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PREVALENCE OF DIABETES MELLITUS AND THEIR COMPLICATION IN ABO BLOOD GROUP

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Abstract

Background: *Diabetes mellitus is a global epidemic affecting around 463 million individuals worldwide. It can lead to complications in various organs like the heart, kidneys, and eyes. Recent studies suggest that diabetes might also influence ABO blood grouping, potentially causing problems in blood transfusions and organ transplants. ABO blood grouping compatibility is essential, as any variation can lead to immune reactions and complications. High blood sugar levels in diabetes could impact ABO antigen expression, increasing the risk of immune reactions and transplant rejection. Understanding the link between diabetes and ABO blood grouping is vital for safe medical procedures in diabetic patients.*

Methodology: *A cross-sectional study was conducted in Timergara dir lower Pakistan to explore the relationship between blood group system and diabetes by recruiting 287 patients 111 male and 176 females from DHQ Hospital Timergara affiliated with Timergara Medical College. Ethical approval was granted and informed written consent was obtained from all participants after explaining the study's potential risk and benefits. Comprehensive clinical examinations were conducted, recording age, lifestyle, and diabetes-related complications on standardized forms. Blood samples were collected following protocols, with ABO blood groups determined via standard agglutination method and blood glucose level measured using the GOD-POD method with the glucose humen kit. Data were statistically analyzed to investigate potential association between diabetes mellitus and the ABO blood group system using a one-sample chi-square test to assess the significance of any observed correlation between specific blood groups and diabetes incidence in the population.*

Results; *This study involved 287 patients (38.7% males, 61.3% females) with 119 diabetic and 168 non-diabetic individuals. The distribution of diabetic*

patients across different blood groups showed a statistically significant association ($p < 0.05$). Additionally, the study found a highly significant association between diabetes and microvascular complications, with retinopathy being the most common complication.

Conclusion; *individuals with B blood group showed a higher susceptibility to diabetes retinopathy was the most prevalent microvascular complication our analysis confirmed the association between diabetes and the ABO blood group and microvascular complications.*

INTRODUCTION

Diabetes mellitus involves various disorders characterized by high blood glucose levels, known as hyperglycemia, due to insufficient insulin production or inefficient insulin use. Insulin, produced by the pancreas, regulates blood sugar levels, but in diabetes, either production is inadequate or usage is impaired. This leads to glucose accumulation in the bloodstream, depriving cells of energy[1]. According to WHO on June 22, 2023, more than half a billion people are living with diabetes worldwide, affecting men, women, and children of all ages in every country, and that number is projected to more than double to 1.3 billion in the next 30 years with every country seeing an increase[2]. Type 1 diabetes is a chronic autoimmune disease where the body's immune system attacks insulin-producing cells in the pancreas, leading to insufficient insulin production and high blood sugar levels. It typically starts in childhood but can occur in adults and is caused by a combination of genetic and environmental factors. It requires lifelong management with insulin therapy[3]. Type II diabetes is a common metabolic disorder marked by high blood sugar due to insulin resistance and inadequate insulin production. It's linked to factors like obesity and sedentary lifestyle. Management often involves lifestyle changes and medications, with some cases requiring insulin therapy to prevent complications[4]. Diabetes mellitus can harm various organs, including the retina, kidneys, nervous system, heart, and blood vessels. Complications such as diabetic retinopathy, nephropathy, neuropathy, and atherosclerosis can lead to vision impairment, kidney dysfunction, nerve damage, and increased risk of heart disease and strokes[5]. The prevalence of diabetic neuropathy in Pakistan has been reported to be around 28% among diabetic patients and 20 to 50% neuropathy affects diabetic patients worldwide[6]. The prevalence of diabetic retinopathy among diabetic patients in Pakistan is estimated to be between 15 to 20% and globally one third of all people with diabetes[7]. The prevalence of diabetic nephropathy among diabetic patients in Pakistan is reported to be around 23 to 30% and globally 20 to 40% of people with diabetes[8].

