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Introduction:

There is conflicting data on the association of blood type with COVID-19 infection. Recent studies have shown an association of blood type in acquisition of COVID-19 infection (Zhao et al., medRxiv 2020), but no association in terms of disease mortality (Latz, Ann Hematol 2020). Prior studies are limited due to lack of diversity. One of the largest studies conducted in China found blood type A conferred highest risk of acquiring COVID-19 infection (Zhao et al., medRxiv 2020). Similar results were found in which the odds of COVID-19 positive infection compared to negative test results were increased in blood group A and decreased in blood group O (Zietz et al., medRxiv 2020). There was no significant association between blood group and intubation or death. Neither of these studies addressed the association of blood groups with thromboembolism. This study aimed to evaluate the impact of blood types on outcomes of COVID-19 infection in a multiracial population.

Methods:

This is a retrospective electronic chart review of all patients admitted to New York-Presbyterian Brooklyn Methodist Hospital in Brooklyn, NY. All patients admitted from March 2020 to April 2020 who tested positive for SARS-CoV-2 nasopharyngeal swab were analyzed. Baseline patient characteristics and outcomes were entered manually by medical professionals via chart review using the electronic medical record (EMR). Baseline characteristics include blood group type, rhesus antigen status, age, gender,
race, comorbid conditions, median initial and peak D-dimer. The primary endpoint was inpatient mortality. The secondary endpoints included thromboembolism (pulmonary embolism, deep venous thrombosis, arterial thrombosis), myocardial infarction, bleeding event, length of stay, intensive care unit admission, and intubation. Chi-square test for categorical variables was used to calculate statistical significance defined as p value ≤ .05 when comparing ABO blood group and rhesus antigen with mortality and development of thromboembolism.

Results:

Our study consisted of 249 patients that were COVID-19 positive with a documented blood group. Our population consisted of 51% of patients that identified as black, 35.7% that identified as white, and 17.7% that identified as Hispanic. Blood type B had the highest rate of patients that identified as black at 58.1% and blood type O had the highest rate that identified as Hispanic at 23.6%. When comparing blood groups A, AB, B and O to the rate of mortality the result was 46%, 44.4%, 41.9% and 50.9% respectively which was found to be not statistically significant (p=0.759). Rh positive patients had a 47.2% mortality rate while Rh negative patients had a 46.9% mortality rate however this was also found to be not statistically significant (p=0.954). Next, we compared development of thromboembolism during hospital stay in the A, AB, B, and O blood type groups and the rate was 8%, 11.1%, 9.3%, and 10.9% respectively with the results not being statistically significant when accounted for blood type (p=0.991). Rate of development of thromboembolism in Rh positive and negative patients was 9.3% and 9.4% respectively which was found to not be statistically significant as well (p=0.998). When looking at comorbidities, 70.2% of our patient population had hypertension and the second prevalent comorbidity was diabetes at 38.2% (Table 1).

Discussion:

In a diverse population, no association between ABO blood group, Rh status, and mortality was found which is similar to the conclusion found in prior studies done by Zhao et al. and Latz et al. in which the majority of the population was either Caucasian or Asian. Additionally, there is no association found between ABO blood group, Rh status and development of thromboembolism. Our patient population consisted mostly of minority groups.

Prior studies have shown that blood type A has the highest risk of positive SARS-CoV-2 test whereas type O has the lowest risk of positive SARS-CoV-2 test. Our study further supplements this discovery by the conclusion that while blood type A conferred highest risk of acquiring COVID-19 infection, blood type had no significant association with mortality. Investigation on a larger scale is necessary to address the
susceptibility of ABO blood group and COVID-19 infection severity in a multiracial population to address racial disparities.

Table 1
Patient Characteristics Categorized by Blood Type of COVID-19 Infected Patients

