results: We included 710 consecutive COVID19 patients, 89 (12.3%) of whom died in hospital. The median age of the patients was 63 years (inter quartile range, 51-71), including 374 men and 336 women. On admission, 44% of patients have proteinuria hematuria and 26.9% have hematuria, and the prevalence of elevated serum creatinine and blood urea nitrogen were 15.5% and 14.1% respectively. During the study period, AKI occurred in 3.2% patients. Kaplan-Meier analysis demonstrated that patients with kidney impairment have higher risk for in-hospital death. Cox proportional hazard regression confirmed that elevated serum creatinine, elevated urea nitrogen, AKI, proteinuria and hematuria was an independent risk factor for in-hospital death after adjusting for age, sex, disease severity, leukocyte count and lymphocyte count. Conclusion: The prevalence of kidney impairment (hematuria, proteinuria and kidney dysfunction) in hospitalized COVID-19 patients was high. After adjustment for confounders, kidney impairment indicators were associated with higher risk of in-hospital death. Clinicians should increase their awareness of kidney impairment in hospitalized COVID-19 patients.Competing Interest StatementThe authors have declared no competing interest.Funding StatementThis work was financially supported by international (regional) cooperation and exchange projects, (NSFC-DFG, Grant No. 81761138041), the Major Research plan of the National Natural Science Foundation of China (Grant No. 91742204), the National Natural Science Foundation of China (Grants 81470948, 81670633, 81570667), the National Key Research and Development Program (Grants 2016YFC0906103, 2018YFC1314000) and the National Key Technology R&amp;D Program (Grant 2013BAI09B06, 2015BAI12B07).Author DeclarationsAll relevant ethical guidelines have been followed; any necessary IRB and/or ethics committee approvals have been obtained and details of the IRB/oversight body are included in the manuscript.YesAll necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived.YesI understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance).Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable.YesThe datasets used and analysed during the current study are available from the corresponding author on reasonable request

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1. **Kidney Infarction in Patients With COVID-19**  
   Post A. American journal of kidney diseases : the official journal of the National Kidney Foundation. 2020;29:No page numbers.

Coronavirus disease 2019 (COVID-19) is a contagious, life-threatening infection caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Recent findings indicate an increased risk of acute kidney injury during COVID-19. The pathophysiological mechanisms leading to acute kidney injury in COVID-19 are unclear, but may include direct cytopathic effects of the virus on kidney tubular and endothelial cells, indirect damage caused by virus-induced cytokine release, and kidney hypoperfusion due to a restrictive fluid strategy. In this case-report we propose an additional pathophysiological mechanism. We describe two cases in which patients with COVID-19 developed a decrease in kidney function due to kidney infarction. These patients did not have atrial fibrillation. One of these patients was treated with therapeutic doses of low molecular weight heparin, whereafter no further deterioration of kidney function was observed. Our findings implicate that the differential diagnosis of acute kidney injury in COVID-19 patients should include kidney infarction, which may have important preventive and therapeutic implications. Copyright © 2020 The Authors. Published by Elsevier Inc. All rights reserved.

1. **Kidney involvement in COVID-19 and rationale for extracorporeal therapies**  
   Ronco C. Nature Reviews Nephrology 2020;16:308-310.

1. **Kidney transplant programmes during the COVID-19 pandemic**  
   Martino F. The Lancet Respiratory Medicine 2020;8:e39.

1. **Liver and kidney injuries in COVID-19 and their effects on drug therapy; a letter to editor**  
   Rismanbaf A. Archives of Academic Emergency Medicine 2020;8:No page numbers.

1. **Management of acute kidney injury in patients with COVID-19**  
   Ronco C. The Lancet Respiratory Medicine. 2020;:No page numbers.

The outbreak of coronavirus disease 2019 (COVID-19) has rapidly evolved into a global pandemic. Most patients with COVID-19 have mild symptoms, but about 5% develop severe symptoms, which can include acute respiratory distress syndrome, septic shock, and multiple organ failure. Kidney involvement is frequent, with clinical presentation ranging from mild proteinuria to progressive acute kidney injury (AKI) necessitating renal replacement therapy (RRT). An understanding of the pathophysiology and mechanisms of kidney damage and AKI in the setting of critical illness and COVID-19 is emerging, although further research is needed to identify patients at risk of AKI and to guide management strategies. As no specific treatment options exist for AKI secondary to COVID-19, intensive care is largely supportive. Current approaches to prevention and management of AKI, and identification of potential indications for use of RRT and sequential extracorporeal therapies, are based mainly on clinical experience, and AKI strategies are adapted empirically to patients with COVID-19. International collaborative and cross-disciplinary research is needed to obtain adequate evidence to support current clinical approaches and to develop new approaches to management. Copyright © 2020 Elsevier Ltd

1. **Management of the SARS-CoV-2 (COVID-19) coronavirus epidemic in hemodialysis units**  
   Arenas M. D. Nefrologia. 2020;:No page numbers.

The current outbreak of SARS-CoV-2 represents a special risk for renal patients due to their comorbidities and advanced age. The usual performance of hemodialysis treatment s in collective rooms increases the risk. The specific information at this time in this regard is very limited. This manuscript includes a proposal for action to prevent infection in the Nephrology Services, and in particular in hemodialysis units, with the objective of early identification of patients who meet the definition of a suspected case of infection by SARS-CoV-2 and propose circuits and mechanisms to carry out hemodialysis treatments. They are recommendations in continuous review and can be modified if the epidemiological situation, the diagnostic and therapeutic options so require. Copyright © 2020

1. **Managing COVID-19 in Renal Transplant Recipients: A Review of Recent Literature and Case Supporting Corticosteroid-sparing Immunosuppression**  
   Johnson K. M. Pharmacotherapy. 2020;:No page numbers.

