

Blood Group Susceptibility towards COVID-19 and Other Diseases

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Abstract: COVID – 19 is a global pandemic caused by a coronavirus named SARS CoV -2. A large family of viruses that causes severe respiratory diseases known as Coronavirus (CoVs) show symptoms such as common cold and range to more rare and severe respiratory diseases such as SARS *i.e* Severe Acute Respiratory Syndrome and MERS *i.e* Middle East Respiratory Syndrome detected for the first time in 2003 and 2012, respectively. It is expected to be a zoonotic virus transmitted via bats categorically, from genus *Rhinolophus* and closely related animals to humans. As this life threatening pandemic started from the Wuhan city of China, and the examination about this disease is still in continuity. It is very important to explore all possible scientific key points regarding this disease to eradicate such a dangerous issue from the society and to save the human race on earth. Literature available till now confirmed that the ABO blood group system showed significant relationship with various diseases. Now, scientific communities were working on different aspects of COVID-19 disease. But by keeping in mind about the severity of this disease and the relationship of blood group system of humans with infectious disease we conducted this study. Present review is designed to explore the relationship of COVID-19 alongwith other disease with the ABO blood group and Von Willebrand Factor. This study will provide information about the scientific evidences regarding the role of blood group antigens in prognosis of COVID-19 alongwith other disease and this can be significant for future research.

Indexed Terms: ABO Blood group, COVID-19, SARS COV-2, COVID-19, Infection, Lethal(Keywords)

I. INTRODUCTION

The ABO blood group system is called as a clinically significant system because of the pre-formed ABO antibodies. The majority of the people will receive ABO-incompatible blood and an acute haemolytic blood reaction will take place when red blood cells were transfused on a random basis *i.e.* without knowing the type of blood type of the individuals. In 1901, Karl Landsteiner has discovered the first blood group system *i.e.* ABO blood types while working on human serum. After mixing sera and red cells of the different co-workers he found that they showed a reaction in different ways thus he named them A, B and O. After that AB phenotype was discovered by the DE Castello and Strule in 1902. By this, Landsteiner concluded that corresponding antibodies are formed when there is a lack of an A and B antigen in an individual. This was known as Landsteiner's Law. Ludwick and Hanke were the first to study blood groups during World War 1 on Macedonian front[1]. Even with the discovery of blood group in 1900, there have been efforts were made by researchers to analyse the possible association between ABO and RH blood group and different diseases.

The novel coronavirus SARS-COV-2 was declared as an pandemic by WHO, after it severely affected the whole world and started from Wuhan, China and slowly spreading to Italy initially than among American population further spreaded in 218 countries across the globe affecting 60,704,328 people out of which 1,427,188 have died due to the severity of this infection. COVID-19 is also known as Novel Coronavirus Pneumonia (NCP) is a new member of the coronavirus family and till date total 7 types of coronaviruses were reported which can infect humans[2].

Reports suggested that the viral infection has a direct link with the ABO blood groups, and the vehemence of susceptibility of infecting a blood group has been a forever debating topic. Individuals with O blood type were

reported less susceptible and referred as less likely to develop COVID-19 whereas, individuals with an A blood type are more prone to developing severe COVID-19 infection. Not only ABO blood group other factors were also significantly contributing to the severity of this infection and the elevated the number of coronavirus infected patients across the globe. People is already having cardiovascular diseases, diabetes, pulmonary tuberculosis, COPD, cancer and various other diseases making this virus easy prey for infection to feeding on[3].

Diabetes mellitus is a common medical obstacle having significant morbidity and mortality. Diabetes mellitus represents as a metabolic disorder with multiple etiology characterized by chronic hyperglycaemia with the exploitation of carbohydrate-protein and fat metabolism appear from defect in insulin secretion or insulin action or both. Diabetes mellitus is ordinarily divided into insulin-dependent diabetes mellitus and non-insulin dependent mellitus. The evidence regarding the role of blood group in diabetes is shown by the literature. Investigations in different countries of a different population show the different results regarding the blood group susceptibility[4].

ABO blood group is a prominent casual factor of plasma level of von Willebrand factor and coagulation factor VIII and ABO antigens also involved in various physiological processes. The differences in the von Willebrand factor among ABO blood group give an idea to relate the relationship between the ABO blood group, and cardiovascular disease. Landsteiner recognized the 1st human blood group system in 1901 and called the ABO blood group. ABO blood groups have a profound implication on homeostasis. Inadequacy of either Von Willebrand factor and coagulation factor VIII of plasma level induces haemorrhagic disorders, excess bleeding, and risk factors for thrombosis cardiovascular events[5]. Also, the main reason for death among people is cardiovascular diseases at the global level were reported by the World health organization (WHO).

