

The Relationship between ABO Blood Groups and Renal Failure in Hospitalized COVID-19 Patients

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Abstract:

Objectives: The purpose of this study was to determine the association between ABO blood group types, renal failure, and the severity of COVID-19 infection.

Methods: A Cross-Sectional Study was Conducted on 198 Confirmed Covid-19 Patients Admitted to Icu Isolation Centers in Sudan from January 2021 to January 2022. Blood Groups Were Determined Using the Slide Method. Renal Failure was Defined as Acute Kidney Injury (Aki) Meeting Kdigo 2012 Criteria or the Need for Renal Replacement Therapy (Rrt). Statistical Analysis was Performed Using SPSS Version 20; Odds Ratios (or) With 95% Confidence Intervals (Ci) Were Calculated Via Chi-Square Test.

Results: Of The 198 Patients, 29 (14.6%) Developed Renal Failure. Blood Group a was Significantly Associated with Renal Failure (Or = 2.500, 95% Ci: 1.078–5.797, P = 0.030). in Contrast, Blood Group O Showed A Protective Trend (Or = 0.419, 95% Ci: 0.180–0.973, P = 0.030). Groups Ab and B Showed No Statistically Significant Association.

Conclusion: Blood Group A May Be a Risk Factor for Renal Failure in Hospitalized Covid-19 Patients, While Blood Group O May Confer Protection. Further Studies are Needed to Confirm these Associations and Explore Underlying Mechanisms.

Keywords: Patients of Covid -19; Abo Blood Groups; Post-Acute Covid -19 Syndrome; Renal Failure.

1 Introduction

COVID-19, caused by SARS-CoV-2, primarily manifests with respiratory complications but frequently involves renal pathology, including acute kidney injury (AKI) and chronic kidney disease (CKD) (Zhou X et al., 2018; Legrand M et al., 2021). Post- COVID -19 conditions, defined by symptoms persisting beyond three months, often include renal dysfunction (Soriano, JB et al., 2022; Aiyegbusi, OL et al., 2021)). Recent studies continue to highlight the significant burden of post-acute renal sequelae (Chippa V et al., 2021). Identifying risk factors for severe outcomes remains crucial (Salzberger, B et al., 2020; Carethers, J.M et al., 2021).

ABO blood groups have drawn attention for their potential influence on disease outcomes (Zhao, J et al., 2020; Zhang, Y et al., 2021). While COVID-19 is primarily a respiratory disease, renal and circulatory dysfunction frequently occur in critically ill patients and in those who do not survive (Li, J et al., 2020). Therefore, ABO blood groups have been studied as potential modulators of Covid -19 severity and complications. Several studies suggest blood group A is associated with worse outcomes, while group O may be protective (Zhao, J et al., 2020; Wu, B. B et al., 2020). However, findings regarding renal – specific outcomes are less consistent and warrant further investigation (Zhang, Y et al., 2021; Bildirici YU et al., 2023).

2 Patients and Methods

2.1 Study design

This was a hospital-based cross-sectional study. A total of 198 blood samples were collected from real-time PCR confirmed COVID-19 patients admitted to the ICU in COVID-19 Isolation Zones (Sugatra and Mycetoma Center) in Wad Madani, 2 Gezira State, Sudan. Data were collected between January 2021 and January 2022. The sample size was determined by convenience sampling based on hospital admissions during the study period, which is acknowledged as a limitation. Patient characteristics: A questionnaire recorded patient demographics and comorbidities. Participants ranged from 10 to 100 years old. Among them, 120 (60.6%) were male, and 78 (39.4%) were female. Blood Grouping Method: Blood grouping was conducted using the slide method with antisera A, B, and D. Agglutination observed after 2 minutes

indicated a positive reaction. Among the 198 participants, 44 (22.2%) were group A, 27 (13.6%) group B, 30 (15.2%) group AB, and 97 (49.0%) group O.

2.2 Definition of Renal Failure

Renal failure was defined as the presence of Acute Kidney Injury (AKI) according to the KDIGO 2012 clinical practice guidelines (serum creatinine increase ≥ 0.3 mg/dL within 48 hours or ≥ 1.5 time's baseline within 7 days) or the requirement for Renal Replacement Therapy (RRT) during hospitalization.

2.3 Ethical approval

Approval was obtained from the Ministry of Health, Department of Epidemics Administration.

2.4 Statistical Analysis:

Data analysis was performed using SPSS version 20. Descriptive statistics were used for demographics and blood group distribution. The association between blood groups and renal failure was analyzed using the chi-square test, and odds ratios (OR) with 95% confidence intervals (CI) were calculated. A significance threshold of $p < 0.05$ was applied. No multivariate regression was performed due to the sample size limitation.

3 Result

In this research, 198 blood samples from confirmed COVID-19 patients were analyzed to determine their ABO blood groups. The distribution included AB (15.1% or 30 individuals), B (13.6% or 27 individuals), A (22.1% or 44 individuals), and O (49.2% or 98 individuals), A total of 29 patients (14.6%) developed renal failure according to the study definition. Table 1 presents the association between ABO blood groups and renal failure. Blood group A was significantly associated with an increased odds of renal failure (OR = 2.500, 95% CI: 1.078–5.797, $p = 0.030$). In contrast, blood group O was associated with a reduced odds of renal failure (OR = 0.419, 95% CI: 0.180–0.973, $p = 0.030$). The associations for blood groups AB (OR = 2.006, 95% CI: 0.770–5.226, $p = 0.124$) and B (OR = 0.424, 95% CI: 0.095–1.895, $p = 0.194$) were not statistically significant. No significant association was found for the Rhesus antigen ($p = 0.590$).