Novel coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome virus (SARS-CoV-2) has become a global health care crisis. The Centers for Disease Control and Prevention (CDC) lists immunocompromised patients, including those requiring immunosuppression following renal transplantation, as high risk for severe disease from SARS-CoV-2. Treatment for other viral infections in renal transplant recipients often includes a reduction in immunosuppression; however, no current guidelines are available recommending the optimal approach to managing immunosuppression in the patients who are infected with SARS-CoV-2. It is currently advised to avoid corticosteroids in the treatment of SARS-CoV-2 outside of critically ill patients. Recently published cases describing inpatient care of COVID-19 in renal transplant recipients differ widely in disease severity, time from transplantation, baseline immunosuppressive therapy, and the modifications made to immunosuppression during COVID-19 treatment. This review summarizes and compares inpatient immunosuppressant management strategies of recently published reports in the renal transplant population infected with SARS-CoV-2 and discusses the limitations of corticosteroids in managing immunosuppression in this patient population. Copyright © 2020 Pharmacotherapy Publications, Inc.

1. **Managing patients in dialysis and with kidney transplant infected with Covid-19. [Italian]**  
   Alberici F. Giornale italiano di nefrologia : organo ufficiale della Societa italiana di nefrologia 2020;37:No page numbers.

We are in the midst of a health emergency that is totally new for us all and that requires a concerted effort, especially when it comes to safeguarding patients on hemodialysis, and kidney transplant recipients. Brescia is currently a very active cluster of infections (2918 cases on the 17/03/2020), second only to Bergamo. The way our structure is organised has allowed us to treat nephropathic patients directly within the Nephrology Unit, following of course a great deal of reshuffling; at the moment, we are treating 21 transplanted patients and 17 on hemodialysis. This has led us to adopt a systematic approach to handling this emergency, not only in managing inpatients, but also in researching the new disease. Our approach is mirrored in the guidelines attached to this article, originally intended for internal use only but potentially very useful to our colleagues, as they face the same exact problems. We have also started collecting data on our positive patients with the aim of understanding better the functioning of this disease and how best to manage it. If anyone is interested, we ask you to please get in touch with us, so we can coordinate our efforts. Copyright by Societa Italiana di Nefrologia SIN, Rome, Italy.

1. **Mild COVID-19 in a pediatric renal transplant recipient**  
   Bush R. American Journal of Transplantation. 2020;:No page numbers.

As of mid-April 2020, the coronavirus disease of 2019 (COVID-19) pandemic has affected more than 2 million people and caused 135,000 deaths worldwide. Not much is known about the effect of this disease in immunosuppressed children with renal transplantation (RT). Here we report a 13-year-old child with multiple comorbidities who acquired COVID-19 five years post-RT in the United States. Maintenance immunosuppression (IS) consisted of sirolimus and mycophenolate. There was no history of travel or exposure to sick contacts. The presenting features were fever, cough, rhinorrhea and hypoxemia. Diarrhea was the only extra pulmonary manifestation. Chest x-ray was normal. He did not require intensive care unit care or ventilation. There was a transient rise in his serum creatinine without change in urine output; dialysis was not required. Slight reduction in IS was done. He had an excellent clinical recovery within four days and was able to be discharged home. His respiratory symptoms resolved but the diarrhea persisted during a 4 week follow-up period. This report provides a brief perspective on the short-term COVID-19 clinical course in an immunosuppressed child. More reports will add valuable information on the potential variety of spectrum of the illness in this subset of children. Copyright This article is protected by copyright. All rights reserved.

1. **Moderately Severe Diarrhea and Impaired Renal Function With COVID-19 Infection**  
   Cappell M. S. The American journal of gastroenterology. 2020;21:No page numbers.

1. **No autopsies on COVID-19 deaths: A missed opportunity and the lockdown of science**  
   Salerno M. Journal of Clinical Medicine 2020;9:No page numbers.

Background: The current outbreak of COVID-19 infection, which started in Wuhan, Hubei province, China, in December 2019, is an ongoing challenge and a significant threat to public health requiring surveillance, prompt diagnosis, and research efforts to understand a new, emergent, and unknown pathogen and to develop effective therapies. Despite the increasing number of published studies on COVID-19, in all the examined studies the lack of a well-defined pathophysiology of death among patients who died following COVID-19 infection is evident. Autopsy should be considered mandatory to define the exact cause of death, thus providing useful clinical and epidemiologic information as well as pathophysiological insights to further provide therapeutic tools. Method(s): A literature review was performed on PubMed database, using the key terms: "COVID-19", "nCov 19", and "Sars Cov 2". 9709 articles were retrieved; by excluding all duplicated articles, additional criteria were then applied: articles or abstracts in English and articles containing one of the following words: "death", "died", "comorbidity", "cause of death", "biopsy", "autopsy", or "pathological". Result(s): A total of 50 articles met the inclusion criteria. However, only 7 of these studies reported autopsy-based data. Discussion(s): The analysis of the main data from the selected studies concerns the complete analysis of 12,954 patients, of whom 2269 died (with a mortality rate of 17.52%). Laboratory confirmation of COVID-19 infection was obtained in all cases and comorbidities were fully reported in 46 studies. The most common comorbidities were: cardiovascular diseases (hypertension and coronary artery disease), metabolic disorders (diabetes, overweight, or obesity), respiratory disorders (chronic obstructive pulmonary disease), and cancer. The most common reported complications were: acute respiratory distress syndrome (ARDS), acute kidney injury, cardiac injury, liver insufficiency, and septic shock. Only 7 papers reported histological investigations. Nevertheless, only two complete autopsies are described and the cause of death was listed as COVID-19 in only one of them. The lack of postmortem investigation did not allow a definition of the exact cause of death to determine the pathways of this infection. Based on the few histopathological findings reported in the analyzed studies, it seems to be a clear alteration of the coagulation system: frequently prothrombotic activity with consequent thromboembolism was described in COVID-19 patients. As a scientific community, we are called on to face this global threat, and to defeat it with all the available tools necessary. Despite the improvement and reinforcement of any method of study in every field of medicine and science, encouraging the autopsy practice as a tool of investigation could also therefore, help physicians to define an effective treatment to reduce mortality. Copyright © 2020 by the authors. Licensee MDPI, Basel, Switzerland.

1. **Novel Corona Virus 2019 pneumonia in a kidney transplant recipient**  
   Namazee N. American Journal of Transplantation. 2020;:No page numbers.

