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Renal Involvement in COVID-19 Patients

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ABSTRACT:

Background: Acute kidney injury (AKI) is a critical complication of COVID19, associated with high morbidity and mortality. Da ta from low resource settings remain scarce.

Objective:To determine the frequency, risk factors, treatment modalities, and outcomes of AKI among hospitalized COVID19 pat ients in Khartoum,Sudan

Methods:A multicenter crosssectional study was conducted from September to December 2021. Data from 170 hospitalized COV ID-19 patients were analyzed using SPSS. AKI was defined and staged using KDIGO criteria.

Results: The frequency of AKI was 66.5% (113/170). Among AKI patients, 69% required renal replacement therapy (RRT), with 51.3% receiving continuous RRT and 48.7% intermittent hemodialysis. Significant predictors of AKI included sepsis (p=0.001) a nd hemodynamic instability (p=0.001). Mortality was significantly higher in AKI patients (57.5% vs. 31.6%, p=0.001). Comorbidi ties showed a non-significant trend toward AKI.

Conclusion:

AKI is highly prevalent among severe COVID19 patients in Sudan and is associated with markedly increased mortality. Early scre ening, prompt management of sepsis and hemodynamic instability, and preparedness for RRT are essential in improving outcomes

KEYWORDS: Acute kidney injury, COVID-19, Sudan.

INTRODUCTION

The SARS_CoV2 pandemic has revealed multiorgan involvement, with acute kidney injury (AKI) emerging as a frequent and seri ous complication among hospitalized patients.[1] AKI in COVID19 is associated with prolonged hospitalization, increased need f or critical care, and high mortality rates.[2,3] The pathophysiology involves direct viral cytopathy via ACE2 receptors, cytokine storm, endothelial dysfunction, hypercoagulability, and hemodynamic instability.[4,5] Despite global reports, data from sub-Saharan Africa, particularly Sudan, are limited. This study aims to elucidate the risk factors, modalities of renal replacement thera py (RRT), clinical outcomes, and management strategies for AKI in COVID-19 patients in Khartoum, Sudan.

EPIDEMIOLOGY AND RISK FACTORS

Global prevalence of AKI in COVID_19 varies widely (5_46%), influenced by demographics, comorbidities, and illness severity. [6,7] Advanced age, male gender, hypertension, diabetes, cardiovascular disease, and chronic kidney disease are established risk factors.

[8,9] The Sudanese population presents a unique profile with high burdens of hypertension and diabetes, potentially amplifying A KI risk.[10].

RENAL REPLACEMENT THERAPY

Approximately 20_30% of COVID_19 AKI patients require RRT.[14] Modalities include continuous RRT (CRRT) and intermitte nt hemodialysis (IHD). CRRT is often preferred in hemodynamically unstable patients, though resource constraints in low-income settings limit its availability. [15] Outcomes are influenced by timing, modality, and comorbidities.

Mortality and Outcomes

AKI significantly increases mortality in COVID_19, with reported odds ratios as high as 23.9.[16] Even mild AKI (Stage 1) elevat es risk. Survivors often experience incomplete renal recovery, leading to chronic kidney disease.[17,18]

Renal Involvement in COVID-19 Patients

Guidelines and Management

KDIGO guidelines recommend early detection using serum creatinine and urine output, avoidance of nephrotoxins, and timely RR T.[19] In COVID-19, additional emphasis is placed on managing hyperinflammation and thrombosis.[20]

DATA COLLECTION & METHODS

Study Design and Setting

A hospital_based cross_sectional study was conducted at three hospitals in Khartoum from September to December 2021.

Included: Adults (≥18 years) hospitalized with PCR-confirmed COVID-19.

Excluded: pre-existing end-stage renal disease on dialysis.

Demographic, clinical, laboratory, and outcome data were extracted using a structured form. AKI was defined and staged using K DIGO criteria.

STATISTICAL ANALYSIS

Data analyzed using SPSS v25.0. Chi-square and t-tests were used for associations. P-value <0.05 was significant.

