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Case report

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A case report of COVID-19 complicated with acute kidney injury (AKI) requiring renal replacement therapy

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Abstract

Following its outbreak in China in late 2019, COVID-19 has assumed pandemic proportions, affecting several countries, including Nigeria. Although the respiratory tract appears to be the major target of the virus, other organs such as the kidneys may not be spared. We present a 50 year old Nigerian male who was admitted with clinical features of COVID-19, developed acute kidney injury (AKI) with uremic encephalopathy, had some sessions of hemodialytic therapy amidst other medications, and recovered full renal function after several weeks with no evidence of infection transmission to other patients, hospital staff or care-givers during the procedure. The essence of the report is to bring to limelight the occurrence of renal disease as a possible complication of COVID-19. Hemodialysis protocols aimed at preventing cross-infection during the procedure is also emphasized.

Introduction

Coronavirus disease 2019 (COVID-19) is pandemic caused by SARS-CoV-2 virus surface spike protein binding to the human angiotensin-converting enzyme 2 (ACE2) receptor. The receptor is expressed in certain organs such as the lungs, kidney, heart and vascular endothelium with the potential of causing multi-organ dysfunction. Following the initial outbreak in China in late 2019, it has spread to every continent except Antarctica. Nigeria is also not left out of this pandemic with about 61.667 cases and 1125 deaths as at October 21, 2020 [1]. The respiratory tract is primarily involved in most cases of COVID-19 infection. Relatively less is known about its effects on other organs such as the kidneys. Kidney complications was initially thought to be rare but more lately, there are reports suggesting that it may be more common than initially believed and could also predict mortality in affected patients with kidney tropism of the virus being posited as a possible mechanism of action [2]. Most of these studies were done outside Africa. The high rate of infectivity of the virus also calls for caution for those with severe renal disease who may be required to undergo dialysis due to the attendant risk of infecting other patients or staff while rendering care to the patient. We hereby present a 50-year old Nigerian who was admitted with features of severe COVID-19 and subsequently developed acute kidney injury (AKI). He was successfully managed with medications and RRT with good outcome. The aim of this report was to highlight the fact that AKI does occur as complication of COVID-19 and that such patients can be successfully managed while minimizing risks to others in a resource poor setting. To the best of the authors´ knowledge, this may be one of the few case reports of severe COVID-19 with AKI who was successfully treated with intermittent hemodialytic therapy with no evidence of cross infection in Nigeria.

Patient and observation

During the peak of the COVID-19 outbreak in Nigeria, a 50 year old government official was admitted on referral from a private health care facility to the Niger Delta University Teaching Hospital (NDUTH) on the 6th of June 2020. NDUTH was the main isolation and treatment centre for COVID-19 in Bayelsa State, Nigeria. The patient had an acute history of fever, non-productive distressful cough and subsequently developed watery diarrhoea, odynophagia and loss of sense of smell and taste. About a week later, he noticed poor urine stream, dysuria, reduction in urinary output and bilateral leg swelling. There was associated body weakness and malaise. There was no history of a recent travel abroad or contact with anyone with cough or dyspnoea. He was diagnosed hypertensive 4 years earlier but not a known diabetic. He was in respiratory distress, mildly pale, with persistent pyrexia ranging from 38.5°c to 39.0°c and some dehydration. His oxygen saturation (SPO_2) at room air was 92%. He also had tachypnea of 36 cycles per minute and widespread coarse crepitations on both lung fields. Blood pressure was 190/120 mmHg with a displaced apex to the 6LICS and a loud A2. He was lethargic but had

no neurological deficit. An assessment of pneumonia (probably viral) was made to exclude COVID-19 pneumonia with AKI on a background of hypertensive heart disease.

Investigations: PCR assay done using nasopharyngeal swabs was positive for SARS-CoV-2. Chest radiograph done showed right lung atelectasis with florid in-homogenous but poorly defined infiltrates suggestive of collapse consolidation with some affectation of the left lung but with relative sparing of the upper lobes (Figure 1).