COVID 19 pandemic is spreading worldwide and the impact of the disease in transplant patients is evolving. In this case report, we presented a 63 years old female kidney transplant recipient who presented with dyspnea and cough and diagnosed with COVID 19 pneumonia. On the 4<sup>th</sup> day of admission, the patient's condition worsened. Therefore, the immunosuppressive medications were discontinued, and hydrocortisone started. The patient died on the 5<sup>th</sup> day. Copyright This article is protected by copyright. All rights reserved.

1. **Outpatient Management of the Kidney Transplant Recipient during the SARS-CoV-2 Virus Pandemic**  
   Gleeson S. E. Clinical journal of the American Society of Nephrology : CJASN. 2020;28:No page numbers.

1. **Patients with chronic kidney disease have a poorer prognosis of coronavirus disease 2019 (COVID-19): an experience in New York City**  
   Yamada T. International Urology and Nephrology. 2020;:No page numbers.

1. **Preliminary data on outcomes of SARS-CoV-2 infection in a Spanish single center cohort of kidney recipients**  
   Montagud-Marrahi E. American Journal of Transplantation. 2020;:No page numbers.

1. **Recommendations for the management of patients with immune-mediated kidney disease during the severe acute respiratory syndrome coronavirus 2 pandemic**  
   Anders H. J. Nephrology, dialysis, transplantation : official publication of the European Dialysis and Transplant Association European Renal Association. 2020;23:No page numbers.

The coronavirus disease 2019 (COVID-19) pandemic has created major challenges for all countries around the globe. Retrospective studies have identified hypertension, cardiovascular disease, diabetes and older age as risk factors for high morbidity and mortality from COVID-19. There is a general concern that patients with immune-mediated kidney diseases, namely those on immunosuppressive therapies and/or those with more advanced kidney failure, could particularly be at risk for adverse outcomes due to a compromised antiviral immunity. Uncertainties exist on how management routines should be reorganized to minimize the risk of severe acute respiratory syndrome coronavirus 2 infection and what measures are necessary for infected patients. The aim of the present review of the Immunonephrology Working Group of the European Renal Association-European Dialysis and Transplant Association is to provide recommendations for the management of patients with immune-mediated kidney diseases based on the available evidence, similar circumstances with other infectious organisms and expert opinions from across Europe. Such recommendations may help to minimize the risk of encountering COVID-19 or developing complications during COVID-19 in patients with immune-mediated kidney disease. Copyright © The Author(s) 2020. Published by Oxford University Press on behalf of ERA-EDTA. All rights reserved.

1. **Recommendations on management of the SARS-CoV-2 coronavirus pandemic (Covid-19) in kidney transplant patients**  
   Lopez V. Nefrologia. 2020;:No page numbers.

The SARS-CoV-2 (Covid-19) coronavirus pandemic is evolving very quickly and means a special risk for both immunosuppressed and comorbid patients. Knowledge about this growing infection is also increasing although many uncertainties remain, especially in the kidney transplant population. This manuscript presents a proposal for action with general and specific recommendations to protect and prevent infection in this vulnerable population such as kidney transplant recipients. Copyright © 2020

1. **Renal Infarct in a COVID-19 Positive Kidney-Pancreas Transplant Recipient**  
   Xu J. J. American journal of transplantation : official journal of the American Society of Transplantation and the American Society of Transplant Surgeons. 2020;01:No page numbers.

The novel coronavirus disease 2019 (COVID-19) is associated with increased risk of thromboembolic events, but the extent and duration of this hypercoagulable state remains unknown. We describe the first case report of renal allograft infarction in a 46-year-old kidney-pancreas transplant recipient with no prior history of thromboembolism, who presented 26 days after diagnosis of COVID-19. At the time of renal infarct, he was COVID-19 symptom free and repeat test for SARS-CoV-2 was negative. This case report suggests that a hypercoagulable state may persist even after resolution of COVID-19. Further studies are required to determine thromboprophylaxis indications and duration in solid organ transplant recipients with COVID-19. Copyright This article is protected by copyright. All rights reserved.

1. **Renal Monomorphology in COVID-19 with Acute Renal Insufficiency. [German]**  
   Tuma J. Praxis 2020;:1-5.

1. **Risk of COVID-19 in young kidney transplant recipients. Results from a single-center observational study**  
   Angeletti A. Clinical Transplantation. 2020;:No page numbers.

Coronavirus Disease 2019 (COVID-19) represents a global public health emergency, recently taken on pandemic proportions, with over 2.7 million confirmed cases worldwide(1). Children/young adults seem to have a less severe clinical manifestation of COVID-19 (2), but data on disease susceptibility in pediatric transplant recipients on chronic immunosuppressive therapy are limited (3, 4). This poses major uncertainties regarding pediatric transplant activity and management of anti-rejection therapy. Copyright This article is protected by copyright. All rights reserved.

1. **Risk of hospitalization and death from COVID-19 infection in patients with chronic plaque psoriasis receiving a biological treatment and renal transplanted recipients in maintenance immunosuppressive treatment**  
   Gisondi P. Journal of the American Academy of Dermatology. 2020;21:No page numbers.

1. **SARS-COV-2 and fabry nephropathy: Potential risks and the pathophysiological perspective**  
   Trimarchi H. Journal of Nephropathology 2020;9:No page numbers.

Fabry disease is an X-linked disorder due to mutations in alpha-galactosidase A gene. It affects the kidney in virtually all patients with classical and some late onset variants. Podocytes, endothelial cells, vascular smooth muscle, tubular and mesangial cells are involved in different ways. Proteinuria and chronic kidney disease are the result of the progressive accumulation of the enzyme substrates globotriaosylceramide (GB3) and lyso-GB3 in the cytoplasm of these cells (mainly in lysosomes), which leads to cellular and organ dysfunction and eventually renal failure and end-stage kidney disease. Specific enzyme replacement therapy and pharmacological chaperone are at present the main therapeutic approach. After enzyme infusion, the delivered enzyme is differentially uptaken by kidney cells in three different ways: By Mannose-6-phosphate receptor, megalin and sortilin. The delivered enzyme gradually clears cells from the accumulation of the glycosphingolipids and contributes to a cellular healthier status. The recent pandemic caused by SARS-CoV-2 has led to the collapse of health systems around the world and to thousands of deaths. Kidney involvement has been reported to range from proteinuria to acute kidney injury, 30% of which may require renal replacement therapy. In this review the potential causes for which Fabry patients should be at increased risk and the necessity not to discontinue therapy are discussed. Copyright © 2020 The Author(s).