RESULTS

DEMOGRAPHICS AND CLINICAL CHARACTERISTICS

Among 170 patients, nearly two_thirds (66.5%) were above 60 years of age (Figure 1), with a male predominance of 62.9% (male : female ratio 1.7:1; Figure 2). The median hospital stay was 1-
7 days for 39.4% of patients, while 32.4% stayed for more than 14 days (Figure 3). Common isolated comorbidities included hype rtension (6.7%), diabetes mellitus (12.9%), and cardiovascular disease (1.2%) (Figure 4).

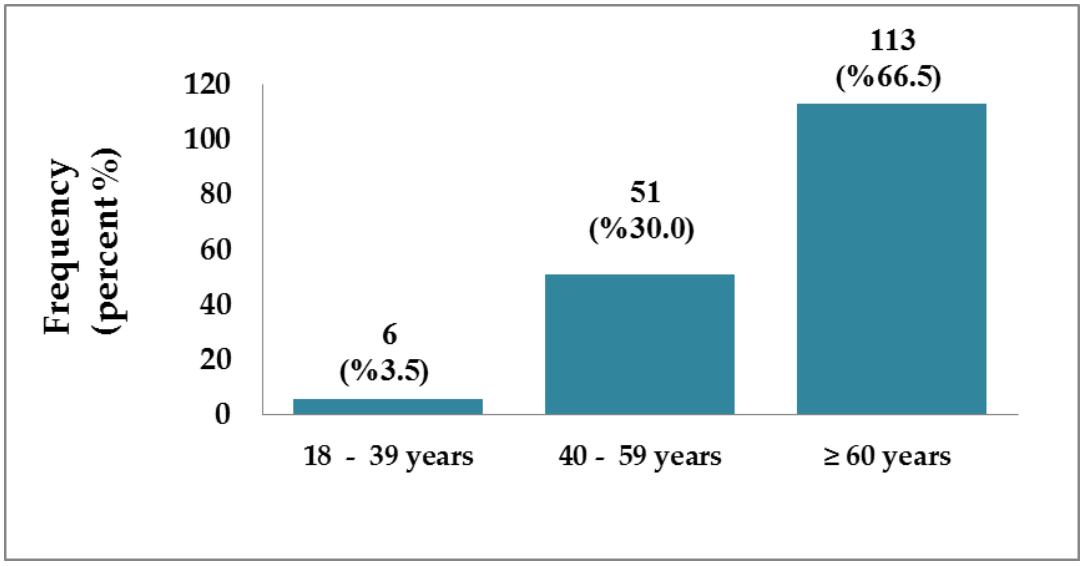

Figure 1. Age distribution of the study participants (n=170).

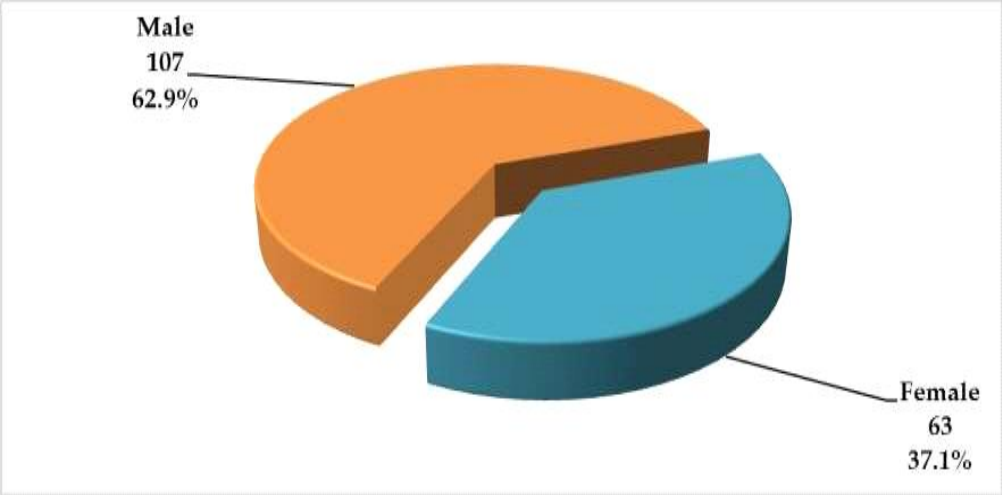

Figure 2. Gender distribution of the study participants (n=170).

