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Research Article
Relationship Between ABO Blood Group and Renal Disease Patients Attending Dee Medical Centre, Bukuru, Jos, Plateau State, Nigeria

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Abstract

Background and Objective: Acute renal failure is a disorder with a feature of high urea and creatinine level with the outcome of an unexpected decrease in kidney function resulting in a significant decline in glomerular filtration rate. Apart from the major clinical importance of ABO blood group on blood transfusion and organ transplantation, there seem to be strong associations between blood group types and some diseases as a result of the carbohydrates compound found on the surface of the red blood cell membrane. This study aims to determine the effect of ABO blood group on acute renal disease patients. **Materials and Methods:** This case study was conducted on 56 patients with acute renal failure attending DEE Medical Center, Bukuru, Jos and Plateau State Nigeria from January-September, 2019. Ethical approval and patient consent statements were taken from everyone and the study was performed in the Medical Laboratory department of the hospital. Total 3 mL of patient blood was put into plain bottles. Serum was used to the determine level of urea and creatinine and ABO blood group was done with red cell samples by tube agglutination method. The data obtained were analyzed by SPSS software version 22. **Results:** Generally, the study revealed a strong association of ABO blood group on acute renal failure ($p<0.001$). However, Group B antigen was statistically discovered to cause the severity of acute renal failure ($p<0.05$). **Conclusion:** The results showed that blood group B individuals are more susceptible and suffer severely in renal disease than other blood group individuals as a result of the presence of D-galactose on its cell membrane.

Key words: ABO blood group, acute renal failure, D-galactose, urea, creatinine, H antigen, transfusion medicine

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

The most essential blood groups in medical practice are ABO blood group systems[1]. It was described by Landsteiner in 1900 and forms the major foundation of blood banking and modern transfusion medicine[2]. ABO blood groups are classified based on the presence or absence of A and B surface antigens into four types namely: A, B, AB and O. The frequency of these four major ABO blood groups differs across various ethnic, geographic and socioeconomic groups[3,4]. The variations of glycoprotein and glycolipids antigens present on red blood cells determine ABO blood groups[5,6]. They were indicated by the expression of the carbohydrate antigens A and B on the erythrocyte membrane and blood plasma regular antibodies (anti-A, anti-B)[7]. These carbohydrate sugars are N-acetylgalactosamine for the A antigen and D-galactose for the B antigen while N-acetylgalactosamine and D-galactose for the blood type AB and absent for the phenotype O. The A, B and AB-related carbohydrate sugars are located on the H antigen and the unmodified H antigen explains the blood group O. The A and B alleles encode a specific glycosyl-transferring enzyme[8].

When the kidney is unable to remove the toxic substance and metabolic waste from the blood, it is called renal failure or disease. Acute and chronic are two types of renal failure[9]. Acute renal failure being our major focus is a disorder with a feature of high urea and creatinine level with the outcome of an unexpected decrease in kidney function resulting in significant decline in glomerular filtration rate[10,11]. The diagnostic yardstick is the laboratory analysis that shows high serum creatinine or Blood Urea Nitrogen (BUN) levels[11]. Advanced age, male gender, African American ethnicity and diabetes mellitus are risk factors[12,11]. For more understanding, Acute Renal Failure (ARF) is classified into origins of kidney injury namely: pre-renal, intrinsic and post-renal. Pre-renal ARF is the limitation of blood flow to the kidney with frequent symptoms of vomiting, diarrhea, poor fluid intake, fever, use of diuretics and heart failure. Intrinsic ARF occurs by destroying kidney tubules, interstitium and glomeruli. Post renal ARF is due to blockage of one or both urinary tracts. For surgical patients, ARF is a scourging clinical problem with a high rate of mortality based on the fundamental of the disease[13].

ABO antigens or carbohydrate (N-acetylgalactosamine and D-galactose) are assumed to be situated on the arterial and venal renal vascular endothelium, peritubular and glomerular capillaries and the epithelial cells of the convoluted tubules and collecting ducts in the kidney[14,6]. In as much as the major focus of ABO blood group are on compatibility both for blood transfusion and organ transplantation[15] however, various studies have made an effort to show associations between blood group types and some diseases including gastric cancer, duodenal ulcers, real failure etc[16]. Some researchers had indicated facts that these blood group antigens may serve as receptors for infectious disease agents and host inflammatory response[15,17,18,5].

This research is intended to determine the effect of ABO blood group on acute renal disease patients in middle belt Nigeria to establish associations between ARF and blood group types among this sector. We hypothesize that the degree of acute renal disease is independent of ABO blood group. Testing the hypothesis with $p<0.05$ ($\alpha = 0.05$).

MATERIALS AND METHODS

Study area: This case study was conducted on 56 patients with acute renal failure attending DEE Medical Center, Buruku, Jos and Plateau State Nigeria from January-September, 2019.

Ethical approval: Ethical approval and patient consent statements were taken from everyone and the study was performed in the Medical Laboratory department of the hospital. At first, all patients with proven acute renal failure were included in the study. During the study, no patient had blood transfusion or dialysis before blood sample collection.

Research protocol: Total 3 mL of patient blood were put into plain bottles. Serum was used to determine the level of urea and creatinine and ABO blood group was done with red cell samples by tube agglutination method.