1. **SARS-CoV-2 identification in lungs, heart and kidney specimens by transmission and scanning electron microscopy**  
   Pesaresi M. European Review for Medical and Pharmacological Sciences 2020;24:5186-5188.

From two COVID-19-related deaths, samples of lung, heart and kidney were collected and processed for Transmission and Scanning Electron Microscopy (TEM and SEM) with the aim of identifying the virus. Virions of SARS-CoV-2 were found in all tissues by TEM and SEM, corroborating the hypothesis that the virus enters the cells of different organs. This is the first report identifying SARS-CoV-2 in different human tissues by TEM and SEM. Copyright © 2020 Verduci Editore s.r.l. All rights reserved.

1. **SARS-CoV-2 infection of kidney organoids prevented with soluble human ACE2**  
   Allison S. J. Nature Reviews Nephrology 2020;16:316.

1. **SARS-CoV-2 receptor networks in diabetic kidney disease, BK-Virus nephropathy and COVID-19 associated acute kidney injury**  
   Menon Rajasree medRxiv 2020;:2020.05.09.20096511.

COVID-19 morbidity and mortality is significantly increased in patients with diabetes and kidney disease via unknown mechanisms. SARS-CoV-2 uses angiotensin-converting enzyme 2 (ACE2) for entry into human host cells, and ACE2 levels in target cells may influence SARS-CoV-2 susceptibility. We investigated how pre-existing conditions and drug treatments alter receptor expression in kidney tissue. Using single cell RNA profiling (scRNAseq) to assess ACE2 and associated SARS-CoV-2 proteases in healthy living donors (LD) kidneys, diabetic kidney disease (DKD), and in kidney injury during viral infection, ACE2 expression was primarily associated with proximal tubular epithelial cells (PTEC). ACE2 mRNA expression levels were significantly upregulated in DKD versus LD, however, ACE2 levels were not altered by exposures to renin angiotensin aldosterone system (RAAS) inhibitors. ACE2+ expression signatures were defined by differential expression analysis and characterized by Bayesian integrative analysis of a large compendium of public -omics datasets, resulting in the identification of network modules induced in ACE2 positive PTEC in DKD and BK virus nephropathy. These ACE2 upregulated cell programs were linked to viral entry, immune activation, endomembrane reorganization, and RNA processing and overlapped significantly with the cellular responses induced by SARS-CoV-2 infection. Similar cellular programs were activated in ACE2-positive PTEC isolated in a urine sample from a COVID19 patient with acute kidney injury, suggesting a consistent ACE2-coregulated expression program that may interact with SARS-Cov-2 infection processes. The SARS-CoV-2 receptor associated gene signatures could seed further research into therapeutic strategies for COVID-19. Functional networks of gene expression signatures are available for further exploration to researchers at HumanBase (hb.flatironinstitute.org/covid-kidney).Competing Interest StatementThe authors have declared no competing interest.Funding StatementThis work was supported in part by the Intramural Research Program at the National Institute of Diabetes and Digestive and Kidney Diseases (DK069062) to HCL and RGN and (DK083912, DK082841, DK020572, DK092926) to RGK, by the extramural research program of the National Institute of Diabetes and Digestive and Kidney Diseases R24 DK082841 Integrated Systems Biology Approach to Diabetic Microvascular Complications and P30 DK081943 University of Michigan O'Brien Kidney Translational Core Center to MK, via Kidney Precision Medicine Project (KPMP, funded by the following grants from the NIDDK: U2C DK114886, UH3DK114861, UH3DK114866, UH3DK114870, UH3DK114908, UH3DK114915, UH3DK114926, UH3DK114907, UH3DK114920, UH3DK114923, UH3DK114933, and UH3DK114937, with U2C DK114886 and UH3 DK114907) to MK and OGT, via the Chan Zuckerberg Initiative Human Cell Atlas Kidney Seed Network to MK and OGT and by JDRF 5-COE-2019-861-S-B JDRF and M-Diabetes Center of Excellence at the University of Michigan to MK.Author DeclarationsAll relevant ethical guidelines have been followed; any necessary IRB and/or ethics committee approvals have been obtained and details of the IRB/oversight body are included in the manuscript.YesAll necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived.YesI understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance).Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable.YesLD, BKVN and COV-AKI single cell data sets are sear hable at NephroCell.miktmc.org. Owing to ethical considerations and privacy protection concerns, and to avoid identifying individual study participants in vulnerable populations, the Institutional Review Board of the National Institute of Diabetes and Digestive and Kidney Diseases has stipulated that individual-level gene expression and genotype data from the American Indian DKD study cannot be made publicly available. A dynamic user-friendly interface at HumanBase (hb.flatironinstitute.org/covid-kidney) is available for researchers to explore the functional networks of gene expression signatures. http://nephrocell.miktmc.org/https://hb.flatironinstitute.org/covid-kidney

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=30ad9f6500d7e6a3c664a6c88b66db80)

1. **Selecting the Most Appropriate Oncological Treatment for Patients with Renal Masses During the COVID-19 Pandemic: Recommendations from a Referral Center**  
   Moschovas M. C. European Urology Focus. 2020;:No page numbers.

1. **Severe COVID-19 in a renal transplant recipient: A focus on pharmacokinetics**  
   Meziyerh S. American Journal of Transplantation. 2020;:No page numbers.