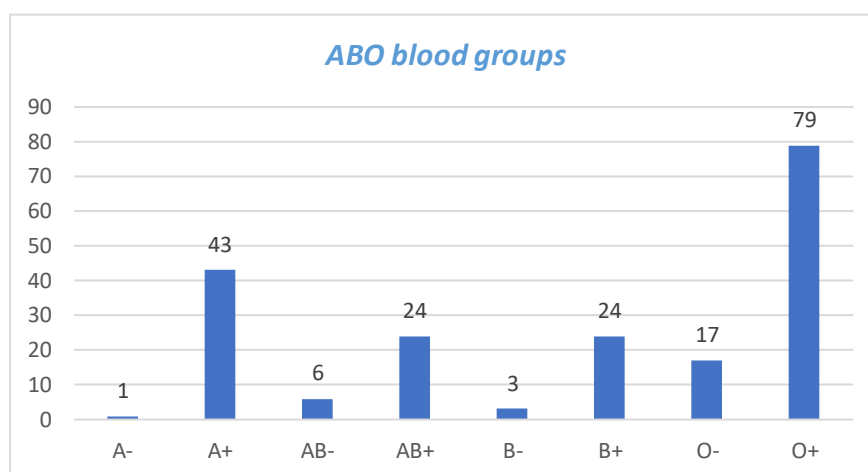


Figure 1: Distribution of ABO blood groups among COVID-19 patients.

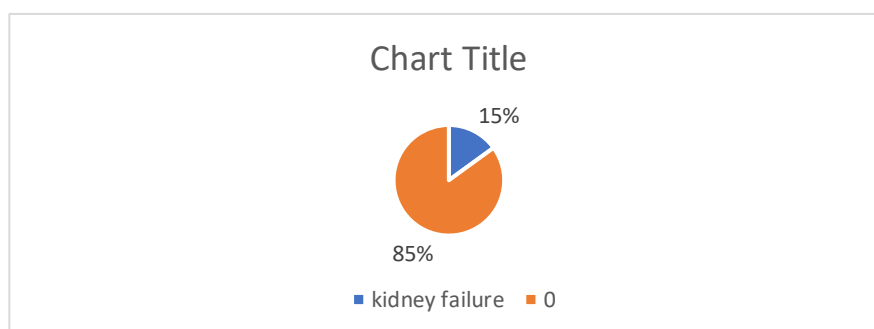


Figure 2: Percentage of severe complications among COVID-19 patients.

Table (1): Association between ABO blood groups and renal failure in hospitalized COVID-19 patients

Blood group	Renal failure		O.R (95%, CI)	P-Value
	No	Yes		
AB	145(86.3)	22(75.9)	2.006 (0.770-5.226)	0.124
A, B, and O	23(13.7)	7(24.1)		
B	143(85.1)	27(93.1)	0.424 (0.095-1.895)	0.194
A, AB, and O	25(14.9)	2(6.9)		
A	135(80.4)	18(62.1)	2.500 (1.078-5.797)	0.030
AB, B, and O	33(19.6)	11(37.9)		
O	81(48.2)	20(69)	0.419 (0.180-0.973)	0.030
A, B, and AB	87(51.8)	9(31)		
Rhesus antigen	Negative	23(13.7)	0.991 (0.316 – 3.111)	0.590
	Positive	4(13.8)		

4 Discussion

This study found a significant association between ABO blood groups and renal failure in hospitalized COVID-19 patients. Consistent with several prior reports, blood group A was associated with higher odds of renal failure (Zhao J et al., 2020; Wu B. B et al., 2020). Conversely, our data suggest a protective effect for blood group O, which aligns with meta-analyses indicating lower severity and mortality risk for group O individuals (Liu N et al., 2021). The non-significant findings for groups AB and B should be interpreted with

caution due to the smaller sample sizes in these subgroups. The potential mechanisms underlying these associations may involve the interaction between the SARS-CoV-2 spike protein and ABO antigens expressed on renal endothelial cells and tubules (Miotto N et al., 2021).

The presence of anti-A antibodies in individuals with blood groups O and B might inhibit viral cellular entry and mitigate direct renal injury (Gerard C et al., 2020). Furthermore, blood group A has been linked to a higher propensity for

inflammation and thrombosis, which could exacerbate COVID-19-related renal microangiopathy (Legrand M et al., 2021). Our finding of a potential protective effect for group O in renal outcomes differs from some earlier studies focusing on general severity. This highlights the need for organ-specific risk stratification. The high prevalence of group O in our Sudanese cohort, combined with other population-specific genetic factors such as APOL1 risk variants, may also influence the risk profile and warrants further investigation (Bildirici Y U et al., 2023). Limitations of this study include its cross-sectional design, which precludes causal inference, the relatively small sample size limiting subgroup analyses, and the single-center recruitment. Future prospective, multi-center studies with larger cohorts and

adjustment for confounders like age, comorbidities, and genetic background are recommended.

5 Conclusion

In conclusion, this study suggests that ABO blood group may influence the risk of renal failure in patients hospitalized with COVID-19, with blood group A associated with increased risk and blood group O potentially protective. These findings underscore the value of blood type as a simple, readily available biomarker for risk stratification. They also add to the pathophysiological understanding of COVID-19 renal involvement. Further research is needed to validate these associations and elucidate the underlying biological mechanisms.

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