COVID-19 Associated Kidney Injury: A Single-Center Community Experience of 684 Consecutive Patients

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AIM

- This study aims to describe the presentation, risk factors, and clinical course for hospitalized patients with COVID-19 at a large tertiary community teaching hospital.

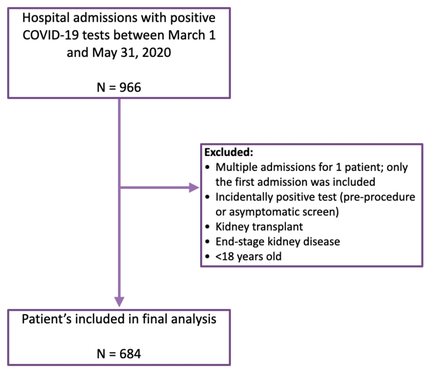
BACKGROUND

- Acute kidney injury associated with COVID-19 is well documented but poorly understood; majority of the published literature currently available in the United States comes from major academic institutions.

MATERIALS & METHODS

- Retrospective descriptive study of the incidence of acute kidney injury for hospitalized patients with COVID-19 between March 1st - May 31st at a single-center community teaching hospital in Cook County, Illinois.
- Acute kidney injury (AKI) was defined by KDIGO criteria.
- Baseline creatinine (SCr) was defined as the median SCr from the previous 365 days until 7 days prior to admission.
- If no baseline SCr was available, SCr upon admission was used as the baseline.

Figure 1. Flowchart of Patient Selection



RESULTS

Table 1. Baseline Characteristics of study cohort, by AKI status

	Overall N=684	No AKI N=453	AKI N=231	P-Value
Age (years)	61.0 (51.0-75.0)	59.0 (49.0-72.0)	67.0 (57.0-77.0)	<0.01
Sex				
Female	307 (44.9%)	212 (46.8%)	95 (41.1%)	0.16
Male	377 (55.1%)	241 (53.2%)	136 (58.9%)	
Race				
American Indian/Alaska Native	2 (0.3%)	1 (0.2%)	1 (4.3%)	
Asian	13 (1.9%)	9 (2.0%)	4 (1.7%)	
Native Hawaiian or Other Pacific Islander	2 (0.3%)	2 (0.4%)	0 (0.0%)	
Black	290 (42.4%)	174 (38.4%)	116 (50.2%)	0.01
White	354 (51.8%)	245 (54.1%)	109 (47.2%)	
More than 1 race	1 (0.2%)	1 (0.2%)	0 (0.0%)	
Unknown/not reported	22 (3.2%)	21 (4.6%)	1 (0.4%)	
Ethnicity				
Hispanic/ Latino	192 (28.2%)	151 (33.4%)	41 (17.8%)	
Not Hispanic/ Latino	476 (69.8%)	289 (63.9%)	187 (81.3%)	<0.01
Not Reported	14 (2.1%)	12 (2.7%)	2 (0.9%)	
AKI Stage				
Stage 1			129 (55.8%)	
Stage 2			36 (15.6%)	N/A
Stage 3			66 (28.6%)	
BMI	31.4 (26.7-37.2)	31.4 (27.0-37.7)	31.3 (26.6-36.8)	<0.33
Baseline Immunosuppressant Tx				
Tacrolimus				
MMF				
Prednisone				
Azathioprine				
Leflunomide				
Belatacept				
Home Medications				
Ace Inhibitor	121 (17.7%)	72 (15.9%)	49 (21.2%)	
ARB	79 (11.6%)	42 (9.3%)	37 (16.0%)	<0.01
Neither	438 (64.0%)	310 (68.4%)	128 (55.4%)	
Unknown	46 (6.7%)	29 (6.4%)	17 (7.4%)	
Comorbidities				
DM 1	3 (0.4%)	0 (0.0%)	3 (1.3%)	0.02
DM2	252 (36.8%)	147 (32.5%)	105 (45.5%)	<0.01
HTN	411 (60.1%)	236 (52.1%)	175 (75.8%)	<0.01
CAD	70 (10.2%)	32 (7.1%)	38 (16.5%)	<0.01
CHF	71 (10.4%)	27 (6.0%)	44 (19.1%)	<0.01
HIV	2 (0.3%)	0 (0.0%)	2 (0.9%)	0.05
COPD	66 (9.7%)	36 (8.0%)	30 (13.0%)	0.03
Asthma	53 (7.8%)	35 (7.7%)	18 (7.8%)	0.98
Restrictive Lung Disease	1 (0.2%)	1 (0.2%)	0 (0.0%)	0.47
Active Malignancy	11 (1.6%)	3 (0.6%)	8 (3.5%)	0.01
Chronic Liver Disease	9 (1.3%)	7 (1.6%)	2 (0.9%)	0.46
Insurance				
Commercial	342 (50.1%)	237 (52.4%)	105 (45.5%)	
Medicare	188 (27.5%)	101 (22.4%)	87 (37.7%)	
Medicaid	82 (12.0%)	65 (14.4%)	17 (7.4%)	<0.01
Self Pay	9 (1.3%)	7 (1.6%)	2 (0.9%)	
Other/unknown	62 (9.1%)	42 (9.3%)	20 (8.7%)	