The current coronavirus disease 2019 (COVID-19) pandemic requires extra attention for immunocompromised patients, including solid organ transplant recipients. We report on a case of a 35-year-old renal transplant recipient who suffered from a severe COVID-19 pneumonia. The clinical course was complicated by extreme overexposure to the mammalian target of rapamycin inhibitor everolimus, following coadministration of chloroquine and lopinavir/ritonavir therapy. The case is illustrative for dilemmas that transplant professionals may face in the absence of evidence-based COVID-19 therapy and concurrent pressure for exploration of experimental pharmacological treatment options. However, the risk-benefit balance of experimental or off-label therapy may be weighed differently in organ transplant recipients than in otherwise healthy COVID-19 patients, owing to their immunocompromised status and potential drug interactions with immunosuppressive therapy. With this case report, we aimed to achieve increased awareness and improved management of drug-drug interactions associated with the various treatment options for COVID-19 in renal transplant patients. Copyright © 2020 The Authors. American Journal of Transplantation published by Wiley Periodicals LLC on behalf of The American Society of Transplantation and the American Society of Transplant Surgeons

1. **Should COVID-19 Concern Nephrologists? Why and to What Extent? The Emerging Impasse of Angiotensin Blockade**  
   Perico L. Nephron 2020;144:213-221.

Here, we review the most recent findings on the effects of SARS-CoV-2 infection on kidney diseases, including acute kidney injury, and examine the potential effects of ARBs on the outcomes of patients with COVID-19. Lastly, we discuss the clinical management of COVID-19 patients with existing chronic renal disorders, particularly those in dialysis and with kidney transplants.

1. **Status of SARS-CoV-2 infection in patients on renal replacement therapy. Report of the COVID-19 Registry of the Spanish Society of Nephrology (SEN)**  
   Sanchez-Alvarez J. E. Nefrologia. 2020;:No page numbers.

Introduction: The recent appearance of the SARS-CoV-2 coronavirus pandemic has had a significant impact on the general population. Patients on renal replacement therapy (RRT) have not been unaware of this situation and due to their characteristics they are especially vulnerable. We present the results of the analysis of the COVID-19 Registry of the Spanish Society of Nephrology. Material(s) and Method(s): The Registry began operating on March 18th, 2020. It collects epidemiological variables, contagion and diagnosis data, signs and symptoms, treatments and outcomes. It is an online registry. Patients were diagnosed with SARS-CoV-2 infection based on the results of the PCR of the virus, carried out both in patients who had manifested compatible symptoms or had suspicious signs, as well as in those who had undergone screening after some contact acquainted with another patient. Result(s): As of April 11, the Registry had data on 868 patients, from all the Autonomous Communities. The most represented form of RRT is in-center hemodialysis (ICH) followed by transplant patients. Symptoms are similar to the general population. A very high percentage (85%) required hospital admission, 8% in intensive care units. The most used treatments were hydroxychloroquine, lopinavir-ritonavir, and steroids. Mortality is high and reaches 23%; deceased patients were more frequently on ICH, developed pneumonia more frequently, and received less frequently lopinavir-ritonavir and steroids. Age and pneumonia were independently associated with the risk of death. Conclusion(s): SARS-CoV-2 infection already affects a significant number of Spanish patients on RRT, mainly those on ICH, hospitalization rates are very high and mortality is high; age and the development of pneumonia are factors associated with mortality. Copyright © 2020

1. **Strategies for prevention and control of the 2019 novel coronavirus disease in the department of kidney transplantation**  
   Li Y. Transplant International. 2020;:No page numbers.

To summarize measures for the prevention and control of the 2019 novel coronavirus disease (COVID-19) in the department of kidney transplantation. We retrospectively analyzed the clinical data of outpatients and inpatients in the department of kidney transplantation from January 20 to March 1, 2020, and followed up the in-home kidney transplant recipients and those waiting for kidney transplantation through the Internet platform. Our department had formulated detailed prevention and control measures, mainly including kidney transplant outpatient management, kidney transplantation ward management, management of kidney transplant surgery, dialysis management of patients waiting for kidney transplantation, personal protection of medical staff, and follow-up management of discharged patients after kidney transplantation. During the epidemic period, there were no COVID-19 cases among 68 outpatient examined kidney transplant recipients, 32 hospitalized kidney transplant recipients, 19 patients waiting for kidney transplantation in hospital, and 30 medical staff. There were no COVID-19 cases among 160 follow-up recipients after kidney transplantation and 60 patients waiting for kidney transplantation. During the epidemic period, we implemented strict prevention and control measures and adjusted working methods and procedures to ensure safe and orderly work of the department. Copyright © 2020 Steunstichting ESOT. Published by John Wiley & Sons Ltd

1. **Subclinical Acute Kidney Injury in COVID-19 Patients: A Retrospective Cohort Study**  
   Sun D. Q. Nephron 2020;:1-4.

1. **Successful recovery from severe COVID-19 pneumonia after kidney transplantation: the interplay between immunosuppression and novel therapy including tocilizumab**  
   Lauterio A. Transplant infectious disease : an official journal of the Transplantation Society 2020;:e13334.

Although immunosuppressed patients may be more prone to SARS-CoV-2 infection with atypical presentation, long-term immunosuppression therapy may provide some sort of protection for severe clinical complications of COVID-19. The interaction between immunosuppression and new antiviral drugs in the treatment of transplanted patients contracting COVID-19 has not yet been fully investigated. Moreover, data regarding the optimal management of these patients are still very limited. We report a case of the successful recovery from severe COVID-19 of a kidney-transplanted patient treated with hydroxychloroquine, lopinavir/ritonavir, steroid and tocilizumab. Copyright This article is protected by copyright. All rights reserved.

1. **Successful recovery of COVID-19 pneumonia in a renal transplant recipient with long-term immunosuppression**  
   Zhu L. American Journal of Transplantation. 2020;:No page numbers.

The current outbreak of Coronavirus Disease 2019 (COVID-19) has raised great concern worldwide, but its impact on transplant recipients is unknown. We report here the clinical features and therapeutic course of the first reported renal transplant recipient with confirmed COVID-19 pneumonia. This is a 52-year-old man who received kidney transplantation 12 years ago. His overall clinical characteristics (symptoms, laboratory examinations, and chest CT) were similar to those of non-transplanted COVID-19 patients. Following a treatment regimen consisting of reduced immunosuppressant use and low dose methylprednisolone-based therapy, the COVID-19 pneumonia in this long-term immunosuppressive patient was successfully recovered. This effectively treated case has reference value for the future treatment of other transplant patients with COVID-19 pneumonia. Copyright © 2020 The American Society of Transplantation and the American Society of Transplant Surgeons

1. **Survival rate in acute kidney injury superimposed COVID-19 patients: a systematic review and meta-analysis**  
   Ali H. Renal Failure 2020;42:393-397.