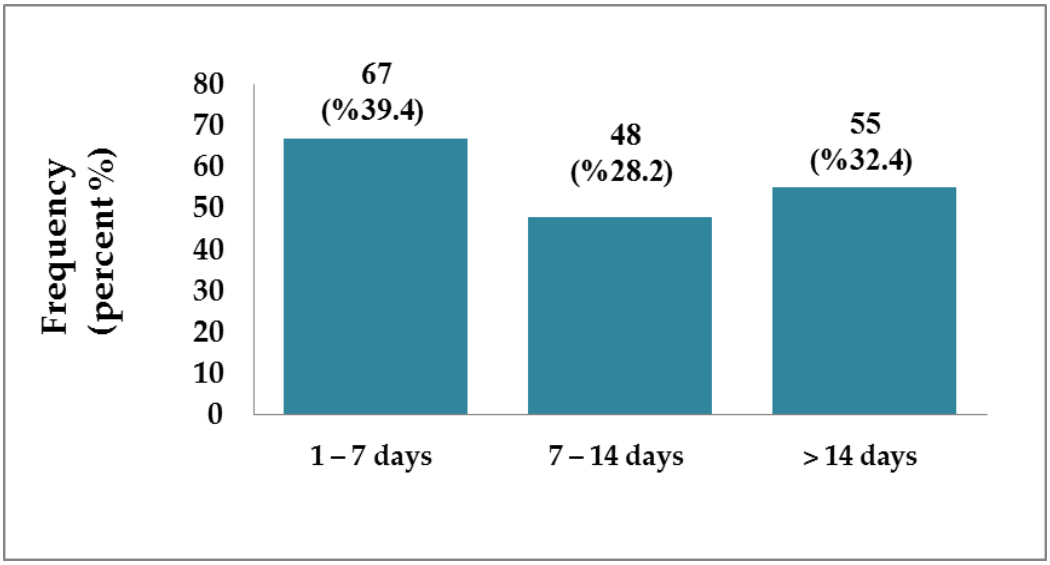

Figure 3. Length of hospital stay among the participants (n=170).

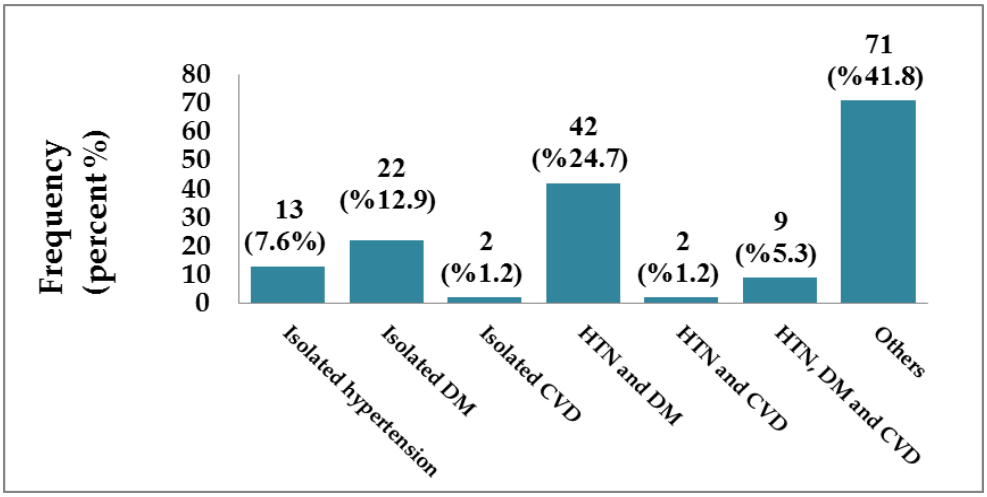

Figure 4. Distribution of comorbidities among the participants (n=170).

CLINICAL COURSE AND INTERVENTIONS

Nearly half (47.6%) of participants required supplemental oxygen, primarily via non rebreather masks (67.9%). Most patients (64.1%) required mechanical ventilation, with the invasive type being predominant (72.5 %) (Tables 1 & 2). The most common complications post_admission were sepsis (68.8%) and hemodynamic instability (42.9%) (Table 3). Only 10% of patients received nephrotoxic medications (Figure 5).

Table 1. Oxygen requirement among participants (n=170).