The ABO blood grouping system categorizes human blood into four types: A, B, AB, and O, based on the presence or absence of antigens on red blood cells. This system revolutionized blood transfusion practices, preventing adverse reactions by matching donors and recipients. Antigens trigger immune responses, while antibodies counteract them. Blood types A and B produce corresponding antibodies, while AB individuals produce none, and type O individuals produce both. Mismatched transfusions can lead to agglutination and life-threatening complications. Compatibility is crucial, with AB individuals being universal recipients and O individuals' universal donors. Beyond transfusions, the ABO system is relevant in organ transplants [9]. Some studies suggest a potential link between ABO blood groups and the risk of developing diabetes or its complications, but further research is needed to confirm these associations[10]. Blood group B has often been associated with a higher prevalence of diabetes mellitus in some populations, including Pakistan. Conversely, blood group O has sometimes been liked to a lower risk of developing diabetes. Research in Pakistan has indicated varying results, but some studies have found a higher prevalence of diabetes mellitus with blood group B[10].

The relationship between blood groups and diabetes is complex and may be influenced by predispositions and environmental factors. In Pakistan, factors such is diet, physical activity, and socioeconomic status also significantly affect diabetes prevalence. Understanding the association between blood groups

and diabetes can help in identifying high-risk groups and tailoring preventive measures. It can also aid in the development of targeted awareness and intervention programs to manage and prevent diabetes[11].

Aims and objectives

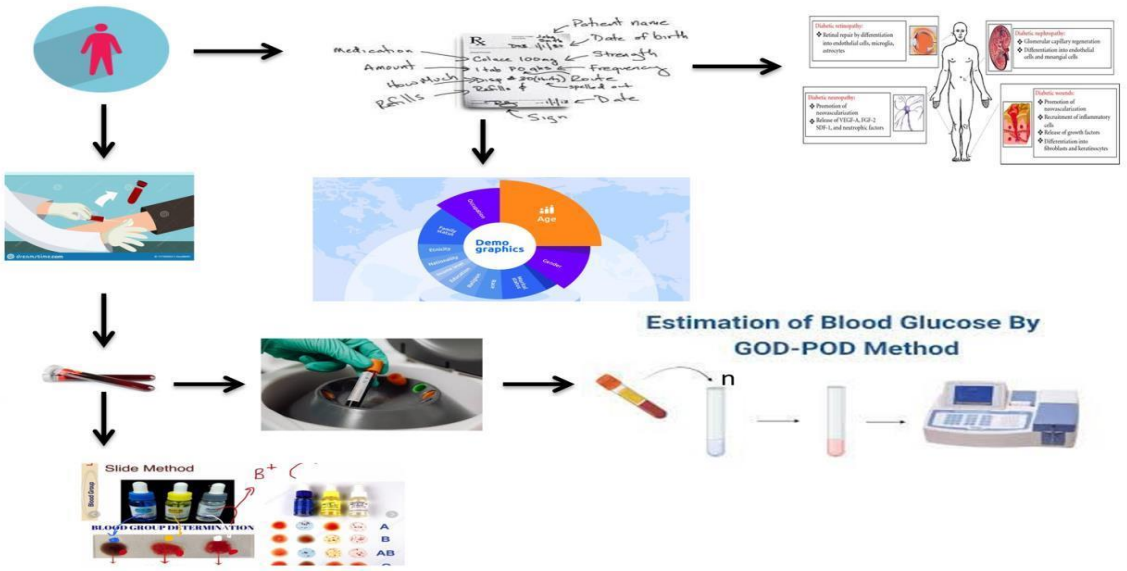
Our study was conducted with the following objectives: To determine whether

1) To investigate the prevalence of diabetes mellitus in ABO blood group.
2) To determine the risk of diabetes-associated complications among populations with various blood groups.

Materials and methods

A cross-sectional study was conducted to explore the relationship between the ABO blood group system and diabetes mellitus among the population of Timergara, Dir Lower, Pakistan. The study involved the random recruitment of 287 diabetic patients from DHQ Hospital Timergara, which is affiliated with Timergara Medical College in Dir Lower. The study cohort consisted of 111 male and 176 female participants. Approval for the study protocol was granted by the ethical review committee. Before participation in the study, all subjects were provided with a thorough explanation of the potential risks and benefits, after which informed written consent was obtained from each participant. Each patient underwent a comprehensive clinical examination, during which detailed information such as age, lifestyle, and diabetes-related complications was recorded on a standardized data form. Blood samples were collected following complete procedural protocols. The ABO blood groups were determined using the standard slide agglutination test, and blood glucose levels were measured using the GOD-POD methodology with the Glucose Human kit. The data collection procedure is illustrated in (Figure 1). The data collected were subjected to statistical analysis to investigate any potential associations between diabetes mellitus and the ABO blood group system. Additionally, a one-sample chi-square test was employed to assess whether a significant association exists between the frequency of specific blood groups and the incidence of diabetes mellitus in the studied population. This rigorous analysis aimed to identify any noteworthy correlation.

