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ORIGINAL RESEARCH

Prevalence of Acute Kidney Injury in Covid-19 Patients- Retrospective Single-Center Study

Ahmed Muhammad Bashir[1], Mahad Sadik Mukhtar[2], Yahye Garad Mohamed[3], Osman Cetinkaya[4], Osman Abubakar Fiidow[5]

[1]Department of Internal Medicine, Mogadishu Somali Turkey, Recep Tayyip Erdogan, Training and Research Hospital, Mogadishu, Somalia; [2]Department of Pulmonology, Mogadishu Somali Turkey, Recep Tayyip Erdogan, Training and Research Hospital, Mogadishu, Somalia; [3]Department of Radiology, Mogadishu Somali Turkey, Recep Tayyip Erdogan, Training and Research Hospital, Mogadishu, Somalia; [4]Department of Emergency Medicine, Mogadishu Somali Turkey, Recep Tayyip Erdogan, Training and Research Hospital, Mogadishu, Somalia; [5]School of Public Health and Research, Somali National University, Mogadishu, Somalia

Correspondence: Ahmed Muhammad Bashir, Department of Internal Medicine, Mogadishu Somali Turkey, Recep Tayyip Erdogan, Training and Research Hospital, Mogadishu, Somalia, Tel +252612527061, Email ambashir@hotmail.com

Introduction: In December 2019, a coronavirus disease 2019 (COVID-19) disease outbreak started in Wuhan, Hubei Province, China, and spread rapidly to other regions of the world. Although diffuse alveolar injury and acute respiratory failure were the most prominent characteristics, further investigation of organ involvement is essential.

Aim: In this study, we aim to determine the prevalence of acute kidney injury (AKI) in covid-19 patients and also the relationship between inflammatory markers, the severity of lung involvement, and acute kidney injury in COVID-19 patients.

Methods: This was a retrospective analysis of 102 COVID-19 patients presented to a tertiary teaching hospital in Mogadishu during the second wave of Covid-19 2021. Patients' age, gender, comorbidities, hemoglobin, platelet, and white blood cell counts, glucose, urea, creatinine, sodium, potassium, CRP, ferritin, real-time polymerase chain reaction (RT PCR) Covid-19 test and CT scan findings were all collected.

Results: The mean age of the patients was 58 (Range 23–91 years), including 64 men and 38 women. The prevalence of acute kidney injury was 12.7%. There was a significant association between acute kidney injury, CRP and ferritin with the p values of P<0.003 and P<0.004, respectively. For severity of lung involvement with computed tomography finding, 35 (34.3%) had mild, 35 (34.3%) had moderate and 32 (31.4%) had severe lung involvement. There was significant association between the lung involvement, Ferritin and CRP levels with P values of P<0.005 and P<0.007 respectively.

Conclusion: Our findings indicate that acute kidney injury is common in covid-19 patients and can increase the morbidity and mortality of these patients. As a result, clinicians in low-resource countries such as Somalia should be more vigilant about kidney injury in patients with severe COVID-19.

Keywords: Somalia, covid-19, acute kidney injury

Introduction

The current Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) outbreak, which began in Hubei Province of the People's Republic of China, has spread rapidly to several other countries. On January 30, 2020, the World Health Organization (WHO) Emergency Committee declared a worldwide health emergency, citing increased case notification rates in Chinese and international regions as evidence.[1]

On March 16, 2020, the Federal Ministry of Health and Human Services of Somalia announced the country's first laboratory-confirmed case of coronavirus disease-19 (COVID-19) in a Somali student arriving from China.[2] Somalia has reported a total confirmed case of 14,363, in which 7471 active cases, 6153 recovered and 745 death cases.[3] According to a research conducted by De Martino Hospital, Somalia's largest and only public sector hospital, 131 patients were admitted between March 30 and June 12, 2020, with 79/131 (60%) being discharged and 52/131 (40%) died during hospitalization.[4]

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It is common for patients with severe COVID-19 to be admitted to the critical care unit due to hypoxemic respiratory failure, requiring mechanical ventilation, or hypotension, requiring the use of vasopressor.[5]

Dehydration, sepsis-induced hypotension or immunologic injury, and microvascular disease are all thought to contribute to COVID-19–associated AKI. Because of poor oral intake, sepsis, and cytokine storm, patients with Covid-19 may develop acute kidney injury, which can vary from prerenal azotemia to acute tubular necrosis.[6,7]

AKI rates vary from 0.5% to 29%, according to early reports from China and Italy, with most estimates falling on the lower end.[8] Older age, diabetes, cardiovascular disease, black race, hypertension, and the requirement for ventilation and vasopressor medicines were all risk factors for AKI.[9]

Our findings show a significantly increased number of acute kidney injury in Somali patients, as well as a relationship between inflammatory markers and COVID-19 severity, which will aid clinicians in monitoring and evaluating the disease's severity and prognosis.

