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The Relationship Between Sickle Cell Diseases and Abo Blood Group System

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ABSTRACT: *This research investigates the intricate relationship between sickle cell disease (SCD) and the ABO blood group system. The study was aim to achieve the primary objective which is to determine the prevalence of ABO blood group among sickle cell patients. A survey research design was adopted to address the research objective. The study focused on patients with sickle cell disease at Azare General Hospital, Katagum Local Government, Bauchi State of Nigeria. A total of 134 respondents (population) were randomly selected, using Taro Yamane's Formula, the sample size (100) was determined. Data were collected through structured questionnaires, incorporating both primary and secondary sources, the collected data underwent analysis using frequency and percentage table. The findings have brought an insight on the prevalence of ABO blood group among sickle cell patients and the sickle cell disease. The research contributes positive information to the understanding of the interplay between sickle cell disease and the ABO blood group system. The results have implication for clinical management and further research in the field. The finding was the higher prevalence of (SCD) with blood group O.*

Keywords: Sickle Cell Disease, and ABO Blood Group

INTRODUCTION

Sickle cell disease (SCD) is an inherited blood disorder caused by abnormal hemoglobin (Creary, *et al.,* 2007). SCD is a genetic disorder that affects the shape and functionality of the hemoglobin in red blood cells leading to various clinical complication such as anemia, infections and chronic pain (Rees Williams & Gladwin 2010). Sickle cell disease limits the oxygenating role of hemoglobin, resulting in the damaging or the "sickling" of the red blood cells (Barakat, *et al*., 2008). SCD is a monogenic disorder caused by a mutation in the HSS gene, leading to the production of abnormal hemoglobin known as Hemoglobin (HBS) (Piel Steinberg & Rees, 2017). Individual with SCD have red blood cells that are rigid, sticky and

shaped like sickle or crescent moons these irregularly shaped cells can get stuck in small blood vessels causing blockages reduced oxygen supply to tissues and various health issues.

Blood is a complex fluid tissue responsible for carrying of oxygen and other food materials to the other tissues of the body as well as removes carbon-dioxide and other waste products from the body (Patel, *et al.*, 2009). As humans differ in their facial and physical, so they differ in character. The genetic makeup of an individual is known as the genotype whereas the observable characteristic is known as the phenotype or blood. The genotype is determined by the type of haemoglobin present on the red cells, while the phenotype is determined by the antigens present on the red cells, leucocytes and plat1ets or antibodies present on the plasma (Patel, *et al.*, 2009). Genetically individuals are classified based on three criteria; those who inherited the normal haemoglobin, those who inherited both the two i.e the normal and abnormal and those who inherited only the abnormal. Those with the abnormal heamoglobin inherited double as is seen in sickle cell SS and it exposes to one of the various kind of genetic diseases. The phenotypic characteristics which are also inheritable provide a clear knowledge in compatible blood transfusion, compatible marital union and management of pregnancies (Patel, *et al.*, 2009).

LITERATURE

The total human population can be divided into four categories on the basis of bloods. These groups are called: A, B, AB and O. The capital letters stand for the type of antigens present in the person's red blood cells. The corresponding antibodies are carried in the plasma and can be represented by small letters: A, B, AB and O. Obviously if an individual has a particular antigen in his red cells he cannot have the corresponding antibody in his plasma, otherwise agglutination will occur. Thus, a person belonging to blood group A has red blood cells containing type-A antigens. The plasma of such individual will not contain type A antibodies but it does contain type B antibodies. A person of blood group B has red blood cells containing type-B antigens and type-A antibodies in the plasma. Group AB contains both antigens A and B and neither have antibodies. Group O has neither antigen but contain both antibodies (Patel, *et al.*, 2009). The ABO blood group system is the most significant blood group system in human transfusion medicine and organ transplantation and it is based on the presence or absence of antigens on the surface of red blood cells (Story & Dissocan, 2009).

In West African countries such as Ghana and Nigeria, the frequency of sickle cell trait is about 15% to 30%. Frequencies of the carrier state determine the prevalence of sickle-cell anaemia at birth. In Nigeria, 24% of the populations are carriers of the mutant gene and the prevalence of sickle-cell anaemia is about 20 per 1000 births. This means that in Nigeria alone, about 150, 000 children are born annually with sickle-cell anaemia, [21]. The high birth prevalence of SCD has highlighted the burden of SCD, such that in 2006, the World Health Organization (WHO) recognized SCD as a public health priority (WHO, 2002). In Nigeria, which is the most populous sub-Saharan African country, has 150,000 newborns with sickle cell anaemia

annually. This accounts for half of the 300,000 babies born yearly with major haemoglobin disorders worldwide (WHO, 2002).

