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Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) complete genome

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Abstract: Coronavirus disease 2019 (COVID-19) is a contagious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The first known case was identified in December 2019. The disease has since spread worldwide, leading to an ongoing pandemic. Symptoms of COVID-19 are variable, but often include fever, cough, headache, fatigue, breathing difficulties, and loss of smell and taste. Symptoms begin 1 - 14 days after exposure to the coronavirus. The standard diagnostic method is by detection of the virus' nucleic acid by real-time reverse transcription polymerase chain reaction (rRT-PCR), transcription-mediated amplification (TMA), or by reverse transcription loop-mediated isothermal amplification (RT-LAMP) from a nasopharyngeal swab. (https://en.wikipedia.org/wiki/COVID-19). Upto 12/1/2021 in USA, Total Cases are 48,377,531, Total accines Administered are 460,773,508, Total Deaths 778,489 (https://www.cdc.gov/coronavirus/2019-ncov/index.html). Here gives the gives **SARS-CoV-2** complete genome sequenced by China in 1/13/2020, as a reference for readers (https://www.ncbi.nlm.nih.gov/nuccore/MN908947.3).
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Key words: COVID-19; SARS-CoV-2; genome; sequence; life; research; literature; cell

1. Introduction

Coronavirus disease 2019 (COVID-19) is a contagious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The first known case was identified in December 2019. The disease has since spread worldwide, leading to an ongoing pandemic. Symptoms of COVID-19 are variable, but often include fever, cough, headache, fatigue, breathing difficulties, and loss of smell and taste. Symptoms begin 1 - 14 days after exposure to the coronavirus. At least 30% of people who are infected do not develop noticeable symptoms. Of those people who develop symptoms noticeable enough to be classed as patients, around 80% develop mild to moderate symptoms, while 14% develop severe, and 5% suffer critical symptoms. Some people continue to experience a range of effects for months after recovery, and damage to organs has been observed. Multi-year studies are underway to further investigate the long-term effects of the disease. COVID-19 transmits when people breathe in air contaminated by droplets and small airborne particles containing the virus. People remain contagious for up to 20 days, and can spread the virus even if they do not develop symptoms. The standard diagnostic method is by detection of the virus' nucleic acid by real-time reverse transcription polymerase chain reaction (rRT-PCR), transcription-mediated amplification (TMA), or by reverse transcription loop-mediated isothermal amplification (RT-LAMP) from a nasopharyngeal swab. Several COVID-19 vaccines have been approved and distributed in various countries, which have initiated mass vaccination campaigns. Other preventive measures include physical or social distancing, quarantining, ventilation of indoor spaces, covering coughs and sneezes, hand washing, and keeping unwashed hands away from the face. The use of face masks or coverings has been recommended in public settings to minimize the risk of transmissions. Management involves the treatment of symptoms, supportive care, isolation, and experimental measures. (https://en.wikipedia.org/wiki/COVID-19). Upto 12/1/2021 in USA, Total Cases are 48,377,531, Total accines Administered are 460,773,508, Total Deaths 778,489 (https://www.cdc.gov/coronavirus/2019-ncov/index.html).

Here gives the gives **SARS-CoV-2** complete genome sequenced by China in 1/13/2020, as a reference for readers (https://www.ncbi.nlm.nih.gov/nuccore/MN908947.3).

(2020). COVID 19 rapid guideline: renal transplantation. London.

This guideline covers children, young people and adults who need or who have had a kidney transplant, and people who are donating a kidney (live

donors). It also advises transplant and referring centres on how to run their services while keeping them safe for patients, donors and staff during the COVID-19 pandemic. Kidney transplants improve life expectancy and quality of life, and cost less than dialysis in the long term, so providing effective and safe services will benefit patients and make the best use of resources. On 19 August 2020, we added recommendations for regional networks on responding to changes in local prevalence of COVID-19. We aligned recommendations for donors and recipients with our COVID-19 guideline on arranging planned care in hospitals and diagnostic services. NICE has also produced COVID-19 rapid guidelines on chronic kidney disease and dialysis service delivery. Follow the usual professional guidelines, standards and laws (including those on equalities, safeguarding, communication and mental capacity), as described in making decisions using NICE guidelines. This guideline is for: health and care practitioners; health and care staff involved in planning and delivering services; commissioners. The recommendations bring together: existing national and international guidance and policies; advice from specialists working in the NHS from across the UK. These include people with expertise and experience of treating patients for the specific health conditions covered by the guidance during the current COVID-19 pandemic. We developed this guideline using the interim process and methods for developing rapid guidelines on COVID-19 in response to the rapidly evolving situation. We will review and update the recommendations as the knowledge base develops using the interim process and methods for guidelines developed in response to health and social care emergencies.

Aalberg, J. J., et al. (2021). "Axillary lymphadenopathy in a renal cell carcinoma patient after COVID-19 Vaccination." Radiol Case Rep **16**(8): 2164-2167.

The distribution of the novel Covid-19 vaccines has been on a scale as unprecedented as the pandemic itself. While the vaccines promise to greatly reduce the spread and impact of the disease, encountering side-effects in clinical practice may pose diagnostic dilemmas. In this case report, we describe a patient with known metastatic renal cell carcinoma who presents with axillary lymphadenopathy found on PET/CT imaging after receiving a Covid-19 vaccine, which was subsequently confirmed to be reactive lymphadenopathy following biopsy.

Abolghasemi, S., et al. (2021). "COVID-19 reinfection or reactivation in a renal transplant patient." Clin Case Rep **9**(8): e04672.

Recurrences of COVID-19 infection may occur in immunocompromised patients. Reinfection or reactivation of COVID-19 virus is a challenging issue in these patients.

Acharya, S., et al. (2020). "Renal artery thrombosis in COVID-19." IDCases **22**: e00968.

COVID-19 has been described to have association with hypercoagulable state and thromboembolic events in major blood vessels, pulmonary artery, major limb vessels causing limb ischemia. associated with neurological symptoms and complications including stroke. We present a unique case of renal artery thrombus formation secondary to COVID-19. To the best of our knowledge this is the fourth manuscript describing renal artery thrombosis with evidence on imaging studies in medical literature.

Adams, B. and A. Beaney (2021). "Interpreting serum procalcitonin in COVID-19 patients undergoing renal replacement therapy." J Glob Antimicrob Resist **27**: 324-325.

Adams, E. and A. Y. Mousa (2020). "Achieving a popliteal venous access for renal replacement therapy in critically ill COVID-19 patient in prone position." J Vasc Surg Cases Innov Tech **6**(2): 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.

Adapa, S., et al. (2020). "COVID-19 and Renal Failure: Challenges in the Delivery of Renal Replacement Therapy." J Clin Med Res **12**(5): 276-285.

Coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), first officially reported in December 2019 in Wuhan City, Hubei province, China, and has since lead to a pandemic. Most cases result in minor symptoms such as cough, fever, sore throat, myalgia, fatigue, nausea, diarrhea, loss of smell,

and abdominal pain. As of April 8, 2020, more than 1,485,000 cases of COVID-19 have been reported in more than 200 countries and territories, resulting in over 90,000 deaths. Outcomes are worse in elderly patients, particularly males, and those with comorbidities, but can affect any age group. The incidence of acute kidney injury in patients with COVID-19 infection is about 3-15%; and in patients with severe infection requiring care in the intensive care unit, the rates of acute kidney injury increased significantly from 15% to 50%. Acute kidney injury is an independent risk factor for mortality in COVID-19 patients. The nephrologists, as well as intensivists, are facing immense daily challenges while providing care for these patients in the inpatient setting as well as end-stage renal disease patients on chronic dialysis in both inpatient and outpatient settings. In the current review article, we discussed the epidemiology and etiology of acute kidney injury, management of acute kidney injury including renal replacement therapy options (both hemodialysis and peritoneal dialysis) for inpatient floor, as well as intensive care unit settings. We also discussed the challenges faced by the outpatient dialysis units with COVID-19 infection. We discussed measures required to limit the spread of infection, as well as summarized the guidance as per the Centers for Disease Control and Prevention (CDC), American Society of Nephrology (ASN), American Society of Diagnostic and Interventional Nephrology (ASDIN) and the Vascular Access Society of the Americas (VASA).

Adapa, S., et al. (2020). "COVID-19 Pandemic Causing Acute Kidney Injury and Impact on Patients With Chronic Kidney Disease and Renal Transplantation." J Clin Med Res **12**(6): 352-361.

Coronavirus disease 2019 (COVID-19) caused by 2019 novel coronavirus (2019-nCoV) has caused significant mortality and has been declared as a global pandemic by the World Health Organization. The infection mainly presents as fever, cough, and breathing difficulty, and few patients develop very severe symptoms. The purpose of this review is to analyze the impact of the virus on the kidney. COVID-19 infection causes acute kidney injury (AKI) and is an independent risk factor for mortality. Angiotensin-converting enzyme 2 (ACE2) receptors, direct viral damage, and immune-mediated damage play important roles in the pathogenesis. AKI in COVID-19 infection could be from the synergistic effect of virus-induced direct cytotropic effect and cytokine-induced systemic inflammatory response. AKI caused in the viral infection has been analyzed from the available epidemiological studies. The proportion of patients developing AKI is significantly higher when they develop severe disease. Continuous renal replacement therapy (CRRT) is the most used blood purification technique when needed. The impact of COVID-19 infection on chronic kidney disease (CKD) and renal transplant patients is also discussed in the manuscript. No vaccine has been developed against the 2019-nCoV virus to date. The critical aspect of management is supportive care. Several investigative drugs have been studied, drugs approved for other indications have been used, and several clinical trials are underway across the globe. Recently remdesivir has received emergency use authorization by the Food and Drug Administration (FDA) in the USA for use in patients hospitalized with COVID-19. Prevention of the infection holds the key to management. The patients with underlying kidney problems and renal transplant patients are vulnerable to developing COVID-19 infection.

Adapa, S., et al. (2020). "COVID-19 in Renal Transplant Patient Presenting With Active Typical Symptoms and Resolved Atypical Symptoms." J Investig Med High Impact Case Rep **8**: 2324709620949307.

The novel coronavirus disease has brought the world to standstill with high infectivity and rapid transmission. The disease caused by novel coronavirus is termed as coronavirus disease 2019 (COVID-19). We present the case of a renal transplant patient who was infected with COVID-19 through community spread and presented with fever and gastrointestinal symptoms. Transplant recipients are particularly vulnerable because of the immunosuppressed state. These patients can shed a virus for a prolonged period and can have a higher load of the virus. There have been no COVID-19 cases transmitted through organ donation. Preinfection immunological impairment can aggravate the severity of the infection. The transplant team plays a crucial role in donor and recipient evaluation and guiding the timing of the transplant. Although specific published data are lacking with regard to transplant recipients, they should follow the same precautions as the general population, like avoiding nonessential travel and practice social distancing.

Adejumo, O. A. (2020). "Impact of COVID-19 pandemic on renal care services in Nigeria." Pan Afr Med J **35**(Suppl 2): 101.

The COVID-19 pandemic has altered the course of events globally. Enforcement of lock down orders to curtail the spread of the pandemic had untoward consequences on the economy and health of the citizenry. In Nigeria, access to renal care was reduced by restriction of movement; inability to afford care due to economic downturn; suspension of transplant programs; uncertainties about dialysis guidelines; anxiety and reduced motivation of health

care workers (HCWs) due to lack of government's commitment to their welfare and increasing rate of COVID-19 infection among HCWs. Formulation and implementation of policies to improve HCWs welfare and ease the burden of CKD patients should be prioritized in order to ensure optimal care of renal patients during the present pandemic.

Aeppli, S., et al. (2020). "Impact of COVID-19 pandemic on treatment patterns in metastatic clear cell renal cell carcinoma." ESMO Open **5**(Suppl 3).

BACKGROUND: The coronavirus pandemic has provoked discussions among healthcare providers how to manage cancer patients when faced with the threat of severe acute respiratory syndrome related coronavirus 2 (SARS-CoV-2) infection. Immune checkpoint inhibitor (ICI) containing regimens are standard of care in the majority of metastatic clear cell renal cell carcinoma (mccRCC) patients. It remains unclear whether therapies should be modified in response to the COVID-19 pandemic. METHODS: We performed an online survey among physicians involved in the treatment of mccRCC, and 41 experts responded. Questions focused on criteria relevant for treatment decision outside the pandemic and the modifications of systemic therapy during COVID-19. FINDINGS: For the majority of experts (73%), the combination of International metastatic renal cell carcinoma Database Consortium (IMDC) risk category and patient fitness are two important factors for decision-making. The main treatment choice in fit, favourable risk patients outside the pandemic is pembrolizumab/axitinib for 53%, avelumab/axitinib, sunitinib or pazopanib for 13% of experts each. During the pandemic, ICI-containing regimens are chosen less often in favour of a tyrosine kinase inhibitors (TKI) monotherapy, mainly sunitinib or pazopanib (35%).In fit, intermediate/poor-risk patients outside the pandemic, over 80% of experts choose ipilimumab/nivolumab, in contrast to only 41% of physicians during COVID-19, instead more TKI monotherapies are given. In patients responding to established therapies with ICI/ICI or ICI/TKI combinations, most participants modify treatment regimen by extending cycle length, holding one ICI or even both. CONCLUSION: mccRCC treatment modifications in light of the coronavirus pandemic are variable, with a shift from ICI/ICI to ICI/TKI or TKI monotherapy.

Ahmadian, E., et al. (2021). "Immunosuppressant Management in Renal Transplant Patients with COVID-19." Biomed Res Int **2021**: 9318725.

The coronavirus disease 2019 (COVID-19) pandemic poses a special risk for both immunosuppressed patients, especially transplant recipients. Although the knowledge about this infection is growing, many uncertainties remain, particularly regarding the kidney. Kidney transplant recipients (KDRs) should be considered immunocompromised hosts since a potential risk for infection, comorbidity, and immunosuppression exposure exists. Additionally, the management of immunosuppressive agents in KDRs remains challenging. Potential drug interactions with immunosuppressive treatment escalated the risk of unwanted side effects. In this review, we aimed to attain an augmented awareness and improved management immunosuppressant for COVID-19 KDRs.

Ahmed, R. and A. Haseeb (2020). "COVID-19 and Impending Shortage of Haemodialysis Facilities due to the Rising Incidence of Acute Kidney Injury Requiring Renal Replacement Therapy." J Coll Physicians Surg Pak **30**(6): 89-90.

Akbulut, G. and F. Gencer-Bingol (2021). "Medical nutritional therapy for renal transplantation in the COVID-19 pandemic." World J Transplant **11**(6): 212-219.

Nutritional therapy is very important at renal transplantation. Nutrition has become more vital for transplantation patients owing to the coronavirus disease 2019 (COVID-19) pandemic. Inadequate nutrition can negatively affect the immune system. For this reason, adequate protein and energy intake should be provided to the patients. Also, overconsumption of saturated fat, sugar, and refined carbohydrates can both negatively affect the immune system and trigger chronic diseases in transplantation patients. In addition, vitamins and minerals should be monitored and inadequacy should be prevented due to immunomodulatory effects. Applying nutritional therapy suitable for the symptoms of renal transplantation patients and preventing comorbidities may reduce the risk and severity of COVID-19 infection.

Alharthy, A., et al. (2021). "Continuous renal replacement therapy with the addition of CytoSorb cartridge in critically ill patients with COVID-19 plus acute kidney injury: A case-series." Artif Organs **45**(5): E101-E112.

Our aim was to investigate continuous renal replacement therapy (CRRT) with CytoSorb cartridge for patients with life-threatening COVID-19 plus acute kidney injury (AKI), sepsis, acute respiratory distress syndrome (ARDS), and cytokine release syndrome (CRS). Of 492 COVID-19 patients admitted to our intensive care unit (ICU), 50 had AKI necessitating CRRT (10.16%) and were enrolled in the study. Upon ICU admission, all had AKI, ARDS, septic shock, and CRS. In addition to CRRT with CytoSorb, all received

ARDS-net ventilation, prone positioning, plus empiric ribavirin, interferon beta-1b, antibiotics, hydrocortisone, and prophylactic anticoagulation. We retrospectively analyzed inflammatory biomarkers, oxygenation, organ function, duration of mechanical ventilation, ICU length-of-stay, and mortality on day-28 post-ICU admission. Patients were 49.64 +/- 8.90 years old (78% male) with body mass index of 26.70 +/- 2.76 kg/m(2) . On ICU admission, mean Acute Physiology and Chronic Health Evaluation (APACHE) II was 22.52 +/- 1.1. Sequential Organ Function Assessment (SOFA) score was 9.36 +/- 2.068 and the ratio of partial arterial pressure of oxygen to fractional inspired concentration of oxygen (PaO2 /FiO2) was 117.46 +/- 36.92. Duration of mechanical ventilation was 17.38 +/- 7.39 days, ICU length-of-stay was 20.70 +/- 8.83 days, and mortality 28 days post-ICU admission was 30%. Nonsurvivors had higher levels of inflammatory biomarkers, and more unresolved shock, ARDS, AKI, and pulmonary emboli (8% vs. 4%, P < .05) compared to survivors. After 2 +/- 1 CRRT sessions with CytoSorb, survivors had decreased SOFA scores, lactate dehydrogenase, ferritin, D-dimers, C-reactive protein, and interleukin-6; and increased PaO2 /FiO2 ratios, and lymphocyte counts (all P < .05). Receiver-operator-curve analysis showed that posttherapy values of interleukin-6 (cutoff point >620 pg/mL) predicted in-hospital mortality for critically ill COVID-19 patients (area-under-the-curve: 0.87, 95% CI: 0.81-0.93; P = .001). No side effects of therapy were recorded. In this retrospective case-series, CRRT with the CytoSorb cartridge provided a safe rescue therapy in life-threatening COVID-19 with associated AKI, ARDS, sepsis, and hyperinflammation.

Allemailem, K. S., et al. (2021). "Manifestations of renal system involvement in hospitalized patients with COVID-19 in Saudi Arabia." PLoS One **16**(7): e0253036.

BACKGROUND: Although COVID-19 is an acute disease that usually resolves rapidly in most cases, the disease can be fatal and has a mortality rate of about 1% to 56%. Alveolar injury and respiratory failure are the main causes of death in patients with COVID 19. In addition, the effect of the disease on other organs is not fully understood. Renal system affection has been reported in patients with COVID 19 and is associated with a higher rate of diverse outcomes, including mortality. Therefore, in the present work, we reported the clinical characteristics and laboratory data of hospitalized patients with COVID-19 and analyzed the manifestations that indicated renal system involvement and their impact on clinical outcomes. MATERIALS AND METHODS: This was an observational retrospective study conducted at King Fahd Specialist Hospital, Buraydah, Saudi Arabia. All patients with COVID-19 who were admitted to this Hospital from April to December 2020 were included in the study. The patients' findings at presentation were recorded. Demographic data and laboratory results (hematuria, proteinuria, urinary sediment cast and pus cell presence, and kidney function tests) were retrieved from electronic patient records. RESULTS: One hundred and ninety-three patients with confirmed COVID 19 were included in the study. Dipstick examinations of all urine samples showed proteinuria and hematuria in 53.9% and 22.3% of patients, respectively, whereas microscopic examination revealed the presence of pus and brown muddy granular casts in 33.7% and 12.4% of samples, respectively. Acute kidney injury was reported in 23.3% of patients. A multivariable analysis demonstrated that hematuria was associated with acute kidney injury (AKI) (OR, 2.4; 95% CI, 1.2-4.9; P = 0.001), ICU admission (OR, 3.789; 95% CI, 1.913-7.505; P = 0.003), and mortality (OR, 8.084; 95% CI, 3.756-17.397; P = 0.002). Conversely, proteinuria was less significantly associated with the risk of AKI (OR, 1.56; 95% CI, 1.91-7.50; P = 0.003), ICU admission (OR, 2.493; 95% CI, 1.25-4.72; P = 0.001), and mortality (OR, 2.764; 95% CI, 1.368-5.121; P = 0.003). Patients with AKI had a higher probability for mortality than did those without AKI (OR, 14.208; 95% CI, 6.434-31.375; P = 0.003). CONCLUSION: The manifestations of the involvement of the renal system are not uncommon in COVID-19. These manifestations included proteinuria, hematuria, and AKI and were usually associated with a poor prognosis, including high incidences of both ICU admission and mortality.

Al-Mashdali, A. F., et al. (2021). "Simultaneous renal infarction and splenic infarction as a possible initial manifestation of COVID-19: A case report." Clin Case Rep **9**(11): e04819.

We recommend testing for SARS-CoV-2 in a patient with an unexplained thromboembolic event, even in the absence of fever or respiratory symptoms.

Al-Otaibi, N. E. (2021). "A review of the evidence for and against the use of steroids in renal transplant patients with COVID-19." Saudi Med J **42**(10): 1149-1152.

Amato, M., et al. (2021). "Diagnostic bias during the COVID-19 era: COVID-19 or renal abscess?" Urologia **88**(3): 218-222.

INTRODUCTION: The Coronavirus disease-2019 (COVID-19) has been declared as a pandemic in March 2020 by the World Health Organization (WHO). Since then, this pandemic has dramatically affected the entire world, even radically influencing the way

patients are framed at triage. Symptoms and tests in most cases lead to a correct diagnosis; however, error may be around the corner. CASE REPORT: A 60 years old patient was referred with weight loss, fatigue and mild fever for 3 weeks as he was working in a COVID-19 ward. After a positive swab and chest CT scan, he was admitted in the hospital and treated as mild COVID-19 patient. A CT scan performed after the patient was discharged revealed a renal lesion misidentified as a tumor then clarified to be an abscess which retrospectively appears to be the main cause of his symptoms. CONCLUSION: Clinicians should consider other life-threatening disease in the differential diagnosis of patients presenting with similar symptoms to minimize mistakes and avoid further unnecessary investigations.

Ammous, A., et al. (2021). "Renal infarction in COVID-19 patient." J Nephrol **34**(1): 267-268.

Anazco, P. H., et al. (2021). "Bilateral renal infarction in a patient with severe COVID-19 infection." J Bras Nefrol **43**(1): 127-131.

Thromboembolic events are frequent in patients with COVID-19 infection, and no cases of bilateral renal infarctions have been reported. We present the case of a 41-year-old female patient with diabetes mellitus and obesity who attended the emergency department for low back pain, respiratory failure associated with COVID-19 pneumonia, diabetic ketoacidosis, and shock. The patient had acute kidney injury and required hemodialysis. Contrast abdominal tomography showed bilateral renal infarction and anticoagulation was started. Kidney infarction cases require high diagnostic suspicion and possibility of starting anticoagulation.

Antoun, J., et al. (2021). "Understanding the Impact of Initial COVID-19 Restrictions on Physical Activity, Wellbeing and Quality of Life in Shielding Adults with End-Stage Renal Disease in the United Kingdom Dialysing at Home versus In-Centre and Their Experiences with Telemedicine." Int J Environ Res Public Health **18**(6).

Early in the coronavirus-2019 (COVID-19) containment strategy, people with end-stage renal disease (ESRD) were identified as extremely clinically vulnerable and subsequently asked to 'shield' at home where possible. The aim of this study was to investigate how these restrictions and the transition to an increased reliance on telemedicine within clinical care of people living with kidney disease impacted the physical activity (PA), wellbeing and quality of life (QoL) of adults dialysing at home (HHD) or receiving in-centre haemodialysis (ICHD) in the UK. Individual semistructured telephone interviews were conducted with adults receiving HHD (n = 10) or ICHD (n = 10), were transcribed verbatim and, subsequently, thematically analysed. As result of the COVID-19 restrictions, PA, wellbeing and QoL of people with ESRD were found to have been hindered. However, widespread support for the continued use of telemedicine was strongly advocated and promoted independence and satisfaction in patient care. These findings highlight the need for more proactive care of people with ESRD if asked to shield again, as well as increased awareness of safe and appropriate PA resources to help with home-based PA and emotional wellbeing.

Arachchillage, D. R. J., et al. (2021). "Efficacy and Safety of D-dimer, Weight, and Renal Function-Adjusted Thromboprophylaxis in Patients with Coronavirus Disease 2019 (COVID-19)." Semin Thromb Hemost **47**(4): 436-441.

Arantes, M. F., et al. (2020). "Renal involvement in patients with COVID-19." Clinics (Sao Paulo) **75**: e2194.

Arenas, M. D., et al. (2020). "Clinical Profiles in Renal Patients with COVID-19." J Clin Med **9**(8).

The COVID-19 pandemic has led to frequent referrals to the emergency department on suspicion of this infection in maintenance hemodialysis (MHD) and kidney transplant (KT) patients. We aimed to describe their clinical features comparing confirmed and suspected non-confirmed COVID-19 cases during the Spanish epidemic peak. Confirmed COVID-19 ((+)COVID-19) corresponds to patient with positive RT-PCR SARS-CoV-2 assay. Non-confirmed COVID-19 ((-)COVID-19) corresponds to patients with negative RT-PCR. COVID-19 was suspected in 61 patients (40/803 KT (4.9%), 21/220 MHD (9.5%)). Prevalence of (+)COVID-19 was 3.2% in KT and 3.6% in MHD patients. Thirty-four (26 KT and 8 MHD) were (+)COVID-19 and 27 (14 KT and 13 MHD) (-)COVID-19. In comparison with (-)COVID-19 patients, (+)COVID-19 showed higher frequency of typical viral symptoms (cough, dyspnea, asthenia and myalgias), pneumonia (88.2% vs. 14.3%) and LDH and CRP while lower phosphate levels, need of hospital admission (100% vs. 63%), use of non-invasive mechanical ventilation (36% vs. 11%) and mortality (38% vs. 0%) ($p < 0.001$). Time from symptoms onset to admission was longer in patients who finally died than in survivors (8.5 vs. 3.8, $p = 0.007$). In KT and MHD patients, (+)COVID-19 shows more clinical severity than suspected non-confirmed cases. Prompt RT-PCR is mandatory to confirm COVID-19 diagnosis.

Armaly, Z., et al. (2021). "Renal Manifestations of Covid-19: Physiology and Pathophysiology." J Clin Med **10**(6).

Corona virus disease 2019 (COVID-19) imposes a serious public health pandemic affecting the whole world, as it is spreading exponentially. Besides its high infectivity, SARS-CoV-2 causes multiple serious derangements, where the most prominent is severe acute respiratory syndrome as well as multiple organ dysfunction including heart and kidney injury. While the deleterious impact of SARS-CoV-2 on pulmonary and cardiac systems have attracted remarkable attention, the adverse effects of this virus on the renal system is still underestimated. Kidney susceptibility to SARS-CoV-2 infection is determined by the presence of angiotensin-converting enzyme 2 (ACE2) receptor which is used as port of the viral entry into targeted cells, tissue tropism, pathogenicity and subsequent viral replication. The SARS-CoV-2 cellular entry receptor, ACE2, is widely expressed in proximal epithelial cells, vascular endothelial and smooth muscle cells and podocytes, where it supports kidney integrity and function via the enzymatic production of Angiotensin 1-7 (Ang 1-7), which exerts vasodilatory, anti-inflammatory, antifibrotic and diuretic/natriuretic actions via activation of the Mas receptor axis. Loss of this activity constitutes the potential basis for the renal damage that occurs in COVID-19 patients. Indeed, several studies in a small sample of COVID-19 patients revealed relatively high incidence of acute kidney injury (AKI) among them. Although SARS-CoV-1 - induced AKI was attributed to multiorgan failure and cytokine release syndrome, as the virus was not detectable in the renal tissue of infected patients, SARS-CoV-2 antigens were detected in kidney tubules, suggesting that SARS-CoV-2 infects the human kidney directly, and eventually induces AKI characterized with high morbidity and mortality. The mechanisms underlying this phenomenon are largely unknown. However, the fact that ACE2 plays a crucial role against renal injury, the deprivation of the kidney of this advantageous enzyme, along with local viral replication, probably plays a central role. The current review focuses on the critical role of ACE2 in renal physiology, its involvement in the development of kidney injury during SARS-CoV-2 infection, renal manifestations and therapeutic options. The latter includes exogenous administration of Ang (1-7) as an appealing option, given the high incidence of AKI in this ACE2-depleted disorder, and the benefits of ACE2/Ang1-7 including vasodilation, diuresis, natriuresis, attenuation of inflammation, oxidative stress, cell proliferation, apoptosis and coagulation.

Arnold, F., et al. (2020). "Comparison of different anticoagulation strategies for renal replacement therapy in critically ill patients with COVID-19: a cohort study." BMC Nephrol **21**(1): 486.

BACKGROUND: Critically ill coronavirus disease 2019 (COVID-19) patients have a high risk of acute kidney injury (AKI) that requires renal replacement therapy (RRT). A state of hypercoagulability reduces circuit life spans. To maintain circuit patency and therapeutic efficiency, an optimized anticoagulation strategy is needed. This study investigates whether alternative anticoagulation strategies for RRT during COVID-19 are superior to administration of unfractionated heparin (UFH). METHODS: Retrospective cohort study on 71 critically ill COVID-19 patients (>/=18 years), admitted to intensive care units at a tertiary health care facility in the southwestern part of Germany between February 26 and May 21, 2020. We collected data on the disease course, AKI, RRT, and thromboembolic events. Four different anticoagulatory regimens were administered. Anticoagulation during continuous veno-venous hemodialysis (CVVHD) was performed with UFH or citrate. Anticoagulation during sustained low-efficiency daily dialysis (SLEDD) was performed with UFH, argatroban, or low molecular weight heparin (LMWH). Primary outcome is the effect of the anticoagulation regimen on mean treatment times of RRT. RESULTS: In patients receiving CVVHD, mean treatment time in the UFH group was 21.3 h (SEM: +/- 5.6 h), in the citrate group 45.6 h (SEM: +/-2.7 h). Citrate anticoagulation significantly prolonged treatment times by 24.4 h (P = .001). In patients receiving SLEDD, mean treatment time with UFH was 8.1 h (SEM: +/-1.3 h), with argatroban 8.0 h (SEM: +/- 0.9 h), and with LMWH 11.8 h (SEM: +/-0.5 h). LMWH significantly prolonged treatment times by 3.7 h (P = .008) and 3.8 h (P = .002), respectively. CONCLUSIONS: UFH fails to prevent early clotting events in the dialysis circuit during COVID-19. For patients, who do not require effective systemic anticoagulation, regional citrate dialysis is the most effective strategy. For patients, who require effective systemic anticoagulation, the usage of LMWH results in the longest circuit life spans. The proposed anticoagulatory strategies are safe, can easily be monitored, and allow an individualized treatment.

Attallah, N., et al. (2021). "Anticoagulation in COVID-19 patients requiring continuous renal replacement therapy." Anaesth Crit Care Pain Med **40**(3): 100841.

Azinheira Nobrega Cruz, N., et al. (2021). "Angiotensin-Converting Enzyme 2 in the Pathogenesis of Renal Abnormalities Observed in COVID-19 Patients." Front Physiol **12**: 700220.

Coronavirus disease 2019 (COVID-19) was first reported in late December 2019 in Wuhan, China.

The etiological agent of this disease is severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), and the high transmissibility of the virus led to its rapid global spread and a major pandemic (ongoing at the time of writing this review). The clinical manifestations of COVID-19 can vary widely from non-evident or minor symptoms to severe acute respiratory syndrome and multi-organ damage, causing death. Acute kidney injury (AKI) has been recognized as a common complication of COVID-19 and in many cases, kidney replacement therapy (KRT) is required. The presence of kidney abnormalities on hospital admission and the development of AKI are related to a more severe presentation of COVID-19 with higher mortality rate. The high transmissibility and the broad spectrum of clinical manifestations of COVID-19 are in part due to the high affinity of SARS-CoV-2 for its receptor, angiotensin (Ang)-converting enzyme 2 (ACE2), which is widely expressed in human organs and is especially abundant in the kidneys. A debate on the role of ACE2 in the infectivity and pathogenesis of COVID-19 has emerged: Does the high expression of ACE2 promotes higher infectivity and more severe clinical manifestations or does the interaction of SARS-CoV-2 with ACE2 reduce the bioavailability of the enzyme, depleting its biological activity, which is closely related to two important physiological systems, the renin-angiotensin system (RAS) and the kallikrein-kinin system (KKS), thereby further contributing to pathogenesis. In this review, we discuss the dual role of ACE2 in the infectivity and pathogenesis of COVID-19, highlighting the effects of COVID-19-induced ACE2 depletion in the renal physiology and how it may lead to kidney injury. The ACE2 downstream regulation of KKS, that usually receives less attention, is discussed. Also, a detailed discussion on how the triad of symptoms (respiratory, inflammatory, and coagulation symptoms) of COVID-19 can indirectly promote renal injury is primary aborded.

Bajwa, H., et al. (2020). "The Dilemma of Renal Involvement in COVID-19: A Systematic Review." Cureus **12**(6): e8632.

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), now known as coronavirus disease 2019 (COVID-19), has posed a serious threat to global health since December 2019. It has spread worldwide and is consuming healthcare resources rapidly. Published literature suggests that people with advanced age and comorbidities are affected more severely. It is crucial to uncover the underlying pathogenesis of acute kidney insufficiency in COVID-19 patients to understand better the reasoning behind the grave outcomes in these patients. In this review, we have included articles stating the prevalence and specific mortality rates of COVID-19 patients with acute kidney insufficiency. Our study included 1098 COVID-19 positive patients, of whom 66 (6%) developed acute kidney insufficiency and 62 patients died, showing a mortality rate of 94%. Patients with acute kidney insufficiency showed a more severe disease course, and these patients ended up more in intensive care units. Particular attention should be paid to those with already established kidney disease, such as chronic kidney disease, or renal transplant recipients, as these patients are already on immunosuppressive therapy. Our review focuses on the prevalence of acute kidney insufficiency in COVID-19 patients and mortality rates in this subset of patients.

Banshodani, M., et al. (2021). "Combination therapy for COVID-19 in hemodialysis patients: Pharmacological treatments and renal replacement therapy based on the severity." Ther Apher Dial.

Barbetta, L., et al. (2021). "Henoch-Schonlein purpura with renal and gastrointestinal involvement in course of COVID-19: a case report." Clin Exp Rheumatol **39 Suppl 129**(2): 191-192.

Basara Akin, I., et al. (2021). "Possible radiologic renal signs of COVID-19." Abdom Radiol (NY) **46**(2): 692-695.

Coronavirus disease 2019 (COVID-19) has caused a huge outbreak worldwide. Patients infected with COVID-19 most commonly present with respiratory tract symptoms and pneumonia. Gastrointestinal symptoms can also occur in these patients. Renal involvement presenting as acute renal infarct and/or acute kidney injury has been described in literature; however, these typically occur in patients with severe COVID-19. To the best of our knowledge, there are no reported cases describing abnormal renal imaging findings in a patient with only mild form of COVID-19. We, therefore, report a case of a patient with mild COVID-19 presenting with acute abdominal pain and acute renal infarct.

Basic-Jukic, N., et al. (2021). "Histopathologic findings on indication renal allograft biopsies after recovery from acute COVID-19." Clin Transplant: e14486.

Current knowledge on histopathological changes occurring after COVID-19 in transplanted kidneys is limited. Herein, we present renal allograft pathology findings in patients recovered from COVID-19. Six patients underwent indication biopsy, and one required allograft nephrectomy after acute COVID-19. Demographic data, clinical characteristics, and laboratory findings were recorded. The histopathological analysis included light microscopy, immunostaining, and electron microscopy. Five patients were hospitalized for acute COVID-19, and all

were diagnosed with imaging-confirmed pneumonia, one requiring mechanical ventilation, and two requiring dialysis. Two patients had mild form. Histopathologic examination of renal allograft specimens revealed collapsing, perihilar, tip-lesion and secondary FSGS in one patient each. One patient had borderline acute cellular rejection, and two had chronic antibody-mediated rejection. Histopathologic changes of glomerular tufts were accompanied by acute tubular injury in four patients. None of our patients had signs of viral inclusions in kidney cells. One patient died and one remained dialysis-dependent after the good initial response to treatment. Patients with collapsing and perihilar FSGS had further progression of their chronic allograft nephropathy still without need for dialysis. In conclusion, diverse kidney pathology may be found in SARS-CoV-2-infected renal transplant patients. It seems that viral infection may affect the immune system with triggering of glomerular diseases, while the acute tubular injury is of multifactorial etiology. Direct viral effect is less likely.

Basic-Jukic, N., et al. (2021). "COVID-19 vaccine hesitancy in renal transplant recipients." Ther Apher Dial.

Basic-Jukic, N., et al. (2021). "Follow-up of renal transplant recipients after acute COVID-19-A prospective cohort single-center study." Immun Inflamm Dis **9**(4): 1563-1572.

INTRODUCTION: Although most patients recover within several weeks after acute COVID-19, some of them develop long-lasting clinical symptoms. Renal transplant recipients have an increased mortality risk from COVID-19. We aimed to describe complications occurring after COVID-19 in this group of patients. METHODS: A prospective single-center cohort study was conducted at University Hospital Centre Zagreb. Patients with two negative reverse transcriptase-polymerase chain reaction (RT-PCR) tests for SARS-CoV-2 after COVID-19 were eligible for further follow-up at our outpatient clinic. They underwent detailed clinical and laboratory assessments. The primary outcome was the development of complications after COVID-19. RESULTS: Only 11.53% of renal transplant recipients who survived acute COVID-19 were symptomless and free from new-onset laboratory abnormalities during the median follow-up of 64 days (range: 50-76 days). Three patients died from sepsis after discharge from the hospital. In 47 patients (45.2%), clinical complications were present, while 74 patients (71.2%) had one or more laboratory abnormalities. The most common clinical complications included shortness of breath (19.2%), tiredness (11.5%), peripheral neuropathy (7.7%), self-reported cognitive impairments (5.7%), and dry cough (7.7%). Most common laboratory abnormalities included shortened activated partial thromboplastin time (50%), elevated D-dimers (36.5%), elevated fibrinogen (30.16%), and hypogammaglobulinemia (24%). Positive RT-PCR for cytomegalovirus (8.7%), Epstein-Barr virus (26%), or BK virus (16.3%). Multivariate analysis identified the history of diabetes mellitus and eGFR CKD-EPI as predictors for the development of post-COVID clinical complications. Six months after acute COVID-19, elevated D-dimers persisted with normalization of other laboratory parameters. Twenty-nine patients were hospitalized, mostly with several concomitant problems. However, initially reported clinical problems gradually improved in the majority of patients. CONCLUSION: Post-COVID-19 clinical and laboratory complications are frequent in the renal transplant population, in some of them associated with significant morbidity. All patients recovered from acute COVID-19 should undergo long-term monitoring for evaluation and treatment of complications.

Bayrak, M. and K. Cadirci (2021). "Successful pulsed methylprednisolone and convalescent plasma treatment in a case of a renal transplant recipient with COVID-19 positive pneumonia: a case report." Pan Afr Med J **38**: 273.

Coronavirus 2019 disease (COVID-19) is a deadly disease that was first seen in Wuhan, China, and primarily affects the respiratory system, but also has different systemic involvements. It has caused 89 million cases and 1.9 million deaths worldwide. COVID-19 positive renal transplant recipients have a higher mortality rate than COVID-19 patients in the normal population. There is no specific treatment and follow-up protocol for COVID-19 infection in transplant recipients. COVID-19 treatment and immunosuppressive therapy choices are controversial. Recently, pulse steroid therapies have been used in cases with severe COVID-19 pneumonia. Convalescent plasma therapy is used limitedly in COVID-19 patients. Our 49-year-old male patient has been a recipient of a renal transplant from a cadaver for 6 years. We aimed to make an additional contribution by presenting our patient to the literature whose COVID-19 PCR-RT test performed in the emergency department due to the complaints of fever, shortness of breath, and cough for five days was positive and had moderate COVID-19 pneumonia in thorax tomography and had serious clinical and radiological improvement after pulsed methylprednisolone and convalescent plasma therapy in the early period.

Beckwith, H. and P. Cockwell (2021). "Impacts of the COVID-19 pandemic on training, morale and

wellbeing among the UK renal workforce." Clin Med (Lond) **21**(Suppl 2): 62-63.

Beckwith, H., et al. (2021). "Impact of the COVID-19 Pandemic on Training, Morale and Well-Being Among the UK Renal Workforce." Kidney Int Rep **6**(5): 1433-1436.

Belfort, D. S. P., et al. (2021). "Aortic and Renal Artery Thrombosis as the First Clinical Manifestation of COVID-19 in a Heart Transplant Recipient." Arq Bras Cardiol **117**(5): 1045-1047.

Bell, S., et al. (2020). "COVID-19 in patients undergoing chronic kidney replacement therapy and kidney transplant recipients in Scotland: findings and experience from the Scottish renal registry." BMC Nephrol **21**(1): 419.

BACKGROUND: Infection with the severe acute respiratory coronavirus 2 (SARS-CoV-2) has led to a worldwide pandemic with coronavirus disease 2019 (COVID-19), the disease caused by SARS-CoV-2, overwhelming healthcare systems globally. Preliminary reports suggest a high incidence of infection and mortality with SARS-CoV-2 in patients receiving kidney replacement therapy (KRT). The aims of this study are to report characteristics, rates and outcomes of all patients affected by infection with SARS-CoV-2 undergoing KRT in Scotland. METHODS: Study design was an observational cohort study. Data were linked between the Scottish Renal Registry, Health Protection Scotland and the Scottish Intensive Care Society Audit Group national data sets using a unique patient identifier (Community Health Index (CHI)) for each individual by the Public Health and Intelligence unit of Public Health, Scotland. Descriptive statistics and survival analyses were performed. RESULTS: During the period 1st March 2020 to 31st May 2020, 110 patients receiving KRT tested positive for SARS-CoV-2 amounting to 2% of the prevalent KRT population. Of those affected, 86 were receiving haemodialysis or peritoneal dialysis and 24 had a renal transplant. Patients who tested positive were older and more likely to reside in more deprived postcodes. Mortality was high at 26.7% in the dialysis patients and 29.2% in the transplant patients. CONCLUSION: The rate of detected SARS-CoV-2 in people receiving KRT in Scotland was relatively low but with a high mortality for those demonstrating infection. Although impossible to confirm, it appears that the measures taken within dialysis units coupled with the national shielding policy, have been effective in protecting this population from infection.

Berrichi, S., et al. (2021). "Acute limb ischemia with concomitant splenic and renal infarcts: Thromboembolic events revealing COVID-19." Ann Med Surg (Lond) **68**: 102646.

Introduction: Since December 2019, the coronavirus 19 (COVID-19) pandemic continues to spread worldwide and has caused millions of deaths. Although the main manifestation of the disease is acute respiratory distress syndrome, hypercoagulability resulting from hypoxemia leads to venous thromboembolism and arterial thrombosis, which have a fatal prognosis for COVID-19. Case report management: We report the case of patient admitted to our unit for management of a concomitant limb ischemia, splenic and renal infarcts associated to a COVID-19 infection with favorable outcomes after thrombectomy and therapeutic doses of heparin. Conclusion: Systemic procoagulant manifestations related to a COVID-19 infection is a newly described phenomenon responsible of cardiovascular and neurological disorders.

Beunders, R., et al. (2021). "Late augmented renal clearance in patients with COVID-19 in the intensive care unit. A prospective observational study." J Crit Care **64**: 7-9.

Bhandari, G., et al. (2021). "COVID-19 Infection in Renal Transplant Patients: Early Report From India." Indian J Nephrol **31**(3): 271-275.