Spirometry done revealed renal USS revealed normal kidney sizes (12.5cm long for each kidney with an anterior-posterior (AP) diameter of 5.8cm and 5.2cm for left and right respectively) and mild reduction of cortico-medullary differentiation (Figure 2). Electrocardiography showed left axis deviation while echocardiogram showed dilatation of the ascending aorta and left atrium with preserved ejection fraction of 60%. Random blood glucose done was 12.5mmol/l. However, an FBS done the next day was 5.6mmol/l. The initial serum urea and creatinine were 8.7mmol/l and 187micromol/l respectively. Serum potassium was 2.5mmol/l while other electrolytes were normal. There were no pre-morbid urea and creatinine values available. Urinalysis revealed + protein, + blood but other parameters were normal Catheter urine specimen showed 3+ blood, bacteria 2+ with culture of klebsiella spp which however was resistant to all antibiotics tested. Clotting time was normal at 4 mins 42 secs while prothrombin time was 19 secs with an International Normalized Ratio (INR) of 0.195. The liver function tests were normal apart from mild hypoproteinaemia (52g/dl). The various laboratory parameters of the patient during the course of the illness are shown in Table 1. A final diagnosis of COVID-19 complicated with AKI in a known hypertensive with hypertensive heart disease and urinary tract infection was made.

Treatment and progress: he was admitted in the isolation unit and commenced on high flow oxygen therapy via nasal prongs at 5L/min, azithromycin, parenteral antibiotics (ceftriaxone and metronidazole) and anti-hypertensives (amlodipine and Lisinopril). After the first week on admission, patient´s condition deteriorated with worsening respiratory distress. SPO2 had dipped to 70 to 78% (while breathing room air) and 84 to 90% (on oxygen therapy). At this point, the oxygen flow was increased incrementally up to 8-15L/min. This was given as a near continuous therapy. Mechanical ventilation was however not used. Other medications given included levofloxacin, prophylactic enoxaparin, zinc, vitamins C and E. In less than two weeks of admission, the urea and creatinine values had increased to 37.3mmol/l and 1223micromol/l for urea and creatinine respectively. Serum potassium was 4.1mmol/l and bicarbonate 11mmol/l. The urinary output had declined to 0.8Lin 24 hours compared with an initial daily output of over 2L on presentation. A gradual but sustained reduction in his hematocrit level was also noticed. He had become lethargic with an alteration in his mental status. A diagnosis of uremic encephalopathy in a COVID-19 positive patient was made. He was continued on oxygen and referred for dialysis in a near-by dialysis centre as the hospital did not have dialysis facilities.

Hemodialysis (HD) treatment protocol: patient was moved to the private dialysis centre by a dedicated COVID-19 hospital ambulance whenever he needed the treatment. The centre had a Consultant Nephrologist, Dialysis Nurses, and Technical Engineers. He had a total of 9 sessions of dialysis with interval of 2-3 days between sessions. Indication for dialysis was uremic encephalopathy He also received some units of blood intra-dialysis. The dialysis procedure was done with caution considering the high rate of infectivity and transmission of COVID-19. All the dialysis staff having access to the patient were fully done with the recommended personal protective equipment (PPE). The components of the PPE included isolation gowns, face shield, N-95 NIOSH-approved N95 facemask, googles and surgical gloves. Care was taken to ensure frequent hand washing and use of alcohol-based hand sanitizers by all staff and patients´ relatives while ensuring that there were

no unnecessary visitors to the dialysis unit. Appropriate physical distancing was maintained except when it was inevitable. Other safety precautions taken included ensuring that no other patient was dialyzed in the same room with patient during the shift. No consumables, catheters and other dialysis materials used for COVID-19 patients were shared with other patients. The dialysis machine was chemically sterilised after the procedure with "citrosteril" after each session while the surfaces of the machine, and other exposed areas were appropriately cleaned with hypochlorite. Finally, chlorine disinfection of the dialysis room, reception, consulting room as well as adjoining areas was done by a team from the State Ministry of Health after each dialysis session.

Outcome: a gradual improvement in patient´s sensorium and overall clinical state was noted with each subsequent session of hemodialysis. By the 6th session of HD, patient had regained consciousness and could communicate. He had also received a unit of blood during each episode of dialysis. Fever had subsided and dyspnoea had resolved with an SP02 of 97% in room air. A repeat test done for COVID-19 was negative. A repeat chest radiography showed no demonstrable lung lesion (Figure 2). There was however cardiomegaly of left ventricular strain and aortic unfolding in keeping with hypertensive heart disease. He was discharged from the hospital but had three more sessions of HD as an out-patient. After the last session done about two months ago, the urea and creatinine values had dropped to normal values. The patient had not required RRT since then. He is presently on follow up in the Nephrology Clinic as an out-patient and has remained clinically stable since discharge. There were no symptoms or other evidence of COVID-19 among staff, his relatives, or other patients of the dialysis centre while patient was being actively managed.