1. **The Chronic Kidney Disease and Acute Kidney Injury Involvement in COVID-19 Pandemic: A Systematic Review and Meta-analysis**  
   Liu Ya-Fei medRxiv 2020;:2020.04.28.20083113.

Aim: The aim of this study was to uncover whether kidney diseases were involved in COVID-19 pandemic from a systematic review. Methods: The studies reported the kidney outcomes in different severity of COVID-19 were included in this study. Standardized mean differences or odds ratios were calculated by employing Review Manager meta-analysis software. Results: Thirty-six trials were included in this systematic review with a total of 6395 COVID-19 patients. The overall effects indicated that the comorbidity of chronic kidney disease (CKD) (OR = 3.28), complication of acute kidney injury (AKI) (OR = 11.02), serum creatinine (SMD = 0.68), abnormal serum creatinine (OR = 4.86), blood urea nitrogen (SMD = 1.95), abnormal blood urea nitrogen (OR = 6.53), received continuous renal replacement therapy (CRRT) (OR = 23.63) was significantly increased in severe group than that in nonsevere group. Additionally, the complication of AKI (OR = 13.92) and blood urea nitrogen (SMD = 1.18) were remarkably elevated in critical group than that in severe group. Conclusion: CKD and AKI are susceptible to occur in patients with severe COVID-19. CRRT is applied frequently in severe COVID-19 patients than that in nonsevere COVID-19 patients. The risk of AKI is higher in critical group than that in severe group.Competing Interest StatementThe authors have declared no competing interest.Funding StatementThis work was funded by the National Natural Science Foundation of China (81701601).Author DeclarationsAll relevant ethical guidelines have been followed; any necessary IRB and/or ethics committee approvals have been obtained and details of the IRB/oversight body are included in the manuscript.YesAll necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived.YesI understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance).Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable.YesThe data used to support the findings of this study are available from the corresponding author upon request.

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=6178b08ce8ab4072fae3d126f613e51b)

1. **The Impact of the COVID-19 Outbreak on the Medical Treatment of Chinese Children with Chronic Kidney Disease (CKD)：A Multicenter Cross-section Study in the Context of a Public Health Emergency of International Concern**  
   Zhang Gaofu medRxiv 2020;:2020.02.28.20029199.

Objective: To investigate the impact of the COVID-19 outbreak on the medical advice seeking of Chinese children with chronic kidney disease (CKD). Materials and Methods: An anonymous online questionnaire survey was conducted in 17 pediatric nephropathy diagnosis and treatment centers in China. The questions collected basic information on the patients and their parents and data on changes in the approach to medical treatment and their needs in the context of the outbreak etc. This is a Multicenter Cross-section Study. Results: A total of 735 valid questionnaires were collected. 555 patients (75.5%) and their parents said that the outbreak had a significant influence on their medical treatment: 264 patients (47.6%) said that it would be delayed by 2 to 4 weeks and 199 patients (35.9%) by 4 to 8 weeks. 510 patients (84.16%) hoped to get in touch with specialists through online consultation, and 528 patients (84.5%) hoped that online consultation could be implemented and that medication could be delivered to them.. A total of 458 patients (62.3%) said that their greatest concern was that the CKD would be aggravated or that they would experience a relapse; only 203 patients were infected by 2019-nCoV. A total of 313 patients (42.5%) experienced anxiety and thus required the intervention of psychologists. Conclusion: The COVID-19 outbreak has affected the medical treatment of children with CKD. Online consultation, medication delivery and psychological counselling are the greatest needs reported by patients and their families and could especially provide solutions for the management of low income children with CKD in remote rural areas in the context of the COVID-19 epidemic.Competing Interest StatementThe authors have declared no competing interest.Clinical TrialChiCTR1800019795Funding StatementThis research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.Author DeclarationsAll relevant ethical guidelines have been followed; any necessary IRB and/or ethics committee approvals have been obtained and details of the IRB/oversight body are included in the manuscript.YesAll necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived.YesI understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance).Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable.YesAll data is available during the study appear in the submitted article.

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1. **The impact of the COVID-19 pandemic on renal transplantation in the UK**  
   Sharma V. Clinical medicine 2020;25:No page numbers.

COVID-19 is impacting provision of renal transplantation in the UK with a reduction in clinical activity. Publicly available Renal Registry and NHS Blood and Transplant reports were analysed to model the number of missed transplant opportunities, waiting list size and change in dialysis population over a six-month period starting 5 March 2020. An estimated 1,670 kidney transplant opportunities may be lost, which will lead to 6,317 active patients on the kidney-alone waiting list, compared to 4,649 based on usual activity estimates. This will result in 1,324 additional patients on dialysis who would otherwise have been transplanted. COVID-19 will lead to a marked loss of transplant opportunities and a significantly larger national waiting list. The existing strain on dialysis capacity will be exacerbated as patients remain on dialysis as the only available form of renal replacement therapy. These findings will help inform policy and service specific strategies. Copyright © Royal College of Physicians 2020. All rights reserved.

1. **Threatening drug-drug interaction in a kidney transplant patient with Coronavirus Disease 2019 (COVID-19)**  
   Bartiromo M. Transplant infectious disease : an official journal of the Transplantation Society. 2020;12:No page numbers.

During the novel coronavirus pandemic, organ transplant recipients represent a frail susceptible category due to long-term immunosuppressive therapy. For this reason, clinical manifestations may differ from general population and different treatment approaches may be needed. We present the case of a 36-year-old kidney transplanted woman affected by Senior-Loken syndrome diagnosed with COVID-19 pneumonia after a contact with her positive mother. Initial symptoms were fatigue, dry cough and coryza; she never had fever nor oxygen supplementation. Hydroxychloroquine and lopinavir/ritonavir were started, and the antiviral drug was replaced with darunavir/cobicistat after two days for diarrhea. Immunosuppressant levels were closely monitored, and we observed very high tacrolimus trough levels despite initial dose reduction. The patient was left with steroid therapy alone. The peculiarity of clinical presentation and the management difficulties represent the flagship of our case-report. We stress the need for guidelines in transplant recipients with COVID-19 infection with particular regard to the management of therapy. Copyright This article is protected by copyright. All rights reserved.