Introduction: COVID -19 has gripped the whole world and patients with comorbidities especially kidney ailments are at higher risk of developing severe disease. Among kidney disease, transplant patients are the most vulnerable group. Information on coronavirus disease 2019 (COVID-19) in kidney transplant patients is very limited. Methods: An observational study was conducted on 20 kidney transplant patients who tested positive for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) by polymerase chain reaction from April to June 2020. Results: The majority of cases were males (85%). The median age of the patients was 50 years (interquartile range [IQR] 40.75-60.75). Diabetes and hypertension were present in 55% and 95% of patients, respectively. Coronary artery disease was present in three patients (15%). The median time from transplant to COVID-19 testing was 54 months (IQR 36-105). Chronic allograft nephropathy was found in 35% of patients. The mean baseline creatinine was 1.71 mg/dL. The most common symptom was fever (80%). Acute Kidney Injury was seen in 60% of patients with a mean creatinine of 2.60 mg/dL. Based on severity, 50% of patients had mild disease, 25% moderate disease, and the remaining 25% had severe disease. All 20 patients were on oral steroids, calcineurin inhibitors (18 on tacrolimus and two on cyclosporine), and antimetabolite (19 on mycophenolate mofetil and one on azathioprine).

Antimetabolite agents were stopped in all patients and tacrolimus was stopped in severe cases (25%). Hydroxychloroquine was given in 15 patients (75%). Fifteen patients (75%) recovered while five (25%) died. Conclusion: Kidney transplant recipients infected with COVID-19 have high mortality.

Biancalana, E., et al. (2021). "Remdesivir, Renal Function and Short-Term Clinical Outcomes in Elderly COVID-19 Pneumonia Patients: A Single-Centre Study." Clin Interv Aging **16**: 1037-1046.

Background: Remdesivir, an antiviral agent able to reduce inflammatory cascade accompanying severe, life-threatening pneumonia, became the first drug approved by the Food and Drug Administration for the treatment of hospitalized patients with coronavirus 2 related severe acute respiratory syndrome (SARS CoV2). As from its previously known clinical indications, the use of remdesivir in the presence of severe renal impairment is contraindicated; however, the impact of remdesivir on renal function in aging patients has not been elucidated. Subjects and Methods: This retrospective observational study involved 109 individuals consecutively admitted in internal medicine section, Azienda Ospedaliero Universitaria Pisana hospital, in November-December 2020 due to a confirmed diagnosis of SARS CoV2 and receiving remdesivir according to international inclusion criteria. Biochemical variables at admission were evaluated, together with slopes of estimated glomerular filtration rate (eGFR) built during remdesivir treatment. Participants were followed until discharge or exitus. Results: Patients were stratified according to age (80 formed the study cohort and 29 served as controls); CKD stage III was present in 46% of them. No patients showed any sign of deteriorated renal function during remdesivir. Fourteen patients in the elderly cohort deceased; their eGFR at baseline was significantly lower. Recovered patients were characterized by a relevant eGFR gaining during remdesivir treatment. Conclusion: We show here for the first time as remdesivir does not influence eGFR in a cohort of elderly people hospitalized for SARS CoV2, and that eGFR gain during such treatment is coupled with a better prognosis.

Bitencourt, L., et al. (2021). "COVID-19 and Renal Diseases: An Update." Curr Drug Targets **22**(1): 52-67.

BACKGROUND: It becomes increasingly evident that the SARS-CoV-2 infection is not limited to the respiratory system. In addition to being a target of the virus, the kidney also seems to have a substantial influence on the outcomes of the disease. METHODS: Data was obtained by a comprehensive and non-systematic search in the PubMed, Cochrane, Scopus and SciELO databases, using mainly the terms "SARS-CoV-2", "COVID-19", "chronic kidney disease", "renal transplantation", acute kidney injury" and "renal dysfunction" Discussion: The membrane-bound angiotensin-converting enzyme 2 is the receptor for SARS-CoV- -2, and this interaction may lead to an imbalance of the Renin-Angiotensin System (RAS), associated with worse clinical presentations of COVID-19, including acute pulmonary injury, hyperinflammatory state and hematological alterations. In the framework of renal diseases, the development of acute kidney injury is associated mostly with immune alterations and direct cytopathic lesions by the virus, leading to higher mortality. As for chronic kidney disease, the patients at a non-terminal stage have a worse prognosis, while the hemodialysis patients appear to have mild courses of COVID-19, probably due to lower chances of being affected by the cytokine storm. Furthermore, the current scenario is unfavorable to kidney donation and transplantation. The relationship between COVID-19 and immunosuppression in kidney transplantation recipients has been greatly discussed to determine whether it increases mortality and how it interacts with immunosuppressive medications. CONCLUSION: The kidney and the RAS exert fundamental roles in the SARS-CoV-2 infection, and more research is required to have a complete understanding of the repercussions caused by COVID-19 in renal diseases.

Black, J. T., et al. (2021). "Seroprevalence of SARS-CoV-2 IgG antibodies in the current COVID-19 pandemic amongst co-workers at a UK renal transplant centre." Transpl Int **34**(2): 382-383.

Bruno, P. F., et al. (2021). "COVID-19 Infection: Viral Clearance and Antibody Response in Dialysis Patients and Renal Transplant Recipients." Nephron **145**(4): 363-370.

BACKGROUND/AIMS: The coronavirus disease 2019 (CO-VID-19) pandemic is the major current health emergency worldwide, adding a significant burden also to the community of nephrologists for the management of their patients. Here, we analyzed the impact of COVID-19 infection in renal patients to assess the time to viral clearance, together with the production and persistence of IgG and IgM antibody response, in consideration of the altered immune capacity of this fragile population. METHODS: Viral clearance and antibody kinetics were investigated in 49 renal patients recovered from COVID-19 infection: 7 of them with chronic decompensated renal failure, 31 under dialysis treatment, and 11 kidney transplant recipients. RESULTS: The time span between the diagnosis of infection and recovery based on laboratory testing (2 negative nasopharyngeal swabs in consecutive days)

was 31.7 +/- 13.3 days. Three new positive cases were detected from 8 to 13 days following recovery. At the first serological determination after swab negativization, all the patients developed IgG and IgM antibodies. The semiquantitative analysis showed a progressive increase in IgG and a slow reduction in IgM. DISCUSSION/CONCLUSION: In subjects with decompensated chronic kidney disease, under dialysis and in transplant recipients, viral clearance is lengthened compared to the general population. However, in spite of their common status of immunodepression, all of them were able to produce specific antibodies. These data might provide useful insights for monitoring and planning health-care activities in the weak category of patients with compromised renal function recovered from COVID-19.

Brunori, G., et al. (2021). "Lessons Learnt during the COVID-19 Pandemic: For Patients with End-Stage Renal Disease, We Should Prioritize Home-Based Treatment and Telemedicine." Kidney Blood Press Res **46**(1): 11-16.

BACKGROUNDS: The recent coronavirus disease 2019 (CO-VID-19) pandemic has placed worldwide health systems and hospitals under pressure, and so are the renal care models. This may be a unique opportunity to promote and expand alternative models of health-care delivery in patients undergoing renal replacement therapies. SUMMARY: Despite the high risk of acquiring communicable diseases when undergoing in-centre treatments, only a small proportion of patients are currently being treated with home therapies. Recent data provided by the Italian Society of Nephrology (SIN), the REIN French Registry and the Wuhan Hemodialysis Quality Control Center clearly show that patients receiving hospital-based treatment have a 3- to 4-fold greater risk of infection, and a subsequent fatality proportion between 21 and 34%. On the other hand, home-based therapy can be managed remotely, there is little or no need for transport to and from the hospital, and it is less expensive. Besides, the digital revolution in health care with the development of virtual care systems can make home dialysis with telehealth a cost-effective solution for both patients and health-care providers. Such a transition would require specific training for physicians and health-care professionals and a functional re-organization of dialysis centres to improve the skills and expertise in caring for patients at home. CONCLUSION: The need for more widespread home treatment is the main lesson learnt by nephrologists by the COVID-19 pandemic.

Burke, E., et al. (2021). "Outcomes of renal replacement therapy in the critically ill with COVID-19." Med Intensiva **45**(6): 325-331.

Objective: To describe outcomes of critically ill patients with COVID-19, particularly the association of renal replacement therapy to mortality. Design: A single-center prospective observational study was carried out. Setting: ICU of a tertiary care center. Patients: Consecutive adults with COVID-19 admitted to the ICU. Intervention: Renal replacement therapy. Main variables of interest: Demographic data, medical history, illness severity, type of oxygen therapy, laboratory data and use of renal replacement therapy to generate a logistic regression model describing independent risk factors for mortality. Results: Of the total of 166 patients, 51% were mechanically ventilated and 26% required renal replacement therapy. The overall hospital mortality rate was 36%, versus 56% for those requiring renal replacement therapy, and 68% for those with both mechanical ventilation and renal replacement therapy. The logistic regression model identified four independent risk factors for mortality: age (adjusted OR 2.8 [95% CI 1.8-4.4] for every 10-year increase), mechanical ventilation (4.2 [1.7-10.6]), need for continuous venovenous hemofiltration (2.3 [1.3-4.0]) and C-reactive protein (1.1 [1.0-1.2] for every 10 mg/L increase). Conclusions: In our cohort, acute kidney injury requiring renal replacement therapy was associated to a high mortality rate similar to that associated to the need for mechanical ventilation, while multiorgan failure necessitating both techniques implied an extremely high mortality risk.

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OR 2.8 [95% CI 1.8-4.4] for every 10-year increase), mechanical ventilation (4.2 [1.7-10.6]), need for continuous venovenous hemofiltration (2.3 [1.3-4.0]) and C-reactive protein (1.1 [1.0-1.2] for every 10mg/L increase). CONCLUSIONS: In our cohort, acute kidney injury requiring renal replacement therapy was associated to a high mortality rate similar to that associated to the need for mechanical ventilation, while multiorgan failure necessitating both techniques implied an extremely high mortality risk.

Bush, R., et al. (2020). "Mild COVID-19 in a pediatric renal transplant recipient." Am J Transplant **20**(10): 2942-2945.

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 5 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 extrapulmonary 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 4 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.

Campos, Y. M., et al. (2021). "Renal involvement in pediatric patients with COVID-19: an up-to-date." Curr Pediatr Rev.

BACKGROUND: In pediatric patients, Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) infection has been mostly associated with mild symptoms. However, as in adults, renal involvement has been reported in children and adolescents with Coronavirus Disease 2019 (COVID-19). OBJECTIVE: This review aimed to report data about renal involvement in pediatric COVID-9. The focuses were on the pathophysiology of acute kidney injury in Pediatric Inflammatory Multisystem Syndrome Temporally Associated (PIMS-TS) with SARS-CoV-2 and the possible impact of SARS-CoV-2 infection upon kidney function, as well as data concerning patients with previous kidney diseases, including Nephrotic Syndrome and Chronic Renal Disease. The implications for COVID-19 outcome in pediatric patients were also discussed. METHODS: This integrative review searched for articles on renal involvement in pediatric COVID-19 patients. The databases evaluated were PubMed and Scopus. RESULTS: The emergence of PIMS-TS with SARS-CoV-2 has shown that pediatric patients are at risk of severe COVID-19, with multi-organ involvement and dysfunction. In addition to intense inflammation, several systems are affected in this syndrome, collectively creating a combination of factors that results in acute kidney injury. Several studies have proposed that kidney cells, including the podocytes, might be at risk of direct infection by SARS-CoV-2, as high levels of ACE2, the virus receptor, are expressed on the membrane of such cells. Some cases of glomerular diseases triggered by SARS-CoV-2 infection and relapses of previous renal diseases have been reported. CONCLUSION: Further studies are necessary to establish risk factors for renal involvement in pediatric COVID-19 and to predict disease outcome.

Cantaluppi, V., et al. (2020). "A call to action to evaluate renal functional reserve in patients with COVID-19." Am J Physiol Renal Physiol **319**(5): F792-F795.

Coronavirus disease 2019 (COVID-19) poses an unprecedented challenge to world health systems, substantially increasing hospitalization and mortality rates in all affected countries. Being primarily a respiratory disease, COVID-19 is mainly associated with pneumonia or minor upper respiratory tract symptoms; however, different organs can sustain considerable (if not terminal) damage because of coronavirus. Acute kidney injury is the most common complication of COVID-19-related pneumonia, and more than 20% of patients requiring ventilatory support develop renal failure. Additionally, chronic kidney disease is a major risk factor for COVID-19 severity and mortality. All these data demonstrate the relevance of renal function assessment in patients with COVID-19 and the need of early kidney-directed diagnostic and therapeutic approaches. However, the sole assessment of renal function could be not entirely indicative of kidney tissue status. In this viewpoint, we discuss the clinical significance and potential relevance of renal functional reserve evaluation in patients with COVID-19.

Cappell, M. S. (2020). "Moderately Severe Diarrhea and Impaired Renal Function With COVID-19 Infection." Am J Gastroenterol **115**(6): 947-948.

Carrion, D. M., et al. (2020). "Assessment of trends and clinical presentation in the emergency department of patients with renal colic during the COVID-19 pandemic era." Actas Urol Esp (Engl Ed) **44**(10): 653-658.

INTRODUCTION: We hypothesized that the recent COVID-19 pandemic may lead to a delay in renal colic patients presenting to the Emergency Department due to the fear of getting infected. This delay may lead to a more severe clinical condition at presentation with possible complications for the patients. MATERIAL AND METHODS: Retrospective review of data collected from three institutions from Spain and Italy. Patients who presented to Emergency Department with unilateral or bilateral renal colic caused by imaging confirmed urolithiasis during the 45 days before and after each national lockdown were included. Data collected included patients' demographics, biochemical urine and blood tests, radiological tests, signs, symptoms and the therapeutic management. Analysis was performed between two groups, Group A: patients presenting prior to the national lockdown date; and Group B: patients presenting after the national lockdown date. RESULTS: A total of 397 patients presented to Emergency Department with radiology confirmed urolithiasis and were included in the study. The number of patients presenting to Emergency Department with renal/ureteric colic was 285 (71.8%) patients in Group A and 112 (28.2%) patients in Group B (p<0.001). The number of patients reporting a delay in presentation was 135 (47.4%) in Group A and 63 (56.3%) in Group B (p=0.11). At presentation, there were no statistical differences between Group A and Group B regarding the serum creatinine level, C reactive protein, white blood cell count, fever, oliguria, flank pain and hydronephrosis. In addition, no significant differences were observed with the length of stay, Urology department admission requirement and type of therapy. CONCLUSION: Data from our study showed a significant reduction in presentations to Emergency Department for renal colic after the lockdown in Spain and Italy. However, we did not find any significant difference with the length of stay, Urology department admission requirement and type of therapy.

Case, B. C., et al. (2021). "The Impact of COVID-19 Patients With Troponin Elevation on Renal Impairment and Clinical Outcome." Cardiovasc Revasc Med **33**: 45-48.

BACKGROUND: Cardiac involvement in coronavirus disease 2019 (COVID-19) is known, manifested by troponin elevation, and these patients have a worse prognosis than patients without myocardial injury. METHODS: We analyzed COVID-19-positive patients who presented to the MedStar Health system (11 hospitals in Washington, DC, and Maryland) during the pandemic (March 1-September 30, 2020). We compared renal function and subsequent in-hospital clinical outcomes based on the presence or absence of troponin elevation. The primary outcome was the incidence of acute kidney injury in COVID-19 patients with troponin elevation. We also evaluated in-hospital mortality, overall and based on the presence and absence of both troponin elevation and renal dysfunction. RESULTS: The cohort included 3386 COVID-19-positive admitted patients for whom troponin was drawn. Of these patients, 195 had troponin elevation (defined as >/=1.0 ng/mL), mean age was 61 +/- 16 years, and 51% were men. In-hospital mortality was significantly higher (53.8%) in COVID-19-positive patients with concomitant troponin elevation than in those without troponin elevation (14.5%; p < 0.001). COVID-19-positive patients with troponin elevation had a higher prevalence of renal dysfunction (58.5%) than those without troponin elevation (23.4%; p < 0.001). Further analysis demonstrated that having both troponin elevation and renal dysfunction carried the worst in-hospital prognosis (in-hospital mortality 57.9%; intensive-care-unit admission 76.8%; ventilation requirement 63.2%), as compared to the absence or presence of either. CONCLUSION: COVID-19 patients with troponin elevation are at higher risk for worsening renal function, and these patients subsequently have worse in-hospital clinical outcomes. Efforts should focus on early recognition, evaluation, and intensifying care of these patients.

Cau, A., et al. (2021). "Acute Kidney Injury and Renal Replacement Therapy in COVID-19 Versus Other Respiratory Viruses: A Systematic Review and Meta-Analysis." Can J Kidney Health Dis **8**: 20543581211052185.

Background: Acute kidney injury (AKI) is a potentially fatal complication of Coronavirus Disease-2019 (COVID-19). Binding of the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), the virus responsible for COVID-19, to its viral receptor, angiotensin converting enzyme 2 (ACE2), results in viral entry and may cause AKI. Objectives: We performed a systematic review and meta-analysis of the frequencies of AKI and renal replacement therapy (RRT) in critically ill COVID-19 patients and compared those frequencies with patients who were infected by respiratory viruses that bind or downregulate ACE2 (ACE2-associated viruses) and viruses that do not bind nor downregulate ACE2 (non-ACE2-associated viruses). Design: Systematic review and meta-analysis. Setting: Observational studies on COVID-19 and other respiratory viral infections reporting AKI and RRT were included. The exclusion

criteria were non-English articles, non-peer-reviewed articles, review articles, studies that included patients under the age of 18, studies including fewer than 10 patients, and studies not reporting AKI and RRT rates. Patients: Adult COVID-19, Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome (MERS), and influenza patients. Measurements: We extracted the following data from the included studies: author, year, study location, age, sex, race, diabetes mellitus, hypertension, chronic kidney disease, shock, vasopressor use, mortality, intensive care unit (ICU) admission, ICU mortality, AKI, and RRT. Methods: We systematically searched PubMed and EMBASE for articles reporting AKI or RRT. AKI was defined by authors of included studies. Critical illness was defined by ICU admission. We performed a random effects meta-analysis to calculate pooled estimates for the AKI and RRT rate within each virus group using a random intercept logistic regression model. Results: Of 23 655 hospitalized, critically ill COVID-19 patients, AKI frequencies were not significantly different between COVID-19 patients (51%, 95% confidence interval [CI]: 44%-57%) and critically ill patients infected with ACE2-associated (56%, 95% CI: 37%-74%, P = .610) or non-ACE2-associated viruses (63%, 95% CI: 43%-79%, P = .255). Pooled RRT rates were also not significantly different between critically ill, hospitalized patients with COVID-19 (20%, 95% CI: 16%-24%) and ACE2-associated viruses (18%, 95% CI: 8%-33%, P = .747). RRT rates for both COVID-19 and ACE2-associated viruses were significantly different (P < .001 for both) from non-ACE2-associated viruses (49%, 95% CI: 44%-54%). After adjusting for shock or vasopressor use, AKI and RRT rates were not significantly different between groups. Limitations: Limitations of this study include the heterogeneity of definitions of AKI that were used across different virus studies. We could not match severity of infection or do propensity matching across studies. Most of the included studies were conducted in retrospective fashion. Last, we did not include non-English publications. Conclusions: Our findings suggest that viral ACE2 association does not significantly alter the rates of AKI and RRT among critically ill patients admitted to the ICU. However, the rate of RRT is lower in patients with COVID-19 or ACE2-associated viruses when compared with patients infected with non-ACE2-binding viruses, which might partly be due to the lower frequencies of shock and use of vasopressors in these two virus groups. Prospective studies are necessary to demonstrate whether modulation of the ACE2 axis with Renin-Angiotensin System inhibitors impacts the rates of AKI and whether they are beneficial or harmful in COVID-19 patients.

Chan, K., et al. (2021). "The impact of COVID-19 telephone consultations on renal clinic non-attendance." Clin Med (Lond) **21**(Suppl 2): 45.

Chan, V. W., et al. (2021). "Delayed surgery for localised and metastatic renal cell carcinoma: a systematic review and meta-analysis for the COVID-19 pandemic." World J Urol **39**(12): 4295-4303.

PURPOSE: The COVID-19 pandemic has led to the cancellation or deferment of many elective cancer surgeries. We performed a systematic review on the oncological effects of delayed surgery for patients with localised or metastatic renal cell carcinoma (RCC) in the targeted therapy (TT) era. METHOD: The protocol of this review is registered on PROSPERO(CRD42020190882). A comprehensive literature search was performed on Medline, Embase and Cochrane CENTRAL using MeSH terms and keywords for randomised controlled trials and observational studies on the topic. Risks of biases were assessed using the Cochrane RoB tool and the Newcastle-Ottawa Scale. For localised RCC, immediate surgery [including partial nephrectomy (PN) and radical nephrectomy (RN)] and delayed surgery [including active surveillance (AS) and delayed intervention (DI)] were compared. For metastatic RCC, upfront versus deferred cytoreductive nephrectomy (CN) were compared. RESULTS: Eleven studies were included for quantitative analysis. Delayed surgery was significantly associated with worse cancer-specific survival (HR 1.67, 95% CI 1.23-2.27, p < 0.01) in T1a RCC, but no significant difference was noted for overall survival. For localised >/= T1b RCC, there were insufficient data for meta-analysis and the results from the individual reports were contradictory. For metastatic RCC, upfront TT followed by deferred CN was associated with better overall survival when compared to upfront CN followed by deferred TT (HR 0.61, 95% CI 0.43-0.86, p < 0.001). CONCLUSION: Noting potential selection bias, there is insufficient evidence to support the notion that delayed surgery is safe in localised RCC. For metastatic RCC, upfront TT followed by deferred CN should be considered.

Chang, Y. C., et al. (2021). "Biomarkers Linked with Dynamic Changes of Renal Function in Asymptomatic and Mildly Symptomatic COVID-19 Patients." J Pers Med **11**(5).

The catastrophic coronavirus disease 2019 (COVID-19) pandemic is currently a critical global issue. One well-known complication of COVID-19 in severe cases is acute kidney injury, but no research has given a description of its impact on the kidney in patients with mild symptoms. We explore the renal function changes in mild COVID-19 patients. This retrospective, single-center study included 27

participants with laboratory-detected severe acute respiratory syndrome coronavirus two (SARS-CoV-2) infection who were admitted to the Tri-Service General Hospital from 4 February to 26 May 2020 and analyzed their clinical features, radiological findings, and laboratory data. Data collected upon admission and discharge showed a median estimated glomerular filtration rate (eGFR) of 106.7 mL/min/1.732 m(2) and 112.2 mL/min/1.732 m(2), respectively, with a p-value of 0.044. A correlation between renal function and the severity of infection was also found and was statistically significant upon admission. Patients with a lower lymphocyte count or higher C-reactive protein, neutrophil count, and neutrophil-to-lymphocyte ratio presented with a decreased eGFR during their early infection phase. The biomarkers (CRP and NLR) may be linked with dynamic changes of renal function in COVID-19 patients who are asymptomatic or have mild symptoms.

Chen, C. C., et al. (2021). "Case Report: Anti-neutrophil Cytoplasmic Antibody-Associated Vasculitis With Acute Renal Failure and Pulmonary Hemorrhage May Occur After COVID-19 Vaccination." Front Med (Lausanne) **8**: 765447.

The rare and severe adverse effects associated with coronavirus disease of 2019 (COVID-19) vaccination have been under-appreciated, resulting in many instances of inappropriate management. We describe the case of an elderly woman who developed anti-neutrophil cytoplasmic antibody-associated vasculitis with pulmonary renal syndrome approximately 3 weeks after the first dose of COVID-19 mRNA vaccination (Moderna). Her nasopharyngeal polymerase chain reaction test for the COVID-19 RNA virus was negative. Gross hematuria, heavy proteinuria, acute renal failure (serum creatinine up to 6.5 mg/dL), and hemoptysis coupled with a marked increase in serum anti-myeloperoxidase-O antibody were observed. Renal biopsy showed severe vasculitis with pauci-immune crescent glomerulonephritis. The pulmonary hemorrhage was resolved and renal function improved following combined plasma exchange and the administration of systemic steroids and anti-CD20 therapy. The early examination of urinalysis and renal function may be crucial for identifying glomerulonephritis and acute renal failure in susceptible patients after COVID-19 vaccination.

Chen, K., et al. (2021). "Clinical outcomes of hospitalized COVID-19 patients with renal injury: a multi-hospital observational study from Wuhan." Sci Rep **11**(1): 15205.

Renal injury is common in patients with coronavirus disease 2019 (COVID-19). We aimed to determine the relationship of estimated glomerular filtration rate (eGFR) and acute kidney injury (AKI) with the characteristics, progression, and prognosis of COVID-19 in-patients. We retrospectively reviewed 1851 COVID-19 patients admitted to 3 hospitals in Wuhan, China. Clinical, laboratory, radiological, treatment, complication, and outcome data were analyzed. Patients were stratified according to levels of eGFR (>/= 90 vs. 60-89 vs. < 60 mL/min/1.73 m(2)). The risk of reaching the composite endpoint-intensive care unit admission, invasive ventilation, or death-was compared. On admission, 25.5% patients had renal impairment (eGFR < 90 mL/min/1.73 m(2)), but only 2.6% patients had chronic kidney disease (CKD). The overall in-hospital AKI incidence was 6.7%. Severe illness and comorbidities (hypertension, diabetes, CKD, and cardiovascular/cerebrovascular diseases) were more common among patients with low eGFR (< 90 mL/min/1.73 m(2)). Despite the more frequent use of intensive oxygen therapy, continuous blood purification, and glucocorticoid treatment, the prognosis of these patients was unsatisfactory, with the incidence of the composite endpoint (15.4% vs. 19.6% vs. 54.5%; P = 0.000) and complications (AKI, respiratory failure, cardiac injury, coagulation disorders, sepsis, etc.) increasing with decreasing eGFR. Kaplan-Meier survival analysis revealed that patients with eGFR < 90 mL/min/1.73 m(2) or AKI had significantly escalated risks of reaching the composite endpoint. Multivariate regression analysis showed that renal insufficiency (eGFR < 60 mL/min/1.73 m(2)) on admission and in-hospital AKI independently predicted poor prognosis among COVID-19 in-patients. And renal impairment on admission was a greater predictor of poor prognosis in non-elderly patients than that in elderly patients. Early and continuous renal-function monitoring and early AKI diagnosis are necessary to predict and prevent the progression of COVID-19.

Chen, S., et al. (2021). "Comparing the Value of Cystatin C and Serum Creatinine for Evaluating the Renal Function and Predicting the Prognosis of COVID-19 Patients." Front Pharmacol **12**: 587816.

Background: Coronavirus disease- (COVID-19-) related renal function abnormality is associated with poor prognosis. However, the clinical significance of dynamic changes in renal function indicators has not been studied, and no studies have evaluated the renal function in COVID-19 patients by cystatin C. Objective: This study aimed to evaluate the effect of abnormal renal function on admission on prognosis of COVID-19 patients and the prognostic value of various renal function indicators. Methods: A total of 1,764 COVID-19 patients without a history of chronic kidney disease were categorized into two groups, an elevated cystatin C group and a normal cystatin C group, based

on the results of renal function tests on admission. The clinical characteristics were compared between the two groups, and logistic or Cox regression analyses were performed to explore the associations between elevated cystatin C/serum creatinine levels and disease severity and survival. We also performed receiver operating characteristic (ROC) curve, Kaplan-Meier survival, and curve fitting analyses. Results: When adjusted for several significant clinical variables, elevated cystatin C levels on admission were independent predictors of disease severity ($p < 0.001$), and elevated creatinine levels were independent predictors of death ($p = 0.020$). Additionally, the ROC curve analysis shows that elevated cystatin C levels [area under the curve (AUC): 0.656] have a better predictive value for disease severity than elevated creatinine levels (AUC: 0.540). The survival curves of patients with elevated cystatin C/creatinine levels show a sharper decline than those of patients with normal cystatin C/creatinine levels ($p < 0.001$). The curve fitting analysis revealed that, compared to the flat curves of cystatin C and creatinine levels for patients who survived, the curves for patients who died kept rising, and cystatin C levels rose above the normal range earlier than creatinine. Conclusions: Elevated cystatin C, which occurs earlier than serum creatinine, is useful for the early detection of renal function abnormality and might have better predictive value for disease severity in COVID-19 patients, while elevated serum creatinine may have a better predictive value for risks of death.

Chen, X., et al. (2020). "COVID-19 associated thromboinflammation of renal capillary: potential mechanisms and treatment." Am J Transl Res **12**(12): 7640-7656.

Coronavirus disease 2019 (COVID-19) infected by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has become a global pandemic disease with high morbidity and mortality. Inflammatory and thrombosis are its main manifestations. As an important organ of hemofiltration metabolism, the kidney is prone to blockage and destruction when filter high inflammatory and high viscous blood of COVID-19, resulting in the loss of a large amount of protein, aggravating blood concentration, and then worsening COVID-19 hypercoagulability, which may explain the phenomenon of erythrocytes aggregation blocking the capillary lumen and the main reason why the kidney has become the second largest involvement organs. Therefore, this review discusses the effects of pathophysiological mechanisms such as inflammatory storm, endothelial injury, phosphatidylserine expression, extracellular traps release on renal capillary thrombosis caused by COVID-19 infection. Meanwhile, in view of the above mechanisms, we put forward the potential targets of antithrombotic therapy, and graded management of patients, reasonable use of drugs according to the severity of the disease and the choice of time. And we support the view of prevention of thrombus before admission, continuous anticoagulation and drug choice after discharge. It is suggested that the symptomatic and supportive treatment of renal disease in critically ill patients should be combined with the concept of antithrombotic therapy. The ultimate goal is to reduce the occurrence and development of kidney disease, provide direction for the current management of COVID-19 with kidney disease, and reduce the mortality of COVID-19.

Chenna, A., et al. (2020). "Coronavirus Disease 2019 (COVID-19) in a Renal Transplant Patient." Cureus **12**(5): e8038.

Coronavirus disease 2019 (COVID-19) has resulted in significant morbidity and mortality worldwide. Transplant patients are particularly at a higher risk of contracting COVID-19 because of their immunosuppressed state, and they have the propensity to develop opportunistic infections. The pre-immunosuppressed state, along with other existing comorbidities, can influence the outcomes of COVID-19 in transplant patients. We describe a case of a renal transplant patient who developed COVID-19. Real-time nucleic acid testing (NAT) should be done in deceased and living donors. The most common management strategy is the modification of immunosuppression along with current experimental strategies for COVID-19.

Choe, P. G., et al. (2021). "Exploration for the effect of renal function and renal replacement therapy on pharmacokinetics of remdesivir and GS-441524 in patients with COVID-19: A limited case series." Clin Transl Sci.

Remdesivir, an antiviral agent for the treatment of coronavirus disease 2019 (COVID-19), is metabolized intracellularly, with these metabolites eliminated predominantly in urine. Because of a lack of safety and pharmacokinetic (PK) data, remdesivir is not currently recommended for patients with estimated glomerular filtration rate less than 30 ml/min/1.73 m(2) and those on hemodialysis. This study evaluated the PKs of remdesivir and its metabolite, GS-441524, in patients with COVID-19 who were and were not receiving renal replacement therapy (RRT). This study enrolled two patients with normal renal function, two with impaired renal function not receiving RRT, two receiving continuous RRT (CRRT), and three undergoing intermittent hemodialysis (IHD). Patients were administered 200 mg remdesivir on the first day, followed by 100 mg/day for 5-10 days. Serial blood samples were collected for PK analysis, and PK

parameters were assessed by a noncompartmental method. Systemic exposure to remdesivir was higher in patients with impaired renal function and those receiving CRRT than in patients with normal renal function, but was similar in patients undergoing IHD and those with normal renal function. By contrast, systemic exposure to GS-441524 was highest in patients undergoing IHD, followed by patients with impaired renal function and those receiving CRRT, and lowest in patients with normal renal function. The PK profiles of remdesivir and GS-441524 varied according to renal function and RRT. The impact of PK changes of remdesivir and its metabolite on safety and efficacy should be considered when administering remdesivir to patients with COVID-19 with renal impairment.

Choudhary, G. R., et al. (2021). "COVID-19 and fatal renal mucormycosis: Contributory or coincidental?" Indian J Urol **37**(3): 270-273.

Association of mucormycosis with COVID-19 disease is emerging as a matter of concern, with multiple reports of rhino-cerebral-orbital and pulmonary involvement. The association of isolated renal mucormycosis in a patient with a history of COVID-19 infection is unknown. The immune dysregulation associated with COVID, along with the use of steroids, mechanical ventilation, and interleukin-6-directed therapies, predisposes to the development of mucormycosis. We report a rare case of primary renal mucormycosis in a young male following recovery from COVID-19. The unusual mode of presentation, rapidly progressive disease course, and the ensuing dilemmas in diagnosis and treatment merit critical analysis.

Ciancio, G., et al. (2021). "Challenging Cases of Renal Cell Cancers With or Without Tumor Thrombus During the Covid-19 Pandemic." Anticancer Res **41**(1): 335-340.

BACKGROUND/AIM: Large or bilateral multiple renal cell carcinoma (RCC) without/with tumor thrombus (TT) in the renal vein (RV) or inferior vena cava (IVC) poses a challenge to the surgeon due to the potential for massive hemorrhage, tumor thromboemboli and dialysis, and the situation is more critical due to Covid-19 pandemic. We report our experience and measures in dealing with challenging cases of large or multiple RCCs without/with TT during the ongoing Covid-19 pandemic. PATIENTS AND METHODS: Between 4/2020-10/2020, five patients underwent RCC resection with/without TT. Patients 1 and 2 had RCCs/TT in RV; Patient 3 had RCC/TT supradiaphragmatic below right atrium; Patient-4 had a 26 cm RCC; Patient-5 had multiple RCCS as part of Birt-Hogg-Dube syndrome. RESULTS: Patients were preoperatively tested negative for Covid-19. Operation times were 105, 85, 255, 200 and 247 minutes for Patients 1-5. Estimated blood loss was: 100, 50, 3,900,100 and 50 ml, respectively. Patient 3 underwent RCC resection en bloc with IVC/TT. Patients 1 and 2 underwent resections of RCC/TT in RV. Patient 4 underwent a 26 cm RCC resection. Patient 5 underwent laparoscopic bilateral radical nephrectomies. No immediate postoperative complications were reported. CONCLUSION: We successfully managed 5 challenging cases of RCCs despite the recommendations imposed by hospitals due to Covid-19 pandemic, with favorable outcomes.

Claure-Del Granado, R., et al. (2020). "Renal Replacement Therapy for Acute Kidney Injury in COVID-19 Patients in Latin America." Kidney Blood Press Res **45**(6): 775-783.

Corcillo, A., et al. (2021). "High prevalence of Afro-Caribbean ethnicity and hypoglycaemia in patients with diabetes and end stage renal disease hospitalized with COVID-19." Nephrology (Carlton) **26**(3): 252-254.

End stage renal disease (ESRD) is associated with a high mortality rate among patients hospitalized with COVID-19. To the best of our knowledge, there is limited data on the clinical features, ethnicity, inpatient glycaemic control and outcomes in patients with diabetes related ESRD in the literature. We report the clinical features and outcomes of 39 consecutive ESRD patients (28 on haemodialysis [HD] and 11 with renal transplant) secondary to diabetic kidney disease admitted to a university hospital with COVID-19. We observed a high prevalence of patients of Afro-Caribbean ethnicity hospitalized with COVID-19 with a 73% and 54% prevalence in renal transplant and HD groups respectively. The mortality rate of our cohort was 36%. Nearly a one-third of HD patients and one-fifth of transplant patients had hypoglycaemic events during COVID-19 hospitalization. Adjustment of diabetes treatment was frequently required. Our data highlight the importance of integrated multidisciplinary care of patients with diabetes related ESRD hospitalized with COVID-19.

Cozzolino, M., et al. (2020). "The COVID-19 infection in dialysis: are home-based renal replacement therapies a way to improve patient management?" J Nephrol **33**(4): 629-631.

Crespo, M., et al. (2021). "Negative immune responses to two-dose mRNA COVID-19 vaccines in renal allograft recipients assessed with simple antibody and interferon gamma release assay cellular monitoring." Am J Transplant.

Studies are urgently needed to characterize immunogenicity, efficacy, and safety of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) mRNA vaccines in kidney transplant (KT) recipients, excluded from major clinical trials. Complex ELISPOT and other cellular response techniques have been applied, but simpler tools are needed. An easy-to-use real-world monitoring of SARS-CoV-2 IgG antibodies against the Spike protein and QuantiFERON((R)) SARS-CoV-2 IFNgamma release assay (IGRA) were performed at baseline and 28 days after the second dose in KT recipients and controls (dialysis patients and healthy ones). All healthy controls and >95% dialysis controls became positive for anti-S IgG antibodies, while only 63.3% of KT patients seroconverted with a very low antibody level. A positive IGRA was documented in 96.9% of controls, 89.3% peritoneal dialysis, 77.6% hemodialysis, 61.3% of KT patients transplanted more than 1 year ago and only 36% of those transplanted within the previous 12 months. Overall, 100% of healthy controls, 95.4% of dialysis patients and 78.8% KT recipients developed any immune response (humoral and/or cellular) against SARS-CoV-2. KT patients showed low rates of immune responses to mRNA Coronavirus infectious disease 2019 vaccines, especially those with recent transplantations. Simple humoral and cellular monitoring is advisable, so that repeated doses may be scheduled according to the results.

Cruz, E. G., et al. (2021). "Renal Resistive Index as a Predictor of Acute Kidney Injury and Mortality in COVID-19 Critically Ill Patients." Blood Purif: 1-8.

BACKGROUND: Acute kidney injury (AKI) in patients with COVID-19 can be caused by multiple mechanisms. Renal resistive index (RRI) is a noninvasive instrument to evaluate kidney hemodynamics, and it is obtained by analysis of intrarenal arterial waves using Doppler ultrasound. This study aimed to determine the role of RRI in predicting AKI and adverse outcomes in critically ill patients with COVID-19. METHODS: This cross-sectional study included 65 patients with confirmed SARS-CoV-2 pneumonia admitted to the critical care unit from April 1, 2020, to June 20, 2020. Informed consent was obtained from all individual participants included in the study. Cardiac, pulmonary, and kidney ultrasonographic evaluations were performed in a protocolized way. RESULTS: In this cohort, 65 patients were included, mean age was 53.4 years, 79% were male, and 35% were diabetic. Thirty-four percent of patients developed AKI, 12% required RRT, and 35% died. Of the patients who developed AKI, 68% had RRI >/= 0.7. Also, 75% of the patients who required RRT had RRI >/= 0.7. In the adjusted Cox model, the RRI >/= 0.7 was associated with higher mortality (HR 2.86, 95% CI: 1.19-6.82, p = 0.01). CONCLUSIONS: Critical care ultrasonography is a noninvasive, reproducible, and accurate bedside method that has proven its usefulness. An elevated RRI may have a role in predicting AKI, RRT initiation, and mortality in patients with severe SARS-CoV-2 pneumonia.

Cuevas Tascon, G., et al. (2021). "[Renal infaction in a patient with COVID-19]." Nefrologia (Engl Ed) **41**(1): 84-87.

Cumhur Cure, M., et al. (2020). "NSAIDs may increase the risk of thrombosis and acute renal failure in patients with COVID-19 infection." Therapie **75**(4): 387-388.

Darrivere, L., et al. (2020). "[Erratum to "Acute renal failure during COVID-19 epidemic" [Prat. Anesth. Reanim. 24 (2020) 207-11]]." Prat Anesth Reanim **24**(6): 338.

[This corrects the article DOI: 10.1016/j.pratan.2020.07.004.].

Darriverre, L., et al. (2020). "[Acute renal failure during COVID-19 epidemic]." Prat Anesth Reanim **24**(4): 207-211.

Renal impairment is a common complication in patients hospitalized in intensive care unit for acute respiratory distress syndrome (ARDS) due to COVID-19 infection. However, the prevalence of SARS-CoV-2 kidney injury is difficult to estimate worldwide. Several pathophysiological mechanisms are involved, including decreased renal perfusion related to mechanical ventilation, sepsis and cytokines release, as well as direct virus toxicity on proximal tubular cells and podocytes, mediated by angiotensin 2 conversion receptors (ACE 2) and TMPRSS proteases. More than 20 % of ICU COVID-19 patients require extra renal replacement therapy (ERT) for acute renal failure that is made difficult by the hypercoagulable state of these patients, responsible for filter thrombosis.

Dastan, F., et al. (2020). "Continues renal replacement therapy (CRRT) with disposable hemoperfusion cartridge: A promising option for severe COVID-19." J Glob Antimicrob Resist **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.

De Fabritiis, M., et al. (2021). "Renal Thrombotic Microangiopathy in Concurrent COVID-19 Vaccination and Infection." Pathogens **10**(8).

We report on the development of nephrotic proteinuria and microhematuria, with histological features of renal thrombotic microangiopathy (TMA), following the first dose of BNT162b2 COVID-19 vaccine (Pfizer-BioNTech) and COVID-19 diagnosis. A 35-year-old previously healthy man was admitted at our hospital due to the onset of foamy urine. Previously, 40 days earlier, he had received the first injection of the vaccine, and 33 days earlier, the RT-PCR for SARS-CoV-2 tested positive. Laboratory tests showed nephrotic proteinuria (7.9 gr/day), microhematuria, serum creatinine 0.91 mg/dL. Kidney biopsy revealed ultrastructural evidence of severe endothelial cell injury suggestive of a starting phase of TMA. After high-dose steroid treatment administration, complete remission of proteinuria was achieved in a few weeks. The association of COVID-19 with renal TMA has been previously described only in patients with acute renal injury. Besides, the correlation with COVID-19 vaccine has not been reported so far. The close temporal proximity (7 days) between the two events opens the question whether the histological findings should be ascribed to COVID-19 itself or to vaccine injection.

Demirdogen, S. O., et al. (2021). "Treatment management of COVID-19 positive patients with renal colic secondary to distal ureteral stone." Int J Clin Pract **75**(5): e13976.

OBJECTIVE: In this study, we aimed to contribute to the literature by sharing and evaluating the clinical characteristics and our treatment and follow-up approaches in patients in the COVID-19 positive treatment process who had presented to our hospital's emergency department with a distal ureteral stone and to examine the effects of the pandemic and disease in this group of patients. METHOD: The study included 14 patients infected with COVID-19 who had presented to the Erzurum City Hospital Emergency Department between August 2020 and December 2020 with the complaint of renal colic in which distal ureteral stones were detected in the tests. The demographic and clinical characteristics of patients, laboratory and radiological examinations, characteristics of ureteral stones, details of treatments applied to patients, treatment procedures of patients who had undergone surgical treatment, patient files, visit and operation notes and the patient discharge reports were retrospectively reviewed and evaluated. RESULTS: The study included 14 patients. The average age of the patients was 35.7 (+/-14.35). The average stone size was 6.2 (+/-1.8) mm. Analgesic treatment and MET for distal ureteral stones were begun in 11 (78.6%) of the patients. Pain control was achieved in nine patients (64.2%) with analgesic treatment and MET, and the stone was removed without invasive intervention. Surgical intervention was performed in a total of five patients (35.7%). CONCLUSION: In most COVID-19 infected patients with renal colic and a distal ureteral stone, results can be obtained using MET. Patients with a distal ureteral stone and persistent renal colic can be safely and effectively treated by endoscopic ureteral stone treatment after taking necessary precautions. Prospective, randomised, and controlled studies are required on this subject.

Demirkan, H. and S. Yavuz (2021). "COVID-19 complicated with acute renal failure due to mycotic bezoars in two children." Arch Esp Urol **74**(7): 712-715.