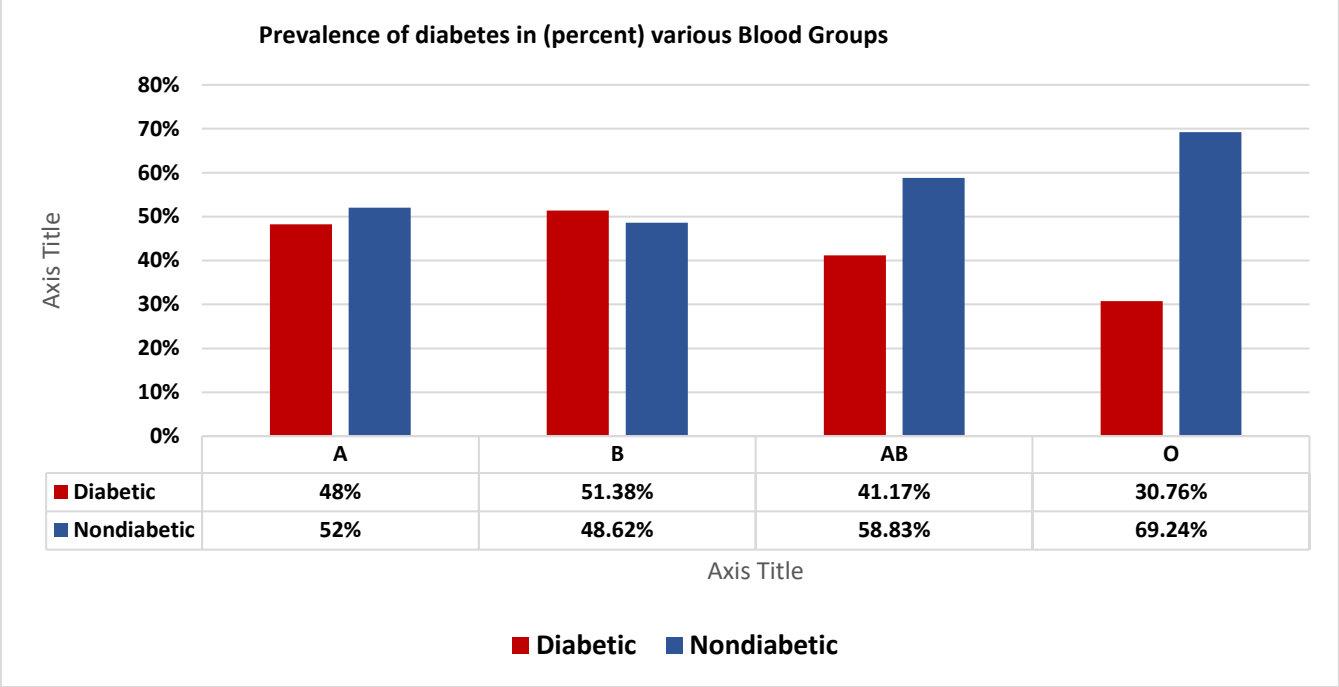
Figure1 data collection procedure



Results

The patients involved were 287, with a gender distribution of 38.7% males and 61.3% females (figure 3). The cohort comprised 119 diabetic patients and 168 non-diabetic patients. The distribution of diabetic and non-diabetic patients across different blood groups was: A 60 non-diabetic and 56 diabetic, B 35 non-diabetic, 37 diabetic, AB 34 non-diabetic, 14 diabetic, O 39 non-diabetic, 12 diabetic (Table 1) the Pearson chi-square, the likelihood ratio and linear by linear tests are below 0.05 (0.002, 0.001, and 0.001) we conclude that there is a statistically significant association between blood group and diabetes shown in (Table 2). With Microvascular complications due to diabetes, retinopathy was the most common complication 28 patients, nephropathic 20 patients, and neuropathic 8 patients, and chi-square tests show that there is a highly significant association between diabetes and microvascular complication (Table 3,4,5,6,7 and 8).