Discussion

We have reported an acutely ill patient who presented with clinical and laboratory features of COVID-19 and associated kidney disease. Our patient met the key diagnostic features of AKI evidenced by a decline in urinary output and an increase in serum creatinine above baseline over a short period. Although the exact mechanism of AKI is unknown, current postulations suggest direct renal cellular injury resulting from renotropic effect of SARS-CoV-2 and "the cytokine storm syndrome" [3]. Our patient was a previously diagnosed hypertensive and presented with severe hypertension. There is at yet no conclusive evidence to suggest that hypertension or uncontrolled blood pressure is related to the outcomes of COVID-19 [4]. However, diabetes or hyperglycemia is an established risk factor for COVID-19 and contributes to its severity and mortality [5]. Though the index patient was not a known diabetic, he presented with hyperglycemia. The ultrasonography findings revealed normal kidney sizes which was fairly consistent with AKI The likelihood of AKI, rather than CKD, is also buttressed by complete resolution of symptoms after treatment and stable renal function several weeks after the last HD.

A large scale retrospective study done in the United States showed a higher AKI incidence among patients with COVID-19 compared with those without COVID-19 [6]. The relationship between the severity of COVID-19 infection and kidney failure can be likened to that between "the chicken and the egg" While severe COVID-19 infection has a higher incidence of kidney involvement compared with mild and moderate disease, the presence of kidney failure worsens prognosis of COVID-19 [7]. Although the indications for RRT in patients with AKI from COVID-19 may not differ from those without COVID-19, AKI patients with COVID-19 are more likely than those without COVID-19 to require RRT and are also less likely to recover kidney function [7]. The indication for dialysis in the index patient was encephalopathy which was most likely from uremia as it appeared to have clinically correlated with the worsening biochemical profile. Provision of RRT in COVID-19 patients is based on certain principles which include keeping the health team safe by appropriate use of PPE, reducing

exposure to health care personnel to the barest minimum and routine disinfection of all dialysis equipment. Studies have also shown that, irrespective of renal function, patients with severe COVID-19 could benefit from extracorporeal treatment [8]. The essence of this is to reduce the level of inflammatory mediators and thus mitigate the effect of the cytokine storm syndrome.

The COVID-19 pandemic brings to limelight peculiar challenges in the care of patients with kidney failure especially those requiring RRT. The high rate of transmissibility of the virus makes nosocomial spread very likely. Specific infection control practices must therefore be put in place. All staff in the dialysis unit must be familiar with donning and duffing procedure for PPE. All dialysis staff involved in the management of the index case wore the complete armory of their PPE. Although there was no dedicated dialysis machine for COVID-19 in the dialysis facility, other measures taken to reduce transmission included ensuring no other patient was dialysed with the patient during the same shift, disinfection of the machine and the entire work station after the session in line with recommended protocols [9]. Additional measures that can be adopted in dialysis centres include screening for body temperature and other COVID-19 symptoms and universal rapid testing for SARS-CoV-2 before entry into the dialysis room [9]. With an increasing surge in number of COVID-19 cases, there is however a morbid fear that dialysis facilities could become overwhelmed in a resource poor country such as ours where the existing health facilities are already grossly under-equipped with material and human resources [10].

Conclusion

AKI requiring RRT could occur in patients with COVID-19 and may resolve following appropriate management. The chances of transmission of the disease in dialysis centres could be markedly reduced if appropriate procedures or guidelines are followed.

Competing interests

The authors declare no competing interests.

Authors' contributions

All the authors have read and agreed to the final manuscript.

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Table and figures

Table 1: laboratory parameters of the patient during and after discharge

Figure 1: chest radiograph of the patient with COVID-19 during illness and after recovery

Figure 2: renal scan of the patient with COVID-19

References

1. The Worldometer. Coronavirus population. Accessed October 22, 2020.
2. Egbi OG, Adejumo OA, Akinbodewa A. Coronavirus infection and kidney disease: a review of current and emerging evidence. Pan Afr Med J. 2020;37: 149. **Google Scholar**
3. Naicker S, Wei Yang C, Hwang S, Liu B, Chen J, Jha V. The novel coronavirus 2019 epidemic and kidneys. Kidney Int. 2020;97(5): 824-828. **PubMed**| **Google Scholar**
4. Schiffrin EL, Flack JM, Ito S, Muntner P, Webb RC. Hypertension and COVID-19. Am J Hypertens. 2020; 33(5): 373-374. **PubMed**| **Google Scholar**