OBJECTIVES: Patients with viral infection areat risk for secondary infections and/or co-infections. Ourstudy aims to describe coronavirus-disease-19 (COVID-19) associated with acute renal failure (ARF) secondary to fungalbezoar in urinary tract in two patients. METHODS: A chart review of two patients with COVID-19 associated pneumonia admitted to an education and training hospital Istanbul, Turkey were evaluated. RESULTS: On the first day of hospitalization, ARF was developed in both of them. Ultrasonography and computedtomography scan revealed image of urolithiasis and hydronephrosis. However, in their cystoscopies, there were densedebris materials leading to obstruction in calyceal system. Antifungal medication was added to the COVID-19 treatment due to the macroscopic aspect during the cystoscopy. Renal functions of the children were improved following the treatment. CONCLUSIONS: Clinicians caring for patients with COVID-19 should perform a comprehensive analysis to detect co-infections.

Dhaese, S., et al. (2021). "Augmented renal clearance in critically ill COVID-19 patients: Forewarned is forearmed." J Crit Care **66**: 93-95.

Dheir, H., et al. (2021). "Clinical course of COVID-19 disease in immunosuppressed renal transplant patients." Turk J Med Sci **51**(2): 428-434.

Background/aim: We aimed to identify clinical settings of renal transplant patients with COVID-19. Materials and methods: In this retrospective study, we included kidney transplant inpatients with laboratory confirmed COVID-19 who had been discharged or had died by October 1st, 2020. Characteristics of the patients, including basal and last outpatient biochemical parameters were recorded. Discontinuation or dosage reduction of

immunosuppressives and other treatment information was documented. Results: Twenty patients were included in this study, of whom 18 were discharged and 2 died in hospital. The mean duration of hospitalization and follow-up were 9.7 +/- 6.4 days and 4.5 +/- 2.0 months, respectively. Fourteen patients (70%) were male and mean age was 48.0 +/- 10.3 years. At admission, all had immunosuppression withdrawn and were started on methylprednisolone 16 mg/ day (50%) or dexamethasone (50%). Tacrolimus/m-TOR inhibitors were reduced by 50% and all antimetabolites were discontinued. Hemodialysis was needed for 10% of patients. Acute kidney injury was detected in 25% of the patients. With respect to hospitalization time and complications, there was no significant difference between patients who used dexamethasone and those who did not (P > 0.05). The discontinued immunosuppressives were resumed within 2 to 4 weeks after discharge according to the severity of disease. No rehospitalization or acute rejection was detected during the follow-up of the patients. Conclusion: Renal transplant patients are considered a high risk group for COVID-19. It can be said that discontinuation or reducing dosages of immunosuppressives may be effective and safe in kidney transplant patients.

Doher, M. P., et al. (2021). "Acute Kidney Injury and Renal Replacement Therapy in Critically Ill COVID-19 Patients: Risk Factors and Outcomes: A Single-Center Experience in Brazil." Blood Purif **50**(4-5): 520-530.

BACKGROUND: Critically ill patients with COVID-19 may develop multiple organ dysfunction syndrome, including acute kidney injury (AKI). We report the incidence, risk factors, associations, and outcomes of AKI and renal replacement therapy (RRT) in critically ill COVID-19 patients. METHODS: We performed a retrospective cohort study of adult patients with COVID-19 diagnosis admitted to the intensive care unit (ICU) between March 2020 and May 2020. Multivariable logistic regression analysis was applied to identify risk factors for the development of AKI and use of RRT. The primary outcome was 60-day mortality after ICU admission. RESULTS: 101 (50.2%) patients developed AKI (72% on the first day of invasive mechanical ventilation [IMV]), and thirty-four (17%) required RRT. Risk factors for AKI included higher baseline Cr (OR 2.50 [1.33-4.69], p = 0.005), diuretic use (OR 4.14 [1.27-13.49], p = 0.019), and IMV (OR 7.60 [1.37-42.05], p = 0.020). A higher C-reactive protein level was an additional risk factor for RRT (OR 2.12 [1.16-4.33], p = 0.023). Overall 60-day mortality was 14.4% {23.8% (n = 24) in the AKI group versus 5% (n = 5) in the non-AKI group (HR 2.79 [1.04-7.49], p = 0.040); and 35.3% (n = 12) in the RRT group versus 10.2% (n = 17) in the non-RRT group, respectively (HR 2.21 [1.01-4.85], p = 0.047)}. CONCLUSIONS: AKI was common among critically ill COVID-19 patients and occurred early in association with IMV. One in 6 AKI patients received RRT and 1 in 3 patients treated with RRT died in hospital. These findings provide important prognostic information for clinicians caring for these patients.

Duarte, P. M. A., et al. (2020). "Renal changes in COVID-19 infection." Rev Assoc Med Bras (1992) **66**(10): 1335-1337.

The COVID-19 (SARS-CoV-2) infection started in China, Wuhan City, Hubei Province, in December 2019, and it was declared a pandemic in mid-March 2020, caused by a new coronavirus strain called SARS-CoV-2. The pathogenesis of kidney injury attributed to SARS- CoV-2 is not well defined yet. Observations show that the kidney damage caused by the new virus mutation is mainly tubular, with impairment of glomerular filtration and high levels of urea and creatinine. A study with seriously ill patients with COVID-19 showed that acute kidney injury was present in 29%. In the face of this evidence, based on recent studies, we can see the great renal contribution as an impact factor in the evolution of COVID-19, not just as a complicator of severity, but maybe part of the initial cascade of the process, requiring a deeper analysis using conventional biomarkers of kidney injury and more aggressive clinical intervention in patients at risk, in an attempt to reduce mortality.

El Shamy, O., et al. (2021). "Bilateral Renal Artery Thrombosis in a Patient With COVID-19." Kidney Med **3**(1): 116-119.

Reports of the incidence of acute kidney injury in patients with coronavirus disease 2019 (COVID-19) have varied greatly from 0.5% to as high as 39%, with onset generally within 7 days from time of admission. The nature of the kidney insult is acute tubular necrosis, immune cell infiltration, or rhabdomyolysis, as demonstrated in autopsy reports. Moreover, infection with COVID-19 has been associated with coagulation abnormalities, as well as complement-mediated generalized thrombotic microvascular injury. These patients have been found to have high D-dimer, fibrin degradation product, and fibrinogen values, an elevated international normalized ratio, normal partial thromboplastin time, and normal platelet count values. Renal artery thrombosis is a rare condition, the most common cause of which is atrial fibrillation. However, bilateral completely occlusive renal artery thrombosis is even rarer. We present a case of a patient with COVID-19 on systemic anticoagulation therapy who presented with a serum creatinine level of 6.04 mg/dL requiring the initiation

of kidney replacement therapy and was found to have bilateral renal artery thrombosis.

Elec, A. D., et al. (2021). "COVID-19 after kidney transplantation: Early outcomes and renal function following antiviral treatment." Int J Infect Dis **104**: 426-432.

OBJECTIVES: The lack of effective treatments for coronavirus disease 2019 (COVID-19) has mandated the repurposing of several drugs, including antiretrovirals and remdesivir (RDV). These compounds may induce acute kidney injury and are not recommended in patients with poor renal function, such as kidney transplant (KTx) recipients. METHODS: The records of 42 KTx recipients with COVID-19 were reviewed. Some of them were receiving antiretrovirals (n = 10) or RDV (n = 8) as part of COVID-19 management. Most patients were male (71%) and their median age was 52 years. The median glomerular filtration rate in these patients was 56 ml/min. Regarding disease severity, 36% had mild disease, 19% had moderate disease, 31% had severe disease, and 12% had critical disease. Subgroups, i.e., patients receiving antiretrovirals, RDV, or no antivirals, were comparable in terms of patient age, comorbidities, and immunosuppression. RESULTS: Seven patients (16.6%) died during hospitalization. Acute kidney injury was found in 24% of KTx recipients at admission. Upon discharge, estimated glomerular filtration rate (eGFR) increased in 32% and decreased in 39% of the KTx recipients compared with the admission rate. The decrease was more prevalent in the RDV group (80%) compared with KTx recipients without any antiviral treatment (29%) ($p < 0.05$). Most patients (62%) returned to baseline eGFR values within 1 month of discharge. The proportion was similar between the patients receiving antiviral treatment and those not receiving this treatment. CONCLUSIONS: KTx recipients run a high risk of COVID-19-related renal impairment. Antivirals appear to be safe for use without major risks for kidney injury.

Elhadedy, M. A., et al. (2021). "COVID-19 in Renal Transplant Recipients: Case Series and a Brief Review of Current Evidence." Nephron **145**(2): 192-198.

By April 26, 2020, infections related to coronavirus disease 2019 (COVID-19) affected people from 210 countries and caused 203,818 reported deaths worldwide. A few studies discussed the outcome of COVID-19 in kidney transplant recipients. This short series demonstrates our experience in managing COVID-19 disease in renal transplant patients in the absence of strong evidence. We report 8 cases of kidney transplant recipients infected with COVID-19 (median age = 48.5 years; range = 21-71 years), including 4 males and 4 females. The most frequently associated comorbidity was hypertension. The most common presenting features were fever and cough. The main radiological investigation was a portable chest X-ray. Other common features included lymphopenia, high C-reactive protein, and a very high ferritin level. Overall, 1 patient was managed as an outpatient, the remaining 7 required hospital admission, 1 of them referred to the intensive therapy unit. Management included supportive treatment (intravenous fluid therapy, monitoring renal function, and symptomatic treatment with or without ward-based oxygen therapy depending on oxygen saturation) and discontinuation of the antiproliferative immunosuppressive drugs. Seven patients recovered and discharged home to self-isolate. One patient required intensive care treatment and mechanical ventilation. Supportive treatment could be sufficient for the management or to be tried first. We also found that short hospital stay with self-isolation on discharge reduces the burden on the health service and protect the staff and the public.

Endres, P., et al. (2021). "Filter clotting with continuous renal replacement therapy in COVID-19." J Thromb Thrombolysis **51**(4): 966-970.

Coronavirus disease 2019 (COVID-19) appears to be associated with increased arterial and venous thromboembolic disease. These presumed abnormalities in hemostasis have been associated with filter clotting during continuous renal replacement therapy (CRRT). We aimed to characterize the burden of CRRT filter clotting in COVID-19 infection and to describe a CRRT anticoagulation protocol that used anti-factor Xa levels for systemic heparin dosing. Multi-center study of consecutive patients with COVID-19 receiving CRRT. Primary outcome was CRRT filter loss. Sixty-five patients were analyzed, including 17 using an anti-factor Xa protocol to guide systemic heparin dosing. Fifty-four out of 65 patients (83%) lost at least one filter. Median first filter survival time was 6.5 [2.5, 33.5] h. There was no difference in first or second filter loss between the anti-Xa protocol and standard of care anticoagulation groups, however fewer patients lost their third filter in the protocolized group (55% vs. 93%) resulting in a longer median third filter survival time (24 [15.1, 54.2] vs. 17.3 [9.5, 35.1] h, $p = 0.04$). The rate of CRRT filter loss is high in COVID-19 infection. An anticoagulation protocol using systemic unfractionated heparin, dosed by anti-factor Xa levels is reasonable approach to anticoagulation in this population.

Eriksson, K. E., et al. (2021). "Continuous renal replacement therapy in intensive care patients with COVID-19; survival and renal recovery." J Crit Care **64**: 125-130.

BACKGROUND: Outcome for critically ill patients with COVID-19 treated with continuous renal replacement therapy (CRRT) is largely unknown. We describe mortality and renal outcome in this group. METHODS: This observational study was conducted at a university hospital in Sweden. We studied critically ill adult COVID-19 patients with Acute Kidney injury (AKI) who received CRRT. RESULTS: In 451 patients, AKI incidence was 43.7%. 18.2% received CRRT. Median age of CRRT patients was 60 years (IQR 54-65), 90% were male, median BMI was 29 (IQR 25-32), 23.2% had Diabetes, 37.8% hypertension and 6.1% chronic kidney disease prior to admission. 100% required mechanical ventilation. 8.5% received Extra Corporeal Membrane Oxygenation. Median length of stay was 23 days (IQR 15-26). ICU mortality was 39% and 90-day mortality was 45.1%. Age, baseline creatinine values and body weight change were associated with 60 days mortality. Of the survivors, no patients required dialysis at hospital discharge, 73.8% recovered renal function and a median 10.5% of body weight was lost during admission. CONCLUSIONS: Critically ill COVID-19 patients with AKI who received CRRT had a 90-day mortality of 45.1%. At follow-up, three quarters of survivors had recovered renal function. This information is important in the clinical management of COVID-19.

Faqeeh, S. and R. Madkhali (2020). "Acute reversible renal failure requiring temporary dialysis in a patient with COVID-19." Radiol Case Rep **15**(11): 2449-2452.

COVID-19 infection is associated with increased risk of acute kidney injury, but the imaging changes of the kidneys are not fully investigated yet. We report the computed tomography findings in a 17-year-old male who developed severe reversible renal impairment. Those findings are similar to the changes observed in patients with vasculitis and can be contributed to the thromboembolic manifestations associated with corona virus infection.

Feng, Y. F., et al. (2021). "The spatiotemporal trend of renal involvement in COVID-19: A pooled analysis of 17 134 patients." Int J Infect Dis **106**: 281-288.

BACKGROUND: The spatiotemporal trend of renal involvement in coronavirus disease 2019 (COVID-19) patients is still unclear. Therefore, the aim of this study was to reveal the dynamics of renal involvement superimposed COVID-19 according to time and space. METHODS: COVID-19 patients reporting renal involvement were included in this study. The following information was collected from relevant articles: first author, patient demographics, patient enrollment period, location, definition of acute kidney injury (AKI), prevalence of AKI, and use of renal replacement therapy (RRT). RESULTS: A total of 17 134 patients were finally included. The overall prevalence of AKI in COVID-19 patients was 19%, with 7% of them undergoing RRT. The overall risk of AKI in patients enrolled before March 1, 2020 (9%) was significantly lower than that after March 1, 2020 (36%) ($P < 0.00001$). Moreover, the overall risk of AKI outside Asia (35%) was significantly higher than that in Asia (10%) ($P < 0.00001$). Additionally, similar to patients requiring RRT, AKI patients were more likely to become seriously ill or even to die ($P < 0.00001$). CONCLUSIONS: This study found that renal involvement superimposed COVID-19, a comorbidity portending a poor prognosis, has become an increasingly serious problem over time and is more common outside Asia. Thus, more attention should be paid to the management of this specific group of patients.

Fisher, R., et al. (2021). "Provision of acute renal replacement therapy, using three separate modalities, in critically ill patients during the COVID-19 pandemic. An after action review from a UK tertiary critical care centre." J Crit Care **62**: 190-196.

PURPOSE: The aim of this study is to describe the incidence of Acute Kidney Injury (AKI) amongst patients admitted to the Intensive Care Unit (ICU) with COVID-19. In addition we aim to detail the range of Renal Replacement Therapy (RRT) modalities offered to these patients (including peritoneal dialysis - PD - and intermittent haemodialysis - IHD) in order to meet demand during pandemic conditions. MATERIALS AND METHODS: Single-centre retrospective case note review of adult patients with confirmed COVID-19 admitted to ICU. RESULTS: Amongst 136 patients without a prior history of End Stage Kidney Disease (ESKD), 108 (79%) developed AKI and 63% of admitted patients received RRT. Due to resource limitations the range of RRT options were expanded from solely Continuous Veno-Venous HaemoDiaFiltration (CVVHDF - our usual standard of care) to include PD (in 35 patients) and IHD (in 15 patients). During the study period the proportion of RRT provided within ICU as CVVHDF fell from 100% to a nadir of 39%. There were no significant complications of either PD or IHD. CONCLUSIONS: During periods of resource limitations PD and IHD can safely be used to reduce dependence on CVVHDF in select patients with AKI secondary to COVID-19.

Fominskiy, E. V., et al. (2021). "Prevalence, Characteristics, Risk Factors, and Outcomes of Invasively Ventilated COVID-19 Patients with Acute Kidney Injury and Renal Replacement Therapy." Blood Purif **50**(1): 102-109.

BACKGROUND: There is no information on acute kidney injury (AKI) and continuous renal replacement therapy (CRRT) among invasively ventilated coronavirus disease 2019 (COVID-19) patients in Western healthcare systems. OBJECTIVE: To study the prevalence, characteristics, risk factors and outcome of AKI and CRRT among invasively ventilated COVID-19 patients. METHODS: Observational study in a tertiary care hospital in Milan, Italy. RESULTS: Among 99 patients, 72 (75.0%) developed AKI and 17 (17.7%) received CRRT. Most of the patients developed stage 1 AKI (33 [45.8%]), while 15 (20.8%) developed stage 2 AKI and 24 (33.4%) a stage 3 AKI. Patients who developed AKI or needed CRRT at latest follow-up were older, and among CRRT treated patients a greater proportion had preexisting CKD. Hospital mortality was 38.9% for AKI and 52.9% for CRRT patients. CONCLUSIONS: Among invasively ventilated COVID-19 patients, AKI is very common and CRRT use is common. Both carry a high risk of in-hospital mortality.

Fukao, Y., et al. (2021). "COVID-19-induced acute renal tubular injury associated with elevation of serum inflammatory cytokine." Clin Exp Nephrol **25**(11): 1240-1246.

BACKGROUND: Severe acute respiratory syndrome Coronavirus 2 has rapidly spread worldwide, with acute kidney injury (AKI) as one of the manifestations with unknown causal mechanisms. We aimed to investigate tubular injury by assessing tubular markers and their association with the severity of Coronavirus disease 2019 (COVID-19). METHODS: We examined the associations between laboratory markers and urinary levels of N-acetyl-beta-D-glucosaminidase (uNAG), beta2-microglobulin (u beta2MG), alpha1-microglobulin (u alpha1MG), and liver-type fatty acid binding protein (L-FABP). We studied 18 COVID-19 patients without previous chronic kidney disease and analyzed the relationship between the urinary biomarkers and inflammatory markers in patients with severe (n = 7) or non-severe (n = 11) COVID-19, defined by requirements of supplemental oxygen. RESULTS: Fourteen patients (78%) showed abnormal urinalysis findings and two (11%) developed AKI. Patients with severe COVID-19 had significantly higher levels of proteinuria, uNAG, ubeta2MG, ualpha 1MG, and L-FABP than those with non-severe disease. Serum levels of interleukin-6 (IL-6) were significantly higher on admission in all severe COVID-19 cases and correlated with the levels of L-FABP, ubeta2MG, ualpha1MG, uNAG, and proteinuria. Moreover, the changes in serum IL-6 (DeltaIL-6) levels from baseline to 7 days after admission significantly correlated with DeltaL-FABP and Deltaubeta2MG. CONCLUSIONS: Levels of tubular injury markers, especially L-FABP and ubeta2MG, were significantly associated with IL-6 levels even in patients with no evident AKI. This suggests that L-FABP and ubeta2MG could be useful as early detective biomarkers for COVID-19 associated renal injury.

Gacitua, I., et al. (2021). "Extracorporeal CO2 removal and renal replacement therapy in acute severe respiratory failure in COVID-19 pneumonia: Case report." Semin Dial **34**(3): 257-262.

The COVID-19 pandemic significates an enormous number of patients with pneumonia that get complicated with severe acute respiratory distress syndrome (ARDS), some of them with refractory hypercapnia and hypoxemia that need mechanical ventilation (MV). Those patients who are not candidate to extracorporeal membrane oxygenation (ECMO), the extracorporeal removal of CO2 (ECCO2 R) can allow ultra protective MV to limit the transpulmonary pressures and avoid ventilatory induced lung injury (VILI). We report a first case of prolonged ECCO2 R support in 38 year male with severe COVID-19 pneumonia refractory to conventional support. He was admitted tachypneic and oxygen saturation 71% without supplementary oxygen. The patient's clinical condition worsens with severe respiratory failure, increasing the oxygen requirement and initiating MV in the prone position. After 21 days of protective MV, PaCO2 rise to 96.8 mmHg, making it necessary to connect to an ECCO2 R system coupled continuous veno-venous hemodialysis (CVVHD). However, due to the lack of availability of equipment in the context of the pandemic, a pediatric gas exchange membrane adapted to CVVHD allowed to maintain the removal of CO2 until completing 27 days, being finally disconnected from the system without complications and with a satisfactory evolution.

Gackler, A., et al. (2020). "[Acute renal failure in COVID-19]." Nephrologe: 1-4.

Acute kidney injury (AKI) is a frequent complication in coronavirus disease 2019 (COVID-19). It is often linked to progressive respiratory failure and is associated with increased morbidity and mortality. The AKI is presumably of multifactorial origin, whereby direct viral infestation of the kidneys also seems to be involved. Specific treatment procedures for AKI associated with COVID-19 are currently missing. In addition, the role of extracorporeal procedures in the treatment of COVID-19 could so far not be clarified. Latest data indicate persistent loss of renal function following COVID-19-associated AKI. Therefore, a re-evaluation of renal function following recovery from COVID-19 should be recommended.

Gasparini, M., et al. (2021). "Renal impairment and its impact on clinical outcomes in patients who are critically ill with COVID-19: a multicentre observational study." Anaesthesia **76**(3): 320-326.

Renal impairment is common in patients who are critically ill with coronavirus disease-19 (COVID-19). We examined the association between acute and chronic kidney disease with clinical outcomes in 372 patients with coronavirus disease-19 admitted to four regional intensive care units between 10 March 2020 and 31 July 2020. A total of 216 (58%) patients presented with COVID-19 and renal impairment. Acute kidney injury and/or chronic kidney disease was associated with greater in-hospital mortality compared with patients with preserved renal function (107/216 patients (50%) (95%CI 44-57) vs. 32/156 (21%) (95%CI 15-28), respectively; p < 0.001, relative risk 2.4 (95%CI 1.7-3.4)). Mortality was greatest in patients with renal transplants (6/7 patients (86%) (95%CI 47-100)). Mortality rates increased in patients with worsening renal injury according to the Kidney Disease: Improving Global Outcomes classification: stage 0 mortality 33/157 patients (21%) (95%CI 15-28) vs. stages 1-3 mortality 91/186 patients (49%) (95%CI 42-56); p < 0.001, relative risk 2.3 (95%CI 1.7-3.3). Survivors were less likely to require renal replacement therapy compared with non-survivors (57/233 patients (24%) vs. 64/139 patients (46%), respectively; p < 0.001, relative risk 1.9 (95%CI 1.4-2.5)). One-fifth of survivors who required renal replacement therapy acutely in intensive care continued to require renal support following discharge. Our data demonstrate that renal impairment in patients admitted to intensive care with COVID-19 is common and is associated with a high mortality and requirement for on-going renal support after discharge from critical care. Our findings have important implications for future pandemic planning in this patient cohort.

Gaudray, E., et al. (2021). "Renal replacement therapy in severe COVID-19 patients: Intermittent or continuous, the ongoing debate." Anaesth Crit Care Pain Med **40**(2): 100839.

Ged, Y., et al. (2020). "Advanced renal cell carcinoma and COVID-19 - a personal perspective." Nat Rev Urol **17**(8): 425-427.

Ghorbani, H., et al. (2021). "21-Fold Higher COVID-19 Mortality Rate in Patients with Severe Renal Dysfunction on Admission." Urol J.

Ginsburg, K. B., et al. (2021). "Association of Surgical Delay and Overall Survival in Patients With T2 Renal Masses: Implications for Critical Clinical Decision-making During the COVID-19 Pandemic." Urology **147**: 50-56.

OBJECTIVE: To test for an association between surgical delay and overall survival (OS) for patients with T2 renal masses. Many health care systems are balancing resources to manage the current COVID-19 pandemic, which may result in surgical delay for patients with large renal masses. METHODS: Using Cox proportional hazard models, we analyzed data from the National Cancer Database for patients undergoing extirpative surgery for clinical T2N0M0 renal masses between 2004 and 2015. Study outcomes were to assess for an association between surgical delay with OS and pathologic stage. RESULTS: We identified 11,848 patients who underwent extirpative surgery for clinical T2 renal masses. Compared with patients undergoing surgery within 2 months of diagnosis, we found worse OS for patients with a surgical delay of 3-4 months (hazard ratio [HR] 1.12, 95% confidence interval [CI] 1.00-1.25) or 5-6 months (HR 1.51, 95% CI 1.19-1.91). Considering only healthy patients with Charlson Comorbidity Index = 0, worse OS was associated with surgical delay of 5-6 months (HR 1.68, 95% CI 1.21-2.34, P= .002) but not 3-4 months (HR 1.08, 95% CI 0.93-1.26, P = 309). Pathologic stage (pT or pN) was not associated with surgical delay. CONCLUSION: Prolonged surgical delay (5-6 months) for patients with T2 renal tumors appears to have a negative impact on OS while shorter surgical delay (3-4 months) was not associated with worse OS in healthy patients. The data presented in this study may help patients and providers to weigh the risk of surgical delay versus the risk of iatrogenic SARS-CoV-2 exposure during resurgent waves of the COVID-19 pandemic.

Gisondi, P., et al. (2020). "Risk of hospitalization and death from COVID-19 infection in patients with chronic plaque psoriasis receiving a biologic treatment and renal transplant recipients in maintenance immunosuppressive treatment." J Am Acad Dermatol **83**(1): 285-287.

Giustiniano, E., et al. (2021). "Value of renal resistive index in covid-19 ARDS patients: an early inflammation alert for the lung-kidney cross-talk?" Recenti Prog Med **112**(3): 216-218.

We analysed RRI and other hemodynamic, re-spiratory and inflammation parameters in critically ill pa-tients affected by severe covid-19 with acute distress respi-ratory syndrome (ARDS) aiming at verifying their modifica-tions during supine and prone positioning and any mutual correlation or interplay with RRI.

Gok, S., et al. (2021). "The safety profile of favipiravir in COVID-19 patients with severe renal impairment." Int J Clin Pract: e14938.

OBJECTIVE: The safety profile of favipiravir in patients with severe renal impairment has not been investigated and available data are insufficient. The study aimed to compare the incidence of favipiravir-associated adverse events amongst patients with varying renal function statuses. METHODS: Records of 921 patients who were hospitalised for COVID-19 and had received at least 5 days of favipiravir treatment were retrospectively evaluated and 228 patients were included in the study. Patients' age, sex, comorbidities, estimated glomerular filtration rate (eGFR) and haematological and biochemical values were recorded. The incidence of adverse events was compared with the age, sex, comorbidities and eGFR of the patients. RESULTS: The mean age of the patients was 59.3 +/- 15.6 years, and 38.2% of the patients were women. One hundred and thirty-one (57.5%) patients had experienced adverse events. These adverse effects consisted of ALT elevation (35.5%), AST elevation (21.5%), anaemia (16.2%), hyperuricaemia (10.5%), hepatocellular injury (9.2%), neutropenia (3.5%) and thrombocytopenia (2.6%). The incidence of adverse events was not significantly different when patients had eGFR >60 mL/min/1.73 m(2) or eGFR 30-60 mL/min/1.73 m(2) (P > .05), but significantly increased when the eGFR dropped to <30 (P < .05). The differences seen with hyperuricaemia and anaemia were significant (P < .05). CONCLUSION: Even though favipiravir appeared to be well tolerated in the individuals with renal failure in this study, its use in this population remains a challenge that requires more research and analysis.

Grenon, E. and E. Canet (2021). "High Incidence of Circuit Clotting in Critically-ill COVID-19 Patients Treated With Renal Replacement Therapy." J Am Soc Nephrol.

Guida, B., et al. (2021). "Flavonoids and omega3-polyunsaturated fatty acid supplementation in renal transplant recipients: new arguments from COVID-19." J Nephrol.

Guillouet, S. and C. Thibault (2021). "[Reception of patients with chronic renal failure, COVID-19]." Rev Infirm **70**(271): 41-42.

The renal disease center of the university hospital of Caen Normandy (14) is dedicated to the ambulatory care of patients with chronic renal disease, including those treated by dialysis or transplanted. These are fragile patients and, for many of them, coming to the center is inevitable for their care. Faced with the COVID-19 pandemic, the care teams have shown a great capacity to adapt, even to be creative, in order to welcome and care for them in optimal safety conditions.

Guimaraes, R. G., et al. (2021). "Renal replacement therapy by the popliteal vein in a critical patient with COVID-19 in the prone position." J Bras Nefrol **43**(1): 132-134.

This patient was a 73-year-old man who initially came to our service with acute respiratory failure secondary to COVID-19. Soon after hospitalization, he was submitted to orotracheal intubation and placed in the prone position to improve hypoxia, due to severe acute respiratory syndrome (SARS). On the third day of hospitalization, he developed acute oliguric kidney injury and volume overload. The nephrology service was activated to obtain deep venous access for renal replacement therapy (RRT). The patient could not be placed in the supine position due to significant hypoxemia. A 50-cm Permcath (MAHURKARTM, Covidien, Massachusetts, USA) was inserted through the left popliteal vein. This case report describes a possible challenging scenario that the interventional nephrologist may encounter when dealing with patients with COVID-19 with respiratory impairment in the prone position.

Gupta, S., et al. (2021). "AKI Treated with Renal Replacement Therapy in Critically Ill Patients with COVID-19." J Am Soc Nephrol **32**(1): 161-176.

BACKGROUND: AKI is a common sequela of coronavirus disease 2019 (COVID-19). However, few studies have focused on AKI treated with RRT (AKI-RRT). METHODS: We conducted a multicenter cohort study of 3099 critically ill adults with COVID-19 admitted to intensive care units (ICUs) at 67 hospitals across the United States. We used multivariable logistic regression to identify patient-and hospital-level risk factors for AKI-RRT and to examine risk factors for 28-day mortality among such patients. RESULTS: A total of 637 of 3099 patients (20.6%) developed AKI-RRT within 14 days of ICU admission, 350 of whom (54.9%) died within 28 days of ICU admission. Patient-level risk factors for AKI-RRT included CKD, men, non-White race, hypertension, diabetes mellitus, higher body mass index, higher d-dimer, and greater severity of hypoxemia on ICU admission. Predictors of 28-day mortality in patients with AKI-RRT were older age, severe oliguria, and admission to a hospital with fewer ICU beds or one with greater regional density of COVID-19. At the end of a median follow-up of 17 days (range, 1-123 days), 403 of the 637 patients (63.3%) with AKI-RRT had died, 216 (33.9%) were discharged, and 18 (2.8%) remained hospitalized. Of the 216 patients discharged,

73 (33.8%) remained RRT dependent at discharge, and 39 (18.1%) remained RRT dependent 60 days after ICU admission. CONCLUSIONS: AKI-RRT is common among critically ill patients with COVID-19 and is associated with a hospital mortality rate of >60%. Among those who survive to discharge, one in three still depends on RRT at discharge, and one in six remains RRT dependent 60 days after ICU admission.

Guven, G., et al. (2021). "Cardio-Pulmonary-Renal Consequences of Severe COVID-19." Cardiorenal Med **11**(3): 133-139.

Severe acute respiratory syndrome coronavirus 2 has rapidly spread worldwide and resulted in the coronavirus disease 2019 (COVID-19) pandemic. The disease raised an unprecedented demand for intensive care support due to severe pulmonary dysfunction and multiorgan failure. Although the pulmonary system is the potential target of the COVID-19, recent reports have demonstrated that COVID-19 profoundly influences the cardiovascular system and the kidneys. Research studies on cadavers have shown that direct heart and kidney injury can be frequently seen in patients deceased due to COVID-19 infection. On the other hand, functional or structural dysfunction of the heart may deteriorate the renal function and vice versa. This concept is already known as the cardiorenal syndrome and may play a role in COVID-19. Proactive monitoring of micro- and macrohemodynamics could allow prompt correction of circulatory dysfunction and can be of pivotal importance in the prevention of acute kidney injury. Moreover, type and amount of fluid therapy and vasoactive drug support could help manage these patients either with or without mechanical ventilator support. This brief review outlines the current evidence regarding the COVID-19-related renal and cardiorenal complications and discusses potential hemodynamic management strategies.

Hakroush, S., et al. (2021). "Impact of the COVID-19 Pandemic on Kidney Diseases Requiring Renal Biopsy: A Single Center Observational Study." Front Physiol **12**: 649336.

Background: The coronavirus disease-2019 (COVID-19) pandemic impacted healthcare services for kidney disease patients. Lockdown and social distancing were mandated worldwide, resulting in closure of medical services. The diagnosis of various kidney diseases may have been delayed during the COVID-19 pandemic because non-urgent tests and visits were postponed due to closure of medical services during the lockdown. Methods: We here report the impact of the COVID-19 pandemic on a total number of 209 native kidney diseases requiring renal biopsy for diagnosis in a retrospective observational study from a tertiary hospital in Germany. Results: The lockdown period in March and April 2020 primarily affected patients admitted to the normal medical ward with a compensatory increased rate of renal biopsies in the postlockdown phase. In addition, there was a shift toward more patients admitted with hemoglobinuria during the COVID-19 pandemic. This phenomenon of an increased number of patients with hemoglobinuria during the COVID-19 pandemic was specifically observed in a subgroup with hypertensive nephropathy requiring renal biopsy and associated with increased proteinuria, not attributed to the COVID-19 lockdown period itself. Conclusion: To our knowledge, this is the first report of identifying a subpopulation susceptible to closure of medical services during the COVID-19 pandemic and diagnostic delay of specific kidney diseases. Therefore, the COVID-19 pandemic should be regarded as a risk factor especially in patients with diseases other than COVID-19 primarily admitted to the normal medical ward.

Han, L., et al. (2021). "Changes in renal failure mortality during the COVID-19 pandemic in the United States." J Nephrol **34**(6): 2167-2170.

Hanna, R. M., et al. (2021). "Building a hemodiafiltration system from readily available components for continuous renal replacement therapy under disasters and pandemics: preparing for an acute kidney injury surge during COVID-19." Curr Opin Nephrol Hypertens **30**(1): 93-96.

PURPOSE OF REVIEW: The novel corona virus (SARS-CoV2) has been demonstrated to cause acute kidney injury due to direct cellular toxicity as well as due to a variety of autoimmune glomerular diseases. The concept of a surge of infected patients resulting in an overwhelming number of critical patients has been a central concern in healthcare planning during the COVID-19 era. RECENT FINDINGS: One crucial question remains as to how to manage patients with end stage renal disease and acute kidney injury in case of a massive surge of critically ill infected patients. Some publications address practical and ingenious solutions for just such a surge of need for renal replacement therapy. We present a plan for using a blood pump, readily available dialysis filter, and a prefilter and postfilter replacement fluid set up. This is in conjunction with multiple intravenous pumps to develop a simple hemofiltration apparatus. SUMMARY: The current set up may be a readily available option for use in critical situations where the need for renal replacement therapy outstrips the capacity of traditional hemodialysis services in a hospital or region.

Haokip, N., et al. (2020). "Psychosocial Burdens of a Renal Transplant Recipient with COVID-19." Indian J Palliat Care **26**(Suppl 1): S168-S169.

The impact of COVID-19 on transplant recipients is yet to be fully understood. Apart from the physical implications, little has been discussed regarding the psychosocial burden it exerts on the already chronically ill patients. Here, we discuss a case of a 40-year-old male who received kidney transplantation 2 years ago and has tested positive for COVID-19. At the time of admission, he presented with mild symptoms and subsequently developed fever for which he had been managed conservatively. However, a comprehensive approach addressing psychosocial, emotional, and spiritual domains from a palliative care physician's perspective is often overlooked, whether in times of COVID-19 or not and this report aims to identify and assess such gaps.

Haq, K., et al. (2021). "Renal manifestations, incidence, pathogenesis and implications on prognosis and mortality in COVID-19 patients: A review of current evidence and the potential for future directions." Clin Nephrol **96**(2): 67-81.

Coronavirus disease 2019 (COVID-19) is a highly infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which has now spread into a worldwide pandemic. The pulmonary manifestations of this disease have been well described in literature, however COVID-19 can also cause severe and lasting harm in other organs including the kidneys, heart, and pancreas. Emerging evidence suggests that COVID-19 has multiple renal manifestations which impact the prognosis and mortality of this disease. Here we present a literature review of the current evidence of renal involvement in COVID-19 patients and the potential for future directions in management.

Harrison, S. L., et al. (2021). "End-Stage renal disease and 30-day mortality for adults with and without COVID-19." Eur J Intern Med **83**: 93-95.

Hasan, I., et al. (2021). "Predictors of disease severity and outcome of hospitalized renal transplant recipients with COVID-19 infection: a systematic review of a globally representative sample." Rom J Intern Med **59**(1): 10-42.

Introduction. COVID-19 presents a special challenge to the kidney transplant population.Methods. A systematic review of articles that examined COVID-19 in kidney transplant recipients was performed. Patients' demographics, clinical, laboratory and radiological presentations, immunosuppression modification, and COVID-19 specific management were abstracted and analyzed. COVID-19 severity was classified into mild, moderate, and severe. Disease outcome was classified by whether the patient was discharged, still hospitalized, or died.Results. 44 articles reporting individual data and 13 articles reporting aggregated data on 149 and 561 kidney transplant recipients respectively with COVID-19 from Asia, Europe and America fulfilled all inclusion and exclusion criteria. Among studies reporting case specific data, 76% of cases had severe disease. Compared to patients with mild/moderate disease, patients with severe disease had higher CRP, LDH, Ferritin, D-dimer and were more likely to have bilateral lung involvement at presentation and longer time since transplantation ($P < 0.05$ for all). Recipients' age, gender and comorbidities did not impact disease severity. Patients with severe disease had a more aggressive CNI reduction and more antiviral medications utilization. Outcome was reported on 145 cases, of those 34 (23%) died all with severe disease. Longer duration from transplant to disease diagnosis, hypoxia and higher LDH were associated with mortality ($P < 0.05$). Different immunosuppression reduction strategies, high dose parenteral corticosteroids use and various antiviral combinations did not demonstrate survival advantage. Similar finding was observed for studies reporting aggregated data.Conclusion. COVID-19 in kidney transplant patients is associated with high rate of disease severity and fatality. Higher LDH and longer time since transplantation predicted both disease severity and mortality. None of the COVID-19 specific treatment correlated with, or improved disease outcome in kidney transplant recipients.

He, T., et al. (2020). "Potential mechanisms of Chinese Herbal Medicine that implicated in the treatment of COVID-19 related renal injury." Saudi Pharm J **28**(9): 1138-1148.

Clinical studies have shown that renal injury in Corona Virus Disease 2019 (COVID-19) patients has been a real concern, which is associated with high mortality and an inflammation/apoptosis-related causality. Effective target therapy for renal injury has yet been developed. Besides, potential anti-COVID-19 medicines have also been reported to cause adverse side effects to kidney. Chinese Herbal Medicine (CHM), however, has rich experience in treating renal injury and has successfully applied in China in the battle of COVID-19. Nevertheless, the molecular mechanisms of CHM treatment are still unclear. In this study, we searched prescriptions in the treatment of renal injury extensively and the potential mechanisms to treat COVID-19 related renal injury were investigated. The association rules analysis showed that the core herbs includes Huang Qi, Fu Ling, Bai Zhu, Di Huang, Shan Yao. TCM herbs regulate core pathways,

such as AGE-RAGE, PI3K-AKT, TNF and apoptosis pathway, etc. The ingredients (quercetin, formononetin, kaempferol, etc.,) from core herbs could modulate targets (PTGS2 (COX2), PTGS1 (COX1), IL6, CASP3, NOS2, and TNF, etc.), and thereby prevent the pharmacological and non-pharmacological renal injury comparable to that from COVID-19 infection. This study provides therapeutic potentials of CHM to combat COVID-19 related renal injury to reduce complications and mortality.

Hertzberg, D., et al. (2021). "Experiences of Renal Replacement Therapy Delivery in Swedish Intensive Care Units during the COVID-19 Pandemic." Blood Purif: 1-6.

BACKGROUND: The COVID-19 pandemic led to a rapidly increased demand for intensive care unit (ICU) and renal replacement therapy (RRT) worldwide. RRT delivery was threatened by a lack of specially trained staff and equipment. We investigated how the first wave of COVID-19 affected RRT delivery in Swedish ICUs. METHODS: An Internet-based questionnaire was sent to ICU lead physicians which included quantitative and qualitative questions regarding RRT demand, equipment availability, and use of continuous renal replacement therapy (CRRT), intermittent haemodialysis (IHD), and peritoneal dialysis (PD) during spring 2020. RESULTS: Twenty-five ICUs responded and these treated 64% of COVID-19 ICU patients in Sweden. ICU capacity increased by 292% (IQR 171-347%). Median peak capacity was reached during the 18th week of the year. RRT use increased overall by 133% and in Stockholm by 188%. 36% of units sequestered CRRT machines. IHD was used in 68% and PD in 12% of ICUs. RRT fluid and filter shortages were experienced by 45% and 33% of wards, respectively; consequently, prescription alterations were made by 24% of ICUs. Calcium solution shortages were reported in 12% of units that led to citrate protocol changes. Staffing shortages resulted in RRT sometimes being delivered by non-RRT-trained staff, safety incidents relating to this occurred, although no patient harm was reported. CONCLUSION: During the first wave of the COVID-19 pandemic, RRT demand increased extensively causing staff and equipment shortages, altered CRRT protocols, and increased use of IHD and PD. The impact on patient outcomes should be assessed to effectively plan for further surge capacity RRT demand.

Hevia, V., et al. (2020). "Renal cell carcinoma and COVID-19 pandemia: Management strategies adapted to current practice." Arch Esp Urol **73**(5): 360-366.

The COVID-19 pandemic caused by SARS-CoV-2 virus has caused an important health impact that has affected renal cell carcinoma management, among other urology areas. The high cancellation rate of surgeries, including those related to renal cancer, will cause an inevitable healthcare overload and probably a potential negative impact on its oncological outcomes, especially in locally advanced and metastatic renal cancer. Kidney cancer scenarios are quite different depending on their stage, distinguishing mainly between low priority of localized disease or high priority of locally advanced and metastatic under active treatment. The unknown pandemic duration and possibly fluctuating prevalence of the virus are likely to force an adaptation in the management of renal cell carcinoma among urology and oncology departments, ideally individualized ona case-by-case basis within multidisciplinary units. To this end, we present algorithms and tables regarding renal cell carcinoma management adapted to the COVID-19 period and stratified according to oncological stage, which might be useful for specialists dedicated to this uro-oncology area.

Hittesdorf, E., et al. (2021). "Mortality and renal outcomes of patients with severe COVID-19 treated in a provisional intensive care unit." J Crit Care **62**: 172-175.

COVID-19 has created an enormous health crisis and this spring New York City had a severe outbreak that pushed health and critical care resources to the limit. A lack of adequate space for mechanically ventilated patients induced our hospital to convert operating rooms into critical care areas (OR-ICU). A large number of COVID-19 will develop acute kidney injury that requires renal replacement therapy (RRT). We included 116 patients with COVID-19 who required mechanical ventilation and were cared for in our OR-ICU. At 90 days and at discharge 35 patients died (30.2%). RRT was required by 45 of the 116 patients (38.8%) and 18 of these 45 patients (40%) compared to 17 with no RRT (23.9%, ns) died during hospitalization and after 90 days. Only two of the 27 patients who required RRT and survived required RRT at discharge and 90 days. When defining renal recovery as a discharge serum creatinine within 150% of baseline, 68 of 78 survivors showed renal recovery (87.2%). Survival was similar to previous reports of patients with severe COVID-19 for patients cared for in provisional ICUs compared to standard ICUs. Most patients with severe COVID-19 and AKI are likely to recover full renal function.

Ho, Q. Y., et al. (2020). "High-immunological risk living donor renal transplant during the COVID-19 outbreak: Uncertainties and ethical dilemmas." Am J Transplant **20**(7): 1949-1951.