Figure 2 Prevalence of diabetes in (percent) in various Blood groups.



Comments; Comparison of diabetes and non-diabetes in various blood groups which shows a high prevalence of diabetes in blood group B.

Figure 3. Distribution of study population according to gender.

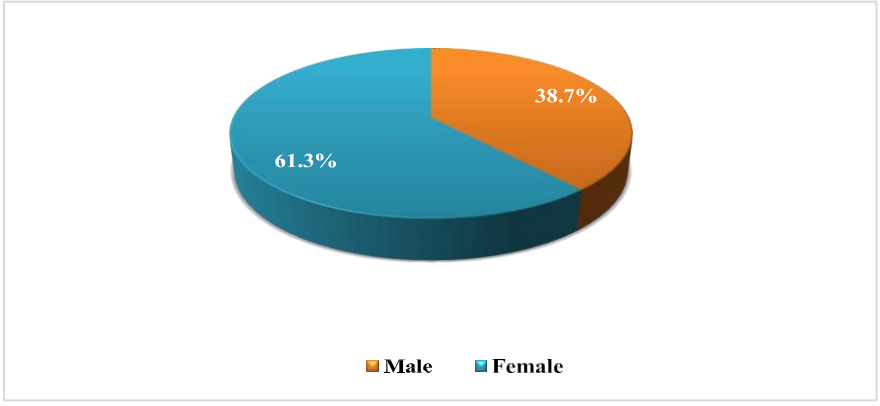


Table 1 Show the Number of diabetic and non diabetic patients

		Diabetic		Total
		Normal	Diabetic	
BG	A	60	56	116
	B	35	37	72
	AB	34	14	48
	O	39	12	51
Total		168	119	287

Table 2 Significant Association of diabetes.

Chi-Square Tests

	Value	df	Asymp. Sig.(2- sided)
Pearson Chi-Square	14.889 [a]	3	.002
Likelihood Ratio	15.430	3	.001
Linear-by-Linear Association	11.622	1	.001
N of Valid Cases	287		

Comment; Chi-square statistical analysis among different blood groups between non-diabetic(N=168) and diabetic population(N=119) significant relationship of any blood group with diabetes was observed because p-value is less than 0.05

Table 3 Retinopathy in normal and diabetic patients.

		Retinopathy		Total
		No	Yes	
Diabetic	Normal	165	3	168
	Diabetic	91	28	119
Total		256	31	287

Table 4 Significant association between diabetic patients and retinopathy.

	Value	df	Asymp. Sig.(2- sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	34.182 [a]	1	.000		
Continuity Correction [b]	31.963	1	.000		
Likelihood Ratio	36.555	1	.000		
Fisher's Exact Test				.000	.000
Linear-by- Linear Association	34.063	1	.000		
N of Valid Cases [b]	287				

Comment; Chi-square test analysis among diabetic and non-diabetic, 28 is retinopathic in diabetic patients which is absorbed association between retinopathy and diabetes.

Table 5 Nephropathy in diabetic patients.

		Nephropathy		Total
		No	Yes	
Diabetic	Normal	167	1	168
	Diabetic	99	20	119
Total		266	21	287

Table 6 Significant association between nephropathy and diabetes.

	Value	df	Asymp. Sig.(2- sided)	Exact Sig. (2- sided)	Exact Sig. (1- sided)
Pearson Chi-Square	26.995 [a]	1	.000		
Continuity Correction [b]	24.657	1	.000		
Likelihood Ratio	30.242	1	.000		
Fisher's Exact Test					
Linear-by-Linear Association	26.901	1	.000	.000	.000
N of Valid Cases [b]	287				

Comment; Chi-square test analysis among diabetic and non-diabetic, 20 is nephropathy in diabetic patients which is absorbed association between nephropathy and diabetes.

Table 7; Neuropathy patients in diabetes.