According to scientific reports and research of the ABO blood groups with the consequences of gastric, heart failure, pulmonary circulation, hypertensive & ischemic heart disease, disease of arteries, stroke diseases, heart valve diseases, and cardiomyopathy. Based on various studies, determined that ABO blood Group, especially O blood group people has lesser risk for thrombosis compared to non-O blood group. This is due to the lower stage of the Von Willebrand factor in the O blood group. The non-O blood group has a high risk of cardiovascular diseases[6].

The ABO blood group system has three main alleles, *i.e.* two co-dominant A & B and one recessive O. These alleles encode the A and B glycosyltransferase activities and transform the H antigen prototype into either A or B antigens. The O blood group has inadequacy of transferase enzyme. The O blood group show unaltered H antigen. The ABO blood group present on red blood cells, and on humans' cells and tissues such as platelets, epithelial, and neurons, which is responsible for the pathogenesis of various disorders. Platelets play a significant role in homeostasis, bleeding & thrombosis as well. Enormous platelets increased the reactivity more than normal platelets. Mean platelets' volume is visionary of acute myocardial infarction (MI). Von Willebrand factor associated with myocardial infarction after percutaneous coronary interventions. Such acute coronary infarction occurs due to thrombosis formation. They found that high mean platelets thrombosis (MPV) had a high myocardial infarction[7].

Blood groups play significant role in the susceptibility or resistance of various infectious and non-infectious diseases. As infectious diseases were related to the attachment of microbes to molecules, probably the ABO antigens were involved to create a polymorphic profile in the mucous membrane. That is why, it is important to alter the potential receptors of bacteria, viruses, etc. Therefore, the diversity of these antigens can be related to the susceptibility to infectious diseases and the feature also represents a functional relationship between blood group and the immune function[8]. Some epidemiological studies observed that the O blood group is more common among individuals infected by *Helicobacter pylori* and some also suggested that similar mechanisms were figured in susceptibility of the negative phenotype to the Uro-pathogenic *Escherichia coli* strain. There is a link between the human immune system and the blood phenotypes, It is feasible to spot antigen A and B in red blood cells and secretions of infants, but they fail to express anti-A and anti-B antibodies up until several months of age. It is possibly the influence of environmental stimuli resulting in similar carbohydrates expressed in micro-organisms that contributes to the production of natural antibodies[8].

The ABO blood group system is the only system in which regular antibodies can be detected; the specificities of anti-A, anti-B, and anti-AB are necessary but not sufficient to protect the body against the upper antigen diversity present within the environment and for normal immune function. Hence, the type of antigens and their specific antibodies are part of the immune system but not the key to the immune system. The exact explanations for the autoimmune disorders were unknown but one theory states that some micro-organisms (bacteria or viruses) or

drugs may trigger the changes that can easily confused the immune system which would make individuals more susceptible to autoimmune disorders[9].

Cancer is uncontrolled growth of abnormal cells within the body. Cancer disrupts the control mechanism of the body thus hindering it's working. Old cells don't perish and instead have uncontrolled growth, forming new, abnormal cells. These extra mass of cells in tissues, are called tumour. Correlation was reported between a person's blood group and therefore the risk of cancer. Different blood group means one person's blood cells aren't precisely the same as another person. There were differences of the proteins within the blood cells, different blood types have different sugar molecules within the blood. ABO blood group is an inherited characteristic. Hazard ratios (HR) for all cancer by ABO blood types were calculated using hazard models[10].

➤ Compared with blood type A, blood type B significantly displays reduced risk of all cancers. Both blood types B and AB have a lower risk of gastrointestinal cancer and colorectal cancer. Blood B has a lower risk of stomach cancer and bladder cancer while blood group AB has an increased risk of cancer of the liver. In 2015, investigators found that those with A, B or AB blood types were at higher risk for developing stomach cancer as compared to people with O blood type. Genetic variation can increase the danger of carcinoma among people with A, B or AB blood types. Meanwhile, O blood type has been linked with a reduced risk of varied cancer like stomach, pancreatic and colorectal. There are many factors that are correlated with a better risk of cancer. The ABO gene plays a task with elevate the risk of cancer risk. This correlation has been studied for quite 60 years but there's no definitive explanation on why the ABO gene are at higher risk for a few cancers[11].