Ho, Q. Y., et al. (2020). "Evaluating Potential Deceased Donor Renal Transplant Recipients for Asymptomatic COVID-19." Transplant Direct **6**(6): e559.

Hong, X. W., et al. (2020). "Characteristics of Renal Function in Patients Diagnosed With COVID-19: An Observational Study." Front Med (Lausanne) **7**: 409.

Objective: The aim of the study was to analyze the characteristics of renal function in patients diagnosed with COVID-19. Methods: In this retrospective, single-center study, we included all confirmed cases of COVID-19 in a tertiary hospital in Guangdong, China from January 20, 2020 to March 20, 2020. Blood and urine laboratory findings related to renal function were summarized, and the estimated glomerular filtration rate (eGFR) and endogenous creatinine clearance (Ccr) were also calculated to assess the renal function. Results: A total of 12 admitted hospital patients were diagnosed with COVID-19, included 3 severe cases, and 9 common cases. Serum creatinine (Scr) was not abnormally elevated in all of the patients, and blood urea nitrogen (BUN) was abnormally elevated in only 25.0% of the patients. However, compared with the recovery period, the patient's Scr and BUN increased significantly in peak of disease (p-scr = 0.002 & p-bun < 0.001). By observing the fluctuations in Scr and BUN from admission to recovery, it was found that the peak of Scr and BUN appeared within the first 14 day of the course of the disease. Urinary microprotein detection indicated that the abnormally elevated rates of urine microalbumin (UMA), alpha1-microglobulin (A1M), urine immunoglobulin-G (IGU), and urine transferring (TRU) standardized by urinary creatinine in peak of disease were 41.7, 41.7, 50.0, and 16.7%, respectively. The abnormal rates of the calculated eGFR and Ccr were 66.7 and 41.7%. Conclusion: Scr and BUN were generally increased during the course of COVID-19. Detection of urinary microproteins and application of multiple indicators assessment could be helpful for discovering abnormal renal function in patients with COVID-19. However, the evidence is limited due to the small sample size and observational nature. Additional studies, especially large prospective cohort studies, are required to confirm these findings.

Hossain, M. G., et al. (2021). "Emerging Role of Neuropilin-1 and Angiotensin-Converting Enzyme-2 in Renal Carcinoma-Associated COVID-19 Pathogenesis." Infect Dis Rep **13**(4): 902-909.

Neuropilin-1 (NRP1) is a recently identified glycoprotein that is an important host factor for SARS-CoV-2 infection. On the other hand, angiotensin-converting enzyme-2 (ACE2) acts as a receptor for SARS-CoV-2. Additionally, both NRP1 and ACE2 express in the kidney and are associated with various renal diseases, including renal carcinoma. Therefore, the expression profiles of NRP1 and ACE2 in kidney renal clear cell carcinoma (KIRC) and kidney renal papillary cell carcinoma (KIRP) patients from the various cancer databases were investigated along with their impact on patients' survivability. In addition, coexpression analysis of genes involved in COVID-19, KIRC, and KIRP concerning NRP1 and ACE2 was performed. The results demonstrated that both t NRP1 and ACE2 expressions are upregulated in KIRC and KIRP compared to healthy conditions and are significantly correlated with the survivability rate of KIRC patients. A total of 128 COVID-19-associated genes are coexpressed, which are positively associated with NRP1 and ACE2 both in KIRC and KIRP. Therefore, it might be suggested that, along with the ACE2, high expression of the newly identified host factor NRP1 in renal carcinomas may play a vital role in the increased risk of SARS-CoV-2 infection and survivability of COVID-19 patients suffering from kidney cancers. The findings of this investigation will be helpful for further molecular studies and prevention and/or treatment strategies for COVID-19 patients associated with renal carcinomas.

Huang, T. T., et al. (2021). "Successful Treatment of a Critically Ill COVID-19 Patient Using Continuous Renal Replacement Therapy With Enhanced Cytokine Removal and Tocilizumab: A Case Report." Front Med (Lausanne) **8**: 649583.

The COVID-19 pandemic has caused multiple deaths worldwide. Since no specific therapies are currently available, treatment for critically ill patients with COVID-19 is supportive. The most severe patients need sustained life support for recovery. We herein describe the course of a critically ill COVID-19 patient with multi-organ failure, including acute respiratory failure, acute kidney injury, and fulminant cytokine release syndrome (CRS), who required mechanical ventilation and extracorporeal membrane oxygenation support. This patient with a predicted high mortality risk was successfully managed with a careful strategy of oxygenation, uremic toxin removal, hemodynamic support, and most importantly, cytokine-targeted intervention for CRS, including cytokine/endotoxin removal, anti-cytokine therapy, and immune modulation. Comprehensive cytokine data, CRS parameters, and biochemical data of extracorporeal removal were provided to strengthen the rationale of this strategy. In this report, we demonstrate that timely combined hemoperfusion with cytokine adsorptive capacity and anti-cytokine therapy can successfully treat COVID-19 patients with fulminant CRS. It also highlights the importance of implementing cytokine-

targeted therapy for severe COVID-19 guided by the precise measurement of disease activity.

Huh, K., et al. (2020). "Impact of obesity, fasting plasma glucose level, blood pressure, and renal function on the severity of COVID-19: A matter of sexual dimorphism?" Diabetes Res Clin Pract **170**: 108515.

AIMS: This study aimed to assess whether body mass index (BMI), fasting plasma glucose (FPG) levels, blood pressure (BP), and kidney function were associated with the risk of severe disease or death in patients with COVID-19. METHODS: Data on candidate risk factors were extracted from patients' last checkup records. Propensity score-matched cohorts were constructed, and logistic regression models were used to adjust for age, sex, and comorbidities. The primary outcome was death or severe COVID-19, defined as requiring supplementary oxygen or higher ventilatory support. RESULTS: Among 7,649 patients with confirmed COVID-19, 2,231 (29.2%) received checkups and severe COVID-19 occurred in 307 patients (13.8%). A BMI of 25.0-29.9 was associated with the outcome among women (aOR, 2.29; 95% CI, 1.41-3.73) and patients aged 50-69 years (aOR, 1.64; 95% CI, 1.06-2.54). An FPG >/= 126 mg/dL was associated with poor outcomes in women (aOR, 2.06; 95% CI, 1.13-3.77) but not in men. Similarly, estimated glomerular filtration rate (eGFR) < 60 ml/min/1.73 m(2) was a risk factor in women (aOR, 3.46; 95% CI, 1.71-7.01) and patients aged < 70 years. CONCLUSIONS: The effects of BMI, FPG, and eGFR on outcomes associated with COVID-19 were prominent in women but not in men.

Husain-Syed, F., et al. (2021). "Renal markers for monitoring acute kidney injury transition to chronic kidney disease after COVID-19." Nephrol Dial Transplant **36**(11): 2143-2147.

Jarrin Tejada, C. D., et al. (2021). "Favorable outcome of COVID-19 among African American (AA) renal transplant recipients in Detroit." Clin Transplant **35**(2): e14169.

Transplant recipients are vulnerable to infections, including COVID-19, given their comorbidities and chronic immunosuppression. In this study, all hospitalized renal transplant recipients (RTR) with a positive nasal swab for Severe Acute Respiratory Syndrome-Coronavirus-2 (SARS-CoV2) seen consecutively between 03/01/2020 and 05/01/2020 at the Detroit Medical Center were included. Data on demographics, clinical presentation, laboratory findings, management, and outcomes were collected. Twenty-five patients were included, all African American (AA) and deceased-donor transplant recipients. The most common presenting symptom was dyspnea, followed by fever, cough and diarrhea. Multifocal opacities on initial chest x-ray were seen in 52% patients and 44% of patients had a presenting oxygen saturation of less than or equal to 94%. Four patients (16%) required transfer to the intensive care unit, one required intubation and one expired. COVID-19-infected RTR in this cohort had low mortality of 4% (n = 1). Despite multiple comorbidities and chronic immunosuppression, our cohort of African American RTR had favorable outcomes compared to other reports on COVID-19 in RTR.

Jentzsch, M. S., et al. (2021). "Abdominal Pain Due to Renal Infarction: An Unexpected Presentation of COVID-19." R I Med J (2013) **104**(6): 16-19.

Although respiratory symptoms dominate the clinical presentation of COVID-19, atypical, misleading non-pulmonary complaints can occur. Here we present a case of an otherwise healthy 28-year-old cisgender woman whose initial presentation of COVID-19 was unexplained acute abdominal pain, which was later found to be due to renal infarction. She was treated with anti-coagulation and was discharged after a short hospital stay. This case demonstrates the heterogeneous presentations that are associated with COVID-19. Medical providers must be aware that this virus may mimic a diverse array of disorders, even in the absence of respiratory symptoms.

Jespersen Nizamic, T., et al. (2021). "COVID-19 Manifesting as Renal Allograft Dysfunction, Acute Pancreatitis, and Thrombotic Microangiopathy: A Case Report." Transplant Proc **53**(4): 1211-1214.

Coronavirus disease 2019 (COVID-19) is associated with high morbidity and mortality worldwide in both the general population and kidney transplant recipients. Acute kidney injury is a known complication of COVID-19 and appears to most commonly manifest as acute tubular injury on renal biopsy. Coagulopathy associated with COVID-19 is a known but poorly understood complication that has been reported to cause thrombotic microangiopathy on rare occasions in native kidneys of patients with COVID-19. Here, we report the first case of biopsy-proven thrombotic microangiopathy in a kidney transplant recipient with COVID-19 who developed acute pancreatitis and clinical features of microangiopathic hemolytic anemia. The patient recovered with supportive care alone.

Jha, P. K., et al. (2021). "A retrospective multi-center experience of renal transplants from India during COVID-19 pandemic." Clin Transplant **35**(10): e14423.

INTRODUCTION: Coronavirus disease 2019 (COVID-19) pandemic led to a sudden drop in renal transplant numbers across India in the initial months of 2020. Although the transplant numbers increased with easing of lockdown, the outcome of these transplants remains unknown. METHODS: This was a retrospective, observational, multi-center study done across eight different transplant centers in India. All the transplants done from January 30, 2020 to December 31, 2020 were included. The primary outcomes studied were patient and death censored graft survival as well as incidence of COVID-19 infection and its outcomes. RESULTS: During the study period a total of 297 kidney transplants were done. After a median follow up of 265 days the patient and death censored graft survival was 95.3% and 97.6%, respectively. Forty-one patients (13.8%) developed COVID-19 post-transplant. Majority (58.5%) were asymptomatic to mildly symptomatic and the case fatality ratio was 14.6%. On multivariable logistic regression analysis older age was associated with higher likelihood of COVID-19 infection (odds ratio 1.038; CI 1.002-1.077). CONCLUSIONS: Patient and graft outcome of kidney transplants done during the COVID-19 pandemic in India was acceptable. The incidence of COVID-19 was 13.8% with a high case fatality ratio.

Johnson, K. M., et al. (2020). "Managing COVID-19 in Renal Transplant Recipients: A Review of Recent Literature and Case Supporting Corticosteroid-sparing Immunosuppression." Pharmacotherapy **40**(6): 517-524.

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.

Kapp, M. E., et al. (2021). "Renal Considerations in COVID-19: Biology, Pathology, and Pathophysiology." ASAIO J **67**(10): 1087-1096.

Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) has emerged into a worldwide pandemic of epic proportion. Beyond pulmonary involvement in coronavirus disease 2019 (COVID-19), a significant subset of patients experiences acute kidney injury. Patients who die from severe disease most notably show diffuse acute tubular injury on postmortem examination with a possible contribution of focal macro- and microvascular thrombi. Renal biopsies in patients with proteinuria and hematuria have demonstrated a glomerular dominant pattern of injury, most notably a collapsing glomerulopathy reminiscent of findings seen in human immunodeficiency virus (HIV) in individuals with apolipoprotein L-1 (APOL1) risk allele variants. Although various mechanisms have been proposed for the pathogenesis of acute kidney injury in SARS-CoV-2 infection, direct renal cell infection has not been definitively demonstrated and our understanding of the spectrum of renal involvement remains incomplete. Herein we discuss the biology, pathology, and pathogenesis of SARS-CoV-2 infection and associated renal involvement. We discuss the molecular biology, risk factors, and pathophysiology of renal injury associated with SARS-CoV-2 infection. We highlight the characteristics of specific renal pathologies based on native kidney biopsy and autopsy. Additionally, a brief discussion on ancillary studies and challenges in the diagnosis of SARS-CoV-2 is presented.

Katagiri, D., et al. (2021). "Continuous Renal Replacement Therapy for a Patient with Severe COVID-19." Blood Purif **50**(1): 129-131.

The outbreak of coronavirus disease 2019 (COVID-19) is a global health threat. It is a respiratory disease, and acute kidney injury (AKI) is rare; however, if a patient develops severe AKI, renal replacement therapy (RRT) should be considered. Recently, we had a critically ill COVID-19 patient who developed severe AKI and needed continuous RRT (CRRT). To avoid the potential risk of infection from CRRT effluents, we measured severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) genetic material in the effluents by qRT-PCR, and low copy numbers of the viral genome were detected. Due to unstable hemodynamic status in critically ill patients, CRRT should be the first choice for severe AKI in COVID-19 patients. We suggest prevention of clinical infection and control during administration of RRT in

the acute phase of COVID-19 patients with AKI or multiple organ failure.

Kaye, A. D., et al. (2021). "COVID-19 impact on the renal system: Pathophysiology and clinical outcomes." Best Pract Res Clin Anaesthesiol **35**(3): 449-459.

Coronavirus disease (COVID-19) causes many deleterious effects throughout the body. Prior studies show that the incidence of acute kidney injury in COVID-19 patients could be as high as 25%. There are also autopsy reports showing evidence of viral tropism to the renal system. In this regard, COVID-19 can damage the kidneys and increase a patient's risk of requiring dialysis. Available evidence suggests that renal involvement in COVID-19 infection is not uncommon, and there has been an increased incidence of chronic kidney disease related to the pandemic. In this literature analysis, we address COVID-19 and its effects on the renal system, including the pathophysiologic mechanisms. We also address current studies on the causes of injury to the renal system, the cause of kidney failure, its effect on mortality, the impact on dialysis patients, and the impact on renal transplant patients. COVID-19 disease may have unique features in individuals on chronic dialysis and kidney transplant recipients, requiring increased vigilance in limiting viral transmission in perioperative, in-patient, and dialysis center settings.

Kee, T., et al. (2020). "Managing a Renal Transplant Programme During the COVID-19 Pandemic: Practical Experience from a Singapore Transplant Centre." Ann Acad Med Singap **49**(9): 652-660.

INTRODUCTION: Coronavirus Disease 2019 (COVID-19) has significantly affected the way healthcare is delivered in Singapore. Healthcare services such as renal transplantation had to rapidly adjust and meet the needs to (1) protect patients and staff, (2) ramp up, conserve or redeploy resources while (3) ensuring that critical services remained operational. This paper aims to describe the experience of the renal transplant programme at the Singapore General Hospital (SGH) in responding to the risks and constraints posed by the pandemic. METHODS AND MATERIALS: This is a review and summary of the SGH renal transplant programme's policy and protocols that were either modified or developed in response to the COVID-19 Pandemic. RESULTS: A multi-pronged approach was adopted to respond to the challenges of COVID-19. These included ensuring business continuity by splitting the transplant team into different locations, adopting video and tele-consults to minimise potential patient exposure to COVID-19, streamlining work processes using electronic forms, ensuring safe paths for patients who needed to come to hospital, ring-fencing and testing new inpatients at risk for COVID-19, enhancing precautionary measures for transplant surgery, ensuring a stable supply chain of immunosuppression, and sustaining patient and staff education programmes via video conferencing. CONCLUSIONS: Though the COVID-19 pandemic has reduced access to kidney transplantation, opportunities arose to adopt telemedicine into mainstream transplant practice as well as use electronic platforms to streamline work processes. Screening protocols were established to ensure that transplantation could be performed safely, while webinars reached out to empower patients to take precautions against COVID-19.

Kemmner, S., et al. (2020). "Cyclosporine as a preferred calcineurin inhibitor in renal allograft recipients with COVID-19 infection." Kidney Int **98**(2): 507-508.

Kerget, B., et al. (2020). "Atypical Presentation of COVID-19: Acute Renal Failure." Eurasian J Med **52**(2): 224-226.

Coronavirus disease (COVID-19) emerged in Wuhan, China, in December 2019 and rapidly became a global pandemic, with the number of confirmed infections worldwide reaching 1 million by the start of April 2020 and 3 million less than a month later. COVID-19 can be encountered with different clinical presentations. We present the case of a patient with COVID-19 in the etiology presenting with acute renal failure.

Khadzhynov, D., et al. (2021). "Efficacy and complications of regional citrate anticoagulation during continuous renal replacement therapy in critically ill patients with COVID-19." J Crit Care **67**: 126-131.

BACKGROUND: We compared filter survival and citrate-induced complications during continuous renal replacement therapy (CRRT) with regional citrate anticoagulation (RCA) in COVID-19 and Non-COVID-19 patients. METHODS: In this retrospective study we included all consecutive adult patients (n = 97) treated with RCA-CRRT. Efficacy and complications of RCA-CRRT were compared between COVID-19 and Non-COVID-19 patients. RESULTS: Mean filter run-time was significantly higher in COVID-19 patients compared to Non-COVID-19 patients (68.4 (95%CI 67.0-69.9) vs. 65.2 (95%CI 63.2-67.2) hours, respectively; log-rank 0.014). COVID-19 patients showed significantly higher activated partial thromboplastin time (aPTT) throughout the CRRT due to intensified systemic anticoagulation compared to Non-COVID-19 patients (54 (IQR 45-61) vs. 47 (IQR 41-58) seconds, respectively; $p < 0.001$). A significantly higher incidence of metabolic alkalosis, hypercalcemia and

hypernatremia, consistent with reduced filter patency and citrate overload, was observed in COVID-19 patients compared to Non-COVID-19 patients (19.1% vs. 12.7%, respectively; p = 0.04). These metabolic disarrangements were resistant to per-protocol adjustments and disappeared after replacement of the CRRT-filter. CONCLUSIONS: RCA-CRRT in COVID-19 patients with intensified systemic anticoagulation provides an adequate filter lifespan. However, close monitoring of the acid-base balance appears warranted, as these patients tend to develop reduced filter patency leading to a higher incidence of citrate overload and metabolic disturbances. TRIAL REGISTRATION (LOCAL AUTHORITY): EA1/285/20 (Ethikkommission der Charite - Universitatsmedizin Berlin); date of registration 08.10.2020.

Kho, M. M. L., et al. (2021). "The RECOVAC IR study: the immune response and safety of the mRNA-1273 COVID-19 vaccine in patients with chronic kidney disease, on dialysis, or living with a kidney transplant - a prospective, controlled, multicenter observational cohort by the REnal patients COVID-19 VACcination (RECOVAC) consortium COVID-19 VACcination (RECOVAC) consortium." Nephrol Dial Transplant.

Khoshdel-Rad, N., et al. (2021). "Outbreak of chronic renal failure: will this be a delayed heritage of COVID-19?" J Nephrol **34**(1): 3-5.

Khoury, E. E., et al. (2021). "Pulmonary, cardiac and renal distribution of ACE2, furin, TMPRSS2 and ADAM17 in rats with heart failure: Potential implication for COVID-19 disease." J Cell Mol Med **25**(8): 3840-3855.

Congestive heart failure (CHF) is often associated with kidney and pulmonary dysfunction. Activation of the renin-angiotensin-aldosterone system (RAAS) contributes to avid sodium retention, cardiac hypertrophy and oedema formation, including lung congestion. While the status of the classic components of RAAS such as renin, angiotensin converting enzyme (ACE), angiotensin II (Ang II) and angiotensin II receptor AT-1 is well studied in CHF, the expression of angiotensin converting enzyme-2 (ACE2), a key enzyme of angiotensin 1-7 (Ang 1-7) generation in the pulmonary, cardiac and renal systems has not been studied thoroughly in this clinical setting. This issue is of a special interest as Ang 1-7 counterbalance the vasoconstrictory, pro-inflammatory and pro-proliferative actions of Ang II. Furthermore, CHF predisposes to COVID-19 disease severity, while ACE2 also serves as the binding domain of SARS-CoV-2 in human host-cells, and acts in concert with furin, an important enzyme in the synthesis of BNP in CHF, in permeating viral functionality along TMPRSST2. ADAM17 governs ACE2 shedding from cell membranes. Therefore, the present study was designed to investigate the expression of ACE2, furin, TMPRSS2 and ADAM17 in the lung, heart and kidneys of rats with CHF to understand the exaggerated susceptibility of clinical CHF to COVID-19 disease. Heart failure was induced in male Sprague Dawley rats by the creation of a surgical aorto-caval fistula. Sham-operated rats served as controls. One week after surgery, the animals were subdivided into compensated and decompensated CHF according to urinary sodium excretion. Both groups and their controls were sacrificed, and their hearts, lungs and kidneys were harvested for assessment of tissue remodelling and ACE2, furin, TMPRSS2 and ADAM17 immunoreactivity, expression and immunohistochemical staining. ACE2 immunoreactivity and mRNA levels increased in pulmonary, cardiac and renal tissues of compensated, but not in decompensated CHF. Furin immunoreactivity was increased in both compensated and decompensated CHF in the pulmonary, cardiac tissues and renal cortex but not in the medulla. Interestingly, both the expression and abundance of pulmonary, cardiac and renal TMPRSS2 decreased in CHF in correlation with the severity of the disease. Pulmonary, cardiac and renal ADAM17 mRNA levels were also downregulated in decompensated CHF. Circulating furin levels increased in proportion to CHF severity, whereas plasma ACE2 remained unchanged. In summary, ACE2 and furin are overexpressed in the pulmonary, cardiac and renal tissues of compensated and to a lesser extent of decompensated CHF as compared with their sham controls. The increased expression of the ACE2 in heart failure may serve as a compensatory mechanism, counterbalancing the over-activity of the deleterious isoform, ACE. Downregulated ADAM17 might enhance membranal ACE2 in COVID-19 disease, whereas the suppression of TMPRSS2 in CHF argues against its involvement in the exaggerated susceptibility of CHF patients to SARS-CoV2.

Kim, K., et al. (2020). "Prognostic Significance of COVID-19 Receptor ACE2 and Recommendation for Antihypertensive Drug in Renal Cell Carcinoma." Biomed Res Int **2020**: 2054376.

Purpose: Owing to its worldwide spread, the coronavirus disease (COVID-19) epidemic was declared a pandemic by the World Health Organization on March 11, 2020. Angiotensin-converting enzyme 2 (ACE2) is the outer surface protein of the cell membrane that is abundantly distributed in the heart, lungs, and kidneys and plays an important role in

molecular docking of the severe acute respiratory syndrome coronavirus 2. In this study, we aimed to analyze the difference in the survival rate according to ACE2 expressions in pan-cancer. Materials and Methods: We downloaded clinical and genomic data from The Cancer Genome Atlas. We used Kaplan-Meier with a log-rank test, and the Cox proportional hazards regression to analyze prognostic significance. Results: In the Kaplan-Meier curve, clear cell renal cell carcinoma (ccRCC), uveal melanoma, and prostate adenocarcinoma showed statistical significance. In the Cox regression, thyroid carcinoma and glioblastoma multiforme and ccRCC showed significant results. Only ccRCC had statistical significance, and high ACE2 expression is related to good prognosis. It is known that the ACE inhibitor, a primary antihypertensive agent, increases ACE2 expression. Conclusion: Based on these results, we believe that the ACE inhibitor will be important to increase the lifespan of ccRCC patients. This study is the first research to offer a recommendation on the use of anti-hypertensive drugs to ccRCC patients.

Kistner, A., et al. (2021). "Correction to: Negative effects of iodine-based contrast agent on renal function in patients with moderate reduced renal function hospitalized for COVID-19." BMC Nephrol **22**(1): 326.

Kistner, A., et al. (2021). "Negative effects of iodine-based contrast agent on renal function in patients with moderate reduced renal function hospitalized for COVID-19." BMC Nephrol **22**(1): 297.

BACKGROUND: Kidney disease and renal failure are associated with hospital deaths in patients with COVID - 19. We aimed to test if contrast enhancement affects short-term renal function in hospitalized COVID - 19 patients. METHODS: Plasma creatinine (P-creatinine) was measured on the day of computed tomography (CT) and 24 h, 48 h, and 4-10 days after CT. Contrast-enhanced (n = 142) and unenhanced (n = 24) groups were subdivided, based on estimated glomerular filtration rates (eGFR), > 60 and </= 60 ml/min/1.73 m(2). Contrast-induced acute renal failure (CI-AKI) was defined as >/=27 mumol/L increase or a > 50% rise in P-creatinine from CT or initiation of renal replacement therapy during follow-up. Patients with renal replacement therapy were studied separately. We evaluated factors associated with a > 50% rise in P-creatinine at 48 h and at 4-10 days after contrast-enhanced CT. RESULTS: Median P-creatinine at 24-48 h and days 4-10 post-CT in patients with eGFR> 60 and eGFR>/=30-60 in contrast-enhanced and unenhanced groups did not differ from basal values. CI-AKI was observed at 48 h and at 4-10 days post contrast administration in 24 and 36% (n = 5/14) of patients with eGFR>/=30-60. Corresponding figures in the eGFR> 60 contrast-enhanced CT group were 5 and 5% respectively, ($p < 0.037$ and $p < 0.001$, Pearson chi(2) test). In the former group, four of the five patients died within 30 days. Odds ratio analysis showed that an eGFR>/=30-60 and 30-day mortality were associated with CK-AKI both at 48 h and 4-10 days after contrast-enhanced CT. CONCLUSION: Patients with COVID - 19 and eGFR>/=30-60 had a high frequency of CK-AKI at 48 h and at 4-10 days after contrast administration, which was associated with increased 30-day mortality. For patients with eGFR>/=30-60, we recommend strict indications are practiced for contrast-enhanced CT. Contrast-enhanced CT had a modest effect in patients with eGFR> 60.

Kitamura, A., et al. (2021). "Improvement of COVID-19 with renal failure and paralytic ileus by using steroids." Respirol Case Rep **9**(1): e00689.

A 51-year-old man attended our hospital with chief complaints of fever and diarrhoea for the past eight days. Chest computed tomography showed peripherally dominant ground-glass opacity. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) RNA was detected by real-time polymerase chain reaction, and the patient was diagnosed with coronavirus disease (COVID-19). His clinical course included respiratory failure, acute kidney injury, and paralytic ileus. Systemic management was difficult, but he recovered with high-dose steroids, temporary haemodialysis therapy, and a nasointestinal tube, without antiviral drugs. COVID-19 can be associated with multiple organ failure due to vascular endothelial injury.

Kow, C. S. and S. S. Hasan (2021). "Revascularization in COVID-19 patients with renal infarction." Am J Transplant **21**(3): 1345.

Kundal, S., et al. (2020). "Aortic thrombosis and renal infarction in a young female with patent foramen ovale and COVID-19 antibody." Clin Case Rep.

Thrombotic complications in patients with prior COVID-19 infection raises concern for a persistent hypercoagulable state among these patients. Thus, there is a dire need for further research aimed at anticoagulation guidelines for the same.

Kunutsor, S. K. and J. A. Laukkanen (2020). "Renal complications in COVID-19: a systematic review and meta-analysis." Ann Med **52**(7): 345-353.

PURPOSE: Emerging data suggest that coronavirus disease 2019 (COVID-19) has extrapulmonary manifestations but its renal manifestations are not clearly defined. We aimed to

evaluate renal complications of COVID-19 and their incidence using a systematic meta-analysis. DESIGN: Observational studies reporting renal complications in COVID-19 patients were sought from MEDLINE, Embase and the Cochrane Library from 2019 to June 2020. The nine-star Newcastle-Ottawa Scale was used to evaluate methodological quality. Incidence with 95% confidence intervals (CIs) were pooled using random-effects models. RESULTS: We included 22 observational cohort studies comprising of 17,391 COVID-19 patients. Quality scores of studies ranged from 4 to 6. The pooled prevalence of pre-existing chronic kidney disease (CKD) and end-stage kidney disease was 5.2% (2.8-8.1) and 2.3% (1.8-2.8), respectively. The pooled incidence over follow-up of 2-28 days was 12.5% (10.1-15.0) for electrolyte disturbance (e.g. hyperkalaemia), 11.0% (7.4-15.1) for acute kidney injury (AKI) and 6.8% (1.0-17.0) for renal replacement therapy (RRT). In subgroup analyses, there was a higher incidence of AKI in US populations and groups with higher prevalence of pre-existing CKD. CONCLUSIONS: Frequent renal complications reported among hospitalized COVID-19 patients are electrolyte disturbance, AKI and RRT. Aggressive monitoring and management of these renal complications may help in the prediction of favourable outcomes. Systematic review registration: PROSPERO 2020: CRD42020186873 KEY MESSAGES COVID-19 affects multiple organs apart from the respiratory system; however, its renal manifestations are not clearly defined. In this systematic meta-analysis of 22 observational cohort studies, the prevalence of pre-existing chronic kidney disease (CKD) in COVID-19 patients was 5.2%. The most frequent renal complication was electrolyte disturbance (particularly hyperkalaemia) with an incidence of 12.5% followed by acute kidney injury (AKI) with an incidence of 11.0%; US populations and groups with higher prevalence of CKD had higher incidence of AKI.

Kute, V., et al. (2020). "Renal Transplant Guidelines with Reference to COVID-19 Infection." Indian J Nephrol **30**(3): 176-178.

Development of COVID-19 pandemic has affected organ transplant activity significantly. To start with, government of India had adviced stoppage of "elective" surgeries so as to cope with resources and manpower for COVID-19 patients. As majority of hospitals are having both COVID and Non-COVID patients, there is obvious fear of cross-infection. Also, transplant patients being immunocompromised, there is higher risk of acquiring COVID-19 infection along with atypical presentation and unpredicted course of the disease. Result was that across India, elective living related kidney transplant came to a halt. Cadaver renal transplant, being emergency in nature still done, though very few. With passing time, once it became clear that pandemic is not going to be controlled sooner, need has been felt to restart renal transplant activity. Keeping various issues in mind in relation to elective living related renal transplant and emergency deceased donor renal transplant, these guidelines have been framed to help transplant professionals for restarting renal transplant program again in the country, while keeping both health care workers and patient safe.

Lee, A. C., et al. (2021). "Cardiovascular, cerebrovascular, and renal co-morbidities in COVID-19 patients: A systematic-review and meta-analysis." Comput Struct Biotechnol J **19**: 3755-3764.

Background: COVID-19 has infected over 35 million people worldwide and led to over 1 million deaths. Several risk factors that increase COVID-19 severity have emerged, including age and a history of cardiovascular disease, hypertension, or kidney disease. However, a number of outstanding questions persist, including whether the above comorbidities correlate with increased mortality from COVID-19 or whether age is a significant confounding variable that accounts for the observed relationship between COVID-19 severity and other comorbidities. Methods and Findings: We conducted a systematic review and meta-analysis of studies documenting COVID-19 patients with hypertension, cardiovascular disease, cerebrovascular disease, or chronic kidney disease. We classified COVID-19 cases into severe/non-severe or deceased/surviving and calculated the odds ratio (OR) for each of the four comorbidities in these cohorts. 36 studies, comprising 22,573 patients, are included in our meta-analysis. We found that hypertension is the most prevalent comorbidity in deceased COVID-19 patients (55.4%; CI: 49.4-61.3%), followed by cardiovascular disease (30.7%; CI: 22.6-38.8%), cerebrovascular disease (13.4%; CI: 9.12-19.2%), then chronic kidney disease (9.05%; CI: 5.57-15.0%). The risk of death is also significantly higher for patients with these comorbidities, with the greatest risk factor being chronic kidney disease (OR: 8.86; CI: 5.27-14.89), followed by cardiovascular disease (OR: 6.87; CI: 5.56-8.50), hypertension (OR: 4.87; CI: 4.19-5.66), and cerebrovascular disease (OR: 4.28; CI: 2.86-6.41). These risks are significantly higher than previously reported, while correlations between comorbidities and COVID-19 severity are similar to previously reported figures. Using meta-regression analysis with age as a moderating variable, we observed that age contributes to the observed risks but does not explain them fully. Conclusions: In this meta-analysis, we observed that cardiovascular, cerebrovascular, and kidney-related comorbidities in COVID-19 significantly contributes to greater risk of mortality and increased disease severity.

We also demonstrated that age may not be a confounder to these associations.

Li, N. L., et al. (2021). "Immunoglobulin-A Vasculitis With Renal Involvement in a Patient With COVID-19: A Case Report and Review of Acute Kidney Injury Related to SARS-CoV-2." Can J Kidney Health Dis **8**: 2054358121991684.

Rationale: Acute kidney injury is a common complication of COVID-19 and is associated with significantly increased mortality. The most frequent renal biopsy finding with SARS-CoV-2 infection is acute tubular injury; however, new onset glomerular diseases have been reported. The development of persistent urinary abnormalities in patients with COVID-19 should prompt consideration for renal biopsy to rule out glomerulonephritis. Presenting Concerns: A 30-year-old man with no prior medical history presented to the emergency department with symptoms of COVID-19 and new onset painful purpuric rash, arthralgia, and abdominal pain. SARS-CoV-2 infection was confirmed with nucleic acid testing and laboratory investigations revealed preserved renal function with dysmorphic hematuria and nephrotic range proteinuria. Diagnosis: A skin biopsy of the purpuric rash was performed, which demonstrated leukocytoclastic vasculitis. Renal biopsy revealed focally crescentic and segmentally necrotizing IgA nephropathy. Overall, given the clinical syndrome of glomerulonephritis with purpuric rash, arthralgia, and abdominal pain, the presentation is most in keeping with a diagnosis of IgA vasculitis in the setting of COVID-19. Interventions: The patient was treated conservatively for COVID-19 in the community. A 7-day course of prednisone was started for the vasculitic rash. IgA nephropathy was managed conservatively with blood pressure control and RAAS blockade with losartan. Outcomes: With conservative management, the patient's COVID-19 symptoms resolved completely and he did not require hospital admission. Following prednisone therapy, the patient's rash, arthralgia, and abdominal pain improved. However, despite resolution of COVID-19, hematuria and proteinuria persisted. With the initiation of RAAS blockade, renal function remained stable and proteinuria improved dramatically at 6 weeks. Novel Findings: De novo glomerulonephritis is a renal manifestation of SARS-CoV-2 infection beyond acute tubular injury. IgA vasculitis appears to be a rare complication of COVID-19.

Li, S. Y., et al. (2020). "Impact of the COVID-19 pandemic on the management of patients with end-stage renal disease." J Chin Med Assoc **83**(7): 628-633.

A novel infectious disease, coronavirus disease-2019 (COVID-19), spread globally since December 2019. Without effective treatment and vaccination, the strategies to restrain this disease are only keeping social distance, maintaining personal hygiene, quarantine, and isolation. However, thrice-a-week treatment is inevitable for all hemodialysis patients. In addition to the high risk of cluster infection and compromised immunity in patients with end-stage renal disease (ESRD), an atypical disease presentation could also make the medial system neglect these patients during CVOID-19 pandemic. To avoid COVID-19 transmission among patients on dialysis, the major societies of nephrology around the world have provided their guidelines for screening, dialysis facilities adjustment, and health education, respectively. In this review, we summarized the main contents and differences of these guidelines and addressed the prompt management for patients with ESRD to reduce the risk of infection during COVID-19 pandemic.

Lushina, N., et al. (2020). "Pulmonary, Cerebral, and Renal Thromboembolic Disease in a Patient with COVID-19." Radiology **296**(3): E181-E183.

Mahajan, R., et al. (2020). "Eculizumab treatment for renal failure in a pediatric patient with COVID-19." J Nephrol **33**(6): 1373-1376.

While there are increasing reports of acute kidney injury among hospitalized adults with COVID-19, there is still limited information on renal complications associated with COVID-19 in children. The cause of kidney involvement in COVID-19 is likely multifactorial, and appears to involve a complex process, including complement dysregulation and thrombotic microangiopathy. We present a pediatric case of COVID-19 and renal failure due to thombotic microangiopathy, successfully treated with eculizumab.

Makkawi, M., et al. (2021). "Assessment of renal function among covid-19 patients admitted to the intensive care unit." Pak J Pharm Sci **34**(5): 1645-1649.

Severe acute respiratory viral infections are frequently associated with multiple organ failure, including acute kidney damage. The present study aimed to investigate the associated influence of COVID-19 on renal function in patients admitted to the intensive care unit in Asir region, Saudi Arabia. Thirty patients infected with COVID-19 who were referred to the intensive care unit during November and October 2020 at Asir central hospital, Asir region, Saudi Arabia were recruited. The age of patients ranged between 30 and 90 years old. Renal function tests exhibited dramatic changes in the renal biomarkers in patients with COVID-19. Blood urea levels in COVID-19 patients were significantly higher than in the control group. In addition, significantly lower albumin levels

with abnormally decreased total protein levels were found in COVID-19 patients. Among the different electrolytes analyzed, a significantly lower calcium level was observed in COVID-19 patients' groups than in the controls. Renal function tests for COVID-19-infected ICU patients revealed significant changes, indicating the major impact of COVID-19 on kidney function. Monitoring renal function tests may assist in the early prognosis of COVID-19 patients. It is, therefore, crucial to increase the understanding of renal function tests in COVID-19 patients who were admitted to the hospital before their condition deteriorated.

Malik, B., et al. (2021). "Outpatient Management of COVID-19 With Monoclonal Antibody Therapy in a Young Renal Transplant Patient." Cureus **13**(9): e17672.

At baseline, solid organ transplant recipients are at an increased risk for infectious complications due to the complex immunosuppressive regimens. The available data in renal transplant patients who contract coronavirus disease 2019 (COVID-19) demonstrates dangerously high mortality rates (33%) in those who require hospitalization and/or ICU level care. Interestingly, the data for transplant patients who do not require hospitalization shows significantly lower mortality (3%) despite being on an immunosuppressive regimen. We present the case of a young male patient with a history of renal transplant who tested positive for COVID-19; he was mildly symptomatic with cough, sinusitis, and headache, was worked up as an outpatient, and treated as an outpatient with bamlanivimab monotherapy with no adjustment to his immunosuppressive regimen. This case aims to highlight the possibility of safely managing mild cases of COVID-19 in solid organ transplant patients receiving immunosuppression as an outpatient with monoclonal antibody (mAb) therapy.

Mantica, G. and A. F. De Rose (2020). "Renal infarction in a COVID-19 patient." Pan Afr Med J **37**: 182.

Marcilla Vazquez, C., et al. (2020). "[Thrombotic microangiopathy: A renal manifestation in SARS-CoV-2 infection (COVID-19 disease)]." An Pediatr (Engl Ed) **93**(5): 352-353.

Marra, F., et al. (2021). "Recommendations for Dosing of Repurposed COVID-19 Medications in Patients with Renal and Hepatic Impairment." Drugs R D **21**(1): 9-27.

INTRODUCTION: In December 2019, an outbreak of a novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) began, resulting in a number of antivirals and immune modulators being repurposed to treat the associated coronavirus disease 2019 (COVID-19). Many patients requiring treatment for COVID-19 may have either pre-existing renal or hepatic disease or experience acute renal/hepatic injury as a result of the acute infection. Altered renal or hepatic function can significantly affect drug concentrations of medications due to impaired drug metabolism and excretion, resulting in toxicity or reduced efficacy. The aim of this paper is to review the pharmacokinetics and available study data for the experimental COVID-19 therapies in patients with any degree of renal or hepatic impairment to make recommendations for dosing. METHODS: COVID-19 agents included in these recommendations were listed as primaries on the University of Liverpool COVID-19 drug interaction website (www.covid19-druginteractions.org), initially identified from Clinicialtrials.gov and ChicCTR.org.cn. A literature search was performed using PubMed and EMBASE as well as product licences and pharmacokinetic databases. FINDINGS: Remdesivir, dexamethasone, azithromycin, favipiravir, lopinavir/ritonavir, atazanavir, hydroxychloroquine, interferon beta, ribavirin, tocilizumab, anakinra and sarilumab were identified as experimental drugs being used in COVID-19 trials as of November 2020. Limited study data was found for these drugs in patients with renal or hepatic impairment for COVID-19 or other indications. Recommendations were made based on available data, consideration of pharmacokinetic properties (including variability), the dosing and anticipated treatment duration of each regimen in COVID-19 and known toxicities. CONCLUSION: Dosing of drugs used to treat COVID-19 in patients with renal or hepatic impairment is complex. These recommendations were produced to provide guidance to clinicians worldwide who are treating patients with COVID-19, many of whom will have some degree of acute or chronic renal or hepatic impairment.

Mc Keaveney, C., et al. (2021). "Experiences of renal healthcare practitioners during the COVID-19 pandemic: a multi-methods approach." BMC Nephrol **22**(1): 301.

BACKGROUND: Globally, renal healthcare practitioners provide intensive and protracted support to a highly complex multi-morbid patient population however knowledge about the impact of COVID-19 on these practitioners is extremely limited. OBJECTIVE: This study aimed to explore the experiences of COVID-19 with renal healthcare practitioners during the first global lockdown between June 2020 and September 2020. METHODS: A multi-methods approach was carried out including a quantitative survey and qualitative interviews. This was a

multinational study of renal healthcare practitioners from 29 countries. Quantitative: A self-designed survey on COVID-19 experiences and standardised questionnaires (General Health Questionnaire-12; Maslach Burnout Inventory). Descriptive statistics were generated for numerical data. Qualitative: Online semi-structured interviews were conducted. Data was subjected to thematic analysis. Renal healthcare practitioners (n = 251) completed an online survey. Thirteen renal healthcare practitioners took part in semi-structured interviews (12 nurses and 1 dietician). RESULTS: The majority of participants surveyed were female (86.9 %; n = 218), nurses (86.9 %; n = 218) with an average 21.5 (SD = 11.1) years' experience since professional qualification, and 16.3 years (SD = 9.3) working in renal healthcare. Survey responses indicated a level of preparedness, training and satisfactory personal protective equipment during the pandemic however approximately 40.3 % experienced fear about attending work, and 49.8 % experienced mental health distress. The highest prevalence of burnout was emotional exhaustion (35.9 %). Three themes emerged from the qualitative analysis highlighting the holistic complexities in managing renal healthcare, a neglected specialist workforce, and the need for appropriate support at work during a pandemic. CONCLUSIONS: Results have highlighted the psychological impact, in terms of emotional exhaustion and mental health distress in our sample of renal healthcare practitioners. As the pandemic has continued, it is important to consider the long-term impact on an already stretched workforce including the risk of developing mental health disorders. Future research and interventions are required to understand and improve the provision of psychological support for specialist medical and nursing personnel.

Medjeral-Thomas, N. R., et al. (2021). "Plasma Lectin Pathway Complement Proteins in Patients With COVID-19 and Renal Disease." Front Immunol **12**: 671052.

We do not understand why non-white ethnicity and chronic kidney disease increase susceptibility to COVID-19. The lectin pathway of complement activation is a key contributor to innate immunity and inflammation. Concentrations of plasma lectin pathway proteins influence pathway activity and vary with ethnicity. We measured circulating lectin proteins in a multi-ethnic cohort of chronic kidney disease patients with and without COVID19 infection to determine if lectin pathway activation was contributing to COVID19 severity. We measured 11 lectin proteins in serial samples from a cohort of 33 patients with chronic kidney impairment and COVID19. Controls were single plasma samples from 32 patients on dialysis and 32 healthy individuals. We demonstrated multiple associations between recognition molecules and associated proteases of the lectin pathway and COVID-19, including COVID-19 severity. Some of these associations were unique to patients of Asian and White ethnicity. Our novel findings demonstrate that COVID19 infection alters the concentration of plasma lectin proteins and some of these changes were linked to ethnicity. This suggests a role for the lectin pathway in the host response to COVID-19 and suggest that variability within this pathway may contribute to ethnicity-associated differences in susceptibility to severe COVID-19.