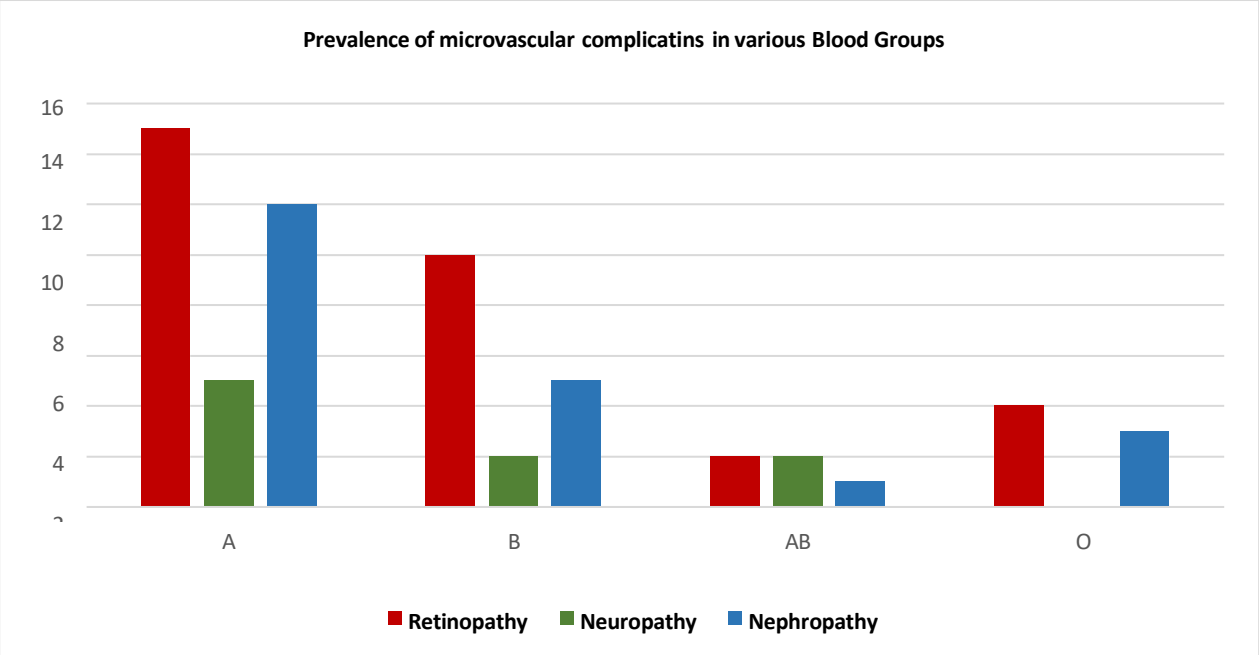
		Neuropathy		Total
		No	Yes	
Diabetic	Normal	167	1	168
	Diabetic	111	8	119
Total		278	9	287

Table 8 Significance association between diabetes and Neuropathy.

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1- sided)
Pearson Chi-Square	8.610[a]	1	.003		
Continuity ...	6.711	1	.010		
Likelihood Ratio	9.149	1	.002		
Fisher's Exact Test				.004	.004

Comment; Chi-square test analysis among diabetic and non-diabetic, 08 is neuropathic in diabetic patients which is absorbed association between neuropathy and diabetes.

Figure 4 Prevalence of microvascular complications in various Blood Groups.



Comment; In blood group A the microvascular complications is high is compared to other blood groups B,AB and O.