II. RELATIONSHIP OF TYPES OF BLOOD

2.1 Association between ABO Blood Group and SARS CoV-2

The ABO blood type is the foremost vital in humans which includes 4 blood types, namely, A, AB, B, and O. stated in their reports that the human blood group ABO type was located on chromosome number 9[12][13]. Studies were confirmed that the ABO blood group played a crucial role in various human diseases, like cardiovascular, autoimmune, and some contagious and non-contagious diseases [14][15]. Blood antigens, also named human histo-blood group antigens (HBGAs), Behal *et al.*, 2010 are one all told the foremost antigens on the surface of human red blood cells[16][17]. They represented polymorphic traits that were inherited among the individuals and the populations[18]. Differences in blood group antigens or their expression can result in increased or decreased host susceptibility to many infections[19]. The ABO blood types have discovered to contribute to the peril of multiple contagious diseases in a series of studies. Another recent study confirmed that The malaria patients with blood type A had a more robust risk of anaemia as compared to the individuals has O and non-A phenotypes [20]. Among patients infected with the dengue virus, it was reported that the patients with AB blood group had higher risk that was quite 2.5 times higher of developing

dengue VHF than did those with other blood types[21]. Furthermore, a meta-analysis proposed that blood groups A, B, and AB may not affect vulnerability to virus infection. However, those with blood type O gave the impression to be more in danger of this infection[22]. Because SARS-CoV-2 may well be a totally new virus, it's unclear whether the ABO blood groups affect individuals' susceptibility to COVID-19.

COVID-19 disease exhibits an awfully wide spectrum of severity. This strongly suggests that host factors influence the final outcomes. While acquired co-morbidities- like age, obesity, history of smoking all these were likely related to clinical severity, it is also linked to genetic factors will convince be relevant to the host thrombo-inflammatory response[23]. It was confirmed that the population of blood group A tends towards more infection risk of COVID-19 as compared to the population having blood group O (3). Growing evidences and stastical data from Wuhan established this fact by comparing the serum samples of infected and healthy individuals of a population. Interestingly they reported that blood type O was least common among the individuals infected with SARS CoV-2 infection (25.8%) compared with physically fit population-based controls (33.8%) and that blood type A was more frequent among the infected population (37.7%) compared with a physically fit population-based controls (32.2%), $p < 0.001$. They had also confirmed that, amidst 206 COVID-19 patients who died, blood type O was notably less frequent (25.2%) compared with their reference population (33.8%, $p=0.014$)[23].

2.2. Cardiovascular Diseases

Cases of COVID-19 were increasing day by day globally. Moreover, it's threatening that the people who already suffering from pre-existing chronic disease were affected promptly. Cardiovascular disease is one of the common diseases which aren't noticed in SARS and MERS patients. Many clinical reports also described the characteristics of patients with COVID-19 have similarities. In the earlier reports of China, they found the risk factors of pre-existing chronic diseases disease such as hypertension, cardiovascular disease, diabetes is a common commodity in COVID-19 patients. The patient who has pre-existing CVD has a high rate of case facility rate (CFR). Patients who have pre-existing CVS have a high risk of COVID-19[24].

The SARS CoV-2 has resemblance with the SARS CoV which was spreaded and reported in 2003. The SARS COVID-2 (COVID-19) is connected to the inflammation. There is an extreme risk of COVID-19 to type 1 myocardial infraction(MI) patient.

2.2.1 Angiotensin-converting enzyme2 inhibitor and angiotensin- renin blocker receptor

When SARS COVID-19 enters into the cells it will bind to the human angiotensin-converting enzyme2 (ACE2) receptors which were found in the kidney, lungs, and heart. Further, it activates the angiotensin renin blockade system which increases the susceptibility towards infectious diseases. These two-angiotensin competing enzymes and renin-angiotensin receptors increase the risk of SARS COVID-19. According to the trials on animals it was confirmed that with ACE2 and ARB will higher the representation and activity of the

ACE2 which increases the risk of COVID-19. Although, lack of clinical evidence on humans regarding ACE2 and ARB yet the ABO blood group is related to the ACE2 receptor and ARB inhibitor. These induce the cough in the CVD patients. There is theoretical representation also available about ACE2 and ARB related to the risk factors such as hypertension, heart failure, and cardiovascular diseases[25].