Oxygen requirement	Frequency	Percent %
Yes	81	47.6
No	89	52.4
Type (n=81)		
-nasal cannula	17	21.0
-Simple Face Mask	18	22.2
-Non-Rebreather Mask	55	67.9

Table 2. Mechanical ventilator requirement among participants (n=170).

Mechanical ventilator requirement	Frequency	Percent %
Yes	109	64.1
No	61	35.9
Type (n=109)		
-Invasive	79	72.5
-Non-Invasive	30	27.5

Table 3. Problems developed after admission (n=170).

Problems developed after admission	Frequency	Percent %
Sepsis	117	68.8
Hemodynamic Instability	73	42.9
Liver Impairment	12	7.1
CNS Depression	6	3.5

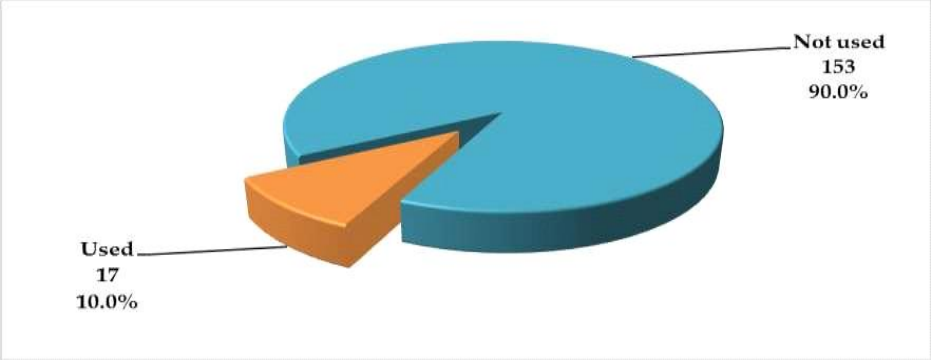

Figure 5. Use of nephrotoxic medication among participants (n=170).

INCIDENCE AND MANAGEMENT OF ACUTE KIDNEY INJURY

The frequency of AKI among participants was 66.5% (113/170) (Figure 7). More than half (55.9%) presented with high serum cre atinine levels at admission (Figure 6). Among AKI patients, 69% required Renal Replacement Therapy (RRT), while 31% were m anaged conservatively (Figure 8). All patients on RRT received more than three sessions. Of those, 51.3% underwent Continuous Renal Replacement Therapy (CRRT) and 48.7% conventional hemodialysis (Figure 10). Vasopressors were used in 36.3% of AKI patients (Figure 9).

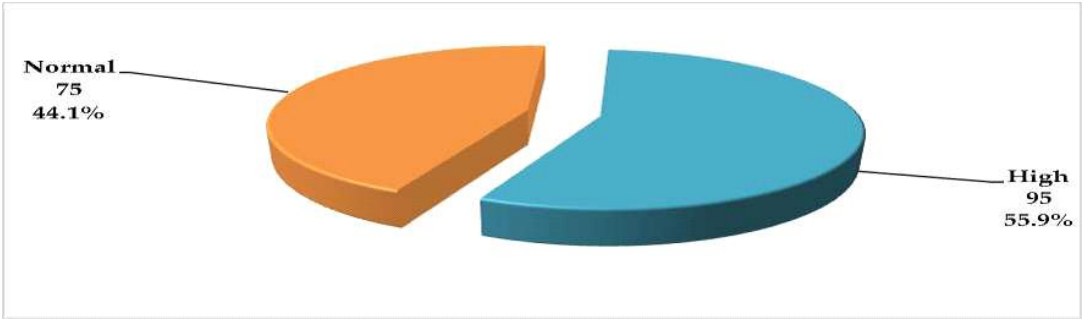

Figure 6. Distribution of participants according to serum creatinine level at admission (n=170).