Discussion

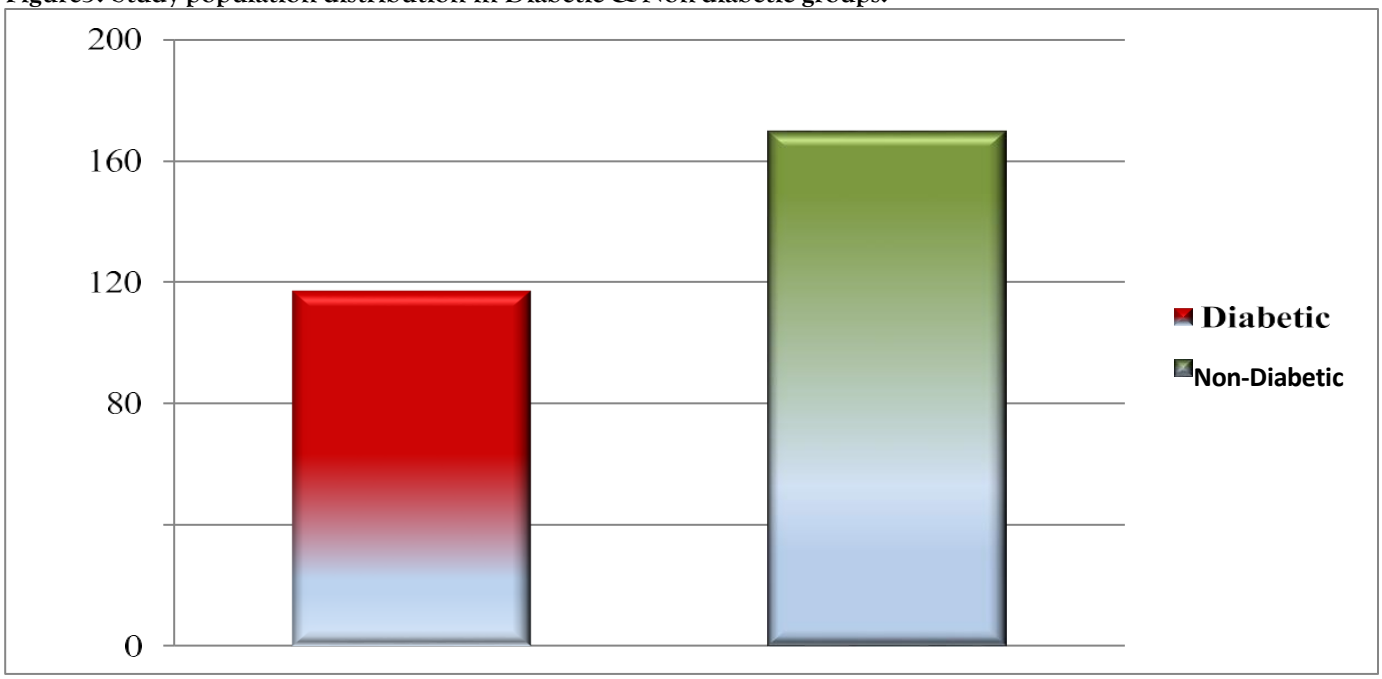
Many investigators have tried to identify a possible association between ABO blood groups and diabetes mellitus. The results have been variable, inconsistent and differed from one region to other. Some people have identified an association between blood groups and diabetes but there are studies where no association could be established[10].

this study included 287 patients in total. Of those, 119 were diabetic, and 168 were non-diabetic (figure 5). 38.7% were male, and 61.3% were female (Figure 3). According to our study, the prevalence of diabetes in various blood groups is described in (table 1) which shows 48% of patients in blood group A, B blood group 51.38% patients, AB blood group 41.17% and O blood group 30.76% patients are diabetic. it means that the B blood group people have a higher risk of diabetes mellitus then A blood group and the last AB and O. This finding of higher frequency of blood group B and the research which is published by Medal and his friends in India also support our study[10].

The research published by A. Bener and M.T. Yousafzai on Oct 8, 2014[12], also support our study, The research published in India, in 2016 indicates that blood group B has a higher frequency of diabetes mellitus compared to other blood groups[13], which aligns with our own findings when compared by Chi-square statistical analysis among different blood groups between non-diabetic (n=168) and diabetic population (N=119) which show a significant relationship between blood group and diabetes.

The prevalence of microvascular complications of diabetes mellitus in various blood groups Retinopathy was the most common complication observed among different blood groups then nephropathy and neuropathy. described in (Figure 4). Associations of different microvascular complications of diabetes have been shown in Tables 4-6-8. The study was conducted in 2017 in Dhaka Bangladesh by Parvin Akter Khanam and his friends they demonstrated that microvascular complications were more common complications observed in diabetic patients[14]. The study done by Charles, and his friend says that there is an association between diabetes and complications[15].

Figure5. Study population distribution in Diabetic & Non-diabetic groups.



Conclusion

We found that a person with B blood group has a high chance of diabetes compared to A, AB, and O. With Microvascular complications due to diabetes, retinopathy was the most common complication 28 patients, nephropathic 20 patients, and neuropathic in 8 patients, Our analysis using chi-square tests showed a highly significant relationship between diabetes and microvascular complications. Additionally, we found a significant association between diabetes and the ABO blood group system.

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