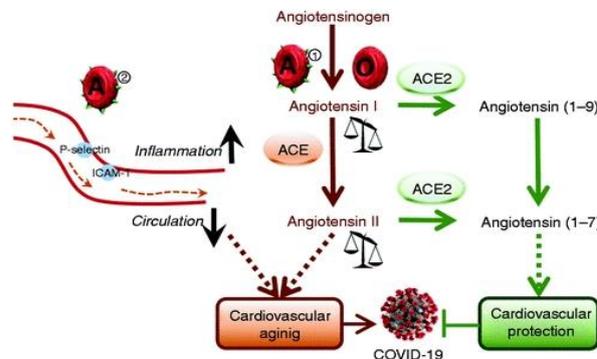


Fig. 1. Conceptual Illustration on the predisposing role of ABO blood group to cardiovascular diseases and COVID-19 severity

Blood O type is protective against the event of cardiovascular diseases and severe COVID-19 because it is related to lower angiotensin-converting enzyme (ACE) level and better ACE2 activity. Blood a sort is risky for the event of cardiovascular diseases and severe COVID-19 due to: (a) its positive association with ACE activity, and (b) the attachment of adhesion molecules on the vascular wall that increases inflammation and reduces blood circulation.

Cardiovascular disease has a major cause of the high rate of mortality during COVID-19 infection. In different countries like China, Australia, England, America, and New Zealand trials were conducted. According to a multi-centre cohort study report of 191 patients of COVID-19 in Wuhan, confirmed about 48% of people have commodity in which 30% patients had hypertension, 19% of patients had diabetes and 8% of patients had coronary heart diseases. The Chinese centre for disease and prevention reported a 2.3% (1023 deaths among 44672 confirmed cases) overall case fatality rate of COVID-19. The particular case-fatality rate of cardiovascular, hypertension, and diabetes was 10.5%, 6% and 7.8% respectively [24].

2.2.2 Diverse Cardiovascular indication

There is a widespread COVID-19 manifestation is viral pneumonia. The COVID-19 is predominantly affecting cardiovascular events such as myocardial injuries, ACS, thromboembolism, cardiac arrhythmias, vascular events and hypertension. In this COVID-19 infection high mortality rate reported due to myocardial events [24].

2.2.3 Correlation of Cardiovascular disease and type of blood group

ABO blood group related to the higher risk of coronary artery disease and myocardial infarction. There are four types of ABO blood gene in the GATC haplotype which is associated with the ACE and most common in none - O blood group patients. ABO blood group is

connected to the ACE activity and ACE inhibitors. The O blood group may have fewer ACEs and more protection possibility with ACE2. The O Blood group have a higher content of interleukin-6 as compared to non- O blood group patients. In interleukin-6 have observed a higher level of C-reactive protein generates caught than control it. Alleles A of ABO blood group have higher suspect to cardiovascular diseases [26].

Non-O blood was detected to low stress in Viral SARS COVID 2. Non-O blood group people have a profound influence on plasma concentration of Von Willebrand factor and factor VIII. Non-O blood groups have a 25% higher circulating rate of Factor VIII and Von Willebrand factor. This lead increase in inflammatory cytokines and cholesterol level. Blood group A has high mortality of CVD because blood group A has less Rh-factor and Have a high rate of cholesterol level [5].

TABLE 1 :COMPARISON OF ABO BLOOD GROUP.

Comparison of ABO blood group distribution between blood donors with Cardiorisk score ≥ 20 and < 20

Blood donors (35–65 years)	N	O blood group, N (%)	Non-O blood group, N (%)				P value*
			A	B	AB	Total	
A: Cardiorisk ≥ 20 (all individuals)	249	99 (39.8)	116 (46.6)	21 (8.4)	13 (5.2)	150 (60.2)	A vs. D =0.24
B: Cardiorisk ≥ 20 (with instrumental test abnormalities)	36	8 (22.2)	21 (58.3)	5 (13.9)	2 (5.6)	28 (77.8)	B vs. D =0.01
C: Cardiorisk ≥ 20 (with clinical symptoms)	23	4 (17.4)	13 (56.5)	4 (17.4)	2 (8.7)	19 (82.6)	C vs. D =0.01
D: Cardiorisk < 20 (controls)	16,911	7,375 (43.6)	7,209 (42.6)	1,620 (9.6)	707 (4.2)	9,536 (56.4)	

