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Case Report

Vulnerability of Blood Type "A" to Coronavirus Delta Strain

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Keywords

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Abstract

***Background**: The precise correlation between blood grouping and the affinity of corona-virus for infection still is indecisive. Using blood grouping kits (ABO) the susceptibility of blood groupings to coronavirus pandemic was investigated in 894 patients from both genders (507 male and 387 female) positive victims admitted state hospitals and/or kept in quarantine at Mosul province, Iraq for the period of (February 1st 2020-January 31st 2022. **Results:** The results revealed that infection in type "A" blood group was significantly (p≤0.05-0.01) (42.6%) higher than other groups followed by type "B" (27.8%), type "AB" (15.6%) and type "O" groups (13.8%). **Conclusion:** It is concluded that blood type "A" is the most vulnerable for infection to the virus than other types due to affinity of the Delta strain coronavirus in attaching extra cell membrane receptors in antigen-A erythrocytes according to key and lock concept, or due to sweet molecule contents of receptors due to the presence of a favorite antibody-b in blood serum of type "A" could serve as additional receptors to the virus that may act as a part of innate immune response to neutralize viral particles in comparison with other blood groups.*

Introduction

There is a general scientific concept that blood type remains unchangeable from birth to death, and as with many other genetic traits, the distribution of "ABO" and Rh blood groups varies significantly between populations [1]. The "ABO" blood group system builds on carbohydrate chains, e.g. antigens that determine the "ABO" blood type which involves two antigens and two antibodies found in human blood. The two antigens, antigen-A and antigen-B are present on the red blood corpuscles (RBC) while both, antibody-a, and antibody-b do present in the serum where they are usually immunoglobulin-M (IgM) antibodies. Accordingly, the type A-blood type is a classification, based on the presence or absence of antibodies and inherited antigenic substances located on the surface of RBCs. These antigens are either proteins, carbohydrates, glycoproteins, or glycolipids, depending on the blood group system present on the surface of other types of cells of various tissues [2]. Several RBC surface antigens can stem from one allele (or an alternative version of a gene) and collectively form a blood group system [3]. The four main blood groups A, B, AB and O are determined by the genes an individual inherits from parents. Each of these four groups can be either Rh+ positive or Rh- negative making in total 8 blood groups which is used for suitability in blood transfusion [4]. No scientific basis exists for blood type personality categorization nor is there any studies to endorse "significant relationship between personality and blood type", rendering the theory 'obsolete' and concluding that no basis exists to assume that personality is anything more than randomly associated with blood type [5,6]. However, some blood types are associated with inheritance of other diseases e.g. the Kell antigen is sometimes associated with McLeod syndrome [7]. There has recently been a debate raised regarding a possible link between blood types and vulnerability to covide-19. Certain blood types may affect susceptibility to infections e.g. being the resistance to specific malaria species seen in individuals lacking the Duffy antigen [8]. The Duffy antigen, presumably as a result of natural selection, is less common in population groups from areas having a high incidence of malaria [9]. Connection of blood groups to certain infectious diseases have been debated for a long time i.e. the blood type-O protects people against COVID-19, whilst blood group-A predisposes people to being infected [10]. Usually, an individual has the same blood group for life, but very rarely an individual's blood type changes through addition or suppression of an antigen in infection, malignancy, or autoimmune disease [11,12]. The question may rise whether or not this variation in blood grouping is correlated with the susceptibility to infection with virus.

A coronavirus is a common virus attacks the epithelial tissue of nose, sinuses, or upper throat and causes infection. The latter could be worsen due accumulation of mucus inside the alveoli leading to blockage of gaseous exchange,

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that consequently leads to respiratory disorders and mortality. Most coronaviruses are not dangerous, however, recently, a new coronavirus (SARS-CoV-2) is found to be particularly attracted to the blood group-A antigen found on pulmonary cells (pneumocytes). Such an attraction is attributed to a protein on the surface of the SARS-CoV-2 virus called the receptor binding domain (RBD), which is a part of virus that attaches to the host cells [13,14]. Early in the pandemic, some reports suggested people with A-type blood were more susceptible to COVID, while those with type "O" blood were less so. But a review of nearly 108,000 patients in a three-state health network has found no link at all between blood type and COVID risk [15]. The WHO is gathering the latest international multilingual scientific findings and knowledge on COVID-19 that is updated on daily basis from searches of bibliographic databases, hand searching, and the addition of other expert-referred scientific articles. A new study provides further evidence that people with certain blood types may be more likely to contract COVID-19 [16]. That makes it an important target for scientists trying to learn how the virus infects people. Since the early stages of ignition of Covid-19 pandemic, researchers are still investigating whether or not ABO blood group is linked to the risk of SARS-CoV-2 infection illness.