Table 2. Urine tests results obtained within 72 hours after the development of acute kidney injury

	N=231
Urinalysis	
1 - 30 protein	33 (14.3%)
31 - 100 protein	44 (19.1%)
>100 protein	27 (11.7%)
1 - 5 Erythrocytes	71 (30.7%)
6 - 10 Erythrocytes	14 (6.1%)
11 - 25 Erythrocytes	12 (5.2%)
26 - 100 Erythrocytes	21 (9.1%)
> 100 erythrocytes	11 (4.8%)
1 - 5 leukocytes	59 (25.5%)
6 - 10 leukocytes	17 (7.4%)
11 - 25 leukocytes	21 (9.1%)
26 - 100 leukocytes	17 (7.4%)
>100 leukocytes	15 (6.5%)
1-5 Hyaline Casts	29 (12.6%)
6 - 10 hyaline casts	8 (3.5%)
> 10 hyaline casts	18 (7.8%)
RBC casts	0 (0.0%)
WBC Casts	0 (0.0%)
Other	18 (7.8%)
Urine Electrolytes	
Urine NA	24.0 (13.5-40.0)
Urine Urea	508.0 (259.0-962.0)
Urine Creatnine	142.0 (91.5-194.0)
FeNa	0.3 (0.1-0.7)
FeUrea	21.1 (15.0-29.5)

Table 3. General and survival outcomes by AKI Status

	Overall N=684	No AKI N=453	AKI N=231	P-Value
RTT (Day initiated)	5.0 (2.0-10.0)	0.0 (0.0-0.0)	5.0 (2.0-10.0)	0.12
HD	9 (16.1%)	0 (0.0%)	9 (16.1%)	
CRRT	27 (48.2%)	1 (25.0%)	26 (50.0%)	<0.01
Both	17 (30.4%)	0 (0.0%)	17 (32.7%)	
Other	3 (5.4%)	3 (75.0%)	0 (0.0%)	
Highest Level of Disposition				
General medical floors/SSU A/SSU B/ Observation	416 (61.3%)	333 (73.8%)	83 (36.4%)	
Progressive Step down unit	50 (7.4%)	31 (6.9%)	19 (8.3%)	<0.01
ICU	213 (31.4%)	87 (19.3%)	126 (55.3%)	
Length of Stay	8.7 (4.8-17.3)	7.7 (4.0-12.7)	15.0 (7.1-27.2)	<0.01
Survival Outcomes				
Still Admitted to hospital (from original admission)	1 (0.2%)	1 (0.2%)	0 (0.0%)	
Discharged WITHOUT HD/PD	559 (81.7%)	421 (92.9%)	138 (59.7%)	
Discharged ON HD/PD	13 (1.9%)	1 (0.2%)	12 (5.2%)	<0.01
Discharged to hospice (home or hospital)	17 (2.5%)	8 (1.8%)	9 (3.9%)	
Death / withdrawal of care / comfort care w/ death in hospital	94 (13.7%)	22 (4.9%)	72 (31.2%)	

- Renal biopsy performed on four patients demonstrated acute tubular necrosis. Fifty-two (22.5%) patients received RRT; most commonly with CRRT in 26 (50%) or combination of both CRRT and HD in 17 (32.7%).
- Risk factors for renal injury included co morbidities such as Type 2 diabetes, hypertension, heart failure, and coronary artery disease.
- Risk factors for renal injury during hospitalization included the use of vasopressors, mechanical ventilation, ECMO. D-dimer, LDH, CRP, procalcitonin and IL-6 upon arrival were significantly higher in patients who developed AKI compared to those who did not.
- Upon discharge, 138 (59.7%) patients were discharged without the need for renal replacement therapy, whereas 12 (5.2%) patients required hemodialysis or peritoneal. Nine patients (3.9%) went to hospice, and 72 (31.2%) of the patients died. One patient was still admitted to the hospital at the end of the study.

CONCLUSION

- Acute Kidney Injury is a poor prognostic indicator for patients with COVID-19. The mortality rates and outcomes of patients with AKI in this setting are comparable to previously published studies (from major academic institutions)

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