Fluid Volume Overload is Associated with Poor Prognosis in Patients Hospitalized with Covid-19 and Acute Kidney Injury

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Introduction

Acute kidney injury (AKI) is common among patients hospitalized for COVID-19 infection, with a prevalence of up to 80% in different populations. AKI among patients hospitalized for COVID-19 is associated with increased length of stay and in-hospital mortality. Current approaches to the prevention and management of AKI, and the identification of potential predictors for the use of renal replacement therapy are based primarily on clinical experience, and AKI strategies have been empirically tailored to patients with COVID-19. Although previous works have widely identified the risk factors independently associated with higher mortality, the role of intravenous fluid management in patients hospitalized for COVID-19 with AKI has not been fully studied. The main objective of the present work was to analyze the association between fluid overload and mortality in patients hospitalized for COVID-19 with AKI.

Methods and Materials

Observational retrospective cohort study that included volume balances, clinical and biochemical data of 234 patients hospitalized with COVID-19 and AKI. Univariate and Cox regression analyses were used to evaluate the association of fluid overload with poor outcomes.

Results

The mean age of the patients was 57 ± 14 years, 69% were women, the mean body mass index (BMI) was 27.9±5.6 kg/m2, and median time in hospital were 11 (6-19) days. Overall, 47.3% had diabetes, 33.8% hypertension, less than 4% overt chronic kidney disease, and 47.9% had Community-Acquired AKI. The median global fluid overload was 434 (-1795 to +3449) cc [44.9% had global volume overload >+1000cc]. The rate of AKI 3, RRT, and mortality was 35.9%, 11.5% and 34.6%, respectively. Volume overload was associated with increased unadjusted risk for AKI 3, RRT, and mortality (HR= 4.104 [1.923-8.758]; HR= 5.461 [1.365-21.849]; HR= 4.279 [1.950-9.393], respectively; p<0.05 for all). After adjusting for demographics and comorbidities (Model 1) the risk for AKI 3, RRT, and mortality was HR= 5.793 (2.527-13.279), HR= 5.461 (1.365-21.849), and HR= 4.590 (2.062-10.219), respectively (p<0.05 for all). Likewise, when biochemical parameters were added to model 1 (model 2), those with volume overload reaming having greater risk for AKI 3, RRT, and mortality (HR= 5.941 [2.595-13.601]; HR= 5.610 [1.405-22.393]; HR= 4.472 [1.998-10.012], respectively; p<0.05 for all).

	Acute Kidney Injury in COVID-19			
Variables	AKI 1 (n= 116)	AKI 2 (n= 34)	AKI 3 (n= 84)	p value
Age (years)	55.4 ± 14.5	54.7 ± 13.7	60.6 ± 12.7	0.017
Female sex (%)	70.7	76.5	64.3	0.384
Body Mass Index (kg/m²)	28.8 ± 5.9	29.8 ± 6.4	31.8 ± 6.9	0.269
Type 2 Diabetes (%)	40.4	57.1	53.6	0.123
Blood pressure >140/90 mmHg (%)	33.7	21.4	39.1	0.248
Chronic Kidney Disease (%)	0.0	3.6	8.7	0.010
Community-Acquired AKI (%)	65.5	52.9	21.4	<0.001
Days in Hospital (d)	8 (6-14)	16 (10-24)	16 (10-24)	0.480
Vasopressor use (%)	12.4	37.9	50.0	<0.001
Mechanical Ventilation (%)	21.9	48.3	70.8	<0.001
D dimer (µg/mL)	0.49 (0.30-0.84)	0.54 (0.24-1.17)	0.90 (0.40-2.06)	0.002
Blood Urea Nitrogen (mg/dL)	19 (14-28)	26 (21-35)	31 (19-56)	<0.001
Lactic Dehydrogenase (IU/L)	354 (251-479)	393 (297-499)	417 (278-556)	0.155
C-Reactive Protein (mg/dL)	14.81 (6.47-21.60)	17.88 (7.40-21.20)	17.44 (11.80-27.90)	0.045
Ferritin (ng/mL)	533 (325-1016)	950 (447-1276)	800 (500-1457)	0.003
Renal Replacement Therapy (%)	2.0	3.8	29.2	<0.001
Volume Overload >1000 (%)	37.9	33.3	59.5	0.057
Mortality (%)	17.2	20.6	64.3	<0.001

Table 1. Clinical and biochemical variables of in-hospital patients with COVID-19 and Acute Kidney Injury.

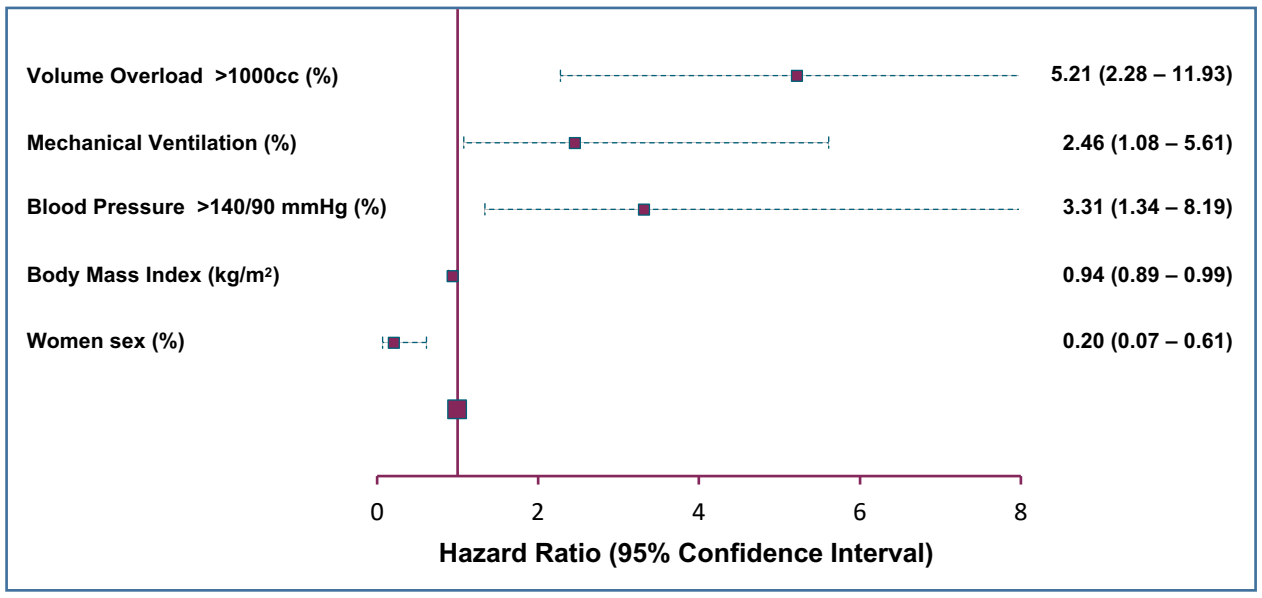

Figure 1. Factors independently associated with increased mortality in patients with COVID-19 and Acute Kidney Injury

Conclusions

In the setting of AKI, fluid volume overload was associated with poor prognosis among hospitalized patients with Covid-19.