The objective of this research is to investigate the most susceptible type of blood group to coronavirus infection, and to tackle the correlation of coronavirus with blood grouping in another part of the global, the Mosul city, Iraq.

Materials and methods

Peripheral blood samples were collected from 894 coronavirus positive diagnosed patients at state hospitals of Mosul province, Iraq for serologic test including blood grouping for the period of February 2021-January January 2022. The victims were from both genders (507 male and 387 female). For extra accuracy blood grouping was performed for all patients subjected to double check their already known blood types using ABO kit at hospital [17]. .

Results

Out of a total of 894, with proportion of male:female (57% male:43% female), patients, respectively involved, only 25% had lost their lives at later stages . The Rh factor showed significant higher percentage of Rh+ (98%) in comparison with Rh- (nearly 2%) with no preference of virus to attack upon this factor. The general overall infection percentage of blood groups recorded in corona-virus victims was significantly type "A" (42%) followed by type "B" (28%), type "AB" (16%) and type "O" (14%), respectively. Percentages amongst the intra-gender, demonstrated a significantly higher (p≤0.05-0.01) blood type "A" in male (47%), followed by 25% for type "B"; almost equally for type "AB" and type "O" (13% and 15%), respectively. In female, the gender percentages showed a slight difference i.e. blood type "A" was insignificantly higher than type "B", followed by type "AB" then type "O", respectively (Table-1).

Discussion

Some Iraqi patients were found reluctant to report infection or to admit state hospitals for test; yet preferred to stay at home for self-treatment. Accordingly, the number of patients should have been higher than what this research included. Nevertheless, such a humble number of victims may still provide enough insight and a preliminary signs of virus preference in attacking specific blood grouping than others. Corona-virus infection involves respiratory system where the virus penetrates the alveoli wall to attach to RBC. However, blood types in human beings are a challenge because it is inherited and not something we can change during life; hence it is genetic factor. Since 20 years past the researchers reported that type "O" blood was associated with a lower risk of the original SARS than other blood groups while other studies had linked type "O" blood to a higher risk of infection by cholera, norovirus, and Helicobacter pylori [5,18].

Earlier researches showed that the SARS-CoV-2 RBD had a strong preference for binding to blood group "A" found on pulmonary cells, but had no preference for blood type "A" red blood cells, or other blood groups found on respiratory or red cell [14]. More specifically, the SARS-CoV-2 receptor-binding domain (RBD) preference to recognize and attach blood type "A" antigen found in the lungs of people with blood type "A" may provide an early insight into the potential link between blood group "A" and COVID-19 infection. It is interesting that the viral RBD only really prefers the type of blood group "A" antigens that are on respiratory cells, which are presumably how the virus is entering most patients and infecting them [19]. Most recently, a recombinant form of the RBD region of the SARS-CoV-2 spike protein is found to detect antibodies in blood specimens [20]. Targeting the RBD seems to make the most sense hypothesis for attraction mechanism between virus and cellular spikes.

Most recently, it has been shown that blood group "O" protects individuals against SARS-CoV-2, whereas blood group "A" predisposes them to being infected. The association between blood groups and outcomes of COVID-19 has not been consistent, but it is speculated that non-O blood group carriers with COVID-19 are at higher risk of developing severe outcomes in comparison to "O" blood group [10]. Hence, presence of antigen, at least, is the key factor in attracting virus

***Table 1**. Correlation of blood-grouping amongst both male and female positive (total 894) coronavirus victims subject to verification for their susceptibility for infection. (* significantly difference (p≤0.05-0.01).*

Blood types	General percentage of Infection (%)	Infection percentages amongst genders.	
		Male	Female
A (n=381)	42.6	237* (-47%)	144* (-37%)
B (n=249)	27.8	126* (-25%)	123*(-32%)
AB (n=141)	15.8	66 (-13%)	75 (-19%)
O (n=123)	13.8	78 (-15%)	45 (-12%)
Total (n=894)	100 (100%)	507 (-100%)	387 (-100%)

to the blood cells that contain antigens. The interaction between blood groups and SARS-CoV-2 infection is hypothesized to be as result of natural antibodies against blood group antigens that may act as a part of innate immune response to neutralize viral particles. Alternatively, blood group antigens could serve as additional receptors for the virus and individuals who are capable of expressing these antigens on epithelial cells, which are known as secretors, would then have a high propensity to be affected by SARS-CoV-2. The mechanism of attraction between the virus and antigen has been postulated as SARS-CoV-2 enters cells through the angiotensin-converting enzyme-2 (ACE2) receptors on their surface. The receptors' levels vary even among individuals with the same blood type. Further study showed that among healthy people, those with type A blood had significantly higher ACE2 protein levels than those with other blood types [21].