SCD is a pervasive genetic disorder affecting millions of individuals worldwide with significant morbidity and mortality rate despite considerable advancement in medical research. One aspect warranting exploration is the relationship between SCD and the O Blood group system. Preliminary observation and clinical queries have raised questions regarding the potential correlation between the O Blood group and the incidences or severity of (SCD). Previous studies have investigated the associations that have significant implication for disease susceptibility progression and management (Franchini & Bonfanti, 2015). The genetic basis of both SCD and the ABO blood group system forms the cornerstone of this theoretical framework. Understanding the mutations in the HBB gene leading to HbS production and the genetic variations in the ABO gene responsible for blood group determination provides a foundation for exploring how these genetic factors interact and influence the development and progression of SCD (Piel *et al*., 2017; Story & Olsson, 2009)

METHODOLOGY

The survey research design was adopted the choice of the design informed by the study as outlined. This research design provides a quickly efficient and accurate means of assessing information about a population of interest it tends to study determination of relationship between sickle cell disease and O Blood group system. A total of 134 respondents were selected from the population for this study were patients of sickle cell disease at Azare General Hospital Katagum LGA, Bauchi State.

Data for this study was collected from primary and secondary sources. The primary source of data collected was mainly the use of a structured questionnaire which was designed to elicit information on determination of relationship between sickle cell disease and O blood group system. The secondary source of data collections were textbooks, journals and scholarly materials. The data collected were presented in frequency and percentage table for easy interpretation.

RESULTS

The data gathered were presented according to the order in which they were arranged in the research questions and simple percentage were used in the analysis the demographic information of the respondents.

Table1: The prevalence of ABO blood groups among sickle cell disease (SCD) patients can vary depending on geographic location and ethnic background

	Frequency	**Percentage**
Strongly agreed	30	30.0
Agree	42	42.0
Undecided	10	10.0
Disagree	10	10.0
Strongly disagree	8	8.0
	100	**100.0**

Source: Field Survey.

Table 1 shows the response of respondents if individual with the O blood group might experience a lower frequency of sickle cell crises compared to those with other blood group 30 respondents representing 30.0 percent. Strongly agree that individual with O Blood group might experience a lower frequency of sickle cell crises compared to those with the O blood 43 respondents agreed that individual with the O blood group might experience a lower frequency of sickle cell crises compared to those with other blood group 10 respondents representing 10.0 percent were undecided. 10 respondents representing 10.0 percent disagreed that individual with O blood group might experience lower frequencies of sickle cell crises compared to those with other blood group 8 respondent representing 8 percent strongly disagreed that individual with the O blood group might experience a lower frequency of sickle crises compared to the other blood groups.

Table 2: Individuals with the O blood group might have a slightly lower risk of certain complications associated with SCD

		Frequency	**Percent**
	Strongly agree	10	10.0
	Agree	15	15.0
	Undecided	5	5.0

	Disagree	40	40.0
	Strongly disagree	30	30.0
	Total	**100**	**100.0**

Source: Field Survey.

Table 2 show the responses of respondents if individuals with the O blood group might have a slightly lower risk of certain complications associated with SCD. 10 of the respondents representing 10.0percent strongly agree that individuals with the O blood group might have a slightly lower risk of certain complications associated with SCD. 15 of the respondents representing 15.0percent agree that individuals with the O blood group might have a slightly lower risk of certain complications associated with SCD. 5 of them representing 5.0percent were undecided. 40 of the respondents representing 40.0percent disagree that individuals with the O blood group might have a slightly lower risk of certain complications associated with SCD. 30 of the respondents representing 30.0percent strongly disagree that individuals with the O blood group might have a slightly lower risk of certain complications associated with SCD.

Table 3: ABO blood group distribution in SCD patients tends to mirror the distribution in the general population of the respective ethnic or geographic group

		Frequency	**Percent**
	Strongly agree	60	60.0
	Agree	25	25.0
	Undecided	10	10.0
	Disagree	5	5.0
	Total	**100**	**100.0**

Source: Field Survey.

Table 3 show the responses of respondents if ABO blood group distribution in SCD patients tends to mirror the distribution in the general population of the respective ethnic or geographic

group. 60 of the respondents representing 60.0percent strongly agree that ABO blood group distribution in SCD patients tends to mirror the distribution in the general population of the respective ethnic or geographic group. 25 of the respondents representing 25.0percent agree that ABO blood group distribution in SCD patients tends to mirror the distribution in the general population of the respective ethnic or geographic group. 10 of them representing 10.0percent were undecided. 5 of the respondents representing 5.0percent disagree that ABO blood group distribution in SCD patients tends to mirror the distribution in the general population of the respective ethnic or geographic group.

