

Clinical Profile and Outcomes of COVID-19 Patients with Acute Kidney Injury In A Tertiary Hospital in Baguio City: A Cross-Sectional Study

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Abstract

Objective: The study aimed to determine the clinical profile and renal outcome of confirmed COVID-19 patients to aid in screening and in improving therapeutic strategies to address the disease.

Participants: All admitted patients, aged 19 years old and above with confirmed COVID-19 infection and referred to nephrology service from January 2021 to January 2022 were reviewed in this study.

Methods: The research study used a retrospective cross-sectional study design that was conducted in a single tertiary training institution. A total of 130 patients were included in the study. Retrospective data from charts of eligible patients were recorded including the history, laboratory tests and treatment regimen. Clinical characteristics and outcomes (frequency, stage of AKI, renal recovery, and mortality) were measured using multiple statistical analyses. Descriptive statistics using frequency and percentages, chi-square tests and one-way analysis of variance (ANOVA) were employed to analyze the data.

Results: Of the 538, 130 patients were referred to nephrology service. 42.3% and 41.5% were classified as mostly having Stage 1 and 3 respectively ($r = 0.36$). The subset of patients who developed acute kidney injury was higher among those with comorbidities such as hypertension, heart disease, and chronic kidney disease ($p < 0.00$ and 95% CI). Patients with AKI stage 3 are more likely to be in critical cases necessitating the need for mechanical ventilation; had higher levels of CRP, D-dimer, LDH, and ferritin, and proteinuria. 44 patients (33%) with AKI stage 3 received hemoperfusion ($p < 0.00$ and 95% CI). The overall mortality rate was 26.2%, with most deaths in AKI stage 3 (16.9%). The mean length of hospital stay is 14 days with full renal recovery most noted in AKI stage 1 (95% CI; $p = 0.00$).

Conclusions: The development of AKI in COVID-19 patients is associated with comorbidities such as hypertension, heart disease, diabetes, chronic kidney disease, and obesity. The level of inflammatory markers and proteinuria can predict the severity of AKI. Mortality rate was most noted in AKI stage 3. Thus, early identification and appropriate management of patients with the propensity to develop acute kidney injury could improve outcomes, and decrease long-term complications of end-stage renal disease thereby making a major impact on the health outcome as well as on the financial burden.

Keywords: Acute kidney disease, acute kidney injury, coronavirus disease 2019 infection, renal recovery

Introduction

The prevalence of AKI in patients with COVID-19 has been variably reported between 0.5 and 75% in different countries. However, reported data on the prevalence of AKI in COVID-19 patients in the Philippines is limited. It has been increasingly recognized that acute kidney injury is a common complication of COVID-19. AKI has been reported to be an indicator of poor prognosis in this subset of patients. In recent studies, the incidence of AKI in COVID-19 was found to be associated with age, comorbidities, and disease severity.

Most recent clinical management of COVID-19 consists of infection prevention and control measures, including supplemental oxygen and mechanical ventilatory support when indicated. In the Philippines, several drugs have been utilized, included are the use of remdesivir, tocilizumab, and dexamethasone. Extracorporeal therapies are also used to address cytokine storm and kidney damage. Due to the adverse impact of AKI, emphasis on early recognition and intervention is essential to increase the likelihood of better outcomes for patients with COVID-19 who would develop AKI.

The study aims describe the clinical profile, management, and outcomes of COVID-19 patients referred to Nephrology Service

Methods and Materials

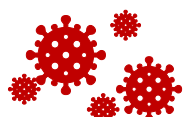
INCLUSION CRITERIA



≥ 19 years old & above



Single Tertiary Hospital



COVID-19 Confirmed Referred to Nephrology service

January 2021 to January 2022

Cross- Sectional Study

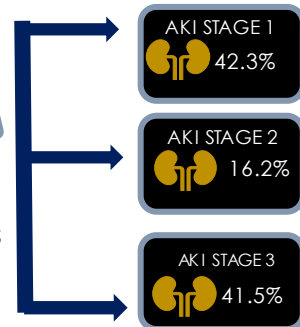
EXCLUSION CRITERIA

- Patients 18 years old and below who were diagnosed with COVID 19
- Patients transferred from another hospital already managed as COVID 19
- Patients with end-stage renal disease on hemodialysis
- Patients who were admitted less than 24 hours