Methods

Data Collection

Ethical permission was gained from the Institutional Review Board (IRB), and due to retrospective nature of our study the ethics committee at the Recep Tayyip Erdogan Training and Research Hospital in Mogadishu, Somalia, declared to waive informed consent and this study was conducted in accordance with the Declaration of Helsinki. Patients' data were obtained from the medical record system and analyzed anonymously to protect patients' privacy.

People who were suspected of having COVID-19 infection and had a chest HRCT scan and a PCR test were studied from March to April of 2021. We collected their clinical and lab data for the study.

Age, gender, comorbidities, hemoglobin, platelet, and white blood cell counts, glucose, urea, creatinine, sodium, potassium, CRP, ferritin, and CT scan findings were all collected.

All biochemical tests were performed using an automated chemistry analyzer and ready-to-use reagent kits following manufacturers' guidelines (Mindray BS 2000M, China).

Real-time polymerase chain reaction (RT- PCR) test was done using Cepheid's GeneXpert IV module instrument. The Picture Archiving and Communication Systems (PACS) were used to collect and assess the outcomes of the chest HRCT images.

HRCT Inspection

Using a Siemens 16-slice CT scanner, On the day of the patients' presentation, all initial chest HRCT scans were performed. Patients were positioned in a supine position while holding a single breath.

HRCT Image Analysis

Each patient's illness severity score was determined by a radiologist with more than 8 years of expertise in evaluating CT images. The scans were first checked for typical COVID-19 pneumonia findings (bilateral, numerous, posterior peripheral ground-glass opacities), as defined by the RSNA Consensus statement.[10] The severity of the condition was then assessed using the grading method outlined below, which is based on a visual evaluation of each affected lobe[11] (Tables 1 and 2).

Table 1 Sum of the Individual Lobar Scores Indicate the Overall Severity of the Five Lobes

Total Score (Numerical)	Severity (Category)
7 or less	Mild
8–17	Moderate
18 or more	Severe

Table 2 Individual Lobar Scores Based on Percentage of Involvement

Lobar Involvement	Score
5% or less	1
5–25%	2
26–49%	3
50–75%	4
>75%	5

Statistical Analysis

SPSS 21.0 was used for the analysis. In descriptive statistics, the demographics, clinical, and laboratory results of the patients were presented as numbers and relative frequencies. A CT score frequency was calculated and compared to other clinical factors. For correlations, correlation coefficient test was applied, binary logistic regression was also used and a p value of less than 0.05 was considered to be statistically significant.

Acute kidney injury is defined according to KDIGO Guidelines as any of: Increase in SCr by X0.3 mg/dl ($X^2$6.5 lmol/l) within 48 hours; or increase in SCr to X1.5 times baseline, which is known or presumed to have occurred within the prior 7 days; or Urine volume of 0.5 mL/kg/h for 6 hours.[12] We did not use urine output to define AKI, since the electronic health record's documentation was unreliable.

Results

Total of 102 patients presented to our clinic during the 2nd wave of covid-19 in Mogadishu. Of these, 64 (62.7%) were male, 38 (37.3%) were female, with the mean age of 58 (Range 23–91 years). 11 (10.8%) of them had diabetes mellitus, 9 (8.8%) hypertension, 4 (3.9%) hypertension and diabetes, 1 (1%) Asthma and while the rest reported no history of any chronic diseases (Table 3). The prevalence of acute kidney injury was 12.7% among COVID-19 Patient presented in our hospital. There was a significant association between acute kidney injury, CRP and ferritin with the p values of P<0.003 and P<0.004, respectively. We found that there is no correlation between the CT lung involvement and acute kidney injury (Table 4).

When we consider inflammatory markers, 86 (84.3%) of our patients had high CRP levels and 56 (54.9%) had high ferritin levels.

Table 3 Sociodemographic Factors of Acute Lung Injury

Variable	Frequency (%)	Mean
Age		
<60 years old	49 (48%)	57.794
≥60 years old	53 (52%)	
Sex		
Male	38 (37.3%)	
Female	64 (62.7%)	
Chronic diseases		
No Known Chronic Disease	75 (73.5%)	
Hypertension	9 (8.8%)	
Diabetes mellitus	11 (10.8%)	
Asthma	2 (2%)	
HTN and Diabetes mellitus	4 (3.9%)	
Hypertension and Asthma	1 (1%)	
Acute Kidney Injury		
No AKI	89 (87.3%)	
AKI	13 (12.7%)	

Table 4 Correlation Between Variables of Interest

	Creatinine	CRP Levels	Ferritin Levels	CT Findings
Creatinine		**0.003**	**0.004**	0.746
CRP Levels	0.003		**0.001**	**0.007**
Ferritin Levels	0.004	**0.001**		**0.005**
CT Findings	0.746	0.007	0.005	

Note: *P*-values in bold fonts are statistically significant.