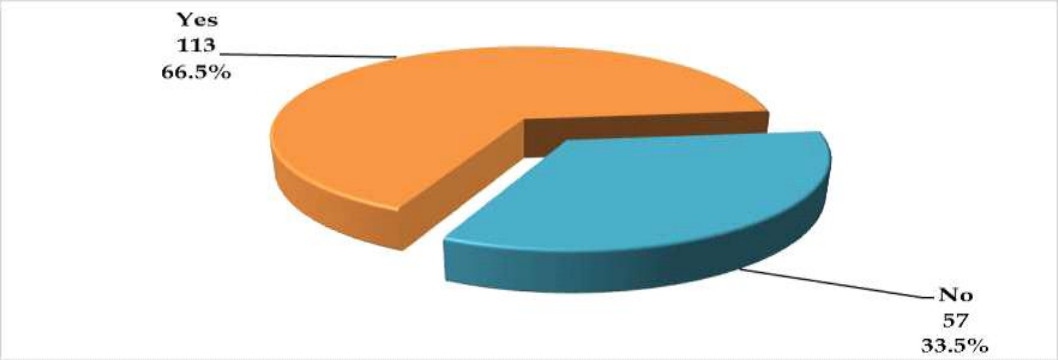

Figure 7. Occurrence of Acute Kidney Injury among participants (n=170).

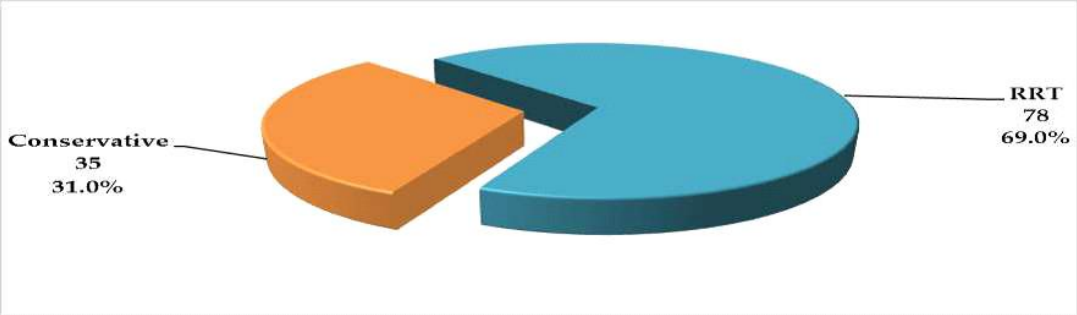

Figure 8. Treatment modalities for patients with AKI (n=113).

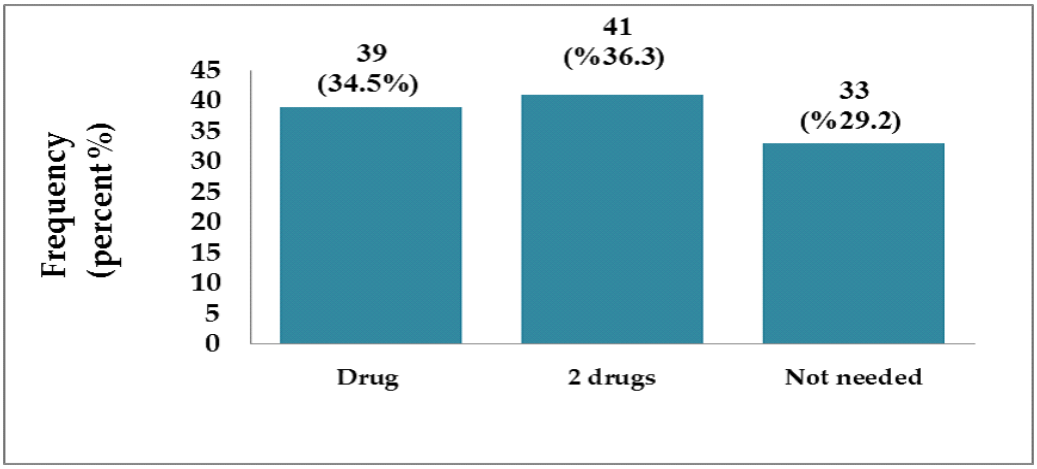

Figure 9. Use of vasopressors among patients with AKI (n=113).

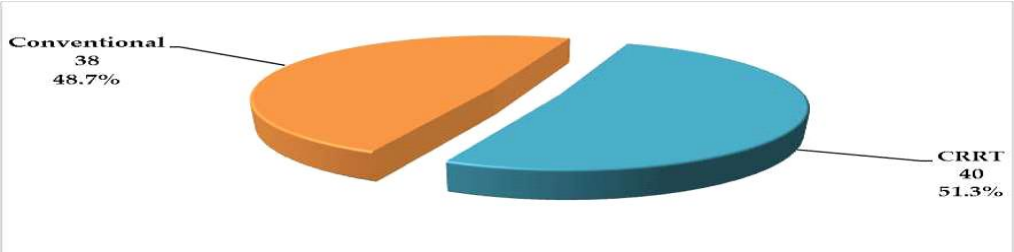

Figure 10. Modality of Renal Replacement Therapy (n=78).