A question has risen as "why would blood group make any difference to SARS-CoV-2?" Several new studies offer possible explanations. One suggests that having type "A" blood makes SARS-CoV-2 "stickier" to host cells [22]. The debate may still require a convincing and a feasible scientific answer as how the virus interacts with blood groups in people? In other words we are requested to find a feasible mechanism responsible for such affinity of the virus to attack group "A" blood group more than others. Such a finding would help then to find new medicines or methods of prevention e.g. specific vaccination for each blood group rather than general trade vaccination which proved failure. The lesser proportion of coronavirus to blood group "AB" might be attributed to 50% interaction of virus to antigen "A" leaving other 50% unattached to group "B" as competition [14]. This could be interpreted as cell membrane of type "A" might contain more SARS virus receptors than type "B" blood cells and others increasing the affinity of group "A" to attract more SARS-CoV-2 virus than others. The blood type "A" antigen on the cells may just makes the virus a little stickier to the type "A" blood cells helps e.g. SARS-CoV-2 stick around and locate the angiotensin-converting enzyme-2 (ACE2) receptors on cells and the virus still requires ACE2 to get in [22]. Blood type "A" could also be a biological marker for susceptibility to SARS-CoV-2 infection and might provide new ideas for clinical diagnosis, treatment, and prevention of COVID-19 [23]. Some galectins have also been shown to engage ABO antigens, which are carbohydrates (sugars). Precisely, perhaps those antigens are the reason why the SARS-CoV-2 RBD seemed to find blood type "A" sweeter than blood type "O" [14]. The Chinese scientist dealt with 137 patients' of acute respiratory distress syndrome or death, have found was associated with the likelihood of becoming infected with SARS-CoV-2 due to higher rate of SARS-CoV-2 RBD binding to RBC among people with type A and lowest in people with type "O" blood [23]. Danish researchers found 31% of unprotected hospital staff members became infected. Blood group "O" was associated with a lower risk of COVID-19 than blood groups A, B, and AB [24]. Researchers in Italy assessed SARS-CoV-2 seroprevalence among 35,709 blood donors had concluded that either the A antigen present in people with blood type "A" and "AB" plays a role in SARS-Cov-2 binding with ACE2 receptors or both antibodies "a" and "b which are produced naturally in people with type "O" blood, might block the virus from sticking to cells, lowering the risk of infection [25]. Although individuals, other than type "O" blood might be more likely to contract COVID-19, due to the fact they are not immune to the disease (Although individuals, other than type "O" blood might be more likely to contract COVID-19, due to the fact they are not immune to the disease [26]. Immunity, no matter of blood type, deems mandatory to everyone as the first steps to minimize their chances of SARS-CoV-2 infection via precise vaccination.

Other new studies also add to the body of evidence around blood group and SARS-CoV-2 susceptibility and offer different potential mechanisms. Our results are in concomitant with (Stowell and Stowell, 2019 [27] in that type "A" blood cells are more likely to be attracted by the SARS-CoV-2 than other blood types' meanwhile the mechanism of attraction and modulation of the influences, race differences are all being stated. This could be interpreted as a specificity of each blood type to have extra affinity to be infected with certain microbes including chemical particles that may enter the body and the consequent body response. Future immunological researches should investigate the possibility of blocking the affinity of SARS-CoV-2 to attack particularly, type "A", blood individuals.

Conclusion

Due to a few feasible reasons e.g. antibody-b affinity, glucoside nature of antigen A, in addition to the extra spike found on the surface of Delta virus that would match the receptor of group-A blood type (cells' surface antigens) the concept "key and lock", is an acceptable interpretation in producing enough attraction between SARS-CoV-2 and RBCs causing specific infection to type "A" rather than other blood cells.

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Conflicts of interest

All authors declare that they have no conflict of interest.

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