1. **Three amino acid changes in avian coronavirus spike protein allow binding to kidney tissue**  
   Bouwman K. M. Journal of Virology 2020;94:No page numbers.

Infectious bronchitis virus (IBV) infects ciliated epithelial cells in the chicken respiratory tract. While some IBV strains replicate locally, others can disseminate to various organs, including the kidney. Here, we elucidate the determinants for kidney tropism by studying interactions between the receptor-binding domain (RBD) of the viral attachment protein spike from two IBV strains with different tropisms. Recombinantly produced RBDs from the nephropathogenic IBV strain QX and from the nonnephropathogenic strain M41 bound to the epithelial cells of the trachea. In contrast, only QX-RBD binds more extensively to cells of the digestive tract, urogenital tract, and kidneys. While removal of sialic acids from tissues prevented binding of all proteins to all tissues, binding of QX-RBD to trachea and kidney could not be blocked by preincubation with synthetic alpha-2,3-linked sialic acids. The lack of binding of QX-RBD to a previously identified IBV-M41 receptor was confirmed by enzyme-linked immunosorbent assay (ELISA), demonstrating that tissue binding of QX-RBD is dependent on a different sialylated glycan receptor. Using chimeric RBD proteins, we discovered that the region encompassing amino acids 99 to 159 of QX-RBD was required to establish kidney binding. In particular, QX-RBD amino acids 110 to 112 (KIP) were sufficient to render IBV-M41 with the ability to bind to kidney, while the reciprocal mutations in IBV-QX abolished kidney binding completely. Structural analysis of both RBDs suggests that the receptor-binding site for QX is located at a different location on the spike than that of M41. IMPORTANCE Infectious bronchitis virus is the causative agent of infectious bronchitis in chickens. Upon infection of chicken flocks, the poultry industry faces substantial economic losses by diminished egg quality and increased morbidity and mortality of infected animals. While all IBV strains infect the chicken respiratory tract via the ciliated epithelial layer of the trachea, some strains can also replicate in the kidneys, dividing IBV into the following two pathotypes: nonnephropathogenic (example, IBV-M41) and nephropathogenic viruses (including IBV-QX). Here, we set out to identify the determinants for the extended nephropathogenic tropism of IBV-QX. Our data reveal that each pathotype makes use of a different sialylated glycan ligand, with binding sites on opposite sides of the attachment protein. This knowledge should facilitate the design of antivirals to prevent coronavirus infections in the field. Copyright © 2020 Bouwman et al.

1. **Updates on coronavirus (COVID-19) and kidney**  
   Athari S. Z. Journal of Nephropathology 2020;9:No page numbers.

The severe acute respiratory syndrome (SARS) is an infectious disease developed in Wuhan, China, at first. It involves the respiratory system and other organs like kidney, gastrointestinal tract and nervous system as well. The recent reports indicated that renal disorder is prevalent in coronavirus patients. The aim of this study was to provide a review of nephropathy caused by severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2) and its mechanisms. The Web of Science, Scopus, and PubMed databases were systematically searched. Articles reporting nephropathy, coronavirus disease (COVID-19), coronavirus and the renal injury were included for assessment. Study designs, contrast agents, case reports and results were assessed. Of the assessed studies, suggested mechanisms include sepsis which caused cytokine storm syndrome or perhaps direct cellular injury due to the virus. In patients who were studied, albuminuria, proteinuria, and hematuria as well as an elevation in blood urea nitrogen and serum creatinine were observed. Additionally CT scan of the kidneys showed a decrease in tissue density suggestive of inflammation and interstitial edema. On the other hand, dialysis patients are a high-risk group than the general population. The current treatment for COVID-19 in acute kidney injury includes supportive management or kidney replacement therapy. All patients need to be quarantined. An N95 fit-tested mask and protective clothing and proper equipment are necessary. Some drugs can be effective to inhibit the outcome of this infection such as lopinavir/ritonavir, remdesvir, Chloroquine phosphate, convalescent plasma, tocilizumab, ACEi/ ARBs (angiotensin-converting enzyme inhibitor/angiotensin receptor blockers), and hrsACE2 (human recombinant soluble angiotensin-converting-enzyme 2). Copyright © 2020 The Author(s);.

1. **Viral Shedding Prolongation in a Kidney Transplant Patient with COVID-19 Pneumonia**  
   Zhang M. American Journal of Transplantation. 2020;:No page numbers.

Coronavirus disease 2019 (COVID-19) pandemic sweeps the globe. The information regarding the kinetic changes of SARS-CoV-2 in immunosuppressed patients is unclear. Herein, we present a case of prolonged viral shedding in a transplant patient with COVID-19 pneumonia. A 49-year-old male kidney recipient was admitted to the hospital on February 7, 2020, for fever and fatigue. He was a permanent resident in Wuhan, China, and began having symptoms on January 29 (day 1 of illness). His maintenance immunosuppressive regime was consisted of tacrolimus (TAC, 1mg twice a day, orally), mycophenolate mofetil (MMF, 0.5g twice a day, orally) and prednisone (Pred, 5mg daily, orally) triple combination. Copyright This article is protected by copyright. All rights reserved.

1. **Visualization of putative coronavirus in kidney**  
   Miller S. E. Kidney International. 2020;:No page numbers.

1. **[A pathological report of three COVID-19 cases by minimal invasive autopsies]**  
   Yao X. H. Chung-Hua Ping Li Hsueh Tsa Chih - Chinese Journal of Pathology 2020;49:411-417.

<b>Objective:</b> To investigate the pathological characteristics and the clinical significance of novel coronavirus (2019-nCoV)-infected pneumonia (termed by WHO as coronavirus disease 2019, COVID-19). <b>Methods:</b> Minimally invasive autopsies from lung, heart, kidney, spleen, bone marrow, liver, pancreas, stomach, intestine, thyroid and skin were performed on three patients died of novel coronavirus pneumonia in Chongqing, China. Hematoxylin and eosin staining (HE), transmission electron microcopy, and histochemical staining were performed to investigate the pathological changes of indicated organs or tissues. Immunohistochemical staining was conducted to evaluate the infiltration of immune cells as well as the expression of 2019-nCoV proteins. Real time PCR was carried out to detect the RNA of 2019-nCoV.