Cancer and its types account for about 12% of deaths across the world, this statistical value was estimated in year 2012. The ABO blood type has been related to various disorders. Several reports which describe the relationship between different types of cancer and ABO blood group. In 1953, the first report was published that describing the link between the A antigen and the risk of stomach cancer. Various other scientific studies were done to determine results and identify the relation with other tumor types. In 2009, a link between the ABO blood type and the risk of carcinoma was established. ABO is associated with risk of cancer because A antigen is detected in tumor cells from non-A individuals as well as glycosylation can also lead to changes in proteins or an increase in those conditions could lead tumor genesis [30]. In 1953, a study was done from England and Scotland with the clinical data of 3632 patients who had stomach cancer and reported the higher risk was noted for A blood group as compared to Blood group O. B was also found but at lower risk in patients. Scientific studies also revealed about the association between blood group A and increased risk of gastric cancer as compared to non-A blood types and O blood group has very low risk of gastric cancer. Stomach cancer accounts for 7% of cancers worldwide [31].

Lung cancer is also the prevalent type of cancer worldwide. But there is no such significant relation was found between blood group and lung cancer in a study conducted on 1257 patients with lung cancer in Wales.

III. COVID-19 relation with hypertension

Interaction of SARS-coV2 and the angiotensin-converting enzyme 2 increases the signal to angiotensin 2. RAS pathway is essential in the pathogenesis and outcome of hypertension [27]. Hypertension is also one of the common reasons for higher mortality. Hypertension conditions will stimulate receptors i.e but the medications or drugs of hypertension inhibit the RAS pathway (ACE2 inhibitors and ARB receptor) [26]. The contagious concomitant use of the RAS drug in CVD and its events potentially affects the outcome from COVID-19 [27]

2.2. COVID-19 relation with myocardial infarctions

COVID-19 infected patients showed elevated level of troponin alongwith some other cardiac enzymes (Huang 2020). Higher level of troponin is clearly confirming the myocardial infraction but diagnostic indications were still not defined but it shows strong correlation with non-coronary conditions like acute respiratory infections [28]. COVID-19 infected cases from china showed higher level of cardiac biomarkers and dysfunction of left ventricle of heart among 12% of infected patients [29]. In COVID-19 patients, which showed left ventricular damage the imbalanced of RAS pathway is assessed by the alteration in β -blockers, ARBs and ACE-I receptors. To explore the clear cut mechanism more scientific research is much needed in this regard. Some specific cardiovascular therapies were used to avoid such serious condition. Several studies for the treatment of COVID-19 come in with some specific drugs such as Chloroquine, hydroxychloroquine, azithromycin and ritonavir/lopinavir independently and in a combination form. These medications were reported to cause cardiac toxicity [25].

2.5. Role of type of blood groups in Cancer

Whereas in this study when lung cancer is classified into proximal tumors and distal tumors and further reported the increased number of cases in type A blood type and O blood type respectively. In a recent study, Turkish patients with non-O blood types were at higher risk of developing lung cancer but in another study of Turkish patients found no relation between ABO blood group and either non-small-cell lung carcinoma or small lung carcinoma. There is a presence of the B allele in patients with either B or AB blood types that leads to the decreased survival of patients with lung cancer [31]. Further, if we point out towards the cases of breast cancer it is also a major concern among females. Reports revealed the role of ABO blood group in patients of breast cancer did not showed significant and direct link. Two more studies revealed that A antigen was linked with the escalated risk of ductal carcinoma in 166 women. While in a cohort of Icelandic patients, risk of familial breast cancer was associated with blood group B [32]. Cases of prostate, liver and cervical cancers were prevalent 8, 6 & 4% across worldwide respectively. Many studies were performed to evaluate the role of histo-blood ABO group in hepatocellular carcinoma (HCC) by researchers. 6275 Chinese male patients, who suffered from chronic hepatitis B infection, with blood group A were showed higher risk for developing HCC as compared to the blood group type O. As well as blood type B also has an increased risk in males and female's patients with blood type B or AB had decreased risk of HCC.

A distinct study from Taiwan revealed that female patients with blood group A were at escalated risk of developing liver cancer. There is no expression in HCC was observed in the evaluation of antigen expression in liver carcinoma tissues [33]. In the Japanese women, the blood group A was found in patients with cervical cancer. This relation was also found in patients from Delhi, India. But there is no relationship found for cervical cancer from Nigeria or southeast Siberia.

Cancer is a multifactorial disease that is affected by germline variation and environmental factors as well.