RISK FACTORS AND PREDICTORS OF AKI

Cross_tabulation analysis revealed significant associations between the occurrence of AKI and sepsis (82.3% in AKI vs. 42.1% in non_AKI, p=0.001) and hemodynamic instability (59.3% vs. 10.5%, p<0.001) (Table 4). Age, gender, and use of nephrotoxic dru gs did not show statistically significant associations.

Table 4. Relation between relevant clinical factors and the occurrence of AKI (n=170)

Factor	AKI (Yes) n=113	AKI (No) n=57	p-value
Age ≥ 60 years	78 (69.0%)	35 (61.4%)	0.296
Male Gender	74 (65.5%)	33 (57.9%)	0.333
Sepsis	93 (82.3%)	24 (42.1%)	0.001
Hemodynamic Instability	67 (59.3%)	6 (10.5%)	<0.001
Nephrotoxic Drugs	13 (11.5%)	4 (7.0%)	0.357

COMORBIDITIES AND AKI

While the frequency of AKI was higher in patients with comorbidities like hypertension, diabetes, and cardiovascular disease, thes e associations did not reach statistical significance ($p > 0.05$ for all) (Table 5).

Table 5. Relation between comorbidities and the occurrence of AKI (n=170).

Comorbidity	AKI (Yes) n=113	AKI (No) n=57	p-value
Isolated Hypertension	9 (8.0%)	4 (7.0%)	0.826
Isolated Diabetes Mellitus	16 (14.2%)	6 (10.5%)	0.505
Hypertension and Diabetes	26 (23.0%)	16 (28.1%)	0.470

DISCUSSION

RISK FACTORS AND PREDICTORS

Our AKI rate (66.5%) exceeds many global reports, reflecting a critically ill cohort.[21] Sepsis and hemodynamic instability were strong predictors, aligning with global data on the central role of systemic inflammation and hypoperfusion in COVID_19 related AKI.[22,23] The high rates of mechanical ventilation and vasopressor use underscore the role of systemic insult.

RENAL REPLACEMENT THERAPY

The high RRT requirement (69%) highlights the severity of renal involvement. The nearequal split between CRRT and IHD reflec ts resourcedriven decisions in our setting. While CRRT may offer hemodynamic benefits in unstable patients, its availability is oft en limited in resource-constrained environments.[24]

MORTALITY AND OUTCOMES

The stark mortality difference (57.5% vs. 31.6%) confirms AKI as a critical prognostic marker, consistent with global meta_analy ses showing AKI multiplies mortality risk.[25] In low_resource settings, delayed recognition and limited RRT capacity likely exac erbate poor outcomes.

RECOMMENDATIONS FOR SCREENING AND MANAGEMENT

1. Early Screening: Implement daily serum creatinine and urine output monitoring in all hospitalized COVID-19 patients, especially those with sepsis or requiring ventilation.
2. Preventive Measures: Aggressively manage sepsis, optimize hemodynamics, and avoid nephrotoxins.
3. RRT Preparedness: Increase isolation-ready HD beds and staff training in both CRRT and IHD modalities.
4. Multidisciplinary Care: Integrate nephrology consultation early in the care of severe COVID-19 cases.
5. Public Health: Strengthen COVID-19 prevention to reduce the incidence of severe cases.

CONCLUSION

AKI is a frequent and deadly complication of COVID19 in Sudan, driven predominantly by sepsis and hemodynamic instability. T he high need for RRT and the associated mortality call for enhanced surveillance, early intervention, and strengthened renal care c apacity. These findings should inform national guidelines and resource allocation in Sudan and similar settings.

REFERENCES

1) Hirsch JS, et al. Acute kidney injury in patients hospitalized with COVID_19. Kidney Int. 2020;98(1):209-18.
2) Cheng Y, et al. Kidney disease is associated with in-hospital death of patients with COVID-19. Kidney Int. 2020;97(5):829-38.
3) Gupta S, et al. AKI in COVID_19_associated multisystem inflammatory syndrome in children (MIS-C). Kidney360. 2020;1(7):614-22.