Statistical analysis: The data obtained were analyzed by SPSS software version 22.

RESULTS

In groups of patients with acute renal disease, Table 1 show that 70% male, 30% female and mean age was 36.32 ± 13.3 years. The average levels of creatinine and BUN in patients with acute renal failure were 547.21 ± 165 Umol L^{-1} and 10.955 ± 1.9 mmol L^{-1}, respectively. The most frequent age in this research work was 34 years.

Table 2 shows the effect of ABO blood group on acute renal disease patients indicating highly significantly ($p = 0.001$) rejecting the null hypothesis stating that the degree of acute renal disease is independent of ABO blood group. Accepting that degree of acute renal disease is dependent on ABO blood group.

Table 1: Demographic and clinical characteristic of acute renal disease

Characteristic	Total of patients number	Percentage (%)
Number of patients	56	
Ages (years)		
10-30	21	37.5
31-50	25	44.6
51-71	10	17.9
Mean age (years)		
36.32+13.3		
Gender		
Male	39	70
Female	17	30
Blood groups		
A	16	28.6
B	7	12.5
AB	3	5.4
O	30	53.5
Renal parameters	Creatinine (Umol L^{-1})	Urea (mmol L^{-1})
(Mean±SD)	547.21±165	10.955±1.9

Table 2: Cross-tabulation on the effect of ABO blood group on acute renal disease patients

Characteristic	Value	Difference	p-value
Pearson chi-square	16.024*	3	0.001
Likelihood ratio	17.374*	3	0.001
N of valid cases	31349		

*Mean difference is significant at the 0.05 level

Table 3: Multiple comparisons of different ABO Blood group in Acute Renal disease (creatinine)

Levels	Mean difference	Std. Error	p-value
A-B*	-162.02	73.54	0.032
A-AB	-59.21	102.10	0.564
A-O	48.09	50.24	0.343
B-AB	102.81	111.98	0.363
B-O*	210.11	68.12	0.003
AB-O	107.30	98.26	0.280

Table 4: Multiple comparisons of different ABO Blood group in Acute Renal disease(Urea)

Levels	Mean difference	Std. Error	p-value
A-B*	1.78	0.850	0.042
A-AB	-1.38	1.184	0.251
A-O	0.163	0.580	0.781
B-AB	-0.41	1.30	0.756
B-O*	-1.62	0.79	0.046
AB-O	-1.21	1.139	0.293

*Mean difference is significant at the 0.05 level

Table 3 shows multiple comparisons of different ABO Blood groups in Acute Renal disease using creatinine as a marker to identify which particular ABO blood group is responsible for the significant difference using least significant differences (LSD) test between means in an analysis of variance (ANOVA) for the analysis. Blood group B is the cause of significant differences as observed ($p = 0.032, 0.003$).

Table 4 shows multiple comparisons of different ABO Blood groups in Acute Renal disease using urea as a marker to identify which particular ABO blood group is responsible for the significant difference using Least Significant Differences (LSD) test between means in an analysis of variance (ANOVA) for the analysis. Blood group B is the cause of the significant differences observed ($p = 0.042, 0.046$).

DISCUSSION

Our finding shows a strong association between acute renal failure and ABO blood group.

ABO blood group has been observed to link with many diseases[19]. A previous study indicates that blood groups A and O were most commonly associated with renal failure while the AB blood group was least associated[8]. Another separate study observed A and O blood group antigen subtypes were involved in the progression of immune-mediated Immunoglobulin A nephropathy[6]. However, these were the contrast of finding where the B blood group was the one associated with acute renal failure.

Reiterating that D-galactose is present in the red blood cell of group B antigen. D-galactose metabolism occurs in the kidney and liver[20]. It was observed in recent studies that treatment with D-galactose resulted in to increase in oxidative damages of kidney and liver damage thereby leading the rise in Creatinine and Blood Urea Nitrogen levels, increase the severity of the acute renal failure, impaired renal and liver function[21-24]. Free radicals released by oxidative damage attack essential cell constituents and also induce lipid peroxidation, damage the membranes of cells and organelles in the liver and kidney, cause the swelling and necrosis of hepatocytes and nephrocytes and ultimately result in liver and kidney injury[21,25]. It can therefore be inferred that D-galactose on the red cell of group B is responsible for the strong association with acute renal failure. We recommend that specific research should be carried out on the effect of D-galactose on renal and liver disease to understanding the mechanism thereof.

CONCLUSION

Our finding shows that blood group B individuals are more susceptible and suffer severely in renal disease than other blood group individuals. We also discovered that D-galactose is responsible for the severity of acute renal failure. It is therefore necessary to ascertain the blood group of renal disease patients not only for a blood transfusion but for the management of the disease. However, the Rh blood group which is another essential blood group system in the medical practice was not included in this research work to determine their effect on renal disease.

SIGNIFICANCE STATEMENT

This study discovered that it can be beneficial to use the therapy that can reduce D-galactose in the management of renal disease patients and such patients should be advised not to take fruits or anything containing D-galactose to fascinate quick recovery. This study will help the researcher to uncover the critical area of renal disease severity that many researchers were not able to explore. Thus, a new theory on these ABO blood group systems on renal disease may be arrived at.

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