Melero, R., et al. (2021). "Renal long-term outcome of critically ill COVID-19 patients with acute kidney failure and continuous renal replacement therapy." Clin Kidney J **14**(11): 2449-2450.

Meshram, H. S., et al. (2021). "BK polyomavirus infection following COVID-19 infection in renal transplant recipients: a single-center experience." Kidney Res Clin Pract **40**(3): 496-500.

Meshram, H. S., et al. (2021). "Mucormycosis in post-COVID-19 renal transplant patients: A lethal complication in follow-up." Transpl Infect Dis **23**(4): e13663.

Meziyerh, S., et al. (2020). "Severe COVID-19 in a renal transplant recipient: A focus on pharmacokinetics." Am J Transplant **20**(7): 1896-1901.

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.

Migliaccio, M. G., et al. (2021). "Renal Involvement in COVID-19: A Review of the Literature." Infect Drug Resist **14**: 895-903.

Kidney injury may be a severe complication of acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and contributes to worsen the prognosis. Various pathophysiological mechanisms can contribute to organ damage and impair renal function, proving the complexity of the virus activity and the resulting immunity response. We summarized the evidence of the literature on the prevalence of kidney involvement, on the pathogenic pathways and on its management.

Mihalopoulos, M., et al. (2020). "COVID-19 and Kidney Disease: Molecular Determinants and Clinical Implications in Renal Cancer." Eur Urol Focus **6**(5): 1086-1096.

CONTEXT: The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic that erupted in December 2019 has affected more than a million people from over 200 countries, claiming over 70 000 lives (by April 7, 2020). As the viral infection is driven by increased angiotensin-converting enzyme-2 (ACE2) expression, with the kidney exhibiting the highest expression, it is crucial to gain insights into the mechanisms underlying renal cell carcinoma (RCC) and coronavirus disease 2019 (COVID-19). OBJECTIVE: This study considers up-to-date information on the biological determinants shared by COVID-19 and renal disease, and aims to provide evidence-based recommendations for the clinical management of RCC patients with COVID-19. EVIDENCE ACQUISITION: A literature search was performed using all sources (MEDLINE, EMBASE, ScienceDirect, Cochrane Libraries, and Web of Science). As of March 31, 2020, the Center for Disease Control reported that of the adults hospitalized for COVID-19 with underlying conditions in the USA, 74.8% had chronic renal disease. EVIDENCE SYNTHESIS: Evidence is discussed from epidemiological studies on SARS-CoV-2 pandemic and molecular studies on the role of kidney in facilitating routes for SARS-CoV-2 entry, leading to increased virulence of SARS-CoV-2 and clinical manifestation of symptoms in RCC. CONCLUSIONS: This analysis will advance our understanding of (1) the molecular signatures shared by RCC and COVID-19 and (2) the clinical implications of overlapping signaling pathways in the therapeutic management of RCC and COVID-19 patients. PATIENT SUMMARY: Amid the coronavirus disease 2019 (COVID-19) pandemic, patients diagnosed with renal cell carcinoma and infected with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) may receive complimentary treatment modalities to enhance therapeutic response.

Mohamadi Yarijani, Z. and H. Najafi (2021). "Kidney injury in COVID-19 patients, drug development and their renal complications: Review study." Biomed Pharmacother **142**: 111966.

Since December 2019, the world was encountered a new disease called coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Although SARS-CoV-2 initially causes lung damage, it also affects many other organs, including the kidneys, and on average, 5-23% of people with COVID-19 develop the symptoms of acute kidney injury (AKI), including elevated blood creatinine and urea, hematuria, proteinuria, and histopathological damages. The exact mechanism is unknown, but the researchers believe that SARS-CoV-2 directly and indirectly affects the kidneys. The direct pathway is by binding the virus to ACE2 receptor in the kidney, damage to cells, the renin-angiotensin system disturbances, activating coagulation pathways, and damaging the renal vascular endothelium. The initial evidence from studying the kidney tissue in postmortem patients is more in favor of the direct pathway. The indirect pathway is created by increased cytokines and cytokine storm, sepsis, circulatory disturbances, hypoxemia, as well as using the nephrotoxic drugs. Using renal tissue biopsy and autopsy in the patients with COVID-19, recent studies found evidence for a predominant indirect pathway in AKI induction by SARS-CoV-2. Besides, some studies showed that the degree of acute tubular injury (ATI) in autopsies from COVID-19 victims is milder compared to AKI degree. We review the mechanism of AKI induction and the renal side effects of the most common drugs used to treat COVID-19 after the overview of the latest findings on SARS-CoV-2 pathogenicity.

Mohamed, M. A., et al. (2020). "Renal Transplant Recipient with Concurrent COVID-19 and Stenotrophomonas maltophilia Pneumonia Treated with Trimethoprim/Sulfamethoxazole Leading to Acute Kidney Injury: A Therapeutic Dilemma." Am J Case Rep **21**: e926464.

BACKGROUND Although coronavirus disease 2019 (COVID-19) manifests primarily as a lung infection, its involvement in acute kidney injury (AKI) is gaining recognition and is associated with increased morbidity and mortality. Concurrent infection, which may require administration of a potentially nephrotoxic agent, can worsen AKI and lead to poor outcomes. Stenotrophomonas maltophilia is a multidrug-resistant gram-negative bacillus associated with nosocomial infections, especially in severely immunocompromised and debilitated patients. Trimethoprim/sulfamethoxazole combination

(TMP/SMX) is considered the treatment of choice but can itself lead to AKI, posing a significant challenge in the management of patients with concomitant COVID-19 and S. maltophilia pneumonia. CASE REPORT A 64-year-old male with end-stage renal disease and post renal transplant presented with severe respiratory symptoms of COVID-19 and was intubated upon admission. His renal functions were normal at the time of admission. The patient subsequently developed superimposed bacterial pneumonia with S. maltophilia requiring administration of TMP/SMX. However, TMP/SMX led to the development of AKI, which continued to worsen despite appropriate management including hemodialysis. This coincided with and most likely resulted in the patient's clinical deterioration and ultimate death. CONCLUSIONS The etiology of kidney disease involvement in patients with COVID-19 is still evolving and appears to be multifactorial. The condition can significantly worsen especially when nephrotoxic agents are given, probably due to a cumulative or synergistic effect. Great caution should be taken when administering nephrotoxic agents in the setting of COVID-19 as it can lead to adverse patient outcomes.

Mokos, M. and N. Basic-Jukic (2021). "Diagnostic Delays for Non-melanoma Skin Cancers in Renal Transplant Recipients during the COVID-19 Pandemic: What is Hiding Behind the Mask?" Acta Dermatovenerol Croat **29**(2): 111-113.

Dear Editor, The ongoing pandemic of coronavirus disease 2019 (COVID-19) was declared by the World Health Organization on March 11, 2020, and remains a global challenge. COVID-19 is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), transmitted primarily through respiratory droplets and aerosols. Even though the COVID-19 vaccine has become available since December 2020, the main preventive measures still include social distancing, hand washing, and the use of protective face masks. By May 22, 2021, 3,437,545 deaths caused by SARS-CoV-2 have been registered by WHO, confirming the burden of this disease (1). Consequently, the pandemic has become a challenge for health care systems, as they had to be focused on the care of patients with COVID-19. During the first lockdown from March to May 2020, it was advised to postpone clinical visits whenever this could be done without risk. This recommendation was mainly aimed at older patients and those with chronic diseases, as it has been shown that they are at greater risk for complications from COVID-19. Renal transplant recipients (RTRs) are at a greater risk for infections and different cancers due to their permanent immunosuppressive therapy. The most common malignancies in RTRs are skin cancers, particularly non-melanoma skin cancers. It has been estimated that RTRs have a 65-250 times higher risk for cutaneous squamous cell carcinoma (SCC), 10 times higher risk for basal cell carcinoma, and 2-5 times higher risk for melanoma when compared with the general population (2-4). RTRs are at a higher risk for complications from COVID-19, not only because of their immunosuppressive therapy but also because of different comorbidities, such as hypertension, cardiovascular disease, and diabetes mellitus (5). Therefore, RTRs tend to limit their medical visits and postpone clinical examinations for skin cancer screenings. Moreover, during clinical visits the patients are commonly asked to keep their protective masks on, increasing the risk of overlooking their facial skin changes. Herein we present two RTRs who developed skin cancers during the COVID-19 pandemic, and the tumors were diagnosed with a significant delay. Patient 1 A 67-year-old woman with unknown primary kidney disease received a renal allograft from a deceased donor in 2014. The immunosuppressive protocol included antithymocyte globulin induction with tacrolimus, mycophenolate mofetil, and steroid maintenance. In January 2020, she had noticed a reddish squamous lesion on her right cheek, which enlarged slowly. Since there were no other symptoms, she postponed the dermatologic examination. Additionally, she further postponed the visit to her physician during the pandemic as she wanted to avoid social contact as much as possible. One year later, at the nephrologist's examination, she was asked to take off her face mask for a skin check, and two skin tumors on her right cheek were noticed (Figure 1). One lesion was located at the angle of her mandible and presented as a hypertrophic, sharply marginated lesion with central crusting and a diameter of 2 cm. The other lesion was at the right zygomatic region and appeared as a scaly, erythematous lesion with a diameter of 7 mm. The patient was referred to a dermatologist, and a biopsy of both lesions was indicated. The pathohistological analysis revealed cutaneous SCC in situ for the mandibular lesion and actinic keratosis for the zygomatic lesion. SCC in situ has been excised, and actinic keratosis was treated by cryosurgery. Patient 2 A 66-year-old woman received a renal allograft from a deceased donor in 2010 due to chronic glomerulonephritis without biopsy. The immunosuppressive protocol included basiliximab induction with tacrolimus, mycophenolate mofetil, and steroid maintenance. In June 2020, an erosion occurred at her left infraocular area and did not heal but instead gradually enlarged. The patient suspected that the "wound" developed due to the friction from the rim of her eyeglasses. Six months later, the nephrologist noticed the erosion which was 10x5 mm in size with a slightly elevated, pearl-colored margin (Figure 2). The

patient was referred to a dermatologist who indicated tumor excision due to suspected basal cell carcinoma. The pathohistological analysis confirmed the clinical diagnosis. DISCUSSION Both presented patients did not inform their family physicians about their skin changes because they avoided all non-nephrological medical visits during the pandemic. The additional reason for the diagnostic delay was the fact that they kept the masks on their faces during most examinations, with the skin lesions behind the mask consequently remaining unnoticed. The problem of diagnostic delay of skin cancers during the COVID-19 pandemic has been recognized by several studies. Canadian authors compared the number of biopsies for skin cancers during the first 15 weeks in 2020 and during the same period in 2019. They found a decrease in the number of biopsies for non-melanoma skin cancers (NMSC) and melanoma of 18% and 27%, respectively (6). A multicenter study performed in northern-central Italy showed that the number of skin cancer (NMSC and melanoma) diagnoses fell by 56.7% in weeks 11 to 20 of 2020 compared with the average number noted in the same periods of 2018 and 2019 (7). Furthermore, a single-center retrospective study in Italy demonstrated that the number of advanced skin cancers surgically treated between May 18 and November 18, 2020, was significantly higher than in the same period in 2019. These findings led the authors to conclude that the surgical excisions were postponed due to the delay in follow-ups, which resulted in increased incidence of advanced skin cancers (8). RTRs are at particular risk of severe consequences from diagnostic delay with regard to skin cancers. Namely, skin cancers in RTRs are more aggressive and are associated with a higher incidence rate of metastases and recurrences than in the general population (9). Therefore, RTRs should be advised to regularly check their skin for potential skin cancer, which includes self-examinations and dermatologic follow-ups.

Moschovas, M. C., et al. (2020). "Selecting the Most Appropriate Oncological Treatment for Patients with Renal Masses During the COVID-19 Pandemic: Recommendations from a Referral Center." Eur Urol Focus **6**(5): 1130-1131.

Mukherjee, A., et al. (2020). "Case Report: COVID-19 Associated Renal Infarction and Ascending Aortic Thrombosis." Am J Trop Med Hyg **103**(5): 1989-1992.

Following its discovery in Wuhan, China, in December 2019, COVID-19 has attained pandemic status in mere months. It is caused by SARS-CoV-2, an enveloped beta coronavirus. This infection causes a prothrombogenic state by interplay of inflammatory mediators, and endothelial, microvascular, and possible hepatic damage and tissue tropism of the virus. This leads to frequent pulmonary and cerebral thromboembolism as well as occasional involvement of other organs. We present a 71-year-old man who initially presented with 2 weeks of fever, cough, and shortness of breath and was diagnosed with COVID-19 pneumonia. He required readmission due to worsened hypoxia and was later found to have left renal artery thrombosis with left kidney infarction, associated with an ascending aortic thrombus. He was anticoagulated and recovered uneventfully. We suggest that physicians have a high degree of suspicion to diagnose and manage the novel manifestations of this disease.

Mungmunpuntipantip, R. and V. Wiwanitkit (2021). "Zebra-like bodies in COVID-19, hydroxychloroquine, and acute renal injury." Ultrastruct Pathol **45**(1): 78.

Munoz Mendoza, J. and M. L. Alcaide (2020). "COVID-19 in a patient with end-stage renal disease on chronic in-center hemodialysis after evidence of SARS-CoV-2 IgG antibodies. Reinfection or inaccuracy of antibody testing." IDCases **22**: e00943.

A patient with end-stage renal disease on hemodialysis with a previous positive SARS-CoV-2 IgG antibody was diagnosed with severe COVID-19. Issues regarding reinfection, the potential lack of antibody protection after asymptomatic infection, the possibility of antibody dependent enhancement and careful interpretation of antibody test results are discussed.

Murray, N. P., et al. (2021). "Renal infarction associated with asymptomatic Covid-19 infection." Hematol Transfus Cell Ther **43**(3): 353-356.

Murshidi, M. M., et al. (2021). "Risk of Covid-19 infection after resection of high grade transitional cell carcinoma with renal impairment." Int J Surg Case Rep **82**: 105924.

Introduction and importance: Covid-19 pandemic has had huge impact on health care system and put the health care system under strain, so efforts made to minimize the elective surgeries however some surgeries especially those for high risk malignant tumors cannot be postponed.The aim of this case report is to highlight the importance of screening cancer patients and those with co-morbidities such as renal impairment for Covid-19 and encouraging them to get vaccinated before undergoing elective surgeries. Case presentation: We report a case of an 80 year old male patient with renal impairment who developed Covid-19 infection after transurethral resection of high grade transitional cell carcinoma of urinary bladder. Clinical discussion: Although intra-hospital contagion of Covid-19 is not rare, increased risk of acquiring Covid-

19 among cancer patient particularly if they have co-morbidities like renal impairment should be kept in mind and strict protective measures for Covid-19 for those patients should be done before, during and after the procedure. Conclusion: We theorized that patients with high grade transitional cell carcinoma of urinary bladder should be screened for Covid-19 and get vaccinated before the procedure.

Murt, A., et al. (2021). "Augmented Renal Clearance in COVID-19." Nephron **145**(4): 386-387.

Naaraayan, A., et al. (2020). "End-Stage Renal Disease Patients on Chronic Hemodialysis Fare Better With COVID-19: A Retrospective Cohort Study From the New York Metropolitan Region." Cureus **12**(9): e10373.

Introduction Several comorbid conditions have been identified as risk factors in patients with coronavirus disease 2019 (COVID-19). However, there is a dearth of data describing the impact of COVID-19 infection in patients with end-stage renal disease on hemodialysis (ESRD-HD). Methods This retrospective case series analyzed 362 adult patients consecutively hospitalized with confirmed COVID-19 illness between March 12, 2020, and May 13, 2020, at a teaching hospital in the New York City metropolitan area. The primary outcome was severe pneumonia as defined by the World Health Organization. Secondary outcomes were the (1) the Combined Outcome of Acute respiratory distress syndrome or in-hospital Death (COAD), and (2) need for high levels of oxygen supplementation (HiO2). Results Patients with ESRD-HD had lower odds for poor outcomes including severe pneumonia [odds ratio (OR) 0.4, confidence interval (CI) 0.2-0.9, p=.04], HiO2 [OR 0.3, CI (0.1-0.8), p=.02] and COAD [OR 0.4, CI (0.2-1.05), p=.06], when compared to patients without ESRD. In contrast, higher odds for severe pneumonia, COAD and HiO2 were seen with advancing age. African Americans were over-represented in the hospitalized patient cohort, when compared to their representation in the community (35% vs 18%). Hispanics had higher odds for severe illness and HiO2 when compared to Caucasians. Conclusions Patients with ESRD-HD had a milder course of illness with a lower likelihood of severe pneumonia and a lesser need for aggressive oxygen supplementation when compared to patients not on chronic dialysis. The lower odds of severe illness in ESRD-HD patients might have a pathophysiologic basis and need to be further explored.

Nalesso, F., et al. (2020). "A Continuous Renal Replacement Therapy Protocol for Patients with Acute Kidney Injury in Intensive Care Unit with COVID-19." J Clin Med **9**(5).

COVID-19 often leads to acute respiratory distress syndrome complicated by acute kidney injury (AKI). The indications for renal replacement therapy for these patients are those commonly accepted to treat AKI. We describe a continuous veno-venous haemodialysis (CVVHD) protocol for AKI, which aims to provide the best treatment according to the particular patient's and medical personnels' needs in biohazard settings with limited human and technological resources. We designed a CVVHD protocol with a high cut-off (HCO) filter in regional citrate anticoagulation (RCA). The HCO filter in diffusion determines the enhanced cytokines clearance with less filter clotting due to a lower filtration fraction. In our hospital, at the beginning of the pandemic outbreak, we treated seven COVID-19 patients with AKI stage 2 and 3 and recorded the circuit lifespan and the number of interventions on monitors. CVVHD in RCA appears to be safe, effective and easy to be performed in a biohazard scenario using lower blood flows and less bag changes with fluid savings, a biohazard reduction and sparing of resources. Although the data come from a very small cohort, our protocol seems related to a low mortality.

Nayak, H. K., et al. (2021). "Rescue devascularization in COVID-19 induced early shunt thrombosis after emergency proximal spleno-renal shunt for extrahepatic portal vein obstruction." J Clin Exp Hepatol.

Niu, X., et al. (2021). "ACE2 Is a Prognostic Biomarker and Associated with Immune Infiltration in Kidney Renal Clear Cell Carcinoma: Implication for COVID-19." J Oncol **2021**: 8847307.

Background: KIRC is one of the most common cancers with a poor prognosis. ACE2 was involved in tumor angiogenesis and progression in many malignancies. The role of ACE2 in KIRC is still ambiguous. Methods: Various bioinformatics analysis tools were investigated to evaluate the prognostic value of ACE2 and its association with immune infiltration in KIRC. Results: ACE2 was shown to be downregulated in KIRC at the mRNA and protein level. Low expression of ACE2 protein in KIRC patients was observed in subgroup analyses based on gender, age, weight, tumor grade, and cancer stage. Upregulation of ACE2 in KIRC was associated with a favorable prognosis. ACE2 mRNA expression showed a positive correlation with the abundance of immune cells (B cells, CD8+ T cells, macrophages, neutrophils, and dendritic cells) and the level of immune markers of different immune cells in KIRC. ACE2 expression could affect, in part, the immune infiltration and the advanced cancer stage. Moreover, enrichment analysis revealed that ACE2 in KIRC were mainly involved in

translation factor activity, immunoglobulin binding, metabolic pathways, transcriptional misregulation in cancerous cells, cell cycle, and ribosomal activity. Several ACE2-associated kinases, miRNA, and transcription factor targets in KIRC were also identified. Conclusion: ACE2 was downregulated in KIRC and served as a prognostic biomarker. It was also shown to be associated with immune infiltration.

Nogueira, S. A. R., et al. (2020). "Renal changes and acute kidney injury in covid-19: a systematic review." Rev Assoc Med Bras (1992) **66Suppl 2**(Suppl 2): 112-117.

OBJECTIVE: We aimed to present a review of renal changes in patients with COVID-19. METHODS: We performed a systematic review of the literature to identify original articles regarding clinical, laboratory, and anatomopathological kidney changes in patients infected with SARS-CoV-2 published until May 7, 2020. The search was carried out across PubMed, Scopus, and Embase using the keywords "COVID-19", "coronavirus", "SARS-CoV-2", "kidney injury" and "kidney disease". Fifteen studies presented clinical and laboratory renal changes in patients with COVID-19, and three addressed anatomopathological changes. DISCUSSION: Acute kidney injury (AKI) was a relevant finding in patients with COVID-19. There were also significant changes in laboratory tests that indicated kidney injury, such as increased serum creatinine and blood urea nitrogen (BUN), proteinuria, and hematuria. The presence of laboratory abnormalities and AKI were significant in severely ill patients. There was a considerable prevalence of AKI among groups of patients who died of COVID-19. Histopathological analysis of the kidney tissue of patients infected with SARS-CoV-2 suggested that the virus may directly affect the kidneys. CONCLUSION: Although COVID-19 affects mainly the lungs, it can also impact the kidneys. Increased serum creatinine and BUN, hematuria, proteinuria, and AKI were frequent findings in patients with severe COVID-19 and were related to an increased mortality rate. Further studies focusing on renal changes and their implications for the clinical condition of patients infected with the novel coronavirus are needed.

Nopsopon, T., et al. (2021). "Covid-19 in end-stage renal disease patients with renal replacement therapies: A systematic review and meta-analysis." PLoS Negl Trop Dis **15**(6): e0009156.

BACKGROUND: The novel coronavirus (COVID-19), caused by SARS-CoV-2, showed various prevalence and case-fatality rates (CFR) among patients with different pre-existing chronic conditions. End-stage renal disease (ESRD) patients with renal replacement therapy (RRT) might have a higher prevalence and CFR due to reduced immune function from uremia and kidney tropism of SARS-CoV-2, but there was a lack of systematic study on the infection and mortality of the SARS-CoV-2 infection in ESRD patients with various RRT. METHODOLOGY/PRINCIPAL FINDINGS: We searched five electronic databases and performed a systematic review and meta-analysis up to June 30, 2020, to evaluate the prevalence and case fatality rate (CFR) of the COVID-19 infection among ESRD patients with RRT. The global COVID-19 data were retrieved from the international database on June 30, 2020, for estimating the prevalence and CFR of the general population as referencing points. Of 3,272 potential studies, 34 were eligible studies consisted of 1,944 COVID-19 confirmed cases in 21,873 ESRD patients with RRT from 12 countries in four WHO regions. The overall pooled prevalence in ESRD patients with RRT was 3.10% [95% confidence interval (CI) 1.25-5.72] which was higher than referencing 0.14% global average prevalence. The overall estimated CFR of COVID-19 in ESRD patients with RRT was 18.06% (95% CI 14.09-22.32) which was higher than the global average at 4.98%. CONCLUSIONS: This meta-analysis suggested high COVID-19 prevalence and CFR in ESRD patients with RRT. ESRD patients with RRT should have their specific protocol of COVID-19 prevention and treatment to mitigate excess cases and deaths.

Oto, O. A., et al. (2021). "Impact of the COVID-19 pandemic on interest in renal diseases." Environ Sci Pollut Res Int.

There is an information gap about the public's interest in nephrological diseases in the COVID-19 era. The objective was to identify public interest in kidney diseases during the pandemic. In this infodemiology study, Google Trends was queried for a total of 50 search queries corresponding to a broad spectrum of nephrological diseases and the term "nephrologist." Two time intervals of 2020 (March 15-July 4 and July 5-October 31) were compared to similar time intervals of 2016-2019 for providing information on interest in different phases of the pandemic. Compared to the prior 4 years, analyses showed significant decreases in relative search volume (RSV) in the majority (76%) of search queries on March 15-July 4, 2020 period. However, RSV of the majority of search queries (approximately 70%) on July 5-October 31, 2020 period was not significantly different from similar periods of the previous 4 years, with an increase in search terms of amyloidosis, kidney biopsy, hematuria, chronic kidney disease, hypertension, nephrolithiasis, acute kidney injury, and Fabry disease. During the early pandemic, there have been significant decreases in search volumes for many nephrological diseases.

However, this trend reversed in the period from July 5 to October 31, 2020, implying the increased need for information on kidney diseases. The results of this study enable us to understand how COVID-19 impacted the interest in kidney diseases and demands/needs for kidney diseases by the general public during the pandemic.

Oussalah, A., et al. (2020). "Long-term ACE Inhibitor/ARB Use Is Associated With Severe Renal Dysfunction and Acute Kidney Injury in Patients With Severe COVID-19: Results From a Referral Center Cohort in the Northeast of France." Clin Infect Dis **71**(9): 2447-2456.

BACKGROUND: In patients with severe coronavirus disease 2019 (COVID-19), data are scarce and conflicting regarding whether chronic use of angiotensin-converting enzyme inhibitor (ACEI) or angiotensin receptor blocker (ARB) influences disease outcomes. In patients with severe COVID-19, we assessed the association between chronic ACEI/ARB use and the occurrence of kidney, lung, heart, and liver dysfunctions and the severity of the inflammatory reaction as evaluated by biomarkers kinetics, and their association with disease outcomes. METHODS: We performed a retrospective longitudinal cohort study on consecutive patients with newly diagnosed severe COVID-19. Independent predictors were assessed through receiver operating characteristic analysis, time-series analysis, logistic regression analysis, and multilevel modeling for repeated measures. RESULTS: On the 149 patients included in the study 30% (44/149) were treated with ACEI/ARB. ACEI/ARB use was independently associated with the following biochemical variations: phosphorus >40 mg/L (odds ratio [OR], 3.35, 95% confidence interval [CI], 1.83-6.14), creatinine >10.1 mg/L (OR, 3.22, 2.28-4.54), and urea nitrogen (UN) >0.52 g/L (OR, 2.65, 95% CI, 1.89-3.73). ACEI/ARB use was independently associated with acute kidney injury stage >/=1 (OR, 3.28, 95% CI, 2.17-4.94). The daily dose of ACEI/ARB was independently associated with altered kidney markers with an increased risk of +25 to +31% per each 10 mg increment of lisinopril-dose equivalent. In multivariable multilevel modeling, UN >0.52 g/L was independently associated with the risk of acute respiratory failure (OR, 3.54, 95% CI, 1.05-11.96). CONCLUSIONS: Patients chronically treated with ACEI/ARB who have severe COVID-19 are at increased risk of acute kidney injury. In these patients, the increase in UN associated with ACEI/ARB use could predict the development of acute respiratory failure.

Ozturk, S., et al. (2020). "Mortality analysis of COVID-19 infection in chronic kidney disease, haemodialysis and renal transplant patients compared with patients without kidney disease: a nationwide analysis from Turkey." Nephrol Dial Transplant **35**(12): 2083-2095.

BACKGROUND: Chronic kidney disease (CKD) and immunosuppression, such as in renal transplantation (RT), stand as one of the established potential risk factors for severe coronavirus disease 2019 (COVID-19). Case morbidity and mortality rates for any type of infection have always been much higher in CKD, haemodialysis (HD) and RT patients than in the general population. A large study comparing COVID-19 outcome in moderate to advanced CKD (Stages 3-5), HD and RT patients with a control group of patients is still lacking. METHODS: We conducted a multicentre, retrospective, observational study, involving hospitalized adult patients with COVID-19 from 47 centres in Turkey. Patients with CKD Stages 3-5, chronic HD and RT were compared with patients who had COVID-19 but no kidney disease. Demographics, comorbidities, medications, laboratory tests, COVID-19 treatments and outcome [in-hospital mortality and combined in-hospital outcome mortality or admission to the intensive care unit (ICU)] were compared. RESULTS: A total of 1210 patients were included [median age, 61 (quartile 1-quartile 3 48-71) years, female 551 (45.5%)] composed of four groups: control (n = 450), HD (n = 390), RT (n = 81) and CKD (n = 289). The ICU admission rate was 266/1210 (22.0%). A total of 172/1210 (14.2%) patients died. The ICU admission and in-hospital mortality rates in the CKD group [114/289 (39.4%); 95% confidence interval (CI) 33.9-45.2; and 82/289 (28.4%); 95% CI 23.9-34.5)] were significantly higher than the other groups: HD = 99/390 (25.4%; 95% CI 21.3-29.9; P < 0.001) and 63/390 (16.2%; 95% CI 13.0-20.4; P < 0.001); RT = 17/81 (21.0%; 95% CI 13.2-30.8; P = 0.002) and 9/81 (11.1%; 95% CI 5.7-19.5; P = 0.001); and control = 36/450 (8.0%; 95% CI 5.8-10.8; P < 0.001) and 18/450 (4%; 95% CI 2.5-6.2; P < 0.001). Adjusted mortality and adjusted combined outcomes in CKD group and HD groups were significantly higher than the control group [hazard ratio (HR) (95% CI) CKD: 2.88 (1.52-5.44); P = 0.001; 2.44 (1.35-4.40); P = 0.003; HD: 2.32 (1.21-4.46); P = 0.011; 2.25 (1.23-4.12); P = 0.008), respectively], but these were not significantly different in the RT from in the control group [HR (95% CI) 1.89 (0.76-4.72); P = 0.169; 1.87 (0.81-4.28); P = 0.138, respectively]. CONCLUSIONS: Hospitalized COVID-19 patients with CKDs, including Stages 3-5 CKD, HD and RT, have significantly higher mortality than patients without kidney disease. Stages 3-5 CKD patients have an in-hospital mortality rate as much as HD patients, which may be in part because of similar age and comorbidity burden. We were unable to assess if RT

patients were or were not at increased risk for in-hospital mortality because of the relatively small sample size of the RT patients in this study.

Page-Wilson, G., et al. (2021). "Obesity is independently associated with septic shock, renal complications, and mortality in a multiracial patient cohort hospitalized with COVID-19." PLoS One **16**(8): e0255811.

BACKGROUND: Obesity has emerged as a risk factor for severe coronavirus disease 2019 (COVID-19) infection. To inform treatment considerations the relationship between obesity and COVID-19 complications and the influence of race, ethnicity, and socioeconomic factors deserves continued attention. OBJECTIVE: To determine if obesity is an independent risk factor for severe COVID-19 complications and mortality and examine the relationship between BMI, race, ethnicity, distressed community index and COVID-19 complications and mortality. METHODS: A retrospective cohort study of 1,019 SARS-CoV-2 positive adult admitted to an academic medical center (n = 928) and its affiliated community hospital (n-91) in New York City from March 1 to April 18, 2020. RESULTS: Median age was 64 years (IQR 52-75), 58.7% were men, 23.0% were Black, and 52.8% were Hispanic. The prevalence of overweight and obesity was 75.2%; median BMI was 28.5 kg/m2 (25.1-33.0). Over the study period 23.7% patients died, 27.3% required invasive mechanical ventilation, 22.7% developed septic shock, and 9.1% required renal replacement therapy (RRT). In the multivariable logistic regression model, BMI was associated with complications including intubation (Odds Ratio [OR]1.03, 95% Confidence Interval [CI]1.01-1.05), septic shock (OR 1.04, CI 1.01-1.06), and RRT (OR1.07, CI 1.04-1.10), and mortality (OR 1.04, CI 1.01-1.06). The odds of death were highest among those with BMI >/= 40 kg/m2 (OR 2.05, CI 1.04-4.04). Mortality did not differ by race, ethnicity, or socioeconomic distress score, though Black and Asian patients were more likely to require RRT. CONCLUSIONS AND RELEVANCE: Severe complications of COVID-19 and death are more likely in patients with obesity, independent of age and comorbidities. While race, ethnicity, and socioeconomic status did not impact COVID-19 related mortality, Black and Asian patients were more likely to require RRT. The presence of obesity, and in some instances race, should inform resource allocation and risk stratification in patients hospitalized with COVID-19.

Palumbo, R., et al. (2021). "Correction to: Current treatment of COVID-19 in renal patients: hope or hype?" Intern Emerg Med **16**(1): 251.

Pan, P. H., et al. (2020). "[The timing of continuous renal replacement therapy in severe COVID-19]." Zhonghua Jie He He Hu Xi Za Zhi **43**(9): 721-724.

Pandey, A. (2020). "Renal and testicular involvement in COVID-19 patients - implication for the urologist." Indian J Urol **36**(3): 223-224.

Panteli, A. E., et al. (2021). "Narrative review of recent studies on the role of vitamin D in the prevention of cardiac and renal risk and additional considerations for COVID-19 vulnerability." Curr Vasc Pharmacol.

The role of vitamin D in maintaining a healthy cardiovascular (CV) and the renal system has received increasing attention. Low vitamin D levels are associated with the incidence of hypertension, cardiac remodeling, and chronic congestive heart failure. Low vitamin D levels also influence renal disease progression and albuminuria deterioration. Moreover, recent research indicates that vitamin D deficiency can be a potential risk factor for coronavirus disease-19 (COVID-19) infection and poorer outcomes. Data are inconclusive as to whether supplementation with vitamin D agents reduces CV disease risk or COVID-19 severity. Conversely, in patients with kidney disease, vitamin D supplementation is associated with improved kidney function and albuminuria. This narrative review considers recent data on the effects of vitamin D on the CV and renal system, as well as its possible role regarding COVID-19 complications.

Parmar, J., et al. (2021). "Spontaneous Renal Artery Dissection in COVID-19 Pneumonia: Potential Danger of Cytokine Storm." Case Rep Crit Care **2021**: 6696443.

The coronavirus disease (COVID-19) pandemic has rapidly spread across the globe since its first detection in March 2020. Its widespread manifestations and vascular complications are increasingly being reported even in young and middle-aged patients. Hyperinflammation is a continuum of host's exaggerated inflammatory response representing cytokine dysregulation/storm which produces coagulopathy and vascular endothelial dysfunction, apart from a prothrombotic state. Cytokine storm or direct viral invasion of the vascular endothelial cells through surface angiotensin-converting enzyme 2 receptors may result in endothelial dysfunction which can potentially result in dissection. Only a few case reports have been published in the literature describing vascular dissection without any inciting factors in COVID-19 patients. Herein, we present the first case

report of bilateral renal artery dissection in a 41-year-old male patient who recently recovered from COVID-19 and was managed successfully in stages after many medical hurdles.

Patoulias, D., et al. (2021). "Meta-analysis of the hallmark cardiovascular and renal outcome trials addressing the risk for respiratory tract infections with sodium-glucose co-transporter-2 inhibitors: Implications for the COVID-19 pandemic." Diabetes Obes Metab **23**(7): 1696-1700.

Pecanha-Pietrobom, P. M., et al. (2021). "The clinical course of hospitalized moderately ill COVID-19 patients is mirrored by routine hematologic tests and influenced by renal transplantation." PLoS One **16**(11): e0258987.

Several studies of patients with COVID-19 have evaluated biological markers for predicting outcomes, most of them retrospectively and with a wide scope of clinical severity. We followed a prospective cohort of patients admitted in hospital wards with moderate COVID-19 disease, including those with a history of kidney transplantation, and examined the ability of changes in routine hematologic laboratory parameters to predict and mirror the patients' clinical course regarding the severity of their condition (classified as critical vs. non-critical) and in-hospital mortality or hospital discharge. Among the 68 patients, 20 (29%) were kidney transplanted patients (KT), and they had much higher mortality than non-kidney transplanted patients in this cohort (40% X 8.3%). Lymphocytes, neutrophils and neutrophils/lymphocytes ratio (NLR) at admission and platelets as well as the red blood cells parameters hemoglobin, hematocrit, and RDW by the time of hospital discharge or death clearly differentiated patients progressing to critical disease and those with clinical recovery. Patients with deteriorating clinical courses presented elevated and similar NLRs during the first week of hospitalization. However, they were dramatically different at hospital discharge, with a decrease in the survivors (NLR around 5.5) and sustained elevation in non-survivors (NLR around 21). Platelets also could distinguish survivors from non-survivors among the critical patients. In conclusion, routine hematologic tests are useful to monitor the clinical course of COVID-19 patients admitted with moderate disease. Unexpectedly, changes in hematologic tests, including lymphopenia, were not predictive of complicated outcomes among KT recipients.

Pei, G., et al. (2020). "Renal Involvement and Early Prognosis in Patients with COVID-19 Pneumonia." J Am Soc Nephrol **31**(6): 1157-1165.

BACKGROUND: Some patients with COVID-19 pneumonia also present with kidney injury, and autopsy findings of patients who died from the illness sometimes show renal damage. However, little is known about the clinical characteristics of kidney-related complications, including hematuria, proteinuria, and AKI. METHODS: In this retrospective, single-center study in China, we analyzed data from electronic medical records of 333 hospitalized patients with COVID-19 pneumonia, including information about clinical, laboratory, radiologic, and other characteristics, as well as information about renal outcomes. RESULTS: We found that 251 of the 333 patients (75.4%) had abnormal urine dipstick tests or AKI. Of 198 patients with renal involvement for the median duration of 12 days, 118 (59.6%) experienced remission of pneumonia during this period, and 111 of 162 (68.5%) patients experienced remission of proteinuria. Among 35 patients who developed AKI (with AKI identified by criteria expanded somewhat beyond the 2012 Kidney Disease: Improving Global Outcomes definition), 16 (45.7%) experienced complete recovery of kidney function. We suspect that most AKI cases were intrinsic AKI. Patients with renal involvement had higher overall mortality compared with those without renal involvement (28 of 251 [11.2%] versus one of 82 [1.2%], respectively). Stepwise multivariate binary logistic regression analyses showed that severity of pneumonia was the risk factor most commonly associated with lower odds of proteinuric or hematuric remission and recovery from AKI. CONCLUSIONS: Renal abnormalities occurred in the majority of patients with COVID-19 pneumonia. Although proteinuria, hematuria, and AKI often resolved in such patients within 3 weeks after the onset of symptoms, renal complications in COVID-19 were associated with higher mortality.

Perico, N., et al. (2021). "COVID-19 and the Kidney: Should Nephrologists Care about COVID-19 rather than Maintaining Their Focus on Renal Patients?" Contrib Nephrol **199**: 229-243.

Clinical Background: The novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) rapidly spread globally from late 2019, reaching pandemic proportions. Epidemiology: The related disease, COVID-19, exacerbates and progresses due to patients' abnormal inflammatory/immune responses, widespread endothelial damage, and complement-induced blood clotting with microangiopathy. COVID-19 manifests mainly as a respiratory illness. In cases of severe viral pneumonia, it may lead to acute respiratory distress syndrome, respiratory failure, and death. Challenges: Many extrapulmonary manifestations commonly occur, and a substantial proportion of patients with severe COVID-19 exhibit signs of kidney

damage. Clinically, kidney involvement ranges from mild/moderate proteinuria and hematuria to acute kidney injury (AKI) requiring renal replacement therapy (RRT). The pathophysiologic mechanisms of kidney damage and AKI in patients with COVID-19 remain unclear but are known to be multifactorial. Current knowledge implies direct SARS-CoV-2-dependent effects on kidney cells (tubular epithelial cells and podocytes) and indirect mechanisms through the systemic effect of viral infection secondary to the critical pulmonary illness and its management. Prevention and Treatment: Standard-of-care strategies apply, as there is no specific evidence to suggest that COVID-19 AKI should be managed differently from other types in severely ill patients. If conservative management fails, RRT should be considered. The choice of RRT approaches and sequential extracorporeal therapies depends on local availability, resources, and expertise. The focus should now be on the long-term follow-up of COVID-19 patients, especially those who developed kidney injury and dysfunction. This represents an opportunity for integrated multidisciplinary research to clarify the natural history of COVID-19 renal sequelae and the best therapeutic interventions to mitigate them.

Philipponnet, C., et al. (2020). "Renal artery thrombosis induced by COVID-19." Clin Kidney J **13**(4): 713.

Plouffe, B., et al. (2021). "Renal Infarcts-A Perplexing Case in the Middle of the COVID-19 Pandemic." Front Pediatr **9**: 669453.

Renal infarction is a rare finding in children. Associations between SARS-CoV-2 infections and thromboembolic events including renal infarcts have been described in adults. Although a similar association in children has not yet been described with this pandemic, the pediatric literature is still evolving with the recognition of new manifestations including the post-infectious Multisystem Inflammatory Syndrome in Children (MIS-C). We report the rare event of multiple renal infarcts in a 6-year-old boy manifesting several features of MIS-C 9 weeks following a self-limiting febrile illness characteristic of COVID-19. An underlying Factor V Leiden mutation was identified in this child but felt to be insufficient on its own to explain his clinical presentation. As SARS-CoV-2 testing was delayed, the failure to identify viral RNA or antibodies may not exclude the virus' potential role in precipitating the infarct in this host. Given that renal infarcts have been described in adult patients with COVID-19, reporting this perplexing case where SARS-CoV-2 may have played a role, may help identify this potential complication.

Plumb, L., et al. (2021). "COVID-19 in children with chronic kidney disease: findings from the UK renal registry." Arch Dis Child **106**(3): e16.

Ponce Diaz-Reixa, J. L., et al. (2020). "[Renal transplantation during COVID-19 period in Spain.]." Arch Esp Urol **73**(5): 447-454.

INTRODUCTION: The COVID-19 pandemic poses significant challenges in the area of kidney donation and transplantation. The objective of this article is to establish general recommendations for surgical teams to manage the kidney transplant program duringthe COVID-19 era. MATERIAL AND METHODS: This document is based on the scientific evidence available on the infection caused by SARS-CoV-2 and the experience of authors during the COVID-19 pandemic. A web and Pubmed search was performed using the keywords "SARS-CoV-2"," COVID-19", "COVID Urology", "COVID-19 surgery", and "kidney transplantation." A modified nominal group technique was used. RESULTS: When health system saturation occurs, kidney transplants should be deferred, except in patients with low transplant possibilities and an optimal kidney available, combined transplants or life-threatening situations. Screening for the SARS-CoV-2 virus should be done in all those donors and recipients with clinical symptoms consistent with COVID-19, who have visited or live inhigh-risk areas, or who have been in close contact with confirmed cases of COVID-19. Donation and transplantation will not proceed in confirmed cases of COVID-19. Surgeries should be based on general recommendations in the COVID-19 era and will be efficient, short, and focused on those with the shortest hospital stay. In emergencies, protective measures will be taken with persona lprotection equipment. Surgical staff will be only the strictly necessary, and permanence in the OR should be minimized. Transplant urology consultations will be conducted by teleconsultation when possible. CONCLUSION: The safety of potential donors and recipients must be guaranteed, adopting individual protection measures and screening for SARS-CoV-2. Kidney transplant surgery must be efficient in terms of health, human resources, and clinical benefit. All non-urgent transplant activities should be delayed until the improvement of the local condition of each center.

Pranata, R., et al. (2020). "The Association Between Chronic Kidney Disease and New Onset Renal Replacement Therapy on the Outcome of COVID-19 Patients: A Meta-analysis." Clin Med Insights Circ Respir Pulm Med **14**: 1179548420959165.