4) Batlle D, et al. Acute kidney injury in COVID_19: emerging evidence of a distinct pathophysiology. J Am Soc Nephrol. 2020;31(7):1380-3.
5) Nadim MK, et al. COVID_19_associated acute kidney injury: consensus report of the 25th Acute Disease Quality Initiati ve (ADQI) Workgroup. Nat Rev Nephrol. 2020;16(12):747-64.
6) Silver SA, et al. The Prevalence of Acute Kidney Injury in Patients Hospitalized With COVID_19 Infection: A Systemati c Review and Meta_analysis. Kidney Med. 2021;3(1):83-98.
7) Fisher M, et al. AKI in Hospitalized Patients with and without COVID_19: A Comparison Study. J Am Soc Nephrol. 202 0;31(9):2145-57.
8) Chan L, et al. AKI in Hospitalized Patients with COVID_. J Am Soc Nephrol. 2021;32(1):151-60.
9) Bowe B, et al. AKI in a National Cohort of Hospitalized US Veterans with COVID-19. Clin J Am Soc Nephrol. 2021;16(1):14-25.
10) Altayb HN, et al. The current situation of COVID_19 in Sudan. New Microbes New Infect. 2021;41:100746.
11) Su H, et al. Renal Histopathological Analysis of 26 Postmortem Findings of Patients with COVID-19 in China. Kidney Int. 2020;98(1):219-27.
12) Ronco C, et al. Management of acute kidney injury in patients with COVID_19. Lancet Respir Med. 2020;8(7):738-42.
13) Hsu CM, et al. Acute kidney injury in patients with COVID_19: a retrospective cohort study from northern Italy. Int Urol Nephrol. 2021;53(8):1693-702.
14) Mohamed MMB, et al. Acute Kidney Injury Associated with Coronavirus Disease 2019 in Urban New Orleans. Kidney3 60. 2020;1(7):614-22.
15) Villa G, et al. Renal Replacement Therapy in ICU Patients: An Italian Survey. Blood Purif. 2018;45(1-3):242-9.
16) Cheruiyot I, et al. Acute kidney injury is associated with worse prognosis in COVID_19 patients: a systematic review an d meta_analysis. Acta Biomed. 2020;91(3):e2020029.
17) Lumlerigul N, et al. Acute kidney injury prevalence, progression and long_term outcomes in critically ill patients with C OVID_19: a cohort study. Ann Intensive Care. 2021;11(1):123.
18) Wald R, et al. The Association Between Recovery From Acute Kidney Injury and the Risk of Incident Chronic Kidney D isease Following COVID_19. J Am Soc Nephrol. 2022;33(6):1183-95.
19) KDIGO Clinical Practice Guideline for Acute Kidney Injury. Kidney Int Suppl. 2012;2(1):1-141.
20) Alhazzani W, et al. Surviving Sepsis Campaign: guidelines on the management of critically ill adults with Coronavirus D isease 2019 (COVID_19). Intensive Care Med. 2020;46(5):854-87.
21) de Almeida DC, et al. Acute kidney injury: Incidence, risk factors, and outcomes in severe COVID-19 patients. PLoS One. 2021;16(5):e0251048.
22) Peerapornratana S, et al. Acute kidney injury from sepsis: current concepts, epidemiology, pathophysiology, prevention a nd treatment. Kidney Int. 2019;96(5):1083-99.
23) Leedahl DD, et al. Derivation of urine output thresholds that identify a very high risk of AKI in patients with septic shoc k. Clin J Am Soc Nephrol. 2014;9(7):1168-74.
24) Gaudry S, et al. Continuous renal_replacement therapy versus intermittent hemodialysis in critically ill patients with acu_ e kidney injury: a systematic review and meta-analysis. Crit Care. 2020;24(1):528.
25) Robbins_Juarez SY, et al. Outcomes for Patients With COVID_19 and Acute Kidney Injury: A Systematic Review and Meta-Analysis. Kidney Int Rep. 2020;5(8):1149-
60.26. Ahmadian E, et al. COVID_19 and kidney injury: pathophysiology and molecular mechanisms. Rev Med Virol. 2 021;31(3):e2176.