5. Abdi A, Jalilian M, Sarbarzeh PA, Vlaisavjevic Z. Diabetes and COVID-19: a systematic review on the current evidences. Diabetes Res Clin Pract 2020;166: 108347. **PubMed**| **Google Scholar**
6. Gansevoort RT, Matsushita K, van der Velde M, Astor BC, Woodward M, Levey AS. Lower estimated GFR and higher albuminuria are associated with adverse kidney outcomes. A collaborative meta-analysis of general and high-risk population cohorts. Kidney Int. 2011;80(1): 93-104. **PubMed**| **Google Scholar**
7. Fisher M, Neugarten J, Bellin E, Yunes M, Stahl L, Johns TS *et al*. AKI in Hospitalized Patients with and without COVID-19: A Comparison Study. JASN. 2020;31(9): 2145-2157. **PubMed**| **Google Scholar**
8. Ronco C, Bagshaw SM, Bellomo R, Clark WR, Husain-Syed F, Kellum JA *et al*. Extracorporeal Blood Purification and Organ Support in the Critically Ill Patient during COVID-19 Pandemic: expert review and Recommendation. Blood Purif. 2020;26: 1-11. **PubMed**| **Google Scholar**
9. Ikizler TA, Kliger AS. Minimizing the risk of COVID-19 among patients on dialysis. Nat Rev Nephrol. 2020;16(6): 311-313. **PubMed**| **Google Scholar**
10. Deep A. Effect of adult COVID-19 surge on the provision of kidney replacement therapy in children. Pediatr Nephrol. 2020;35(11): 2023-2030. **PubMed**| **Google Scholar**

Table 1: laboratory parameters of the patient during and after discharge					
Parameter	**Reference range**	**Week 1 on Admission**	**Week 2 on Admission**	**Week 3 on Admission**	**After Discharge**
Serum					
Urea	1.7-9.1	8.7	28.4		9.9, 6.4
Creatinine	187	187	638		157, 145
Potassium	3.5-5.3	3.5	4.6		3.9, 3.8
Bicarbonate	24-30		12		24
Calcium	2.1-2.6		2.4		2.2
Sodium	128-142		138		143
Chloride	96-108		110		
Hematocrit		36			
Platelet count (x 109/l)	140-400	192			
Total protein					87
Albumin					42
Clotting time	5-12 mins	4 mins 42 secs			
Prothrombin time (secs)	20-23	19			
Urine Protein	Positive +	+			Negative (-)
Blood	Positive +	+			Negative (-)
Urobilinogen	Negative-	_			Positive (+}
Others	Norma_	_			Normal

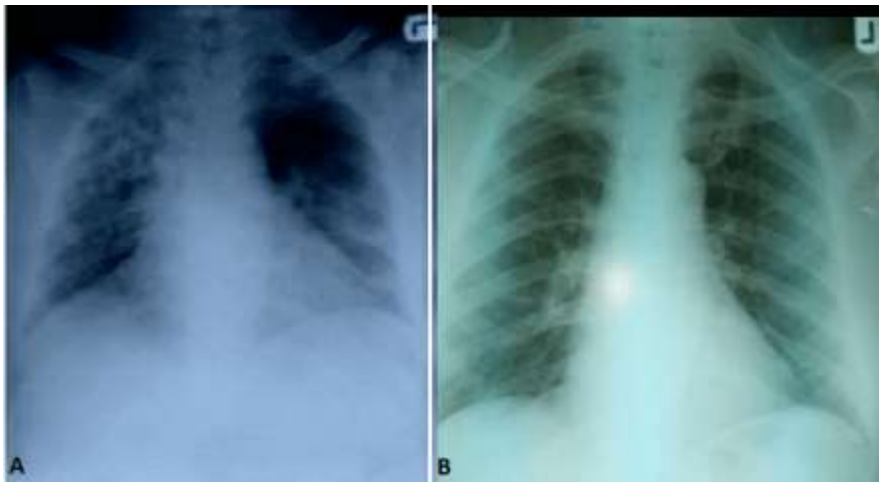

Figure 1: chest radiograph of the patient with COVID-19 during illness and after recovery

Figure 2: renal scan of the patient with COVID-19