538 Confirmed COVID-19



130 Patients



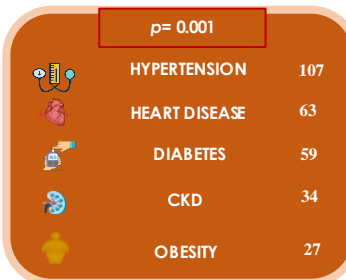
Results

- Out of the 130 confirmed COVID-19 patients who developed AKI, 55 (42.3%) was classified as stage 1, 21 (16.2%) as stage 2 and 54 (41.5%) as stage 3.
- Majority of the population was aged 61 to 80 years old (48.5%) with the mean age of 65. Most of the patients were male (63.1%). However, there was no significant difference between age nor sex across the different AKI stages ($p = 0.22$, $p = 0.23$ respectively).
- Patients classified as stage 3 AKI presented significantly with the most number of comorbidities. The top five identified comorbidities with AKI in decreasing order were hypertension, heart disease, diabetes, CKD and obesity.
- Patients were mostly unvaccinated and was significantly associated with the development of AKI
- There is significant association between cytokine storm and the development of AKI, most notably in AKI stage 3
- Patients with AKI stage 3 were found to have significantly lower PaO₂/Fio₂ ratio level. Furthermore, significantly higher levels of proteinuria, CRP and LDH ($p = 0.00 - 0.16$), and significantly lower levels of hemoglobin, and ionized calcium were evident among patients with COVID-19 associated AKI stage 3.
- Patients with AKI stage 3 received the most number of treatment modalities for COVID-19 infection which includes remdesivir, anticoagulants, diuretics, tocilizumab, and inotropes.
- Overall mortality rate of patients who developed AKI was noted to be 26.2%
- Patients with AKI stage 3 had lower recovery rates necessitating continuation of dialysis after discharge.
- Patients who have undergone hemodialysis received the most number of medication. Of the 57 (43.8%) who received hemoperfusion, 47 (36.3%) had poorer renal recovery thus needing continuation after discharge.



61 to 80 years old

$p = 0.2$



Proportions of Vaccinated Confirmed COVID-19 Patients Who Developed AKI

$p = 0.037$

Unvaccinated 85.4% Vaccinated 14.6%

Proportions of COVID-19 Patients in Cytokine Storm with AKI

$p = 0.03$

AKI Stage 1 5.4%
AKI Stage 2 5.8%
AKI Stage 3 16.9%

AKI STAGE 1,2 < STAGE 3

$p < 0.05$

- ↑ Inflammatory markers
- ↑ Proteinuria
- ↓ Decrease PaO₂/Fio₂
- ↑ Mechanical ventilation
- ↑ Use of Remdesivir, Tocilizumab, Anticoagulant, Diuretics

Mortality, Length of hospitalization, and Renal Recovery of Confirmed COVID-19 patients with Acute Kidney Injury

Stage	AKI Stage 1	AKI Stage 2	AKI Stage 3	TOTAL	Test Statistics P value
Outcome					
Died	6 (4.6%)	6 (4.6%)	22 (16.9%)	34 (26.2%)	0.001
Survived	49 (37.7)	15 (11.5)	32 (24.6)	96 (73.8)	0.000
TOTAL				130	
Mean Length of Hospital Stay in Days (SD)					
	13.20(6.34)	12.62 (7.00)	14.80 (12.95)	13.77 (9.70)	0.584
Renal Recovery (n=96)					
Partial	12 (12.5)	9 (9.4)	9 (9.4)	30 (31.3)	0.000
Full	36 (37.5)	5 (5.2)	2 (2.1)	43 (44.8)	
Needs dialysis after discharge	1 (1.0)	1 (1.0)	21 (21.9)	23 (24.0)	0.044

Discussion

The findings in this study are comparable to an observational study where it has reported an increased incidence of AKI in severe cases of COVID-19 pneumonia and high in-hospital mortality associated with AKI staging whereby the death was highest among AKI stage 3.

A significant association exist between COVID-19 vaccination and development of AKI. Most of the patients were unvaccinated. There are reports of acute kidney injury after COVID-19-vaccination, however, most of the literatures are from single case studies. Other evidences, however, show that COVID-19 vaccines decrease hospitalization rate and duration in patients with kidney disease. This can be a potential confounding factor in the outcome of COVID-19 patients since mortality is increased in patients with AKI who are mostly unvaccinated.

COVID-19 patients with AKI stage 3 are more likely to undergo renal replacement therapy and are less likely to have full renal recovery needing dialysis after discharge which is consistent with previous observations. There was also higher rates of mortality among patients who requires renal replacement therapy than those with AKI non- RRT requiring. This higher mortality rate can probably be explained by the elevated illness burden.

The study reports the use of remdesivir, tocilizumab and all other drugs most notable in AKI stage 3 requiring dialysis for severe COVID-19 pneumonia. Pharmacovigilance studies confirmed the association of AKI with the usage of remdesivir and tocilizumab. Thus, it is vital to recognize the organ interactions and maintain vigilance while treating these interrelated conditions in the critically ill.

The development of acute kidney injury can be an indicator of more severe disease, leading to multi-organ dysfunction. This suggests the importance of protecting kidney function as an essential component of clinical treatment.

Conclusions

- Comorbidities such as hypertension, heart disease, diabetes, CKD and obesity are strongly associated with the development of AKI among COVID-19 patients.
- Patient who developed AKI were mostly unvaccinated.
- Severity of AKI can be predicted by the level of the inflammatory markers, proteinuria, and progression of COVID-19 pneumonia.
- Overall mortality rate was high in AKI stage 3. Amongst patients who recovered, a significant percentage had full renal recovery at the time of discharge
- Patients who developed AKI stage 3 may require renal replacement therapy even after discharge which can have a major impact on health outcomes.



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