In autoimmune disorders or diseases, immune system of your own body attacks healthy cells of the host's body itself. As the ABO blood group is correlated to the immune system, a person can produce regular and irregular antibodies based on their blood antigens. This feature represents a link between blood group and immune function [34]. Patients with autoimmune disease represent a substantial portion of the individuals with transfusion associated alloantibodies. As per some studies that showed the most common autoimmune disorder among all immunized patients was psoriasis (27%) and rheumatoid arthritis (18 %) [35].

A study was conducted on 570 and 951 people in US who included 5 autoimmune diseases: - Systemic Sclerosis, Systemic Lupus Erythematosus, Rheumatoid Arthritis, Psoriasis and Ankylosing Spondylitis. The results of this study showed that there was no significant difference in percentage was noted in blood type distribution among the 5 surveyed autoimmune diseases. This study confirmed the ABO blood type may play critical role in some autoimmune disease [35]. Pemphigus is an autoimmune disease of skin and mucous membrane that is caused by auto- antibodies works against desmosomes. This results in the loss of cell-cell adhesion properties and form epidermal blisters. This disease occurs due to immunological disturbance [36]. Assessment was done on the basis of epidemiological factors such as sex, age, and different types of pemphigus. Under a study, out of 573 patients, 203 were male and 370 were female. According to ABO blood group of percentage of blood group O, A, B and AB was 37%, 33.5%, 22.9% and 6.6% respectively. Further, the explanation of ABO blood group and this particular disease is still unclear [37]. Further we keep focus on another disease i.e Multiple Sclerosis which is also a serious autoimmune disease which occurs due to genetic and environmental factors. To find the relationship between ABO blood group and multiple Sclerosis, several studies were conducted by researchers. Patients were selected from the Neurology Department of hospital Universitario Don Ostia. The Data of patients was collected from and assessed by using Pearson's chi-squared test. The analysis showed that A+ and B+ alleles are a risk factor whereas O group is a protective factor and study was done with no difference such as age or gender [38]. Another study was performed to understand the relationship between the types of Rheumatic diseases and ABO blood groups. This study included the patients selected at the immunology Rheumatology clinic in Aydin, Turkey. Patients were examined on the basis of age, gender and types of rheumatology diseases were recorded. Data analysis was done using chi-square test. There were 823 total patients in which group of 581 were females and 241 were male patients. Also, there were 9 types of diseases

Therefore, the frequency of the ABO blood group varies globally due to the differences in allele frequency of the ABO blood group. When all types of cancers were considered together, the absolute best frequency of blood group B (40.5%), followed blood type A (34.2%), O (16.0%) and AB (9.3%) were noted in patients with cancer. The frequency of blood group A was higher and blood group O was lower in cancer patients. Blood group A was higher in breast and lung cancer [32].

2.6. Link of Autoimmune disease s with blood types

were studied, including Spondyloarthritis (SPA), Vasculitis, Undifferentiated connective tissue disease (UCTD0), Bechet's disease, Familial Mediterranean fever (FMF), Systemic Sclerosis Sjogren's syndrome and Rheumatoid Arthritis. In total 350 patients had blood group A type, 273 had blood group O type, 127 had B type and 73 had AB type blood group. There was a difference in the distribution of blood types in rheumatic diseases. But in the case of SPA or Vasculitis, UCDAO and Bechet's disease and Rheumatoid Arthritis were common in blood type A, and FMF, SLE, Systemic Sclerosis. Moreover, Sjogren's syndrome was more common in O blood type patients [38]. With this study, it was concluded that the most common blood type in all rheumatic diseases was A followed by O, B and AB. The reason for these differences is due to the variations between the genetic characteristics of the diseases. The relationship of autoimmune diseases with ABO blood group system depends on various genetic, environmental and epidemiological factors such as age, gender, sex, nationality and type of autoimmune disease. Therefore, it is difficult to conclude about the variation of blood groups among various autoimmune diseases [11].

Conclusion

As per the scientific data it is confirmed that the type of blood group plays significant and vital role in pathogenesis of various human disorders. Recent studies and case reports upon infection of COVID-19 clearly signify the impact of type of antigens with respective to the blood groups. As previous researches were reported the impact of types of different blood groups. By considering all those scientific key points this review summarized and concluded the significance in variation of blood group antigens in prognosis of various diseases along with COVID-19. This will provide the maximum scientifically proven information's, statements and reports at a single platform for the future research.

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