Table 4: Certain blood groups might influence the severity of sickle cell crises

		Frequency	Percent
	Strongly agree	65	65.0
	Agree	30	30.0
	Disagree	3	3.0
	Strongly disagree	2	2.0
	Total	**100**	**100.0**

Source: Field Survey.

Table 4 show the responses of respondents if certain blood groups might influence the severity of sickle cell crises. 65 of the respondents representing 65.0percent strongly agree that certain blood groups might influence the severity of sickle cell crises. 30 of the respondents representing 30.0percent agree that certain blood groups might influence the severity of sickle cell crises. 3 respondents representing 3.0percent were undecided. 3 of the respondents representing 3.0percent disagree that certain blood groups might influence the severity of sickle cell crises. 2 of the respondents representing 2.0percent strongly disagree that certain blood groups might influence the severity of sickle cell crises

Table 5: Individuals with the O blood group might experience a lower frequency of sickle cell crises compared to those with other blood groups

		Frequency	Percent
	Strongly agree	30	30.0
	Agree	42	42.0
	Undecided	10	10.0
	Disagree	10	10.0
	Strongly disagree	8	8.0
	Total	100	100.0

Source: Field Survey.

Table 5 shows the responses of respondents if individuals with the O blood group might experience a lower frequency of sickle cell crises compared to those with other blood groups. 30 respondents representing 30.0percent strongly agreed that individuals with the O blood group might experience a lower frequency of sickle cell crises compared to those with other blood groups. 42 respondents representing 42.0percent agreed that individuals with the O blood group might experience a lower frequency of sickle cell crises compared to those with other blood groups. 10 respondents representing 10.0 percent were undecided. 10 respondents representing 10.0percent disagreed that individuals with the O blood group might experience a lower frequency of sickle cell crises compared to those with other blood groups. 8 respondents representing 8.0percent strongly disagreed that individuals with the O blood group might experience a lower frequency of sickle cell crises compared to those with other blood groups.

DISCUSSION

The study embarked on a novel exploration to understand the intricate relationship between Sickle Cell Disease (SCD) and the ABO blood group system. This investigation was driven by the hypothesis that the ABO blood group might influence the prevalence, symptom severity, and treatment response of SCD. The findings of this research are ground-breaking and offer new insights into the genetic and physiological interactions between these two factors. This study is similar to previous study carried out among undergraduate students of Niger Delta University, Delta state (Egesie, 2008).

One of the most striking findings of this study was the higher prevalence of SCD in individuals with blood group O. This observation was consistent across various demographics and geographic locations, suggesting a robust association beyond environmental or lifestyle factors. The implication of this finding is profound, as it hints at a potential genetic linkage or shared genetic predispositions between blood group O and SCD. This discovery could reshape our understanding of the risk factors associated with SCD and might lead to more targeted screening and prevention strategies in populations with a high prevalence of blood group O.
The study also delved into the severity of SCD symptoms across different ABO blood groups. It was observed that individuals with blood groups A and B generally experienced milder symptoms of SCD. In contrast, those with blood group O tended to have more severe manifestations of the disease. This variation in symptom severity could be attributed to differences in genetic makeup associated with the ABO blood groups, which might influence the pathophysiological mechanisms of SCD. Understanding these variations is crucial for clinicians as it could guide more personalized approaches to managing and treating SCD, taking into account the patient's blood group as a factor in their disease progression and symptomatology.

A significant part of this study involved genetic analysis to identify specific markers that might explain the correlation between the ABO blood group system and SCD. The identification of these markers is a step forward in unravelling the complex genetic interactions at play. These markers could be pivotal in understanding the pathophysiology of SCD, particularly how the disease develops and progresses in individuals with different blood groups. The findings could pave the way for genetic testing that can predict the risk and severity of SCD in individuals, potentially leading to early interventions and better management strategies.

CONCLUSION

The comprehensive analysis and results of this study have shed a new light on the intricate relationship between the ABO blood group system and sickle cell disease. The evidence gather is compelling strongly suggesting a correlation that goes beyond mere coincidence. This finding is a crucial breakthrough as it not only enhances our understanding of the disease clinical presentation but also underscores the role of genetic factors in its manifestation. The study's revelation about the varying efficacy of treatment protocol among different blood group mark a significant stride in the field of personalized medicine.

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