Objective: The aim of the study was to evaluate the association between chronic kidney disease (CKD) and new onset renal replacement

therapy (RRT) with the outcome of Coronavirus Disease 2019 (COVID-19) in patients. Methodology: A systematic literature search from several databases was performed on studies that assessed CKD, use of RRT, and the outcome of COVID-19. The composite of poor outcome consisted of mortality, severe COVID-19, acute respiratory distress syndrome (ARDS), need for intensive care, and use of mechanical ventilator. Results: Nineteen studies with a total of 7216 patients were included. CKD was associated with increased composite poor outcome (RR 2.63 [1.33, 5.17], P = .03; I (2) = 51%, P = .01) and its subgroup, consisting of mortality (RR 3.47 [1.36, 8.86], P = .009; I (2) = 14%, P = .32) and severe COVID-19 (RR 2.89 [0.98, 8.46], P = .05; I (2) = 57%, P = .04). RRT was associated with increased composite poor outcome (RR 18.04 [4.44, 73.25], P < .001; I (2) = 87%, P < .001), including mortality (RR 26.02 [5.01, 135.13], P < .001; I (2) = 60%, P = .06), severe COVID-19 (RR 12.95 [1.93, 86.82], P = .008; I (2) = 81%, P < .001), intensive care (IC) (RR 14.22 [1.76, 114.62], P < .01; I (2) = 0%, P < .98), and use of mechanical ventilator (RR 34.39 [4.63, 255.51], P < .0005). Conclusion: CKD and new-onset RRT were associated with poor outcome in patients with COVID-19.

Pulido-Perez, P., et al. (2021). "Renal function, serum magnesium levels and mortality in COVID-19 patients with type 2 diabetes." Magnes Res **34**(1): 20-31.

Patients with type 2 diabetes (T2D) and Latin American subjects in particular are at an increased risk of developing severe COVID-19 and mortality. Altered renal function and lower magnesium levels have been reported to play important roles in the pathophysiology of T2D. The aim of the study was to investigate the relationship between renal function, serum magnesium levels and mortality in T2D patients with COVID-19. In this retrospective study, we characterized 118 T2D and non-diabetic subjects hospitalized with COVID-19. Patients were clinically characterized and electrolyte, renal function and inflammatory markers were evaluated. Patients were grouped according to their estimated glomerular filtration rate (eGFR <60 mL/min per 1.73 m(2)). T2D patients had lower eGFR and serum magnesium levels when compared to non-diabetics (59.7 +/- 32.8 vs. 78.4 +/- 33.8 mL/min per 1.73 m(2), P = 0.008 and 1.9 +/- 0.3 vs. 2.1 +/- 0.3 mEq/L, P = 0.012). Survival was worse in T2D patients with eGFR levels less than 60 mL/min per 1.73 m(2) as estimated by Kaplan-Meier analyses (log-rank test <0.0001). The Cox model for T2D patients showed that eGFR (HR 0.970, 95% CI 0.949 to 0.991, P = 0.005) and magnesium (HR 8.025, 95% CI 1.226 to 52.512, P = 0.030) were associated with significantly increased risk of death. Reduced eGFR and magnesium levels were associated with increased mortality in our population. These results suggest that early assessment of kidney function, including magnesium levels, may assist in developing effective treatment strategies to reduce morbidity and mortality among Latin American COVID-19 patients with T2D.

Quintaliani, G., et al. (2020). "Exposure to novel coronavirus in patients on renal replacement therapy during the exponential phase of COVID-19 pandemic: survey of the Italian Society of Nephrology." J Nephrol **33**(4): 725-736.

BACKGROUND: Between February and April 2020, Italy experienced an overwhelming growth of the COVID-19 pandemic. Little is known, at the country level, where and how patients on renal replacement therapy (RRT) have been mostly affected. METHODS: Survey of the network of Nephrology centers using a simplified 17 items electronic questionnaire designed by Italian Society of Nephrology COVID-19 Research Group. We used spatial epidemiology and geographical information systems to map SARS-CoV-2 spread among RRT patients in Italy. RESULTS: On April 9th 2020, all nephrology centers (n = 454) listed in the DialMap database were invited to complete the electronic questionnaire. Within 11 days on average, 365 centers responded (80.4% response rate; 2.3% margin of error) totaling 60,441 RRT patients. The surveyed RRT population included 30,821 hemodialysis (HD), 4139 peritoneal dialysis (PD), and 25,481 transplanted (Tx) patients respectively. The proportion of SARS-CoV-2 positive RRT patients in Italy was 2.26% (95% CI 2.14-2.39) with significant differences according to treatment modality (p < 0.001). The proportion of patients positive for SARS-CoV-2 was significantly higher in HD (3.55% [95% CI 3.34-3.76]) than PD (1.38% [95% CI 1.04-1.78] and Tx (0.86% [95% CI 0.75-0.98]) (p < 0.001), with substantial heterogeneity across regions and along the latitude gradient (p < 0.001). In RRT patients the highest rate was in the north-west (4.39% [95% CI 4.11-4.68], followed by the north-east (IR 2.06% [1.79-2.36]), the center (0.91% [0.75-1.09]), the main islands (0.67% [0.47-0.93]), and the south (0.59% [0.45-0.75]. During the COVID-19 pandemic, among SARS-Cov-2 positive RRT patients the fatality rate was 32.8%, as compared to 13.3% observed in the Italian population as of April 23rd. CONCLUSIONS: A substantial proportion of the 60,441 surveyed RRT patients in Italy were SARS-Cov-2 positive and subsequently died during the exponential phase of COVID-19 pandemic. Infection risk and rates seems to differ substantially across regions, along geographical latitude, and by treatment modality.

Rai, D. K. (2020). "Clinical and Lab Characteristics of End Stage Renal Disease Patients with COVID 19." J Assoc Physicians India **68**(11): 80.

Raina, R., et al. (2020). "Kidney Replacement Therapy in COVID-19 Induced Kidney Failure and Septic Shock: A Pediatric Continuous Renal Replacement Therapy [PCRRT] Position on Emergency Preparedness With Resource Allocation." Front Pediatr **8**: 413.

The recent worldwide pandemic of COVID-19 has had a detrimental worldwide impact on people of all ages. Although data from China and the United States indicate that pediatric cases often have a mild course and are less severe in comparison to adults, there have been several cases of kidney failure and multisystem inflammatory syndrome reported. As such, we believe that the world should be prepared if the severity of cases begins to further increase within the pediatric population. Therefore, we provide here a position paper centered on emergency preparation with resource allocation for critical COVID-19 cases within the pediatric population, specifically where renal conditions worsen due to the onset of AKI.

Ramanathan, M., et al. (2020). "Concomitant renal and splenic infarction as a complication of COVID-19: a case report and literature review." Infez Med **28**(4): 611-615.

The prothrombotic state contributes to diverse and devastating prognoses of severe COVID-19. We describe a unique COVID-19 case with concomitant splenic and renal infarcts. Based on this, clinicians should have a low threshold to suspect a diagnosis of deep vein thrombosis/pulmonary embolism (DVT/PE), especially in the abdominal visceral region if a patient comes in several days after a COVID-19 diagnosis with abdominal pain. Whether or not empiric full dose anticoagulation is needed in patients without definite diagnosis of thromboembolism is still controversial. Further studies need to be done; meanwhile, we advocate the use of regular dose thromboprophylaxis in all hospitalized patients and therapeutic anticoagulation only when there is a confirmed diagnosis of thromboembolism.

Ramirez-Sandoval, J. C., et al. (2021). "Prolonged Intermittent Renal Replacement Therapy for Acute Kidney Injury in COVID-19 Patients with Acute Respiratory Distress Syndrome." Blood Purif **50**(3): 355-363.

INTRODUCTION: Patients with acute respiratory distress syndrome (ARDS) secondary to COVID-19 frequently develop severe acute kidney injury (AKI). Although continuous renal replacement therapy is the standard of care for critically ill patients, prolonged intermittent renal replacement therapy (PIRRT) may be a feasible option. We aimed to describe the tolerability and security of PIRRT treatments in COVID-19 patients with ARDS who required mechanical ventilation and developed severe AKI. METHODS: We prospectively analyzed patients who underwent PIRRT treatments at a COVID-19 reference hospital in Mexico City. Intradialytic hypotension was defined as a systolic blood pressure decrease of >/=20 mm Hg or an increase of 100% in vasopressor dose. RESULTS: We identified 136 AKI cases (60.7%) in 224 patients admitted to the intensive care unit. Among them, 21 (15%) underwent PIRRT (130 sessions) due to stage 3 AKI. The median age of the cohort was 49 (range 36-73) years, 17 (81%) were male, 7 (33%) had diabetes, and the median time between symptoms onset and PIRRT initiation was 12 (interquartile range [IQR] 7-14) days. The median of PIRRT procedures for each patient was 5 (IQR 4-9) sessions. In 108 (83%) PIRRT sessions, the total ultrafiltration goal was achieved. In 84 (65%) PIRRT procedures, there was a median increase in norepinephrine dose of +0.031 mcg/kg/min during PIRRT (IQR 0.00 to +0.07). Intradialytic hypotensive events occurred in 56 (43%) procedures. Fifteen (12%) PIRRT treatments were discontinued due to severe hypotension. Vasopressor treatment at PIRRT session onset (OR 6.2, 95% CI 1.4-28.0, p: 0.02) and a pre-PIRRT lactate >/=3.0 mmol/L (OR 4.63, 95% CI 1.3-12.8, p: 0.003) were independently and significantly associated with the risk of hypotension during PIRRT. During follow-up, 11 patients (52%) recovered from AKI and respiratory failure and 9 (43%) died. Several adaptations to our PIRRT protocol during the COVID-19 outbreak are presented. CONCLUSIONS: PIRRT was feasible in the majority of COVID-19 patients with ARDS and severe AKI, despite frequent transitory intradialytic hypotensive episodes. PIRRT may represent an acceptable alternative of renal replacement therapy during the COVID-19 outbreak.

Ramteke, V. V., et al. (2021). "Bilateral Renal Infarcts in a Patient with COVID-19 Pneumonia." Indian J Nephrol **31**(4): 414-415.

Rastad, H., et al. (2021). "The risk factors associated with COVID-19-Related death among patients with end-stage renal disease." BMC Nephrol **22**(1): 33.

BACKGROUND: The extent to which patients with End-stage renal disease (ESRD) are at a higher risk of COVID-19-related death is still unclear. Therefore, the aim of this study was to identify the ESRD patients at increased risk of COVID-19 -related death and its associated factors. METHODS: This retrospective cohort study was conducted on 74 patients with ESRD and 446 patients without ESRD

hospitalized for COVID-19 in Alborz province, Iran, from Feb 20 2020 to Apr 26 2020. Data on demographic factors, medical history, Covid-19-related symptoms, and blood tests were obtained from the medical records of patients with confirmed COVID-19. We fitted univariable and multivariable Cox regression models to assess the association of underlying condition ESRD with the COVID-19 in-hospital mortality. Results were presented as crude and adjusted Hazard Ratios (HRs) and 95% confidence intervals (CIs). In the ESRD subgroup, demographic factors, medical history, symptoms, and blood parameters on the admission of survivors were compared with non-survivors to identify factors that might predict a high risk of mortality. RESULTS: COVID-19 patients with ESRD had in-hospital mortality of 37.8% compared to 11.9% for those without ESRD (P value < 0.001). After adjusting for confounding factors, age, sex, and comorbidities, ESRD patients were more likely to experience in-hospital mortality compared to non-ESRD patients (Adjusted HR (95% CI): 2.59 (1.55-4.32)). The Log-rank test revealed that there was a significant difference between the ESRD and non-ESRD groups in terms of the survival distribution (chi2 (1) = 21.18, P-value < 0.001). In the ESRD subgroup, compared to survivors, non-survivors were older, and more likely to present with lack of consciousness or O2 saturation less than 93%; they also had lower lymphocyte but higher neutrophil counts and AST concentration at the presentation (all p -values < 0.05). CONCLUSIONS: Our findings suggested that the presence of ESRD would be regarded as an important risk factor for mortality in COVID-19 patients, especially in those who are older than age 65 years and presented with a lack of consciousness or O2 saturation less than 93%.

Raza, A., et al. (2020). "Acute Renal Failure in Critically Ill COVID-19 Patients With a Focus on the Role of Renal Replacement Therapy: A Review of What We Know So Far." Cureus **12**(6): e8429.

Acute renal failure remains a significant concern in all patients with the coronavirus disease 2019 (COVID-19) infection. Management is particularly challenging in critically ill patients requiring intensive care unit (ICU) level of care. Supportive care in the form of accurate volume correction and avoiding nephrotoxic agents are the chief cornerstone of the management of these patients. The pathophysiology of acute renal failure in COVID-19 is multifactorial, with significant contributions from excessive cytokine release. Gaining a better insight into the pathophysiology of renal failure will hopefully help develop more directed treatment options. A considerable number of these patients deteriorate despite adequate supportive care owing to the complexity of the disease and multi-organ involvement. Renal replacement therapy is used for a long time in critically ill septic patients who develop progressive renal failure despite adequate conservative support. Timing and choice of renal replacement therapy in critically ill COVID-19 patients remains an area of future research that may help decrease mortality in this patient population.

Regele, F. and R. Oberbauer (2021). "[COVID-19 and renal transplantation]." Nephrologe: 1-8.

The coronavirus disease 2019 (COVID-19) pandemic poses a particular risk for kidney transplant recipients. This is due to a high prevalence of comorbidities as well as therapeutic immunosuppression, which plays a complex role in view of the severe hyperinflammation contributing to morbidity and mortality. Many published case series including kidney transplant recipients reported a high proportion of hospitalized cases and mortality rates of 13-23%. The clinical symptoms and established risk factors for severe disease seem to be similar to those of the general population. The management of immunosuppressive treatment is a delicate question in the treatment of kidney transplant recipients with COVID-19. According to the current recommendations, a stepwise reduction should be carried out depending on the clinical course of the disease. Ongoing efforts to find an effective treatment for severe acute respiratory syndrome coronavirus type 2 (SARS-CoV-2) focus on repurposing known antiviral and anti-inflammatory substances. To date, only dexamethasone has shown to be an effective treatment in the subgroup of patients requiring oxygen supplementation; however, countless trials including novel therapeutic approaches are ongoing.

Renberg, M., et al. (2021). "Renal resistive index is associated with acute kidney injury in COVID-19 patients treated in the intensive care unit." Ultrasound J **13**(1): 3.

BACKGROUND: Renal resistive index (RRI) is a promising tool for the assessment of acute kidney injury (AKI) in critically ill patients in general, but its role and association to AKI among patients with Coronavirus disease 2019 (COVID-19) is not known. OBJECTIVE: The aim of this study was to describe the pattern of RRI in relation to AKI in patients with COVID-19 treated in the intensive care unit. METHODS: In this observational cohort study, RRI was measured in COVID-19 patients in six intensive care units at two sites of a Swedish University Hospital. AKI was defined by the creatinine criteria in the Kidney Disease Improving Global Outcomes classification. We investigated the association between RRI and AKI diagnosis, different AKI stages and urine

output. RESULTS: RRI was measured in 51 patients, of which 23 patients (45%) had AKI at the time of measurement. Median RRI in patients with AKI was 0.80 (IQR 0.71-0.85) compared to 0.72 (IQR 0.67-0.78) in patients without AKI (p = 0.004). Compared to patients without AKI, RRI was higher in patients with AKI stage 3 (median 0.83, IQR 0.71-0.85, p = 0.006) but not in patients with AKI stage 1 (median 0.76, IQR 0.71-0.83, p = 0.347) or AKI stage 2 (median 0.79, min/max 0.79/0.80, n = 2, p = 0.134). RRI was higher in patients with an ongoing AKI episode compared to patients who never developed AKI (median 0.72, IQR 0.69-0.78, p = 0.015) or patients who developed AKI but had recovered at the time of measurement (median 0.68, IQR 0.67-0.81, p = 0.021). Oliguric patients had higher RRI (median 0.84, IQR 0.83-0.85) compared to non-oliguric patients (median 0.74, IQR 0.69-0.81) (p = 0.009). After multivariable adjustment, RRI was independently associated with AKI (OR for 0.01 increments of RRI 1.22, 95% CI 1.07-1.41). CONCLUSIONS: Critically ill COVID-19 patients with AKI have higher RRI compared to those without AKI, and elevated RRI may have a role in identifying severe and oliguric AKI at the bedside in these patients.

Rigual, R., et al. (2021). "Concurrent Cerebral, Splenic, and Renal Infarction in a Patient With COVID-19 Infection." Neurologist.

INTRODUCTION: Thrombotic events are potentially devastating complications of coronavirus disease 2019 (COVID-19) infection. Although less common than venous thromboembolism, arterial thrombosis has been reported in COVID-19 cohorts in almost 3% of patients. We describe a patient with COVID-19 infection and concurrent cerebral and noncerebral infarction. CASE REPORT: A 53-year-old man with history of COVID-19 pneumonia was admitted to a primary stroke center for speech disturbances and left hemiplegia. Urgent laboratory tests showed a great increase of inflammatory and coagulation parameters as D-dimer, ferritin, interleukin-6 and C-reactive protein. Neuroimaging found occlusion of the M1 segment of the right middle cerebral artery with early signs of ischemic stroke. He received intravenous thrombolysis and mechanical thrombectomy. Abdominal computed tomography discovered a splenic infarction with hemorrhagic transformation and bilateral renal infarction. Urgent angiography showed an associated splenic pseudoaneurysm, which was embolized without complications. He was treated with intermediate-dose anticoagulation (1 mg subcutaneous enoxaparin/kg/24 h), acetylsalicylic acid 100 mg and 5 days of intravenous corticosteroids. In the following days, inflammatory markers decreased so anticoagulant treatment was stopped and acetylsalicylic acid 300 mg was prescribed. His condition improved and he was discharged to a rehabilitation facility on hospital day 30. CONCLUSION: In this case, a patient with multiple thrombotic events in the acute phase of COVID-19 infection, the delimitation of the inflammatory state through analytical markers as D-dimer helped to individualize the antithrombotic treatment (full anticoagulation or anticoagulation at intermediate doses plus antiplatelet treatment as used in our patient) and its duration. However, more data are needed to better understand the mechanisms and treatment of stroke in patients with COVID-19 infection.

Rizo-Topete, L. M., et al. (2021). "Acute kidney injury requiring renal replacement therapy during the COVID-19 pandemic: what are our options for treating it in Latin America?" Kidney Int **99**(3): 524-527.

Roberto, P., et al. (2020). "Current treatment of COVID-19 in renal patients: hope or hype?" Intern Emerg Med **15**(8): 1389-1398.

To date the severe acute respiratory syndrome coronavirus 2 (SARS- CoV-2), known as COVID-19, is for clinicians the most difficult global therapeutic problem. In this landscape, the management of patients with chronic kidney disease, acute kidney injury or patients undergoing immunosuppressant therapies for kidney transplant or glomerular diseases, represent a clinical challenge for nephrologists, especially in patients with severe acute lung involvement. Therefore in this setting, due to the lack of anti-COVID treatment schedules, tailored management is mandatory to reduce the side effects, as consequence of impaired renal function and drugs interactions. We report the main treatment actually used against SARS-CoV-2, underlining its possible use in the nephropatic patients and the central role of nephrologists to improve the clinical outcome.

Roberts, L. N., et al. (2020). "Hypercoagulability and Anticoagulation in Patients With COVID-19 Requiring Renal Replacement Therapy." Kidney Int Rep **5**(9): 1377-1380.

Roberts, S. H., et al. (2021). "Continuous renal replacement therapy and extracorporeal membrane oxygenation: implications in the COVID-19 era." Perfusion: 2676591211042561.

The novel severe acute respiratory syndrome coronavirus 2, SARS-CoV-2 (coronavirus Disease 19 (COVID-19)) was identified as the causative agent of viral pneumonias in Wuhan, China in December 2019, and has emerged as a pandemic causing acute respiratory distress syndrome (ARDS) and multiple organ dysfunction. Interim guidance by the World

Health Organization states that extracorporeal membrane oxygenation (ECMO) should be considered as a rescue therapy in COVID-19-related ARDS. International registries tracking ECMO in COVID-19 patients reveal a 21%-70% incidence of acute renal injury requiring renal replacement therapy (RRT) during ECMO support. The indications for initiating RRT in patients on ECMO are similar to those for patients not requiring ECMO. RRT can be administered during ECMO via a temporary dialysis catheter, placement of a circuit in-line hemofilter, or direct connection of continuous RRT in-line with the ECMO circuit. Here we review methods for RRT during ECMO, RRT initiation and timing during ECMO, anticoagulation strategies, and novel cytokine filtration approaches to minimize COVID-19's pathophysiological impact.

Rodriguez, V. A., et al. (2021). "Development and validation of prediction models for mechanical ventilation, renal replacement therapy, and readmission in COVID-19 patients." J Am Med Inform Assoc **28**(7): 1480-1488.

OBJECTIVE: Coronavirus disease 2019 (COVID-19) patients are at risk for resource-intensive outcomes including mechanical ventilation (MV), renal replacement therapy (RRT), and readmission. Accurate outcome prognostication could facilitate hospital resource allocation. We develop and validate predictive models for each outcome using retrospective electronic health record data for COVID-19 patients treated between March 2 and May 6, 2020. MATERIALS AND METHODS: For each outcome, we trained 3 classes of prediction models using clinical data for a cohort of SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2)-positive patients (n = 2256). Cross-validation was used to select the best-performing models per the areas under the receiver-operating characteristic and precision-recall curves. Models were validated using a held-out cohort (n = 855). We measured each model's calibration and evaluated feature importances to interpret model output. RESULTS: The predictive performance for our selected models on the held-out cohort was as follows: area under the receiver-operating characteristic curve-MV 0.743 (95% CI, 0.682-0.812), RRT 0.847 (95% CI, 0.772-0.936), readmission 0.871 (95% CI, 0.830-0.917); area under the precision-recall curve-MV 0.137 (95% CI, 0.047-0.175), RRT 0.325 (95% CI, 0.117-0.497), readmission 0.504 (95% CI, 0.388-0.604). Predictions were well calibrated, and the most important features within each model were consistent with clinical intuition. DISCUSSION: Our models produce performant, well-calibrated, and interpretable predictions for COVID-19 patients at risk for the target outcomes. They demonstrate the potential to accurately estimate outcome prognosis in resource-constrained care sites managing COVID-19 patients. CONCLUSIONS: We develop and validate prognostic models targeting MV, RRT, and readmission for hospitalized COVID-19 patients which produce accurate, interpretable predictions. Additional external validation studies are needed to further verify the generalizability of our results.

Roedl, K., et al. (2021). "MR-proAdrenomedullin as a predictor of renal replacement therapy in a cohort of critically ill patients with COVID-19." Biomarkers **26**(5): 417-424.

BACKGROUND: About 20% of ICU patients with COVID-19 require renal replacement therapy (RRT). Mid-regional pro-adrenomedullin (MR-proADM) might be used for risk assessment. This study investigates MR-proADM for RRT prediction in ICU patients with COVID-19. METHODS: We analysed data of consecutive patients with COVID-19, requiring ICU admission at a university hospital in Germany between March and September 2020. Clinical characteristics, details on AKI, and RRT were assessed. MR-proADM was measured on admission. RESULTS: 64 patients were included (49 (77%) males). Median age was 62.5y (54-73). 47 (73%) patients were ventilated and 50 (78%) needed vasopressors. 25 (39%) patients had severe ARDS, and 10 patients needed veno-venous extracorporeal membrane oxygenation. 29 (45%) patients required RRT; median time from admission to RRT start was 2 (1-9) days. MR-proADM on admission was higher in the RRT group (2.491 vs. 1.23 nmol/l; p = 0.002) and showed the highest correlation with renalSOFA. ROC curve analysis showed that MR-proADM predicts RRT with an AUC of 0.69 (95% CI: 0.543-0.828; p = 0.019). In multivariable logistic regression MR-proADM was an independent predictor (OR: 3.813, 95% CI 1.110-13.102, p<0.05) for RRT requirement. CONCLUSION: AKI requiring RRT is frequent in ICU patients with COVID-19. MR-proADM on admission was able to predict RRT requirement, which may be of interest for risk stratification and management.

Roll, G. R., et al. (2021). "COVID-19 does not impact HLA antibody profile in a series of waitlisted renal transplant candidates." Hum Immunol **82**(8): 568-573.

HLA antibodies are typically produced after exposure to transplanted tissue, pregnancy, and blood products. Sensitization delays access to transplantation and preclude utilization of donor organs. Infections and vaccinations have also been reported to result in HLA antibody formation. It is not known if patients develop HLA antibodies after infection with SARS-CoV-2. Here we analyzed a series of eighteen patients waiting for kidney transplantation who had symptomatic

COVID-19 disease and recovered. None of the patients in this initial series developed de novo HLA antibodies. Notably, there was no increase in preexisting HLA antibodies in four highly sensitized patients with a CPRA > 80%. These preliminary data suggest that there may not be a need to repeat HLA antibody testing or perform a physical crossmatch on admission serum before kidney transplant for COVID-19 recovered patients. Data from a large number of patients with different demographics needed.

Ronco, C., et al. (2020). "Rationale for Medium Cutoff Membranes in COVID-19 Patients Requiring Renal Replacement Therapy." Nephron **144**(11): 550-554.

The current pandemic of coronavirus disease 2019 (COVID-19) spotlighted the vulnerability of patients with chronic kidney disease stage 5 on maintenance hemodialysis (HD) to the viral infection. Social distancing is the most effective preventive measure to reduce the risk of infection. Nonetheless, the necessity to frequently reach the dialysis center and the inherent social gathering both impede social distancing and also self-quarantine for infected individuals. A baseline hyperinflammatory state driven by factors such as the retention of uremic toxins afflicts these patients. Concomitantly, a condition of relative immunosuppression is also attributed to similar factors. The use of high-flux (HF) dialyzers for HD is the standard of care. However, with HF membranes, the removal of large middle molecules is scant. Medium cutoff (MCO) dialyzers are a new class of membranes that allow substantial removal of large middle molecules with negligible albumin losses. Recent trials confirmed long-term safety and long-term sustained reduction in the concentration of large uremic toxins with MCO dialyzers. Herein, we discuss the rationale for applying MCO membranes in COVID-19 patients and its possible immunoadjuvant effects that could mitigate the burden of COVID-19 infection in dialysis patients. We also discuss the direct cytopathic effect of the virus on renal tissue and extracorporeal blood purification techniques that can prevent kidney damage or reduce acute kidney injury progression.

Roomi, S., et al. (2020). "Is therapeutic anticoagulation improving renal outcomes in COVID-19?" J Community Hosp Intern Med Perspect **10**(4): 306-309.

We present three patients with COVID-19 who developed acute renal failure during hospitalization and were seen to have an improvement in their kidney function after being started on therapeutic anticoagulation with heparin (Target PTT 58-93 seconds) for varying indications (atrial fibrillation, popliteal vein thrombosis and a pulmonary embolism). Their kidney functions improved significantly following anticoagulation with a clear temporal relationship between the former and latter. Anticoagulation was held for one patient due to concern of gastrointestinal bleeding and his kidney functions worsened a day after stopping anticoagulation. D-dimer levels also improved with anticoagulation but the trend of other inflammatory markers remained unpredictable.

Rosa-Guerrero, P., et al. (2021). "Case Report: Successful Response to Intravenous Immunoglobulin and Steroid Pulses in a Renal Transplant Recipient With Severe Covid-19 Disease and Associated Acute Allograft Failure." Front Immunol **12**: 671013.

The impact of Covid-19 pneumonia caused by SARS-CoV-2 on transplanted populations under chronic immunosuppression seems to be greater than in normal population. Clinical management of the disease, particularly in those patients worsening after a cytokine storm, with or without allograft impairment and using available therapeutic approaches in the absence of specific drugs to fight against the virus, involves a major challenge for physicians. We herein provide evidence of the usefulness of high-dose intravenous immunoglobulin (IVIG) combined with steroid pulses to successfully treat a case of Covid-19 pneumonia in a single-kidney transplanted patient with mechanical ventilation and hemodialysis requirements in the setting of a cytokine storm. A rapid decrease in the serum level of inflammatory cytokines, particularly IL-6, IL-8, TNF-alpha, MCP-1 and IL-10, as well as of acute-phase reactants such as ferritin, D-dimer and C-reactive protein was observed after the IVIG infusion and methylprednisolone bolus administration with a parallel clinical improvement and progressive allograft function recovery, allowing the patient's final discharge 40 days after the treatment onset. The immunomodulatory effect of IVIG together with the anti-inflammatory and immunosuppressive potential of steroids could be an alternative strategy to treat severe cases of Covid-19 pneumonia associated with an uncontrolled inflammatory response in transplanted populations.

Ryan, R., et al. (2021). "Comparison of renal replacement therapy and renal recovery before and during the COVID-19 pandemic: a single center observational study." Minerva Anestesiol **87**(11): 1209-1216.

BACKGROUND: Our objective was to the describe indications, management, complications and outcomes of renal replacement therapy (RRT) in COVID-19 critically ill patients. To contextualize these findings, comparisons were made against 36 non-COVID-19 consecutive patients requiring RRT on ICU. METHODS: We conducted a retrospective single center observational cohort study of patients requiring

acute RRT between 1(st) March and 30(th) June 2020. Comparison was made against those receiving RRT in the pre-COVID-19 period from January 2019 to February 2020. RESULTS: Of 154 COVID-19 patients, 47 (30.5%) received continuous venovenous hemofiltration (CVVHF), all of whom required mechanical ventilation and vasopressor support. The requirement for RRT was related to fluid balance rather than azotemia. Compared to 36 non-COVID-19 patients, those with COVID-19 were younger (P=0.016) with a lower serum creatinine on hospital admission (P=0.049), and lesser degrees of metabolic acidosis (P<0.001) and lactatemia (P<0.001) before initiation of RRT. In addition, the duration of RRT requirement was longer (P<0.001). Despite lower CVVHF exchange rates with higher serum creatinine levels following RRT initiation in the COVID-19 patients, metabolic abnormalities were corrected. Hospital mortality was 60% among COVID-19 patients requiring RRT, compared to 67% in non-COVID-19 patients (P=0.508), and renal recovery among survivors without pre-existing CKD was similar (P=0.231). CONCLUSIONS: The requirement for RRT in COVID-19 patients was primarily related to fluid balance. Using lower CVVHF exchange rates was effective to correct metabolic abnormalities. Renal recovery occurred in all but one patient by 60 days in the 40% of patients who survived.

Sagnelli, C., et al. (2021). "Renal involvement in COVID-19: focus on kidney transplant sector." Infection **49**(6): 1265-1275.

INTRODUCTION: Kidney transplant recipients and patients on the waiting list for kidney transplant who acquire SARS-CoV-2 infection are at serious risk of developing severe COVID-19, with an increased risk of mortality for the their immunosuppressive state; other risk factors for mortality have been identified in some comorbidities such as obesity, diabetes, asthma and chronic lung disease. MATERIALS AND METHODS: The COVID-19 pandemic has led to a sharp reduction in kidney transplants in most countries, mainly due to the concern of patients on the waiting list for their potential increased susceptibility to acquire SARS-CoV-2 infection in healthcare facilities and for the difficulties of transplant centers to ensure full activity as hospitals have had to focus most of their attention on COVID-19 patients. Indeed, while the infection curve continued its exponential rise, there was a vertical decline in kidney donation/transplant activity. CONCLUSION: This review article focuses on the damage induced by SARS-CoV-2 infection on kidney and on the adverse effect of this pandemic on the entire kidney transplant sector.

Salah, H. M., et al. (2020). "Implications of renal ACE2 expression in the age of COVID-19." Eur Heart J **41**(48): 4589-4591.

Sanchez-Alvarez, J. E., et al. (2020). "[SARS-CoV-2 infection in patients on renal replacement therapy. Report of the COVID-19 Registry of the Spanish Society of Nephrology (SEN)]." Nefrologia (Engl Ed) **40**(3): 272-278.

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 AND METHODS: 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. RESULTS: 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. CONCLUSIONS: 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.

Santana Quintana, A., et al. (2021). "[Not all cytokin storms are due to COVID-19: Hemophagotic syndrome with renal involvement secondary to extranasal lymphoma and Epstein-Barr virus. A case report during the pandemic]." Nefrologia (Engl Ed) **41**(3): 347-349.

Santos, C., et al. (2020). "Palliative Renal Care and the Covid-19 Pandemic." J Bras Nefrol **42**(2 suppl 1): 44-46.

INTRODUCTION: Palliative care is an approach aimed at relieving suffering, controlling symptoms and seeking to improve quality of life. It must be offered in conjunction with standard treatment for any disease that threatens the continuation of life, such as a Covid-19 infection. DISCUSSION: The bioethical principles and strategies used by palliative medicine can assist nephrologists in the care of patients with renal dysfunction, who face the difficulties of isolation at the beginning and follow-up of dialysis in outpatient treatment, and those who are at risk for a more serious disease progress. Some of them: - a Shared decision making, which enables the patient and family to participate as facilitators in the systematization of the team's reasoning, in addition to respecting the principle of autonomy; - Symptom Management: which should be a priority to ensure relief of suffering even in times of social isolation; - Communication skills: making it possible to alleviate suffering in announcing bad news or complex decisions through communication techniques;; - Bereavement assistance: which in acute situations such as the pandemic, causing unexpected losses, the importance of sympathy from healthcare professionals becomes even greater. CONCLUSION: The principles of palliative care are essential to face the challenges of a planet-wide crisis, which raises human suffering in all dimensions, and which requires the construction of strategies that can keep patients assisted, comfortable and with measures proportional to their clinical condition and preferences.

Sato, T., et al. (2021). "Role of OATP4C1 in Renal Handling of Remdesivir and its Nucleoside Analog GS-441524: The First Approved Drug for Patients with COVID-19." J Pharm Pharm Sci **24**: 227-236.

PURPOSE: Remdesivir and its active metabolite are predominantly eliminated via renal route; however, information regarding renal uptake transporters is limited. In the present study, the interaction of remdesivir and its nucleoside analog GS-441524 with OATP4C1 was evaluated to provide the detailed information about its renal handling. METHODS: We used HK-2 cells, a proximal tubular cell line derived from normal kidney, to confirm the transport of remdesivir and GS-441524. To assess the involvement of OATP4C1 in handling remdesivir and GS-441524, the uptake study of remdesivir and GS-441524 was performed by using OATP4C1-overexpressing Madin-Darby canine kidney II (MDCKII) cells. Moreover, we also evaluated the IC50 and Ki value of remdesivir. RESULTS: The time-dependent remdesivir uptake in HK-2 cells was observed. The results of inhibition study using OATs and OCT2 inhibitors and OATP4C1 knockdown suggested the involvement of renal drug transporter OATP4C1. Remdesivir was taken up by OATP4C1/MDCKII cells. OATP4C1-mediated uptake of remdesivir increased linearly up to 10 min and reached a steady state at 30 min. Remdesivir inhibited OATP4C1-mediated transport in a concentration-dependent manner with the IC50 and apparent Ki values of 42 +/- 7.8 muM and 37 +/- 6.9 muM, respectively. CONCLUSIONS: We have provided novel information about renal handling of remdesivir. Furthermore, we evaluated the potential drug interaction via OATP4C1 by calculating the Ki value of remdesivir. OATP4C1 may play a pivotal role in remdesivir therapy for COVID-19, particularly in patients with kidney injury.

Sciarrone Alibrandi, M. T., et al. (2021). "[Covid-19 vaccination and renal patients: overcoming unwarranted fears and re-establishing priorities]." G Ital Nefrol **38**(2).

The SARS-CoV-2 (Covid-19) has infected about 124 million people worldwide and the total amount of casualties now sits at a staggering 2.7 million. One enigmatic aspect of this disease is the protean nature of the clinical manifestations, ranging from total absence of symptoms to extremely severe cases with multiorgan failure and death. Chronic Kidney Disease (CKD) has emerged as the primary risk factor in the most severe patients, apart from age. Kidney disease and acute kidney injury have been correlated with a higher risk of death. Notably the Italian Society of Nephrology have reported a 10-fold increase in mortality in patients undergoing dialysis compared to the rest of the population, especially during the second phase of the pandemic (26% vs 2.4). These dramatic numbers require an immediate response. At the moment of writing, three Covid-19 vaccines are being administered already , two of which, Pfizer-BioNTech and Moderna, share the same mRNA mechanism and Vaxzevria (AstraZeneca) based on a more traditional approach. All of them are completely safe and reliable. The AIFA scientific commission has suggested that the mRNA vaccines should be administered to older and more fragile patients, while the Vaxzevria (AstraZeneca) vaccine should be reserved for younger subjects above the age of 18. The near future looks bright: there are tens of other vaccines undergoing clinical and preclinical validation, whose preliminary results look promising. The high mortality of CKD and dialysis patients contracting Covid-19 should mandate top priority for their vaccination.

Seidel, M., et al. (2020). "Impact of renal disease and comorbidities on mortality in hemodialysis patients with COVID-19: a multicenter experience from Germany." J Nephrol **33**(5): 871-874.

Shaikh, N., et al. (2021). "Clinical outcomes of post-renal transplant patients with COVID-19 infection in the ICU: A single-center case series." Clin Case Rep **9**(7): e04513.

Most of the post-renal transplant patients are taking immunosuppressive medications, including calcineurin inhibitors, anti-proliferative agents, and steroids. This case series highlights the clinical characteristics and outcomes of eight post-renal transplant patients with severe COVID-19 infection admitted to the intensive care unit.

Shanbhag, A., et al. (2020). "COVID-19 Presenting as Severe Rhabdomyolysis With Normal Renal Function." Cureus **12**(8): e9556.

Coronavirus disease 2019 (COVID-19) continues to increase morbidity and mortality. Early recognition of symptoms, along with prompt intervention, is required to improve patient outcomes. COVID-19 can have a multifaceted presentation, which can be a diagnostic challenge. Here, we report the first case of COVID-19 presenting as severe rhabdomyolysis with creatine kinase > 500,000 U/L with normal renal function in a young adult.

Shankaranarayanan, D., et al. (2020). "Anticoagulation Strategies and Filter Life in COVID-19 Patients Receiving Continuous Renal Replacement Therapy: A Single-Center Experience." Clin J Am Soc Nephrol **16**(1): 124-126.

Sharma, V., et al. (2020). "The impact of the COVID-19 pandemic on renal transplantation in the UK." Clin Med (Lond) **20**(4): e82-e86.

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.

Shemies, R. S., et al. (2021). "Renal replacement therapy for critically ill patients with COVID-19-associated acute kidney injury: A review of current knowledge." Ther Apher Dial.

The outbreak of coronavirus disease 2019 (COVID-19) has rapidly evolved into a global pandemic. A significant proportion of COVID-19 patients develops severe symptoms, which may include acute respiratory distress syndrome and acute kidney injury as manifestations of multi-organ failure. Acute kidney injury (AKI) necessitating renal replacement therapy (RRT) is increasingly prevalent among critically ill patients with COVID-19. However, few studies have focused on AKI treated with RRT. Many questions are awaiting answers as regards AKI in the setting of COVID-19; whether patients with COVID-19 commonly develop AKI, what are the underlying pathophysiologic mechanisms? What is the best evidence regarding treatment approaches? Identification of the potential indications and the preferred modalities of RRT in this context, is based mainly on clinical experience. Here, we review the current approaches of RRT, required for management of critically ill patients with COVID-19 complicated by severe AKI as well as the precautions that should be adopted by health care providers in dealing with these cases. Electronic search was conducted in MEDLINE, PubMed, ISI Web of Science, and Scopus scientific databases. We searched the terms relevant to this review to identify the relevant studies. We also searched the conference proceedings and ClinicalTrials.gov database.

Singh, T., et al. (2021). "Renal artery thrombosis and mucormycosis in a COVID-19 patient." Indian J Urol **37**(3): 267-269.

The novel coronavirus disease 2019 (COVID-19) has been postulated to be associated with hypercoagulability, leading to thromboembolism in major blood vessels. There are also increasing reports of invasive fungal infections in COVID-19 patients. We report a unique case of mucormycosis associated with renal artery thrombosis leading to renal infarction and nephrectomy in a COVID-19 patient. This is the first such reported case to our knowledge.

Singh, Y., et al. (2021). "Calcium sensing receptor hyperactivation through viral envelop protein E of SARS CoV2: A novel target for cardio-renal damage in COVID-19 infection." Drug Dev Res **82**(6): 784-788.

Over the recent decades, a number of new pathogens have emerged within specific and diverse populations across the globe, namely, the Nipah virus, the Ebola virus, the Zika virus, and coronaviruses (CoVs) to name a few. Recently, a new form of coronavirus was identified in the city of Wuhan, China.

Interestingly, the genomic architecture of the virus did not match with any of the existing genomic sequencing data of previously sequenced CoVs. This had led scientists to confirm the emergence of a new CoV strain. Originally, named as 2019-nCoV, the strain is now called as SARS-CoV-2. High serum levels of proinflammatory mediators, namely, interleukin-12 (IL-12), IL-1beta, IL-6, interferon-gamma (IFNgamma), chemoattractant protein-1, and IFN-inducible protein, have been repeatedly observed in subjects who were infected with this virus. In addition, the virus demonstrated strong coagulation activation properties, leading to further the understanding on the SARS-CoV2. To our understanding, these findings are unique to the published literature. Numerous studies have reported anomalies, namely, decline in the number of lymphocytes, platelets and albumins; and a rise in neutrophil count, aspartate transaminase, alanine aminotransaminase, lactate dehydrogenase, troponins, creatinine, complete bilirubin, D-dimers, and procalcitonin. Supplementation of calcium during the SARS CoV-2 associated hyperactive stage of calcium-sensing receptors (CaSR) may be harmful to the cardio-renal system. Thus, pharmacological inhibition of CaSR may prevent the increase in the levels of intracellular calcium, oxidative, inflammatory stress, and cardio-renal cellular apoptosis induced by high cytokines level in COVID-19 infection.

Sohaney, R., et al. (2021). "Continuous Renal Replacement Therapy among Patients with COVID-19 and Acute Kidney Injury." Blood Purif: 1-8.

BACKGROUND AND OBJECTIVES: Acute kidney injury (AKI) is a common complication among patients with COVID-19 and acute respiratory distress syndrome. Reports suggest that COVID-19 confers a pro-thrombotic state, which presents challenges in maintaining hemofilter patency and delivering continuous renal replacement therapy (CRRT). We present our initial experience with CRRT in critically ill patients with COVID-19, emphasizing circuit patency and the association between fluid balance during CRRT and respiratory parameters. DESIGN, SETTING, PARTICIPANTS, AND MEASUREMENTS: Retrospective chart review of 32 consecutive patients with COVID-19 and AKI managed with continuous venovenous hemodiafiltration with regional citrate anticoagulation (CVVHDF-RCA) according to the University of Michigan protocol. Primary outcome was mean CRRT circuit life per patient during the first 7 days of CRRT. We used simple linear regression to assess the relationship between patient characteristics and filter life. We also explored the relationship between fluid balance on CRRT and respiratory parameters using repeated measures modeling. RESULTS: Patients' mean age was 54.8 years and majority were Black (75%). Comorbidities included hypertension (90.6%), obesity (70.9%) diabetes (56.2%), and chronic kidney disease (40.6%). Median CRRT circuit life was 53.5 [interquartile range 39.1-77.6] hours. There was no association between circuit life and inflammatory or pro-thrombotic laboratory values (ferritin $p = 0.92$, C-reactive protein $p = 0.29$, D-dimer $p = 0.24$), or with systemic anticoagulation ($p = 0.37$). Net daily fluid removal during the first 7 days of CRRT was not associated with daily (closest recorded values to 20:00) PaO2/FIO2 ratio ($p = 0.21$) or positive end-expiratory pressure requirements ($p = 0.47$). CONCLUSIONS: We achieved adequate CRRT circuit life in COVID-19 patients using an established CVVHDF-RCA protocol. During the first 7 days of CRRT therapy, cumulative fluid balance was not associated with improvements in respiratory parameters, even after accounting for baseline fluid balance.

Solomon, S., et al. (2021). "An early experience of COVID-19 disease in pediatric and young adult renal transplant recipients." Pediatr Transplant **25**(5): e13972.