| Characteristics          | A (n=87) | AB (n=9) | B (n=43) | O (n=110) | Rh+ (n=213) | Rh- (n=32) |
|--------------------------|----------|----------|----------|-----------|-------------|------------|
| Median Age               | 70       | 77       | 70       | 65        | 69          | 69         |
| Gender                   |          |          |          |           |             |            |
| Male                     | 40 (45.97%) | 3 (33.3%) | 20 (46.5%) | 58 (52.7%) | 104 (48.6%) | 15 (46.9%) |
| Female                   | 47 (54.02%) | 6 (66.7%) | 23 (53.5%) | 52 (47.3%) | 109 (50.9%) | 17 (53.1%) |
| Race                     |          |          |          |           |             |            |
| White                    | 34 (39.08%) | 4 (44.4%) | 15 (34.9%) | 36 (32.7%) | 72 (33.6%) | 16 (50.0%) |
| Black                    | 40 (45.97%) | 3 (33.3%) | 25 (58.1%) | 58 (52.7%) | 112 (52.3%) | 12 (37.5%) |
| Asian                    | 2 (2.29%)  | 0        | 1 (2.3%)  | 4 (3.6%)  | 5 (2.3%)    | 1 (3.1%)   |
| Other                    | 4 (4.59%)  | 1 (11.1%) | 1 (2.3%)  | 14 (12.7%) | 11 (5.1%)   | 1 (3.1%)   |
| Hispanic                 | 11 (12.64%) | 1 (11.1%) | 6 (13.95%) | 26 (23.6%) | 38 (17.8%)  | 6 (18.8%)  |
| Not Specified            | 7 (8%)    | 1 (11.1%) | 1 (2.3%)  | 6 (5.5%)  | 13 (6.1%)   | 2 (6.3%)   |
| Median BMI               | 26.54     | 24.13     | 27.35     | 27.8      | 27.35       | 27.41      |
| Smoker                   | 20 (23.0%) | 4 (44.4%) | 11 (25.6%) | 26 (23.6%) | 53 (24.8%)  | 8 (25.0%)  |
| Comorbidities            |          |          |          |           |             |            |
| Congestive Heart Failure | 11 (12.6%) | 0        | 8 (18.6%) | 7 (6.4%)  | 24 (11.2%)  | 2 (6.3%)   |
| Chronic Kidney Disease   | 20 (23%)  | 2 (22.2%) | 10 (23.3%) | 13 (11.8%) | 23 (10.7%)  | 6 (18.8%)  |
| Diabetes                 | 24 (27.5%) | 3 (33.3%) | 22 (51.16%) | 46 (41.9%) | 79 (36.9%)  | 18 (56.3%) |
| End Stage Renal Disease  | 14 (28.7%) | 1 (11.1%) | 8 (18.6%) | 12 (11.0%) | 33 (15.4%)  | 2 (6.3%)   |
| HIV                      | 0         | 0        | 2 (4.7%)  | 2 (1.8%)  | 4 (1.9%)    | 0 (0%)     |
| Hypertension             | 54 (62.1%) | 8 (88.9%) | 34 (79.1%) | 79 (71.8%) | 150 (71.1%) | 22 (68.9%) |
| Pulmonary Disease        | 20 (22.9%) | 1 (11.1%) | 10 (23.25%) | 31 (28.2%) | 65 (30.4%)  | 9 (28.1%)  |
| Median Initial D Dimer   | 831.05    | 622.7    | 543.2     | 1647.9    | 882.9       | 993.1      |
| Median Peak D Dimer      | 2349.0    | 1783.35  | 2340.3    | 5695.0    | 3587.15     | 3475.0     |
| Median Initial Creatinine| 1.21      | 1.44     | 1.24      | 1.32      | 1.32        | 1.165      |
| Mortality                | 40 (46%)  | 4 (44.4%) | 18 (41.9%) | 56 (50.9%) | 101 (47.2%) | 15 (46.9%) |
| Length of stay (days)    | 8         | 9        | 21        | 9.5       | 8           | 14         |
| ICU admission            | 32 (36.8%) | 5 (55.6%) | 18 (41.9%) | 58 (52.7%) | 93 (42.5%)  | 19 (59.4%) |
| Intubation               | 36 (41.4%) | 5 (55.6%) | 16 (37.2%) | 57 (51.8%) | 93 (43.5%)  | 20 (62.5%) |
| Transfusion              | 23 (26.4%) | 5 (55.6%) | 12 (27.9%) | 34 (30.9%) | 67 (31.3%)  | 12 (37.5%) |
| Thromboembolism          | 7 (8%)    | 1 (11.1%) | 4 (9.3%)  | 12 (10.9%) | 20 (9.3%)   | 3 (9.4%)   |
| Deep Venous Thrombosis   | 6 (6.9%)  | 1 (11.1%) | 2 (4.7%)  | 10 (9.1%)  | 16 (7.1%)   | 3 (9.4%)   |
| Pulmonary Embolism       | 1 (1.1%)  | 0        | 0         | 2 (1.8%)  | 3 (1.4%)    | 0 (0%)     |
| Arterial Thrombosis      | 0         | 0        | 2 (4.7%)  | 0 (0%)    | 1 (1.9%)    | 0 (0%)     |
| Bleeding Events          | 9 (11%)   | 1 (11.1%) | 6 (14.6%) | 12 (10.9%) | 22 (10.3%)  | 6 (18.8%)  |
| Myocardial Infarction    | 3 (3.4%)  | 0        | 4 (9.3%)  | 8 (7.3%)  | 14 (6.5%)   | 1 (3.1%)   |

Disclosures
No relevant conflicts of interest to declare.
Author notes
* Asterisk with author names denotes non-ASH members.

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