1. **[Covid-19, the Kidney and Hypertension]**  
   Angel-Korman A. Harefuah 2020;159:231-234.

INTRODUCTION: COVID-19, is a new corona virus of the Beta Coronavirus genus which originated in bats. The virus first emerged in China in December 2019 and has rapidly spread since to other areas worldwide. The World Health Organization (WHO) has therefore recently declared it as the source of a pandemic. The disease caused by the virus manifests in most cases as a lower respiratory tract infection leading to fever, cough and dyspnea, while more severe cases can led to respiratory failure and/or multi organ failure. COVID-19 enters the human cell using the ACE2, an enzyme abundant in renal tubular epithelial cells. Theoretically, this may be significant in several ways: acute kidney injury (AKI) as well as proteinuria and/or microhematuria could be associated with the penetration of COVID-19 into the cells. Moreover, medications based on RAAS inhibition, such and ACE inhibitors and ARBs, upregulate the enzyme ACE2 and could therefore hypothetically explain the high prevalence of hypertension and diabetes reported as previous diagnoses in severe cases. In the setting of chronic kidney disease, the risk of infection with COVID-19 is not clear at this time. However, hemodialysis patients represent a unique group of patients, mostly elderly and immunocompromised, for whom dialysis is a life-saving treatment which cannot be stopped. Hence, the COVID-19 pandemic has presented a complex medical and logistic challenge for the medical staff in hospital and community based dialysis units.

1. **[How to understand the histopathology of SARS and coronavirus disease-19 (COVID-19) associated with acute respiratory distress syndrome]**  
   Chen J. Chung-Hua Ping Li Hsueh Tsa Chih - Chinese Journal of Pathology 2020;49:289-290.

1. **Protective effects of hypericin against infectious bronchitis virus induced apoptosis and reactive oxygen species in chicken embryo kidney cells**  
   Chen H. Poultry Science 2019;98:6367-6377.

Avian infectious bronchitis virus (IBV), a coronavirus, causes infectious bronchitis leading to enormous economic loss in the poultry industry worldwide. Hypericin (HY) is an excellent compound that has been investigated in antiviral, antineoplastic, and antidepressant. To investigate the inhibition effect of HY on IBV infection in chicken embryo kidney (CEK) cells, 3 different experimental designs: pre-treatment of cells prior to IBV infection, direct treatment of IBV-infected cells, and pre-treatment of IBV prior to cell infection were used. Quantitative real-time PCR (qRT-PCR), immunofluorescence assay (IFA), flow cytometry, and fluorescence microscopy were performed and virus titer was determined by TCID50. The results revealed that HY had a good anti-IBV effect when HY directly treated the IBV-infected cells, and virus infectivity decreased in a dose-dependent manner. Furthermore, HY inhibited IBV-induced apoptosis in CEK cells, and significantly reduced the mRNA expression levels of Fas, FasL, JNK, Bax, Caspase 3, and Caspase 8, and significantly increased Bcl-2 mRNA expression level in CEK cells. In addition, HY treatment could decrease IBV-induced reactive oxygen species (ROS) generation in CEK cells. These results suggested that HY showed potential antiviral activities against IBV infection involving the inhibition of apoptosis and ROS generation in CEK cells.

1. **PCR array profiling of antiviral genes in human embryonic kidney cells expressing human coronavirus OC43 structural and accessory proteins**  
   Beidas M. Archives of virology 2018;163:2065-2072.

Human coronavirus OC43 (HCoV-OC43) is a respiratory virus that usually causes a common cold. However, it has the potential to cause severe infection in young children and immunocompromised adults. Both SARS-CoV and MERS-CoV were shown to express proteins with the potential to evade early innate immune responses. However, the ability of HCoV-OC43 to antagonise the intracellular antiviral defences has not yet been investigated. The potential role of the HCoV-OC43 structural (M and N) and accessory proteins (ns2a and ns5a) in the alteration of antiviral gene expression was investigated in this study. HCoV-OC43M, N, ns2a and ns5a proteins were expressed in human embryonic kidney 293 (HEK-293) cells before challenge with Sendai virus. The Human Antiviral Response PCR array was used to profile the antiviral gene expression in HEK-293 cells. Over 30 genes were downregulated in the presence of one of the HCoV-OC43 proteins, e.g. genes representing mitogen-activated protein kinases, toll-like receptors, interferons, interleukins, and signaling transduction proteins. Our findings suggest that similarly to SARS-CoV and MERS-CoV, HCoV-OC43 has the ability to downregulate the transcription of genes critical for the activation of different antiviral signaling pathways. Further studies are needed to confirm the role of HCoV-OC43 structural and accessory proteins in antagonising antiviral gene expression.

1. **Isolation of a coronavirus from kidney biopsies of endemic Balkan nephropathy patients**  
   Uzelac-Keserovic B. Nephron 1999;81:141-5.

Endemic Balkan nephropathy (EBN) is a kidney disease of unknown etiology limited to Bulgaria, Rumania and former Yugoslavia. Primary kidney tissue cultures were established as explants from tissue obtained at operations from 5 EBN patients with urinary tract tumors. Four out of the five biopsy specimens on extended culture incubation at 33 degrees C yielded a coronavirus virus (EBNV) which was cytopathogenic for human fibroblast and Vero cells. In cells inoculated with EBNV, cytoplasmic immunofluorescence was found using antisera for human coronaviruses OC43 and 229E as well as the porcine transmissible gastroenteric virus and avian (chicken) bronchitis virus. In neutralization tests, EBNV failed to react with antisera to these viruses. Using hyperimmune serum raised with EBNV, positive cytoplasmic immunofluorescence was seen with cells infected with OC43, 229E, TGV and significantly with the kidney tissue of the biopsy specimens from the EBN patients. A screen for neutralizing antibody using the EBN virus revealed that 87.2% of EBN patients on dialysis were positive, also 74% of people from an endemic area were also positive, while only 13.5% from outside were positive. It is suggested that a coronavirus is involved in the etiology of the disease and that humans are an incidental host of a coronavirus zoonosis.

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