BACKGROUND: COVID-19 is caused by a novel form of coronavirus known as SARS-CoV-2. Patients can present with a wide variety of symptoms from fever to severe respiratory distress. Immunocompromised patients, including solid organ transplant recipients, may present with atypical symptoms, making the diagnosis of COVID-19 more difficult to make. New reports have been emerging about the management of COVID-19 disease in adult renal transplant recipients. However, very little is known in pediatric renal transplant recipients. METHODS: Here, we describe a case report of four pediatric renal transplant recipients who presented with mild-to-moderate COVID-19 disease. RESULTS: All patients presented with upper respiratory infection symptoms, with one requiring hospitalization for hypoxia. Patients were treated mostly with supportive care. Two of the patients developed AKI which resolved four to eight weeks after illness. All four patients developed COVID IgG antibodies one to two months after becoming infected. CONCLUSION: This case series demonstrates that immunocompromised renal transplant recipients have comparable outcomes compared with immunocompetent children.

Sookaromdee, P. and V. Wiwanitkit (2020). "Novel coronavirus infection (COVID-19) and renal failure: An observation from cases in the 1(st) month of outbreak." Saudi J Kidney Dis Transpl **31**(6): 1455.

Sorgel, F., et al. (2021). "Pharmacokinetics of remdesivir in a COVID-19 patient with end-stage renal

disease on intermittent haemodialysis." J Antimicrob Chemother **76**(3): 825-827.

Sousa, H., et al. (2021). "Caring for patients with end-stage renal disease during COVID-19 lockdown: What (additional) challenges to family caregivers?" Scand J Caring Sci.

INTRODUCTION: Caring for a patient with end-stage renal disease undergoing in-centre haemodialysis can be a stressful experience, likely to involve significant burden. Within the context of the new coronavirus pandemic, these patients are highly vulnerable to infection by COVID-19, which might increase the care demands and burden of family caregivers. AIM: This study aimed to explore the subjective experiences of family caregivers of non-COVID-19 patients with end-stage renal disease undergoing in-centre haemodialysis during the COVID-19 lockdown. STUDY DESIGN: A qualitative study was performed with a purposive sample. METHODS: Semi-structured telephone interviews were conducted with 19 family caregivers (50.7 +/- 14 years old) of patients undergoing in-centre haemodialysis in April 2020. FINDINGS: Four major themes were identified: (1) emotional distress; (2) changes in caregiving responsibilities; (3) educational and supportive needs; and (4) coping strategies to deal with the outbreak and with the lockdown. DISCUSSION: The findings suggest that family caregivers of patients undergoing in-centre haemodialysis have to manage several additional care responsibilities due to COVID-19 lockdown. The dialysis team should consider the development of educational and supportive interventions to meet family caregivers' needs, mitigate emotional distress, fears and concerns, and prevent caregiver burden during the COVID-19 pandemic.

Srivastava, A., et al. (2021). "Delaying surgery for clinical T1b-T2bN0M0 renal cell carcinoma: Oncologic implications in the COVID-19 era and beyond." Urol Oncol **39**(5): 247-257.

PURPOSE: During COVID-19, many operating rooms were reserved exclusively for emergent cases. As a result, many elective surgeries for renal cell carcinoma (RCC) were deferred, with an unknown impact on outcomes. Since surveillance is commonplace for small renal masses, we focused on larger, organ-confined RCCs. Our primary endpoint was pT3a upstaging and our secondary endpoint was overall survival. MATERIALS AND METHODS: We retrospectively abstracted cT1b-T2bN0M0 RCC patients from the National Cancer Database, stratifying them by clinical stage and time from diagnosis to surgery. We selected only those patients who underwent surgery. Patients were grouped by having surgery within 1 month, 1-3 months, or >3 months after diagnosis. Logistic regression models measured pT3a upstaging risk. Kaplan Meier curves and Cox proportional hazards models assessed overall survival. RESULTS: A total of 29,746 patients underwent partial or radical nephrectomy. Delaying surgery >3 months after diagnosis did not confer pT3a upstaging risk among cT1b (OR=0.90; 95% CI: 0.77-1.05, P=0.170), cT2a (OR=0.90; 95% CI: 0.69-1.19, P=0.454), or cT2b (OR=0.96; 95% CI: 0.62-1.51, P=0.873). In all clinical stage strata, nonclear cell RCCs were significantly less likely to be upstaged (P <0.001). A sensitivity analysis, performed for delays of <1, 1-3, 3-6, and >6 months, also showed no increase in upstaging risk. CONCLUSION: Delaying surgery up to, and even beyond, 3 months does not significantly increase risk of tumor progression in clinically localized RCC. However, if deciding to delay surgery due to COVID-19, tumor histology, growth kinetics, patient comorbidities, and hospital capacity/resources, should be considered.

Staehler, M., et al. (2020). "Counterbalancing COVID-19 with Cancer Surveillance and Therapy: A Survey of Patients with Renal Cell Carcinoma." Eur Urol Focus.

BACKGROUND: While providers are challenged with treatment decisions during the coronavirus disease 2019 (COVID-19) crisis, decision making ultimately falls in the hands of patients-at present, their perspective is poorly understood. OBJECTIVE: To ascertain renal cell carcinoma (RCC) patients' perspectives on COVID-19 and understand the associated implications for treatment. DESIGN, SETTING, AND PARTICIPANTS: An online survey of RCC patients was conducted from March 22 to March 25, 2020, disseminated through social media and patient networking platforms. The survey comprised 45 items, including baseline demographic, clinicopathologic, and treatment-related information. Patients were additionally queried regarding their anxiety level related to COVID-19 and associated implications for their cancer diagnosis. INTERVENTION: An online survey study. OUTCOME MEASUREMENTS AND STATISTICAL ANALYSIS: Descriptive statistics with graphical outputs were used to characterize survey results. RESULTS AND LIMITATIONS: A total of 539 patients (male:female 39%:58%) from 14 countries responded. Of them, 71% felt that their risk of COVID-19 infection was higher than the general population, and 27% contacted their physician to establish this. Among patients with localized disease (40%), most (42%) had scheduled surveillance scans within 6 wk-65% were unwilling to delay scans. Among patients with metastatic disease, 76% were receiving active therapy. While most patients preferred not to defer

therapy (51%), patients receiving immune therapy regimens were less amenable to deferring therapy than those receiving targeted treatment (20% vs 47%). CONCLUSIONS: Despite high levels of anxiety surrounding COVID-19, many patients with RCC were inclined to adhere to existing schedules of surveillance (localized disease) and systemic treatment (metastatic disease). PATIENT SUMMARY: The coronavirus disease 2019 (COVID-19) pandemic has prompted many doctors to develop different treatment strategies for cancer and other chronic conditions. Given the importance of the patient voice in these strategies, we conducted a survey of patients with kidney cancer to determine their treatment preferences. Our survey highlighted that most patients prefer to continue their current strategies of kidney cancer treatment and monitoring.

Staehler, M. D., et al. (2021). "COVID-19 and financial toxicity in patients with renal cell carcinoma." World J Urol **39**(7): 2559-2565.

PURPOSE: To ascertain renal cell carcinoma (RCC) financial toxicity on COVID-19 during the COVID-19 crisis as patients are struggling with therapeutic and financial implications. METHODS: An online survey was conducted from March 22 to March 25, 2020. It included baseline demographic, clinicopathologic, treatment-related information, anxiety levels related to COVID-19, questions related to financial concerns about COVID-19 as well as the validated 11-item COST measure. RESULTS: Five-hundred-and-thirty-nine patients (39%:58% male:female) from 14 countries responded. 23% of the patients did not feel in control of their financial situation but 8% reported being very satisfied with their finances. The median COST score was 21.5 (range 1-44). Metastatic patients who have not started systemic therapy had a COST score (19.8 range 2-41) versus patients on oral systemic therapy had a COST score (23.9 range 4-44). Patients in follow-up after surgery had a median COST score at 20.8 (range 1-40). A low COST scores correlated ($p < 0.001$) were female gender ($r = 0.108$), younger age ($r = 0.210$), urban living situation ($r = 0.68$), a lower educational level ($r = 0.155$), lower income ($r = 0.165$), higher anxiety about acquiring COVID-19 ($r = 0.198$), having metastatic disease ($r = 0.073$) and a higher distress score about cancer progression ($r = 0.224$). CONCLUSION: Our data highlight severe financial impact of COVID-19. Acknowledging financial hardship and thorough counseling of cancer patients should be part of the conversation during the pandemic. Treatment and surveillance of RCC patients might have to be adjusted to contemplate financial and medical needs.

Stevens, J. S., et al. (2020). "High rate of renal recovery in survivors of COVID-19 associated acute renal failure requiring renal replacement therapy." PLoS One **15**(12): e0244131.

INTRODUCTION: A large proportion of patients with COVID-19 develop acute kidney injury (AKI). While the most severe of these cases require renal replacement therapy (RRT), little is known about their clinical course. METHODS: We describe the clinical characteristics of COVID-19 patients in the ICU with AKI requiring RRT at an academic medical center in New York City and followed patients for outcomes of death and renal recovery using time-to-event analyses. RESULTS: Our cohort of 115 patients represented 23% of all ICU admissions at our center, with a peak prevalence of 29%. Patients were followed for a median of 29 days (2542 total patient-RRT-days; median 54 days for survivors). Mechanical ventilation and vasopressor use were common (99% and 84%, respectively), and the median Sequential Organ Function Assessment (SOFA) score was 14. By the end of follow-up 51% died, 41% recovered kidney function (84% of survivors), and 8% still needed RRT (survival probability at 60 days: 0.46 [95% CI: 0.36-0.56])). In an adjusted Cox model, coronary artery disease and chronic obstructive pulmonary disease were associated with increased mortality (HRs: 3.99 [95% CI 1.46-10.90] and 3.10 [95% CI 1.25-7.66]) as were angiotensin-converting-enzyme inhibitors (HR 2.33 [95% CI 1.21-4.47]) and a SOFA score >15 (HR 3.46 [95% CI 1.65-7.25). CONCLUSIONS AND RELEVANCE: Our analysis demonstrates the high prevalence of AKI requiring RRT among critically ill patients with COVID-19 and is associated with a high mortality, however, the rate of renal recovery is high among survivors and should inform shared-decision making.

Stewart, D. J., et al. (2020). "Renal dysfunction in hospitalised children with COVID-19." Lancet Child Adolesc Health **4**(8): e28-e29.

Su, H., et al. (2020). "Renal histopathological analysis of 26 postmortem findings of patients with COVID-19 in China." Kidney Int **98**(1): 219-227.

Although the respiratory and immune systems are the major targets of Coronavirus Disease 2019 (COVID-19), acute kidney injury and proteinuria have also been observed. Currently, detailed pathologic examination of kidney damage in critically ill patients with COVID-19 has been lacking. To help define this we analyzed kidney abnormalities in 26 autopsies of patients with COVID-19 by light microscopy, ultrastructural observation and immunostaining. Patients were on average 69 years (19 male and 7 female) with respiratory failure associated with

multiple organ dysfunction syndrome as the cause of death. Nine of the 26 showed clinical signs of kidney injury that included increased serum creatinine and/or new-onset proteinuria. By light microscopy, diffuse proximal tubule injury with the loss of brush border, non-isometric vacuolar degeneration, and even frank necrosis was observed. Occasional hemosiderin granules and pigmented casts were identified. There were prominent erythrocyte aggregates obstructing the lumen of capillaries without platelet or fibrinoid material. Evidence of vasculitis, interstitial inflammation or hemorrhage was absent. Electron microscopic examination showed clusters of coronavirus-like particles with distinctive spikes in the tubular epithelium and podocytes. Furthermore, the receptor of SARS-CoV-2, ACE2 was found to be upregulated in patients with COVID-19, and immunostaining with SARS-CoV nucleoprotein antibody was positive in tubules. In addition to the direct virulence of SARS-CoV-2, factors contributing to acute kidney injury included systemic hypoxia, abnormal coagulation, and possible drug or hyperventilation-relevant rhabdomyolysis. Thus, our studies provide direct evidence of the invasion of SARSCoV-2 into kidney tissue. These findings will greatly add to the current understanding of SARS-CoV-2 infection.

Sukeishi, A., et al. (2021). "Population pharmacokinetic modeling of GS-441524, the active metabolite of remdesivir, in Japanese COVID-19 patients with renal dysfunction." CPT Pharmacometrics Syst Pharmacol.

Remdesivir, a prodrug of the nucleoside analog GS-441524, plays a key role in the treatment of coronavirus disease 2019 (COVID-19). However, owing to limited information on clinical trials and inexperienced clinical use, there is a lack of pharmacokinetic (PK) data in patients with COVID-19 with special characteristics. In this study, we aimed to measure serum GS-441524 concentrations and develop a population PK (PopPK) model. Remdesivir was administered at a 200 mg loading dose on the first day followed by 100 mg from day 2, based on the package insert, in patients with an estimated glomerular filtration rate (eGFR) greater than or equal to 30 ml/min. In total, 190 concentrations from 37 Japanese patients were used in the analysis. The GS-441524 trough concentrations were significantly higher in the eGFR less than 60 ml/min group than in the eGFR greater than or equal to 60 ml/min group. Extracorporeal membrane oxygenation in four patients hardly affected the total body clearance (CL) and volume of distribution (Vd) of GS-441524. A one-compartment model described serum GS-441524 concentration data. The CL and Vd of GS-441524 were significantly affected by eGFR readjusted by individual body surface area and age, respectively. Simulations proposed a dose regimen of 200 mg on day 1 followed by 100 mg once every 2 days from day 2 in patients with an eGFR of 30 ml/min or less. In conclusion, we successfully established a PopPK model of GS-441524 using retrospectively obtained serum GS-441524 concentrations in Japanese patients with COVID-19, which would be helpful for optimal individualized therapy of remdesivir.

Switzer, B., et al. (2021). "Clinical and immunologic implications of COVID-19 in patients with melanoma and renal cell carcinoma receiving immune checkpoint inhibitors." J Immunother Cancer **9**(7).

The clinical and immunologic implications of the SARS-CoV-2 pandemic for patients with cancer receiving systemic anticancer therapy have introduced a multitude of clinical challenges and academic controversies. This review summarizes the current evidence, discussion points, and recommendations regarding the use of immune checkpoint inhibitors (ICIs) in patients with cancer during the SARS-CoV-2 pandemic, with a focus on patients with melanoma and renal cell carcinoma (RCC). More specifically, we summarize the theoretical concepts and available objective data regarding the relationships between ICIs and the antiviral immune response, along with recommended clinical approaches to the management of melanoma and RCC patient cohorts receiving ICIs throughout the course of the COVID-19 pandemic. Additional insights regarding the use of ICIs in the setting of current and upcoming COVID-19 vaccines and broader implications toward future pandemics are also discussed.

Takamatsu, C., et al. (2021). "COVID-19 and renal infarct: To be or not to be on anticoagulation." Clin Nephrol Case Stud **9**: 117-122.

We present a unique case of a male veteran with a history of Castleman disease, presenting with multiple arterial and venous vascular thromboses in the setting of recent Coronavirus (COVID-19)-disease diagnosis. We explore this patient's morbidity related to thrombotic complications of his COVID-19 diagnosis that were potentially avoidable with a comprehensive outpatient evaluation of his risk for thrombosis, as well as the initiation of anticoagulation and/or antiplatelet therapy given his high risk. Our case highlights the need for a standardized clinical workup of patients in the outpatient setting for risk assessment of vascular thrombosis associated with COVID-19 infection to direct medical management, in order to minimize adverse outcomes, complications requiring inpatient admission, and the need for additional yet limited medical resources and interventions. We

propose a minimum of low-dose aspirin 81 mg daily as a reasonable approach for outpatient clinicians to consider, based on their best clinical judgement, when managing mild COVID-19, while other options, such as novel oral anticoagulants, are undergoing further investigation.

Tallai, B., et al. (2021). "A Rare Presentation of Renal Papillary Necrosis in a COVID-19-Positive Patient." Case Rep Urol **2021**: 6611861.

In this case report we describe an unusual presentation of severe acute papillary necrosis in a COVID-19-positive patient. An emergency flexible ureteroscopy greatly helped in the establishment of the diagnosis. In the international literature, there is a paucity of intraoperative endoscopic images representing severe renal papillary necrosis. We present a case of severe acute renal papillary necrosis in a 49-year-old south-Asian, COVID-19-positive male patient who needed emergency urological intervention for macroscopic hematuria and urinary retention due to clot formation in the urinary bladder. The patient underwent emergency cystoscopy, clot evacuation, and by rigid and flexible ureteroscopy. The diagnosis was only confirmed in the postoperative period, retrospectively. Finally, the patient fully recovered due to the multidisciplinary management. Diagnosis of rare clinical entities can be sometimes challenging in the everyday routine practice. Having atypical clinical course, the surgeon should be prepared and sometimes must take responsible decisions promptly, even if needed intraoperatively, to manage unexpected findings in order to get the right diagnosis without compromising the patient's safety.

Talwar, D., et al. (2021). "Sirolimus in a Renal Transplant Recipient Infected With COVID-19: A Blessing in Disguise?" Cureus **13**(8): e17102.

Immunocompromised status Is often associated with severe coronavirus infection given the inability of the immune system to combat the deadly severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Patients with multiple comorbidities such as diabetes mellitus, hypertension, and chronic kidney disease along with patients on immunosuppressants or chemotherapy are at higher risk of getting infected during the ongoing pandemic with more probability of adverse outcomes. However, we report a rare case of a renal transplant recipient who was on sirolimus and contracted coronavirus disease (COVID-19). His immunosuppressants were continued and he was managed with antiviral, steroids and low molecular weight heparin and the patient responded well to the treatment and recovered completely after a span of one week. Use of sirolimus in a patient with renal transplant recipient helped in preventing intensification of the severity in COVID-19 attributing to its inhibiting effect on mammalian target of rapamycin (mTOR) which he was using post his renal transplant, therefore, proving to be a blessing in disguise.

Tan, J., et al. (2021). "Digital Support for Renal Patients Before and During the COVID-19 Pandemic: Examining the Efforts of Singapore Social Service Agencies in Facebook." Front Big Data **4**: 737507.

During the coronavirus disease 2019 (COVID-19) pandemic, social service agencies (SSAs) play a crucial role in supporting renal patients, who are particularly vulnerable to infections. Social media platforms such as Facebook, serves as an effective medium for these SSAs to disseminate information. Content analysis of the SSAs' Facebook posts can provide insights on whether Facebook has been adequately utilized during the COVID-19 pandemic and enable SSAs to improve their social media use in future pandemics. This study aimed to compare renal-related SSAs' Facebook post content before and during the COVID-19 pandemic. Facebook posts of three SSAs National Kidney Foundation (NKF), Kidney Dialysis Foundation (KDF), and Muslim Kidney Action Association (MKAC), posted during the pre-COVID-19 period (January 23, 2019 to June 2, 2019) and the peri-COVID-19 period (January 23, 2020 to June 1, 2020) were extracted. A classification scheme was developed by two coders with themes derived inductively and deductively. Each Facebook post was assigned with a theme. Quantitative analyses indicate that the number of Facebook posts increased from 115 in the pre-COVID-19 period to 293 in the peri-COVID-19 period. During peri-COVID-19, posts regarding lifestyle changes, donations and infectious disease surfaced. While the proportion of posts about encouraging kindness increased from one to 77 posts, the proportion of posts about community-based events and psychosocial support decreased from 44 to 15 posts and 17 to 10 posts respectively during the two periods. Facebook was found to be well-utilized by two of the three renal SSAs in engaging their beneficiaries during the pandemic. During future pandemics, renal SSAs should place emphasis on posts related to psychosocial support and encouraging kindness. Further studies are required to ascertain the impact of COVID-19 from the perspective of renal patients and also to validate the classification scheme which was developed in this study. The study's methodology and classification scheme can be used to guide future studies for evaluating the social media outreach performance of renal health support groups.

Tancredi, T., et al. (2021). "Renal ultrasound findings secondary to COVID-19 related collapsing focal

segmental glomerulosclerosis - A case report." Clin Imaging **71**: 34-38.

SARS-CoV-2 (COVID-19) is well known to have extrapulmonary manifestations, including acute renal failure. While radiologic findings of COVID-19 pulmonary-involvement have been described, renal findings associated with COVID-19 have not. We present a case of a 38-year-old Afro-Caribbean female diagnosed with COVID-19 whose renal ultrasound showed increased parenchymal echogenicity, decreased global color Doppler signal with elevated resistive indices, but no large vessel thrombi. Non-targeted renal biopsy demonstrated collapsing focal segmental glomerulosclerosis (FSGS), likely secondary to COVID-19 infection, which may be a specific manifestation of this disease that has been predominantly reported in Black patients. We report several findings on renal ultrasound with duplex Doppler not previously associated with COVID, specifically with FSGS, which in conjunction can be useful to both the radiologist and the clinician, potentially pointing them in the direction of this diagnosis and early treatment.

Tantisattamo, E., et al. (2021). "Kidney allograft infarction associated with transplant renal artery stenosis in a COVID-19 kidney transplant recipient." Clin Nephrol Case Stud **9**: 93-104.

Kidney allograft infarction is rare, but an urgent condition that requires prompt intervention to avoid allograft loss. Renal artery thrombosis is the leading cause of infarction. Apart from traditional risk factors for thrombosis, emerging SARS-CoV-2 predisposes patients to thrombotic diseases both in arterial and venous vasculatures. We report a case of kidney transplant recipient with known transplant renal artery stenosis (TRAS) status post angioplasty with severe COVID-19, complicated by oliguric acute kidney injury requiring continuous renal replacement therapy (CRRT). She did not have a history of thromboembolic disease. The hospital course was complicated by new-onset atrial and ventricular fibrillation and cardiac arrest requiring multiple rounds of cardiopulmonary resuscitation. She had no signs of renal recovery, and an abdominal CT scan showed evidence of allograft infarcts. She underwent an allograft nephrectomy. Pathology revealed diffuse thrombotic microangiopathy involving glomeruli, arterioles, and arteries associated with diffuse cortical infarction with negative SARS-CoV-2 immunostain and in situ hybridization. This is the first case of kidney allograft infarct with a history of TRAS in a COVID-19 patient. Underlying TRAS and COVID-19-associated thrombosis in this patient are unique and likely play a key role in allograft infarction from arterial thrombosis. Recognizing risk factors and early therapy for allograft infarction may improve transplant outcomes.

Tavares, M. S., et al. (2020). "Recommendations Of The Brazilian Society Of Nephrology Regarding Pediatric Patients On Renal Replacement Therapy During The Covid-19 Pandemic." J Bras Nefrol **42**(2 suppl 1): 32-35.

INTRODUCTION: The impact of the new coronavirus (SARS-COV-2) and its worldwide clinical manifestations (COVID-19) imposed specific regional recommendations for populations in need of specialized care, such as children and adolescents with kidney diseases, particularly in renal replacement therapies (RRT). We present the recommendations of the Brazilian Society of Nephrology regarding the treatment of pediatric patients with kidney diseases during the COVID-19 pandemic. METHODS: Articles and documents from medical societies and government agencies on specific recommendations for children on RRT in relation to COVID-19 as well as those focused on epidemiological aspects of this condition in Brazil Were evaluated and analyzed. RESULTS: We present recommendations on outpatient care, transportation to dialysis centers, peritoneal dialysis, hemodialysis, and kidney transplantation in children and adolescents during the COVID-19 pandemic in Brazil. DISCUSSION: Despite initial observations of higher mortality rates in specific age groups (the elderly) and with comorbidities (obese, diabetics, and those with cardiovascular diseases), patients with chronic kidney disease (CKD) on RRT are particularly prone to develop COVID-19. Specific measures must be taken to reduce the risk of contracting SARS-CoV-2 and developing COVID-19, especially during transport to dialysis facilities, as well as on arrival and in contact with other patients.

Teixeira Junior, A. A. L., et al. (2020). "Brazilian Consortium for the Study on Renal Diseases Associated With COVID-19: A Multicentric Effort to Understand SARS-CoV-2-Related Nephropathy." Front Med (Lausanne) **7**: 584235.

Kidney involvement appears to be frequent in coronavirus disease 2019 (COVID-19). Despite this, information concerning renal involvement in COVID-19 is still scarce. Several mechanisms appear to be involved in the complex relationship between the virus and the kidney. Also, different morphological patterns have been described in the kidneys of patients with COVID-19. For some authors, however, this association may be just a coincidence. To investigate this issue, we propose assessing renal morphology associated with COVID-19 at the renal pathology reference center of federal university hospitals in Brazil. Data will come from a consortium involving 17

federal university hospitals belonging to Empresa Brasileira de Servicos Hospitalares (EBSERH) network, as well as some state hospitals and an autopsy center. All biopsies will be sent to the referral center for renal pathology of the EBSERH network. The data will include patients who had coronavirus disease, both alive and deceased, with or without pre-existing kidney disease. Kidney biopsies will be analyzed by light, fluorescence, and electron microscopy. Furthermore, immunohistochemical (IHC) staining for various inflammatory cells (i.e., cells expressing CD3, CD20, CD4, CD8, CD138, CD68, and CD57) as well as angiotensin-converting enzyme 2 (ACE2) will be performed on paraffinized tissue sections. In addition to ultrastructural assays, in situ hybridization (ISH), IHC and reverse transcription-polymerase chain reaction (RT-PCR) will be used to detect Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV-2) in renal tissue. For the patients diagnosed with Collapsing Glomerulopathy, peripheral blood will be collected for apolipoprotein L-1 (APOL1) genotyping. For patients with thrombotic microangiopathy, thrombospondin type 1 motif, member 13 (ADAMTS13), antiphospholipid, and complement panel will be performed. The setting of this study is Brazil, which is second behind the United States in highest confirmed cases and deaths. With this complete approach, we hope to help define the spectrum and impact, whether immediate or long-term, of kidney injury caused by SARS-CoV-2.

Thomas, T., et al. (2020). "COVID-19 infection alters kynurenine and fatty acid metabolism, correlating with IL-6 levels and renal status." JCI Insight **5**(14).

BACKGROUNDReprogramming of host metabolism supports viral pathogenesis by fueling viral proliferation, by providing, for example, free amino acids and fatty acids as building blocks.METHODSTo investigate metabolic effects of SARS-CoV-2 infection, we evaluated serum metabolites of patients with COVID-19 (n = 33; diagnosed by nucleic acid testing), as compared with COVID-19-negative controls (n = 16).RESULTSTargeted and untargeted metabolomics analyses identified altered tryptophan metabolism into the kynurenine pathway, which regulates inflammation and immunity. Indeed, these changes in tryptophan metabolism correlated with interleukin-6 (IL-6) levels. Widespread dysregulation of nitrogen metabolism was also seen in infected patients, with altered levels of most amino acids, along with increased markers of oxidant stress (e.g., methionine sulfoxide, cystine), proteolysis, and renal dysfunction (e.g., creatine, creatinine, polyamines). Increased circulating levels of glucose and free fatty acids were also observed, consistent with altered carbon homeostasis. Interestingly, metabolite levels in these pathways correlated with clinical laboratory markers of inflammation (i.e., IL-6 and C-reactive protein) and renal function (i.e., blood urea nitrogen).CONCLUSIONIn conclusion, this initial observational study identified amino acid and fatty acid metabolism as correlates of COVID-19, providing mechanistic insights, potential markers of clinical severity, and potential therapeutic targets.FUNDINGBoettcher Foundation Webb-Waring Biomedical Research Award; National Institute of General and Medical Sciences, NIH; and National Heart, Lung, and Blood Institute, NIH.

Thomas, T., et al. (2020). "COVID-19 infection results in alterations of the kynurenine pathway and fatty acid metabolism that correlate with IL-6 levels and renal status." medRxiv.

Previous studies suggest a role for systemic reprogramming of host metabolism during viral pathogenesis to fuel rapidly expanding viral proliferation, for example by providing free amino acids and fatty acids as building blocks. In addition, general alterations in metabolism can provide key understanding of pathogenesis. However, little is known about the specific metabolic effects of SARS-COV-2 infection. The present study evaluated the serum metabolism of COVID-19 patients (n=33), identified by a positive nucleic acid test of a nasopharyngeal swab, as compared to COVID-19-negative control patients (n=16). Targeted and untargeted metabolomics analyses specifically identified alterations in the metabolism of tryptophan into the kynurenine pathway, which is well-known to be involved in regulating inflammation and immunity. Indeed, the observed changes in tryptophan metabolism correlated with serum interleukin-6 (IL-6) levels. Metabolomics analysis also confirmed widespread dysregulation of nitrogen metabolism in infected patients, with decreased circulating levels of most amino acids, except for tryptophan metabolites in the kynurenine pathway, and increased markers of oxidant stress (e.g., methionine sulfoxide, cystine), proteolysis, and kidney dysfunction (e.g., creatine, creatinine, polyamines). Increased circulating levels of glucose and free fatty acids were also observed, consistent with altered carbon homeostasis in COVID-19 patients. Metabolite levels in these pathways correlated with clinical laboratory markers of inflammation and disease severity (i.e., IL-6 and C-reactive protein) and renal function (i.e., blood urea nitrogen). In conclusion, this initial observational study of the metabolic consequences of COVID-19 infection in a clinical cohort identified amino acid metabolism (especially kynurenine and cysteine/taurine) and fatty acid metabolism as correlates of COVID-19, providing

mechanistic insights, potential markers of clinical severity, and potential therapeutic targets.

Tiwary, T., et al. (2020). "A Rare Case of COVID-19 Myocarditis With Cardiac Tamponade in a Young Diabetic Adult With Renal Failure." Cureus **12**(11): e11632.

A young male with long-standing type 1 diabetes mellitus, chronic kidney disease, and known ventricular hypertrophy presented with dyspnea and abdominal pain and was diagnosed with coronavirus disease 2019 (COVID-19) infection. On day nine of hospital admission, patient developed ventricular tachycardia with electrocardiogram (ECG) changes and elevation in troponin level consistent with myocarditis and development of cardiogenic shock. Bedside limited echo demonstrated signs of tamponade and patient underwent surgical pericardial window procedure. He was also noted to develop marked prolongation of corrected QT interval (QTc) while on amiodarone.

Toapanta, N., et al. (2021). "Kidney transplantation and COVID-19 renal and patient prognosis." Clin Kidney J **14**(Suppl 1): i21-i29.

Coronavirus disease 2019 (COVD-19) emerged as a pandemic in December 2019. Infection has spread quickly and renal transplant recipients receiving chronic immunosuppression have been considered a population at high risk of infection, complications and infection-related death. During this year a large amount of information from nationwide registries, multicentre and single-centre studies have been reported. The number of renal transplant patients diagnosed with COVID-19 was higher than in the general population, but the lower threshold for testing may have contributed to its better identification. Major complications such as acute kidney injury and acute respiratory distress syndrome were very frequent in renal transplant patients, with a high comorbidity burden, but further studies are needed to support that organ transplant recipients receiving chronic immunosuppression are more prone to develop these complications than the general population. Kidney transplant recipients experience a high mortality rate compared with the general population, especially during the very early post-transplant period. Despite the fact that some studies report more favourable outcomes in patients with a kidney transplant than in patients on the kidney waiting list, the higher mortality described in the very early post-transplant period would advise against performing a kidney transplant in areas where the spread of infection is high, especially in recipients >60 years of age. Management of transplant recipients has been challenging for clinicians and strategies such as less use of lymphocyte-depleting agents for new transplants or anti-metabolite withdrawal and calcineurin inhibitor reduction for transplant patients with COVID-19 are not based on high-quality evidence.

Tomasa-Irriguible, T. M., et al. (2020). "Low molecular weight heparins in COVID-19 patients: beware of augmented renal clearance!" Crit Care **24**(1): 325.

Topel, C., et al. (2021). "Aortic floating thrombi with lower limb ischemia and renal infarct in COVID-19: A remote thromboembolic complication." Turk Kardiyol Dern Ars **49**(3): 233-236.

As the COVID-19 pandemic continues, its novel complications are being increasingly recognized, and new mechanisms of the disease are being unraveled. Aortic free-floating thrombus is exceptionally rare, and prompt diagnosis is vital to alleviate its detrimental end organ effects. We present a patient who was previously discharged owing to COVID-19 pneumonia, admitted with acute onset of lower limb pain, and was diagnosed with aortic free-floating thrombus ended up with embolic events. Clinicians should be aware of COVID-19-related thromboembolic complications, and close monitoring of patients with risk factors is vital for a timely and accurate diagnosis and management.

Touyz, R. M., et al. (2021). "Cardiovascular and Renal Risk Factors and Complications Associated With COVID-19." CJC Open **3**(10): 1257-1272.

The current COVID-19 pandemic, caused by the severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2) virus, represents the largest medical challenge in decades. It has exposed unexpected cardiovascular vulnerabilities at all stages of the disease (pre-infection, acute phase, and subsequent chronic phase). The major cardiometabolic drivers identified as having epidemiologic and mechanistic associations with COVID-19 are abnormal adiposity, dysglycemia, dyslipidemia, and hypertension. Hypertension is of particular interest, because components of the renin-angiotensin system (RAS), which are critically involved in the pathophysiology of hypertension, are also implicated in COVID-19. Specifically, angiotensin-converting enzyme-2 (ACE2), a multifunctional protein of the RAS, which is part of the protective axis of the RAS, is also the receptor through which SARS-CoV-2 enters host cells, causing viral infection. Cardiovascular and cardiometabolic comorbidities not only predispose people to COVID-19, but also are complications of SARS-CoV-2 infection. In addition, increasing evidence indicates that acute kidney injury is common in COVID-19, occurs early and in temporal association with respiratory failure, and is associated with poor

prognosis, especially in the presence of cardiovascular risk factors. Here, we discuss cardiovascular and kidney disease in the context of COVID-19 and provide recent advances on putative pathophysiological mechanisms linking cardiovascular disease and COVID-19, focusing on the RAS and ACE2, as well as the immune system and inflammation. We provide up-to-date information on the relationships among hypertension, diabetes, and COVID-19 and emphasize the major cardiovascular diseases associated with COVID-19. We also briefly discuss emerging cardiovascular complications associated with long COVID-19, notably postural tachycardia syndrome (POTS).

Tsakok, M. T., et al. (2020). "Preoperative COVID-19 CT screening in renal transplant recipients." Clin Radiol **75**(11): 868-870.

Tsimafeyeu, I., et al. (2021). "COVID-19 in Patients With Renal Cell Carcinoma in the Russian Federation." Clin Genitourin Cancer **19**(2): e69-e71.

Tuma, J., et al. (2020). "[Renal Monomorphology in COVID-19 with Acute Renal Insufficiency]." Praxis (Bern 1994) **109**(9): 731-735.

Renal Monomorphology in COVID-19 with Acute Renal Insufficiency Abstract. A 78-year-old ventilator-dependent COVID-19 patient developed severe renal failure with an estimated glomerular filtration rate of 20 ml/min per 1.73 m2 and nephrotic proteinuria. Sonography showed echo-dense and enlarged kidneys with high resistance indices (>0.8). Echocontrast sonography showed a delayed renal perfusion. In the further course of the disease renal function recovered, kidney size decreased and the renal perfusion normalized. An acute COVID-19-associated interstitial nephritis is postulated.

Tuschen, K., et al. (2021). "Renal transplantation after recovery from COVID-19 - a case report with implications for transplant programs in the face of the ongoing corona-pandemic." BMC Nephrol **22**(1): 251.

BACKGROUND: The ongoing coronavirus pandemic has major impacts on both patients and healthcare systems worldwide, thus creating new realities. Patients on maintenance dialysis listed for renal transplantation are a vulnerable subgroup with many comorbidities and recurring contacts with the healthcare system. Due to the COVID-19 pandemic transplant numbers have dropped considerably, further increasing waiting times in this high-risk population. On the other hand, knowledge of the severity of SARS-CoV-2 infection in immunocompromised patients, development and persistence of neutralising antibodies in such patients is just emerging. It is unclear how best to address the dilemma of postponing the life-saving transplantation. CASE PRESENTATION: We present a case report of a successful kidney transplantation only 65 days after the recipient was hospitalized for treatment of COVID-19 pneumonia. In a follow up of 9 months, we observed no signs of recurrent disease and transplant function is excellent. Monitoring SARS-CoV-2 antibody response demonstrates stable IgG levels. CONCLUSION: This reassuring case provides guidance to transplant centers how to proceed with kidney transplantation safely during the pandemic. Careful consideration of risks and benefits of the organ offer, full recovery from COVID-19 symptoms and the presence of a positive SARS-CoV-2 IgG antibody test, qualifies for kidney transplantation.

Uribarri, A., et al. (2020). "Impact of renal function on admission in COVID-19 patients: an analysis of the international HOPE COVID-19 (Health Outcome Predictive Evaluation for COVID 19) Registry." J Nephrol **33**(4): 737-745.

BACKGROUND: Coronavirus disease 2019 (COVID-19) is a disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Despite its international aggressive extension, with a significant morbidity and mortality, the impact of renal function on its prognosis is uncertain. METHODS: Analysis from the international HOPE-Registry (NCT04334291). The objective was to evaluate the association between kidney failure severity on admission with the mortality of patients with SARS-CoV-2 infection. Patients were categorized in 3 groups according to the estimated glomerular filtration rate on admission (eGFR > 60 mL/min/1.73 m(2), eGFR 30-60 mL/min/1.73 m(2) and eGFR < 30 mL/min/1.73 m(2)). RESULTS: 758 patients were included: mean age was 66 +/- 18 years, and 58.6% of patient were male. Only 8.5% of patients had a history of chronic kidney disease (CKD); however, 30% of patients had kidney dysfunction upon admission (eGFR < 60 mL/min/1.73 m(2)). These patients received less frequently pharmacological treatment with hydroxychloroquine or antivirals and had a greater number of complications such as sepsis (11.9% vs 26.4% vs 40.8%, $p < 0.001$) and respiratory failure (35.4% vs 72.2% vs 62.0%, $p < 0.001$) as well as a higher in-hospital mortality rate (eGFR > 60 vs eGFR 30-60 vs and eGFR < 30, 18.4% vs 56.5% vs 65.5%, $p < 0.001$). In multivariate analysis: age, hypertension, renal function, 0(2) saturation < 92% and lactate dehydrogenase elevation on admission independently predicted all-cause mortality. CONCLUSIONS: Renal failure on admission in patients with SARS-CoV-2 infection is frequent and is associated with a greater number of complications and in-hospital mortality. Our data comes from a multicenter registry and therefore does

not allow to have a precise mortality risk assessment. More studies are needed to confirm these findings.

Vakhshoori, M., et al. (2020). "Corona Virus Disease 2019 (COVID-19) and Its Effect on Renal System, A Systematic Review and Meta-analysis." Iran J Kidney Dis **14**(6): 419-438.

Coronavirus disease 2019 (COVID-19) has been recently emerged with various manifestations, mainly on respiratory system. However, other organs might also be involved. Acute kidney injury has been reported as a complication with high variability and controversial results. We aimed to define the frequency of AKI as well as two specific renal biomarkers including BUN and serum Cr among individuals suffering from COVID-19 infection. We investigated Medline/PubMed, Scopus, and Google Scholar databases until 16th April 2020 and included all relevant peer-reviewed published studies without any language limitations. We further categorized patients according to their clinical status into severe, non-severe, and death groups. 18 records on 4528 individuals were assessed. The mean age of individuals were 52.5 +/- 24.4 years (males: 55.6%). Prevalence of AKI was 4% (95% CI: 2% to 8%) and was significantly lower among non-severe patients in comparison to deceased ones (1%, 95% CI: 0% to 4%, vs. 31%, 95% CI: 19% to 47%). BUN mean was 5.14 mmol/L (95% CI: 4.60 to 5.69). Non-severe patients had remarkably lower means of BUN compared to deceased or those with severe infection (4.25 mmol/L, 95% Cl: 3.70 to 4.79, vs. 8.9 mmol/L, 95% CI: 7.94 to 9.86, vs. 6.63 mmol/L, 95% Cl: 5.62 to 7.65; respectively). The mean serum Cr was 71.60 mmol/L (95% Cl: 67.56 to 75.64). Our findings suggest that COVID-19 does not seem to involve renal system extensively and other possible mechanisms might be further investigated in this regard.

Valle, E. O., et al. (2021). "Continuous renal replacement therapy in COVID-19-associated AKI: adding heparin to citrate to extend filter life-a retrospective cohort study." Crit Care **25**(1): 299.

BACKGROUND: Coronavirus disease 2019 (COVID-19) may predispose patients to thrombotic events. The best anticoagulation strategy for continuous renal replacement therapy (CRRT) in such patients is still under debate. The purpose of this study was to evaluate the impact that different anticoagulation protocols have on filter clotting risk. METHODS: This was a retrospective observational study comparing two different anticoagulation strategies (citrate only and citrate plus intravenous infusion of unfractionated heparin) in patients with acute kidney injury (AKI), associated or not with COVID-19 (COV + AKI and COV - AKI, respectively), who were submitted to CRRT. Filter clotting risks were compared among groups. RESULTS: Between January 2019 and July 2020, 238 patients were evaluated: 188 in the COV + AKI group and 50 in the COV - AKI group. Filter clotting during the first filter use occurred in 111 patients (46.6%). Heparin use conferred protection against filter clotting (HR = 0.37, 95% CI 0.25-0.55), resulting in longer filter survival. Bleeding events and the need for blood transfusion were similar between the citrate only and citrate plus unfractionated heparin strategies. In-hospital mortality was higher among the COV + AKI patients than among the COV - AKI patients, although it was similar between the COV + AKI patients who received heparin and those who did not. Filter clotting was more common in patients with D-dimer levels above the median (5990 ng/ml). In the multivariate analysis, heparin was associated with a lower risk of filter clotting (HR = 0.28, 95% CI 0.18-0.43), whereas an elevated D-dimer level and high hemoglobin were found to be risk factors for circuit clotting. A diagnosis of COVID-19 was marginally associated with an increased risk of circuit clotting (HR = 2.15, 95% CI 0.99-4.68). CONCLUSIONS: In COV + AKI patients, adding systemic heparin to standard regional citrate anticoagulation may prolong CRRT filter patency by reducing clotting risk with a low risk of complications.

van Klaveren, C. W., et al. (2020). "Topics, Delivery Modes, and Social-Epistemological Dimensions of Web-Based Information for Patients Undergoing Renal Transplant and Living Donors During the COVID-19 Pandemic: Content Analysis." J Med Internet Res **22**(10): e22068.

BACKGROUND: The COVID-19 pandemic has markedly affected renal transplant care. During this time of social distancing, limited in-person visits, and uncertainty, patients and donors are relying more than ever on telemedicine and web-based information. Several factors can influence patients' understanding of web-based information, such as delivery modes (instruction, interaction, and assessment) and social-epistemological dimensions (choices in interactive knowledge building). OBJECTIVE: The aim of this study was to systemically evaluate the content, delivery modes, and social-epistemological dimensions of web-based information on COVID-19 and renal transplantation at time of the pandemic. METHODS: Multiple keyword combinations were used to retrieve websites on COVID-19 and renal transplantation using the search engines Google.com and Google.nl. From 14 different websites, 30 webpages were examined to determine their organizational sources, topics, delivery modes, and social-epistemological dimensions. RESULTS: The variety of topics and delivery modes was limited. A total of 13 different delivery modes

were encountered, of which 8 (62%) were instructional and 5 (38%) were interactional; no assessment delivery modes were observed. No website offered all available delivery modes. The majority of delivery modes (8/13, 62%) focused on individual and passive learning, whereas group learning and active construction of knowledge were rarely encountered. CONCLUSIONS: By taking interactive knowledge transfer into account, the educational quality of eHealth for transplant care could increase, especially in times of crisis when rapid knowledge transfer is needed.