We evaluated the lung involvement with computed tomography finding, 35 (34.3%) had mild, 35 (34.3%) had moderate and 32 (31.4%) had severe lung involvement. There was significant association between the lung involvement, Ferritin and CRP levels with P values of and P<0.005 and P<0.007 respectively.

Multiple logistic regression model was used. After adjustment for the other variables, gender, anaemia, Lung injury were significantly predicting the Acute kidney injury among COVID-19 patients. It was found that female patients were 17 times higher of having Acute kidney injury compared with male (AOR= 17.05; p= 0.036), being anaemic have 8.6 times higher of being acute lung injury compared with normal (AOR=8.6; p< 0.035), for those who had mild lung injury were 102 times higher of being acute kidney injury comparing to severe lung injury (Table 5).

Discussion

Most of our patients were female aged ≥60 years. The prevalence of acute kidney injury reported was 12.7% among COVID-19 patients. There were significance weak direct positive association between creatinine and CRP Levels, Ferritin Levels as well as CT Findings. Being male, older (>60 years), hypertensive and anemic were reported to be the risk factors of acute kidney injury.

Although in most patients of COVID-19 is characterized by mild-to-moderate symptoms, it is burdened by consistent morbidity and mortality due to respiratory failure, ARDS and sepsis.[13] COVID-19 is mostly a respiratory infection, but it can cause multiple organ systems disease, with kidney involvement being typical in moderate-to-severe cases.[14] AKI is a common complication among individuals who are admitted to the hospital for a variety of reasons. We observed that 12.7% diagnosed with COVID-19 developed acute kidney injury (AKI) during their presentation.

Among patients hospitalized with COVID-19, a study carried out by Hirsch et al[9] found that 36.6% developed AKI during their admission. This is a higher rate than has previously been reported from China and other countries, from smaller studies, and from studies that included patients at varying stages of disease. Cheng et al[15] reported from Wuhan, China, a rate of AKI of only 5.1% of 701 patients. The etiology of AKI in COVID-19 patients has not yet been accurately estimated. The close temporal association between AKI and the development of respiratory failure is somewhat

Table 5 Predictors of Acute Kidney Injury

Variable	B	S.E.	df	Odd Ratio	95% CI		P value
					Lower	Upper	
Gender							
Male	1						
Female	2.837	1.352	1	17.059	1.204	241.644	**0.036**
Hemoglobin							
Anemia	2.157	1.022	1	8.644	1.167	64.034	**0.035**
Normal	1						
Lung Injury severity							
Mild	4.629	1.815	1	102.445	2.920	3593.703	**0.011**
Moderate	1.267	1.641	1	3.550	0.142	88.533	0.440
Severe	1						

Note: *P*-values in bold fonts are statistically significant.

indicative of ischemic acute tubular necrosis, which occurs frequently in conjunction with systemic collapse and is thought to be related to AKI. Other etiologies, on the other hand, must be taken into consideration. The prothrombotic state that has been observed in individuals with COVID-19 shows that there are additional renal pathogenic mechanisms at action in these patients.

Su et al.[16] Observed in renal histopathological analysis of 26 postmortem covid-19 patients a significant acute tubular injury, the occlusion of microvascular lumens mainly by erythrocytes with ensuing endothelial damage, as well as glomerular and vascular changes indicative of underlying diabetic or hypertensive disease.

In our study, we found that there is a strong association between ferritin levels and severity of lung involvement. Of interest, besides chest X-ray and CT scan, lung ultrasonography has been pointed as a cost-effective non-invasive approach to assess pulmonary involvement in the scenario of a pandemic.[17] According Sumbul et al[18] the PaO2/FiO2 value, which is an important indicator for ARDS and respiratory support requirements, and mLUS were found to have a close and significant relationship. Pleural effusion is a rare imaging finding, according to Carubbi et al.[19] And none of their patients showed concurrent lymphadenopathy.

Medical oxygen scarcity has impeded response attempts in many African countries during covid-19 pandemics. Despite the general financial crisis, instability and weak capacity of the Somali Ministry of Health, Somalia has now been able to control the Covid-19 situation. Donors have been instrumental in assisting the Somali Ministry of Health in coping up with the situation.

Limitations

This study has limitations. First, because this is an observational study, we cannot draw causal conclusions about exposures and AKI. Second, besides the reported confounders, unmeasured confounders may exist. Third, we used only electronic health record systems to identify AKI.

Conclusion

Our findings show the prevalence of acute kidney injury at presentation of covid-19 patients is high and is associated with in-hospital mortality. Hence, clinicians in low resource countries like Somalia should increase their awareness of kidney disease in patients with severe COVID-19 and focus on increasing the primary prevention and population education to implement the covid-19 preventive measurements. Further similar studies with more sample size is recommended.

Disclosure

The authors report no conflicts of interest in this work.

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