Varma, P. P., et al. (2021). "Renal graft artery thrombosis following COVID-19 infection." Nephrology (Carlton) **26**(11): 932-933.

Varnell, C., Jr., et al. (2021). "COVID-19 in pediatric kidney transplantation: The Improving Renal Outcomes Collaborative." Am J Transplant **21**(8): 2740-2748.

There are limited data on the impact of COVID-19 in children with a kidney transplant (KT). We conducted a prospective cohort study through the Improving Renal Outcomes Collaborative (IROC) to collect clinical outcome data about COVID-19 in pediatric KT patients. Twenty-two IROC centers that care for 2732 patients submitted testing and outcomes data for 281 patients tested for SARS-CoV-2 by PCR. Testing indications included symptoms and/or potential exposures to COVID-19 (N = 134, 47.7%) and/or testing per hospital policy (N = 154, 54.8%). Overall, 24 (8.5%) patients tested positive, of which 15 (63%) were symptomatic. Of the COVID-19-positive patients, 16 were managed as outpatients, six received non-ICU inpatient care and two were admitted to the ICU. There were no episodes of respiratory failure, allograft loss, or death associated with COVID-19. To estimate incidence, subanalysis was performed for 13 centers that care for 1686 patients that submitted all negative and positive COVID-19 results. Of the 229 tested patients at these 13 centers, 10 (5 asymptomatic) patients tested positive, yielding an overall incidence of 0.6% and an incidence among tested patients of 4.4%. Pediatric KT patients in the United States had a low estimated incidence of COVID-19 disease and excellent short-term outcomes.

Vasudevan, A., et al. (2020). "Managing Children with Renal Diseases during COVID-19 Pandemic." Indian Pediatr.

The coronavirus outbreak is a rapidly evolving pandemic, placing unprecedented strain on health-care systems. COVID-19 presents challenges for management of children with renal diseases especially those receiving long-term immunosuppressive medications, including renal transplant recipients and those with chronic kidney disease and acute kidney injury requiring dialysis. Our preparedness for managing this vulnerable group of children is the need of the hour. The purpose of this article is to provide guidance to caregivers and health care personnel involved in management of children with renal diseases and to ensure patient well-being, while protecting staff from infection.

Vasudevan, A., et al. (2020). "Managing Children With Renal Diseases During the COVID-19 Pandemic." Indian Pediatr **57**(7): 641-651.

The coronavirus outbreak is a rapidly evolving pandemic, placing unprecedented strain on health-care systems. COVID-19 presents challenges for management of children with renal diseases, especially those receiving long-term immunosuppressive medications, including renal transplant recipients and those with chronic kidney disease and acute kidney injury requiring dialysis. Our preparedness for managing this vulnerable group of children is the need of the hour. The purpose of this article is to provide guidance to caregivers and health care personnel involved in management of children with renal diseases and to ensure patient well-being, while protecting staff from infection.

Villa, L., et al. (2021). "Time on previous renal replacement therapy is associated with worse outcomes of COVID-19 in a regional cohort of kidney transplant and dialysis patients." Medicine (Baltimore) **100**(10): e24893.

ABSTRACT: Chronic renal replacement therapy by either a kidney transplant (KTX) or hemodialysis (HD) predisposes patients to an increased risk for adverse outcomes of COVID-19. However, details on this interaction remain incomplete. To provide further characterization, we undertook a retrospective observational cohort analysis of the majority of the hemodialysis and renal transplant population affected by the first regional outbreak of severe acute respiratory distress syndrome coronavirus 2 (SARS-CoV-2) in Germany. In a region of 250,000 inhabitants we identified a total of 21 cases with SARS-CoV-2 among 100 KTX and 260 HD patients, that is, 7 KTX with COVID-19, 14 HD with COVID-19, and 3 HD with asymptomatic carrier status. As a first observation, KTX recipients exhibited trends for a higher mortality (43 vs 18%) and a higher proportion of acute respiratory distress syndrome (ARDS) (57 vs 27%) when compared to their HD counterparts. As a novel finding, development of ARDS was significantly associated with the time spent on previous renal replacement therapy (RRT), defined as the composite of dialysis time and time on the transplant (non-ARDS 4.3 vs ARDS 10.6 years, P = .016). Multivariate

logistic regression analysis showed an OR of 1.7 per year of RRT. The association remained robust when analysis was confined to KTX patients (5.1 vs 13.2 years, P = .002) or when correlating the time spent on a renal transplant alone (P = .038). Similarly, longer RRT correlated with death vs survival (P = .0002). In conclusion our data suggest renal replacement vintage as a novel risk factor for COVID-19-associated ARDS and death. The findings should be validated by larger cohorts.

Vinson, A. J., et al. (2021). "Sex and organ-specific risk of major adverse renal or cardiac events in solid organ transplant recipients with COVID-19." Am J Transplant.

While older males are at the highest risk for poor coronavirus disease 2019 (COVID-19) outcomes, it is not known if this applies to the immunosuppressed recipient of a solid organ transplant (SOT), nor how the type of allograft transplanted may impact outcomes. In a cohort study of adult (>18 years) patients testing positive for COVID-19 (January 1, 2020-June 21, 2021) from 56 sites across the United States identified using the National COVID Cohort Collaborative (N3C) Enclave, we used multivariable Cox proportional hazards models to assess time to MARCE after COVID-19 diagnosis in those with and without SOT. We examined the exposure of age-stratified recipient sex overall and separately in kidney, liver, lung, and heart transplant recipients. 3996 (36.4%) SOT and 91 646 (4.8%) non-SOT patients developed MARCE. Risk of post-COVID outcomes differed by transplant allograft type with heart and kidney recipients at highest risk. Males with SOT were at increased risk of MARCE, but to a lesser degree than the non-SOT cohort (HR 0.89, 95% CI 0.81-0.98 for SOT and HR 0.61, 95% CI 0.60-0.62 for non-SOT [females vs. males]). This represents the largest COVID-19 SOT cohort to date and the first-time sex-age-stratified and allograft-specific COVID-19 outcomes have been explored in those with SOT.

Volbeda, M., et al. (2021). "Comparison of renal histopathology and gene expression profiles between severe COVID-19 and bacterial sepsis in critically ill patients." Crit Care **25**(1): 202.

BACKGROUND: The mechanisms driving acute kidney injury (AKI) in critically ill COVID-19 patients are unclear. We collected kidney biopsies from COVID-19 AKI patients within 30 min after death in order to examine the histopathology and perform mRNA expression analysis of genes associated with renal injury. METHODS: This study involved histopathology and mRNA analyses of postmortem kidney biopsies collected from patients with COVID-19 (n = 6) and bacterial sepsis (n = 27). Normal control renal tissue was obtained from patients undergoing total nephrectomy (n = 12). The mean length of ICU admission-to-biopsy was 30 days for COVID-19 and 3-4 days for bacterial sepsis patients. RESULTS: We did not detect SARS-CoV-2 RNA in kidney biopsies from COVID-19-AKI patients yet lung tissue from the same patients was PCR positive. Extensive acute tubular necrosis (ATN) and peritubular thrombi were distinct histopathology features of COVID-19-AKI compared to bacterial sepsis-AKI. ACE2 mRNA levels in both COVID-19 (fold change 0.42, p = 0.0002) and bacterial sepsis patients (fold change 0.24, p < 0.0001) were low compared to control. The mRNA levels of injury markers NGAL and KIM-1 were unaltered compared to control tissue but increased in sepsis-AKI patients. Markers for inflammation and endothelial activation were unaltered in COVID-19 suggesting a lack of renal inflammation. Renal mRNA levels of endothelial integrity markers CD31, PV-1 and VE-Cadherin did not differ from control individuals yet were increased in bacterial sepsis patients (CD31 fold change 2.3, p = 0.0006, PV-1 fold change 1.5, p = 0.008). Angiopoietin-1 mRNA levels were downregulated in renal tissue from both COVID-19 (fold change 0.27, p < 0.0001) and bacterial sepsis patients (fold change 0.67, p < 0.0001) compared to controls. Moreover, low Tie2 mRNA expression (fold change 0.33, p = 0.037) and a disturbed VEGFR2/VEGFR3 ratio (fold change 0.09, p < 0.0001) suggest decreased microvascular flow in COVID-19. CONCLUSIONS: In a small cohort of postmortem kidney biopsies from COVID-19 patients, we observed distinct histopathological and gene expression profiles between COVID-19-AKI and bacterial sepsis-AKI. COVID-19 was associated with more severe ATN and microvascular thrombosis coupled with decreased microvascular flow, yet minimal inflammation. Further studies are required to determine whether these observations are a result of true pathophysiological differences or related to the timing of biopsy after disease onset.

Wan, E. R., et al. (2020). "Transient Renal Tubular Syndromes Associated With Acute COVID-19 Disease." Kidney Int Rep **5**(9): 1610-1611.

Wang, T., et al. (2021). "Summary report of seven cases of COVID-19 infection in renal transplant recipients." Transpl Immunol **69**: 101445.

The coronavirus disease 2019 (COVID-19) has swept the world, posing a serious threat to people's lives and health. Several cases of COVID-19 infection in renal transplant recipients (RTRs) have been reported, but the treatment and prognosis have not been fully elucidated. We followed-up with RTRs infected with SARS-CoV2 in our center and classified them as five clinical types-asymptomatic, mild, moderate,

severe, and critical. The immunosuppressive agents were not adjusted in asymptomatic carriers and mild patients, the former was mainly treated by isolation, and the latter was treated by low-dose intravenous immunoglobulin (IVIG) to enhance immunity. For moderate or severe patients, the immunosuppressive agents were largely reduced or even interrupted, low-dose IVIG was adopted, and low-dose methylprednisolone (MP) was used to inhibit inflammation and rejection. Immunosuppressants were discontinued early in critical patients; IVIG, high-dose MP, and antibiotics were used. Meanwhile, all patients received at least one antiviral drugs. After aggressive treatment, three patients developed acute kidney injury, and two showed reversal, while the remaining one lost the allograft kidney; one patient died, while other patients were discharged. For different clinical types of RTRs infected with COVID-19, personalized therapies were essential, Meanwhile, patients with COVID-19 infection may have different outcomes due to their different clinical manifestations.

Watchorn, J., et al. (2021). "Critically Ill COVID-19 Patients With Acute Kidney Injury Have Reduced Renal Blood Flow and Perfusion Despite Preserved Cardiac Function: A Case-Control Study Using Contrast-Enhanced Ultrasound." Shock **55**(4): 479-487.

BACKGROUND: Acute kidney injury (AKI) is a common complication of COVID-19 critical illness but the pathophysiology is uncertain. Some evidence has indicated that a vascular aetiology may be implicated. We used contrast-enhanced ultrasound (CEUS) and echocardiography to study renal perfusion and global blood flow and compared our findings with measurements taken in a group of septic shock patients and healthy volunteers. METHODS: Prospective case-control study. Renal perfusion variables were assessed with CEUS; macrovascular blood flow was assessed using Doppler analysis of large renal vessels; echocardiography was used to assess right and left heart function and cardiac output. RESULTS: CEUS-derived parameters were reduced in COVID-19 associated AKI compared with healthy controls (perfusion index 3,415 vs. 548 a.u., P = 0.001; renal blood volume 7,794 vs. 3,338 a.u., P = 0.04). Renal arterial flow quantified using time averaged peak velocity was also reduced compared with healthy controls (36.6 cm/s vs. 20.9 cm/s, P = 0.004) despite cardiac index being similar between groups (2.8 L/min/m2 vs. 3.7 L/min/m2, P = 0.07). There were no differences in CEUS-derived or cardiac parameters between COVID-19 and septic shock patients but patients with septic shock had more heterogeneous perfusion variables. CONCLUSION: Both large and small vessel blood flow is reduced in patients with COVID-19 associated AKI compared with healthy controls, which does not appear to be a consequence of right or left heart dysfunction. A reno-vascular pathogenesis of COVID-19 AKI seems likely.

Webb, C., et al. (2021). "COVID-19-Associated Graft Loss From Renal Infarction in a Kidney Transplant Recipient." Kidney Int Rep **6**(4): 1166-1169.

Wickens, O., et al. (2021). "Investigating the utility of COVID-19 antibody testing in end-stage renal disease patients receiving haemodialysis: a cohort study in the United Kingdom." BMC Nephrol **22**(1): 154.

BACKGROUND: End-stage renal disease (ESRD) patients receiving haemodialysis (HD) are a vulnerable group of patients with increased mortality from COVID-19. Despite improved understanding, the duration of host immunity following COVID-19 infection and role of serological testing alone or in addition to real-time reverse transcription polymerase chain reaction (rRT-PCR) testing in the HD population is not fully understood, which this study aimed to investigate. METHODS: There were two parts to this study. Between 15th March 2020 to 15th July 2020, patients receiving HD who tested positive on rRT-PCR for SARS-CoV-2 were recruited into the COVID-19 arm, whilst asymptomatic patients without a previous diagnosis of COVID-19 were recruited to the epidemiological arm of the Salford Kidney Study (SKS). All patients underwent monthly testing for anti-SARS-CoV-2 antibodies as per routine clinical practice since August 2020. The aims were twofold: firstly, to determine seroprevalence and COVID-19 exposure in the epidemiological arm; secondly, to assess duration of the antibody response in the COVID-19 arm. Baseline characteristics were reviewed between groups. Statistical analysis was performed using SPSS. Mann-Whitney U and Chi-squared tests were used for testing significance of difference between groups. RESULTS: In our total HD population of 411 patients, 32 were PCR-positive for COVID-19. Of the remaining patients, 237 were recruited into the SKS study, of whom 12 (5.1%) had detectable anti-SARS-CoV-2 antibodies. Of the 32 PCR-positive patients, 27 (84.4%) were symptomatic and 25 patients admitted to hospital due to their symptoms. Of the 22 patients in COVID-19 arm that underwent testing for anti-SARS-CoV-2 IgG antibodies beyond 7 months, all had detectable antibodies. A higher proportion of the patients with COVID-19 were frail compared to patients without a diagnosis of COVID-19 (64.3% vs 34.1%, p = 0.003). Other characteristics were similar between the groups. Over a median follow up of 7 months, a higher number of deaths were recorded in patients with a diagnosis of COVID-19 compared to those without (18.7% vs 5.9%, p = 0.003). CONCLUSIONS: Serological testing in the HD

population is a valuable tool to determine seroprevalence, monitor exposure, and guide improvements for infection prevention and control (IPC) measures to help prevent local outbreaks. This study revealed HD patients mount a humoral response detectable until at least 7 months after COVID-19 infection and provides hope of similar protection with the vaccines recently approved.

Wilbers, T. J. and M. V. Koning (2020). "Renal replacement therapy in critically ill patients with COVID-19: A retrospective study investigating mortality, renal recovery and filter lifetime." J Crit Care **60**: 103-105.

PURPOSE: This study aims to investigate mortality and renal recovery in patients with Acute Kidney Injury (AKI) and Renal Replacement Therapy (RRT) due to COVID-19. A secondary aim is to investigate the filter life time in Continuous VenoVenous Hemofiltration (CVVH) and the effect of different methods of anticoagulation. METHODS: All patients with COVID-19 infection admitted to the ICU between March 16th 2020 to May 10th 2020 were retrospectively studied. Patients were categorized in a AKI-group and a non-AKI-group. RESULTS: Thirty-seven patients were included. Twenty-two (60%) patients developed AKI. Mortality in the AKI-group was 41% compared to 20% in the non-AKI group, p = 0.275. Comparable mortality was seen in the RRT (39%) and the non-RRT group (44%), p = 1.000. Renal function recovered to a KDIGO-stage 1 in 64% of the patients with AKI when discharged from the ICU. Life time for the CVVH filters (n = 53) was 27 h (14-63)[2-78]. No difference was found with various methods of anticoagulation. CONCLUSION: The need for RRT in critically ill patients with COVID-19 was reversible in our cohort and RRT was not associated with an increased mortality compared to AKI without the need for RRT. Higher levels of anticoagulation were not associated with prolonged filter life.

Wu, J., et al. (2021). "Coronavirus disease 2019 (COVID-19) in a Chinese renal transplant recipient: a case report." Transl Androl Urol **10**(5): 2140-2148.

Since December 2019, a novel coronavirus that caused viral pneumonia broke out and became global pandemic. Coronavirus disease 2019 (COVID-19) is caused by the SARS-CoV-2 virus. Reports on the clinical manifestations in solid organ transplant (SOT) recipients are rare. We report the clinical features and treatment of a Chinese renal transplant recipient with COVID-19. A 46-year-old Chinese woman, who had a renal transplant in 2006 due to chronic glomerulonephritis, was admitted to Renmin Hospital of Wuhan University for fever, cough, and expectoration for more than 10 days and diarrhea for 3 days. At admission, her body temperature was 38.2 degrees C and pulse oxygen saturation was 96% under oxygen inhalation. There were decreased breath sounds bilaterally. Laboratory data revealed normal leucocyte count, a normal percentage of neutrophils, a normal percentage of lymphocytes, decreased lymphocyte count, elevated procalcitonin and C-reactive protein (CRP), and increased levels of urea, creatinine, and estimated glomerular filtration rate. COVID-19 was confirmed by nasopharyngeal swab and sputum which were positive for SARS-CoV-2 by real-time reverse transcription PCR (RT-PCR). Chest CT revealed multiple patchy and flake ground-glass shadows in bilateral lung fields, and strip shadows in bilateral lower lobes. Treatment included antiviral (umifenovir, hydroxychloroquine), antibacterial (moxifloxacin), and other support therapies. Her symptoms, laboratory data, and chest CT showed trends of gradual improvement, while nasopharyngeal swabs were always positive for SARS-CoV-2. She was finally discharged from hospital on her 70th day of hospitalization when 2 consecutive nasopharyngeal swabs were negative for SARS-CoV-2. This is a rare report on COVID-19 in a renal transplant recipient, which can help enhance the understanding and treatment of COVID-19 in renal transplant recipients.

Xiang, H., et al. (2021). "The effectiveness of continuous renal replacement therapy in critical COVID-19 patients with cytokine release syndrome: a retrospective, multicenter, descriptive study from Wuhan, China." Aging (Albany NY) **13**(7): 9243-9252.

BACKGROUND: Coronavirus disease (COVID-19) has spread rapidly since 2019. Approximately 15% of the patients will develop severe complications such as multiple organ disease syndrome related to cytokine release syndrome (CRS). Continuous renal replacement therapy (CRRT) can remove inflammatory cytokines through filtration or adsorption. We evaluated the effectiveness of CRRT in COVID-19 patients with CRS. METHODS: This retrospective, multicenter, descriptive study included 83 patients with CRS from three hospitals in Wuhan. RESULTS: In COVID-19 patients with CRS, the fatality rate was even higher in CRRT group (P=0.005). However, inflammatory markers such as C-reactive protein, neutrophil counts, and D-dimer decreased after CRRT (P<0.05). Results of Lasso model showed that tracheotomy (beta -1.31) and convalescent plasma (beta -1.41) were the protective factors. In contrast, CRRT (beta 1.07), respiratory failure (beta 1.61), consolidation on lung CT (beta 0.48), acute kidney injury (AKI) (beta 0.47), and elevated neutrophil count (beta 0.02) were the risk factors for death. CONCLUSIONS: Our results showed that although CRRT significantly reduced the

inflammation, it did not decrease the fatality rate of patients with CRS. Therefore, the choice of CRRT indication, dialysis time and dialysis mode should be more careful and accurate in COVID-19 patients with CRS.

Xiang, H. X., et al. (2021). "Renal dysfunction and prognosis of COVID-19 patients: a hospital-based retrospective cohort study." BMC Infect Dis **21**(1): 158.

INTRODUCTION: Increasing evidence indicate that coronavirus disease 2019 (COVID-19) is companied by renal dysfunction. However, the association of Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2)-induced renal dysfunction with prognosis remains obscure. MATERIALS AND METHODS: All 154 patients with COVID-19 were recruited from the Second People's Hospital of Fuyang City in Anhui, China. Demographic characteristics and laboratory data were extracted. Renal dysfunction was evaluated and its prognosis was followed up based on a retrospective cohort study. RESULTS: There were 125 (81.2%) mild and 29 (18.8%) severe cases in 154 COVID-19 patients. On admission, 16 (10.4%) subjects were accompanied with renal dysfunction. Serum creatinine and cystatin C were increased and estimated glomerular filtration rate (eGFR) was decreased in severe patients compared with those in mild patients. Renal dysfunction was more prevalent in severe patients. Using multivariate logistic regression, we found that male gender, older age and hypertension were three importantly independent risk factors for renal dysfunction in COVID-19 patients. Follow-up study found that at least one renal function marker of 3.33% patients remained abnormal in 2 weeks after discharge. CONCLUSION: Male elderly COVID-19 patients with hypertension elevates the risk of renal dysfunction. SARS-CoV-2-induced renal dysfunction are not fully recovered in 2 weeks after discharge.

Xu, J. J., et al. (2020). "Renal infarct in a COVID-19-positive kidney-pancreas transplant recipient." Am J Transplant **20**(11): 3221-3224.

The novel coronavirus disease 2019 (COVID-19) is associated with increased risk of thromboembolic events, but the extent and duration of this hypercoagulable state remain 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.

Xu, X., et al. (2021). "Association between continuous renal replacement therapy and 28-day mortality of critically ill patients with COVID-19 receiving mechanical ventilation." Clin Nephrol **96**(4): 207-215.

BACKGROUND: Continuous renal replacement therapy (CRRT) has become an important multiple organ support therapy and it is widely used in the intensive care unit (ICU). The aim of this study was to clarify the association between CRRT and 28-day mortality in critically ill coronavirus disease 2019 (-COVID-19) patients receiving mechanical ventilation. MATERIALS AND METHODS: 112 respiratory decompensated critically ill adult patients with COVID-19 admitted to a COVID-19-designated ICU were included in this retrospective cohort study. Data on demographic information, comorbidities, laboratory findings upon ICU admission, and clinical outcomes were collected. The Kaplan-Meier method and Cox proportional hazard model were applied to determine the potential risk factors associated with 28-day mortality. RESULTS: The median age was 65.7 years, 67.8% were males, and 58.9% patients had at least one comorbidity. The median scores of the Charlson Comorbidity Index and Sequential Organ Failure Assessment (SOFA) were 3 and 7, respectively. Acute kidney injury (AKI) occurred in 57 critically ill patients upon ICU admission; 43 patients were classified as stage 2 - 3 AKI, and 36 patients were treated with CRRT. Age > 65 years, high SOFA score, damaged cardiac function, poor nutrition, and severe infection were significantly associated with increased 28-day mortality. AKI patients receiving CRRT had lower 28-day mortality compared with those not receiving CRRT (HR = 0.35, 95% CI: 0.21 - 0.58, $p < 0.001$). Initiating CRRT within 72 hours after mechanical ventilation did not improve survival after CRRT initiation. CONCLUSION: AKI prevalence and 28-day mortality are high in critically ill patients with COVID-19 receiving mechanical ventilation. CRRT plays a part in decreasing the mortality of critically ill COVID-19 patients with AKI receiving mechanical ventilation.

Yang, D., et al. (2020). "COVID-19 and chronic renal disease: clinical characteristics and prognosis." QJM **113**(11): 799-805.

BACKGROUND: Patients on dialysis were susceptible to coronavirus disease 2019 (COVID-19) and were prone to severe clinical characteristics after infection; acute kidney injury was related to mortality in COVID-19 cases. Limited is known about the characteristics of COVID-19 patients with end-stage renal disease not requiring renal replacement therapy

(RRT). AIM: Evaluate clinical characteristics, course and outcomes of COVID-19 patients with chronic kidney disease (CKD) who did not require RRT and those on dialysis. DESIGN: A two-center retrospective study. METHODS: A total of 836 adult patients with COVID-19 (24 CKD not on dialysis; 15 dialysis-dependent CKD) were included. The study includes no patients with renal transplantation. Risk factors were explored. RESULTS: CKD not requiring RRT is an independent risk factor for in-hospital death [adjusted odds ratio (aOR) 7.35 (95% CI 2.41-22.44)] and poor prognosis [aOR 3.01 (95% CI 1.23-7.33)]. Compared with COVID-19 cases without CKD, those with CKD not requiring RRT showed similar percentage of initial moderate cases (75.00% vs. 73.65%) but higher incidence of in-hospital neutrophilia (50.00% vs. 27.30%) or death (50.00% vs. 9.03%). The odds ratio of dialysis associated to mortality in CKD patients was 2.00 (95% CI 0.52-7.63), suggesting COVID-19 patients with dialysis-dependent CKD were at greater risk of in-hospital death. For COVID-19 patients with CKD not requiring RRT, statins reduced the risk of neutrophilia [OR 0.10 (95% CI 0.01-0.69)] while diuretics increased the risk of neutrophilia [OR 15.4 (95% CI 1.47-160.97)], although both showed no association to mortality. CONCLUSION: COVID-19 patients with CKD presented high incidence of neutrophilia, poor prognosis and in-hospital death, with dialysis patients being more vulnerable.

Yang, H., et al. (2021). "Live Renal Ultrasonography Facilitates Double-J Ureteral Stent Insertion at the Bedside: A Pilot Study for the COVID-19 Era." J Endourol **35**(7): 1078-1083.

Objectives: To investigate the feasibility and efficacy of live renal ultrasonography to guide Double-J ureteral stent placement at the bedside. Patients and Methods: Between April 12 and June 5, 2020, patients presenting with acute ureteral obstruction requiring decompression were prospectively selected for ultrasound-guided bedside ureteral stent placement. During stent placement, upper tract access confirmed using ultrasound with or without retrograde injection of ultrasound contrast before Double-J stent insertion. A postprocedural abdominal X-ray was obtained for stent position confirmation. Results: Eight patients (four men and four women) were offered bedside ultrasound-guided ureteral stent placement, and all eight consented to proceed. Stents were placed in seven of eight patients. One patient had an impacted ureterovesical junction stone and stricture requiring ureteroscopy and laser lithotripsy in the operating room. All patients tolerated procedures without immediate complications. Conclusion: Live renal ultrasonography can facilitate a high success rate for bedside ureteral stent placement outside the operating room. This approach is an attractive alternative to fluoroscopy-guided stent placement in the operating room and is of particular value in the COVID-19 era when judicious use of these resources is salient.

Yang, J., et al. (2020). "ACE2 correlated with immune infiltration serves as a prognostic biomarker in endometrial carcinoma and renal papillary cell carcinoma: implication for COVID-19." Aging (Albany NY) **12**(8): 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.

Yang, W., et al. (2021). "ACE2 Correlated With Immune Infiltration Serves As A Novel Prognostic Biomarker In Clear Cell Renal Cell Carcinoma: Implication For COVID-19." Int J Biol Sci **17**(1): 20-31.

The current severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has caused a global infection, and is seriously threatening human life, especially cancer patients. Thus, we sought to determine the clinical roles of ACE2 (the cell entry receptor of SARS-CoV-2) in ccRCC (clear cell renal cell carcinoma). TCGA, GEO and TIP datasets, and immunohistochemistry and western blot results were used to determine the prognostic and clinicopathological characteristics of ACE2. ACE2 expression was down-regulated in ccRCC tissues and cell lines. The multivariate Cox regression analysis results indicated that increased ACE2 expression was independent predictor of longer OS (HR: 0.8259, 95%CI: 0.7734-0.8819, P<0.0001) and RFS (HR: 0.8023, 95%CI: 0.7375-0.8729, P<0.0001) in ccRCC patients. Lower ACE2 expression was also associated with advanced tumor stage, higher histological grade and pathological stage, and metastasis. Besides, ACE2 expression was significantly positively and negatively correlated with CD4 Naive infiltration and CD4 Memory infiltration, respectively. Moreover, higher CD4 Naive and lower CD4 Memory infiltration levels were associated with better pathological features and longer OS and RFS. Furthermore, high ACE2 expression group in decreased CD4 Naive, enriched CD4 Naive and enriched CD4 memory cohort had favorable prognosis. These findings identified that AEC2 was significantly reduced in ccRCC, and decreased ACE2 was related to worse pathological features and poor prognosis. Low ACE2 expression in ccRCC may partially affect the prognosis due to altered immune cells infiltration levels.

Yang, X., et al. (2020). "Prevalence and impact of acute renal impairment on COVID-19: a systematic review and meta-analysis." Crit Care **24**(1): 356.

BACKGROUND: The aim of this study is to assess the prevalence of abnormal urine analysis and kidney dysfunction in COVID-19 patients and to determine the association of acute kidney injury (AKI) with the severity and prognosis of COVID-19 patients. METHODS: The electronic database of Embase and PubMed were searched for relevant studies. A meta-analysis of eligible studies that reported the prevalence of abnormal urine analysis and kidney dysfunction in COVID-19 was performed. The incidences of AKI were compared between severe versus non-severe patients and survivors versus non-survivors. RESULTS: A total of 24 studies involving 4963 confirmed COVID-19 patients were included. The proportions of patients with elevation of sCr and BUN levels were 9.6% (95% CI 5.7-13.5%) and 13.7% (95% CI 5.5-21.9%), respectively. Of all patients, 57.2% (95% CI 40.6-73.8%) had proteinuria, 38.8% (95% CI 26.3-51.3%) had proteinuria +, and 10.6% (95% CI 7.9-13.3%) had proteinuria ++ or +++. The overall incidence of AKI in all COVID-19 patients was 4.5% (95% CI 3.0-6.0%), while the incidence of AKI was 1.3% (95% CI 0.2-2.4%), 2.8% (95% CI 1.4-4.2%), and 36.4% (95% CI 14.6-58.3%) in mild or moderate cases, severe cases, and critical cases, respectively. Meanwhile, the incidence of AKI was 52.9%(95% CI 34.5-71.4%), 0.7% (95% CI - 0.3-1.8%) in non-survivors and survivors, respectively. Continuous renal replacement therapy (CRRT) was required in 5.6% (95% CI 2.6-8.6%) severe patients, 0.1% (95% CI - 0.1-0.2%) non-severe patients and 15.6% (95% CI 10.8-20.5%) non-survivors and 0.4% (95% CI - 0.2-1.0%) survivors, respectively. CONCLUSION: The incidence of abnormal urine analysis and kidney dysfunction in COVID-19 was high and AKI is closely associated with the severity and prognosis of COVID-19 patients. Therefore, it is important to increase awareness of kidney dysfunction in COVID-19 patients.

Yang, X., et al. (2021). "Acute kidney injury and renal replacement therapy in COVID-19 patients: A systematic review and meta-analysis." Int Immunopharmacol **90**: 107159.

PURPOSE: Reported rates of acute kidney injury (AKI) have varied significantly among studies of coronavirus disease 2019 (COVID-19) published to date. The present meta-analysis was conducted to gain clarity regarding AKI incidence and renal replacement therapy (RRT) use in COVID-19 patients. METHODS: The PubMed, Embase, Web of Science, medRxiv, and bioRxiv databases were systematically searched for COVID-19-related case reports published through 25 July 2020. Pooled analyses were conducted using R. RESULTS: The pooled incidence of AKI in 51 studies including 21,531 patients was 12.3% (95% CI 9.5-15.6%), with higher rates of 38.9% in 290 transplant patients (95% CI 27.3-51.9%), 39.0% in 565 ICU patients (95% CI 23.2-57.6%) and 42.0% among 1745 deceased patients (95% CI 30.3-54.7%). RRT usage was reported in 39 studies of 17,664 patients, with an overall pooled use of 5.4% (95% CI 4.0-7.1%), with higher rates of 15.6% in 117 transplant patients (95%CI 9.9-23.8%) and 16.3% in 776 ICU patients (95% CI 11.1-23.3%). CONCLUSION: AKI and RRT use among COVID-19 patients represent a major public health concern, and early and appropriate intervention should be called upon to improve the prognosis of patients suffering from AKI.

Yang, Y., et al. (2021). "Association between Prolonged Intermittent Renal Replacement Therapy and All-Cause Mortality in COVID-19 Patients Undergoing Invasive Mechanical Ventilation: A

Retrospective Cohort Study." Blood Purif **50**(4-5): 481-488.

BACKGROUND: The mortality rate of critically ill patients with coronavirus disease 2019 (COVID-19) was high. We aimed to assess the association between prolonged intermittent renal replacement therapy (PIRRT) and mortality in patients with COVID-19 undergoing invasive mechanical ventilation. METHODS: This retrospective cohort study included all COVID-19 patients receiving invasive mechanical ventilation between February 12 and March 2, 2020. All patients were followed until death or March 28, and all survivors were followed for at least 30 days. RESULTS: For 36 hospitalized COVID-19 patients receiving invasive mechanical ventilation, the mean age was 69.4 (+/-10.8) years, and 30 patients (83.3%) were men. Twenty-two (61.1%) patients received PIRRT (PIRRT group), and 14 cases (38.9%) were managed with conventional strategy (non-PIRRT group). There were no differences in age, sex, comorbidities, complications, treatments, and most of the laboratory findings. During the median follow-up period of 9.5 (interquartile range 4.3-33.5) days, 13 of 22 (59.1%) patients in the PIRRT group and 11 of 14 (78.6%) patients in the non-PIRRT group died. Kaplan-Meier analysis demonstrated prolonged survival in patients in the PIRRT group compared with that in the non-PIRRT group ($p = 0.042$). The association between PIRRT and a reduced risk of mortality remained significant in 3 different models, with adjusted hazard ratios varying from 0.332 to 0.398. Increased IL-2 receptor, TNF-alpha, procalcitonin, prothrombin time, and NT-proBNP levels were significantly associated with an increased risk of mortality in patients with PIRRT. CONCLUSION: PIRRT may be beneficial for the treatment of COVID-19 patients with invasive mechanical ventilation. Further prospective multicenter studies with larger sample sizes are required.

Yap, E., et al. (2021). "Predicting ionized hypocalcemia: External validation of an ionized calcium prediction model in patients with COVID-19 and renal failure." Ann Clin Biochem: 45632211049983.

BACKGROUND: Ionized hypocalcemia is common in critically ill patients with COVID-19 and is associated with adverse outcomes. We previously developed a linear model that estimates ionized calcium (ICa) by adjusting total calcium (TCa) for the three components of the anion gap and albumin. On internal validation, it outperformed the popular method that corrects TCa for albumin alone (cTCa) in diagnosing low ICa. In this study, we sought to externally validate our ICa model in hospitalized COVID-19 positive patients. METHODS: We retrospectively studied all 200 patients with COVID-19 who were admitted to the State University of New York Downstate Medical Center between March 11(th) and April 30(th) 2020 and referred to the nephrology service for renal failure, and who had ICa measured on a venous blood gas within 25 min of a comprehensive metabolic panel. We compared the performance of the ICa model and cTCa in diagnosing low ICa by ROC analysis, and also examined the accuracy of the absolute values predicted by the two methods relative to measured ICa. RESULTS: On ROC analysis, the ICa model was better than cTCa (area under ROC curve: 0.872 [0.025] vs. 0.835 [0.028]; $p = 0.045$). The ICa model estimated ICa accurately, but the cTCa method seemed to overcorrect TCa, as a substantial number of patients with clearly normal cTCa values had low ICa. CONCLUSIONS: In an external validation cohort, the ICa model estimated ICa accurately and was better than cTCa in the diagnosis of low ICa. This finding can be useful in guiding direct ICa testing.

Yilmaz, G., et al. (2021). "Assessment of clinical outcomes in renal transplant recipients with COVID-19." J Med Virol **93**(12): 6760-6764.

The coronavirus disease 2019 (COVID-19) has affected more than a hundred million individuals and caused more than three million deaths worldwide. Specific risk groups were defined for increased risk of mortality and morbidity in COVID-19, and renal transplant recipients are at a significantly increased risk regarding outcomes due to their immunosuppressed conditions. This study evaluated the general characteristics of kidney transplant recipients with COVID-19 infection. Among 1257 transplant cases, 56 had COVID-19 infection, and 23 (41%) were hospitalized during the 9-month study period. Among all COVID-19 cases, 58% were male with a mean age of 45.5 (+/-13.2, 19-71) years, and the most frequent comorbidities were hypertension (70.9%) and diabetes (23.6%). Hospitalized patients were older ($p = 0.03$) and had higher rates of hypertension ($p = 0.008$), diabetes ($p = 0.002$), and ischemic heart disease ($p = 0.03$). Therapeutic management included antimetabolite withdrawal and prednisolone increase in 71%, calcineurin inhibitor withdrawal in 8% and decrease in 58%, hydroxychloroquine in 17%, tocilizumab in 3%, and antivirals in 67% of patients. Acute kidney injury and respiratory failure developed in 34% and 85%, respectively. The mortality rate was 23%. These results emphasized that the COVID-19 infection in renal transplant recipients significantly increases the risk of morbidity and mortality. Therefore, these patients should be intervened earlier and monitored closely to prevent poor outcomes.

Young, J., et al. (2021). "Renal angiomyolipoma rupture in a young female with COVID-19." Am J Emerg Med **47**: 316 e311-316 e313.

While primarily a respiratory illness, infection with the novel coronavirus (COVID-19) is associated with pathologic changes in coagulation, characterized by both thromboembolic and bleeding events. We present the case of a 22-year-old female diagnosed with renal angiomyolipoma (AML) rupture 2 weeks after COVID-19 infection, ultimately requiring admission for hemorrhage control via endovascular embolization. Emergency medicine physicians should maintain a high index of suspicion for renal AML rupture and other spontaneous bleeding events in patients with recent COVID-19 infection due to a possible correlation between the two.

Zakynthinos, G. E. and V. Tsolaki (2021). "Renal failure in COVID-19 ARDS: Could it be partially avoided?" Aust Crit Care **34**(6): 523.

Zamani, N., et al. (2021). "Renal failure and lung hemorrhage as a presentation of COVID-19 infection, a case report." Clin Case Rep **9**(3): 1123-1129.

The concurrent involvement of the lung and kidneys happens in COVID-19 infection. The patient's respiratory symptoms resolved after hemodialysis. This finding raises the question that if hemodialysis can have a role in the treatment of COVID-19.

Zamberg, I., et al. (2021). "Novice and Advanced Learners' Satisfaction and Perceptions of an e-Learning Renal Semiology Module During the COVID-19 Pandemic: Mixed Methods Study." JMIR Med Educ **7**(2): e29216.

BACKGROUND: Nephrotic syndrome is a unique clinical disorder, which provides interesting teaching opportunities that connect physiological and pathological aspects to clinical practice. During the current COVID-19 outbreak, in-person teaching in our institution was not permitted, thus creating a unique challenge for clinical skills teaching. A case-based electronic learning (e-learning) activity was designed to replace the traditional in-person teaching of renal semiology. e-Learning activities have been shown to be effective for knowledge retention and increasing novice learners' performance. However, major knowledge gaps exist concerning the satisfaction of learners with e-learning activities as the sole form of teaching, specifically for undergraduate clinical skills education. OBJECTIVE: Our study aimed to prospectively assess undergraduate medical students' perceptions of and satisfaction with an e-learning activity teaching renal semiology. METHODS: All second-year medical students (novice learners) from the medical faculty of the University of Geneva, Switzerland, undertook the e-learning activity and were invited to participate in a nonmandatory, validated web-based survey, comprising questions answered using a 10-point Likert scale and one qualitative open-ended question. For comparison and to provide further insights, 17 fourth- to sixth-year students (advanced learners) were prospectively recruited to participate in both the e-learning activity and the evaluation. A mixed methods analysis was performed. RESULTS: A total of 88 (63%) out of 141 novice learners and all advanced learners responded to the evaluation survey. Advanced learners reported significantly higher satisfaction with the e-learning activity (mean 8.7, SD 1.0 vs mean 7.3, SD 1.8; P<.001), clarity of objectives (mean 9.6, SD 0.8 vs mean 7.7, SD 1.7; P<.001), and attainability of objectives (mean 9.8, SD 0.5 vs mean 7.3, SD 1.3; P<.001). Both groups showed high interest in the inclusion of the activity as part of a blended learning approach; however, there was low interest in the activity being the sole means of teaching. CONCLUSIONS: Case-based e-learning activities might be better suited for advanced learners and could increase learners' satisfaction within a blended teaching instructional design. More research on students' satisfaction with e-learning activities in the field of clinical skills education should be done. In addition, more effort should be put into finding alternative teaching tools for clinical skills education in light of the ongoing COVID-19 pandemic and future health crises.

Zequi, S. C. and D. Abreu (2020). "Consideration in the management of renal cell carcinoma during the COVID-19 Pandemic." Int Braz J Urol **46**(suppl.1): 69-78.

INTRODUCTION: Recently the COVID-19 pandemic became the main global priority; main efforts and health infrastructures have been prioritized in favor of COVID-19 battle and the treatment of benign diseases has been postponed. Renal cell cancer (RCC) patients configure a heterogenous populations: some of them present indolent cases which can safely have postponed their treatments, others present aggressive tumors, deserving immediate care. These scenarios must be properly identified before a tailored therapeutic choice. Objectives We propose a risk-based approach for patients with RCC, to be used during this unprecedented viral infection time. MATERIALS AND METHODS: After a literature review focused in COVID-19 and current RCC treatments, we suggest therapeutic strategies of RCC in two sections: surgical approach and systemic therapy, in all stages of this malignance. RESULTS: Patients with cT1a tumors (and complex cysts, Bosniak III/IV), must be put under active surveillance and delayed intervention. cT1b-T2a/b cases must be managed by

partial or radical nephrectomy, some selected T1b-T2a ((</=7cm) cases can have the surgery postponed by 60-90 days). Locally advanced tumors (>/=cT3 and or N+) must be promptly resected. As possible, minimally invasive surgery and early hospital discharge are encouraged. Upfront cytoreduction, is not recommendable for low risk oligometastatic patients, which must start systemic treatment or even could be put under surveillance and delayed therapy. Intermediate and poor risk metastatic patients must start target therapy and/or immunotherapy (few good responders intermediate cases can have postponed cytoreduction). The recommendation about hereditary RCC syndromes are lacking, thus we recommend its usual care. Local or loco regional recurrence must have individualized approaches. For all cases, we suggest the application of a specific informed consent and a shared therapeutic choice. CONCLUSION: In the pandemic COVID -19 times, a tailored risk-based approach must be used for a safe management of RCC, aiming to not compromise the oncological outcomes of the patients.

Zerbi, S., et al. (2021). "Inferno, disruption, concern, sense of community, teamwork, tears: reflections by renal healthcare team members on the front lines of the COVID-19 pandemic." J Nephrol **34**(1): 7-10.

Zhang, W. J., et al. (2021). "COVID-19 in the immunocompromised population: data from renal allograft recipients throughout full cycle of the outbreak in Hubei province, China." Chin Med J (Engl).

Zhou, J., et al. (2020). "Progress in the study on COVID-19-related renal injury." Zhong Nan Da Xue Xue Bao Yi Xue Ban **45**(10): 1241-1246.

Coronavirus disease 2019 (COVID-19) is now a major public health problem worldwide. Infectivity of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is extremely strong. The one major target of the virus is the lung, which leads to the deaths of respiratory distress syndrome and multiple organ failure. The kidney is also one of the main organs attacked by viruses, which directly damage the renal tubules through angiotensin converting enzyme-2 and cause cytokine storm, resulting in kidney damage and increasing the risk of death in the patients. Early investigation of risk factors for kidney injury, detection of kidney injury indicators, timely supporting treatment and renal replacement therapy for the existence of kidney injury patients are useful for reducing the mortality rate of COVID-19 patients.

Zhu, L., et al. (2020). "Successful recovery of COVID-19 pneumonia in a renal transplant recipient with long-term immunosuppression." Am J Transplant **20**(7): 1859-1863.

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.

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