Association of ABO and Rh Blood Groups with Diabetes Mellitus and Hypertension in Basrah City

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Abstract
The aim of the study was to investigate the relationship between ABO and Rh blood groups with diabetes mellitus and hypertension. The study was including 2890 subjects (1496 males and 1394 females). 2480 healthy subjects (1356 males and 1124 females). 259 subjects had diabetes mellitus (95 males and 164 females), and 151 subjects had hypertension (45 males and 106 females). The study includes distribution of blood groups; 25.6% were blood group A, 26.57% were blood group B, 8.5% were blood group AB and 39.31% group O. The frequency of Rh-negative blood was 8.54% and Rh-positive 91.45%. There was a significant difference between healthy subjects and diabetic patients in B and Rh-positive blood groups.
Regarding the healthy and hypertensive subjects there were significant difference in B and Rh-positive blood groups, also there was a significant difference in O^+ blood group. There was a significant difference between healthy male subjects and hypertensive male patients in B^- blood group.

الترابط بين فصائل الدم والعامل الريسي مع داء السكري وارتفاع ضغط الدم في مدينه البصره

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الخلاصه:
الهدف من الدراسة لاختبار العلاقة بين فصائل الدم (ABO) والعامل الريسي (Rh) مع داء السكري وارتفـاع ضغط الدم. تم أجراء هذه الدراسة كمحاوله لإثبات أي علاقة معنوية بين كل فـصيله مـن فـصائل الـدم (ABO) أو Rh مع ضغط الدم وداء السكري. أجريت هذه الدراسة في مدينه ألبصره للفترة من تشرين الثاني ٢٠٠٤ حتى تموز ٢٠٠٥، شملت الدراسه٢٨٩٠ فردا (١٤٩٦ذكور، ١٣٩٤إناث). ٢٤٨٠ أفـراد أصـحاء (١٣٥٦ ذكور، ١١٢٤ إناث). ٢٥٩ فرد مصابين بداء السكري (٩٥ ذكور، ١٦٤ إناث)، ١٥١ فرد مصابين بارتفاع ضغط الدم (٤٥ ذكور، ١٠٦ إناث). تضمنت الدراسة انتشار فصائل الدم: ٦،٢٥% فـصيله دم A، ٢٦,٥٧% فصيله دم B، ٨,٥% فصيله دم AB و٣٩,٣١% فصيله دم O. كان تردد Rh^- ٨,٥٤% بينمـا Rh^+ ٩١,٤٥%.
التحليل الإحصائي أوضح أن هناك فروقات معنوية بين الأفراد الأصحاء ومرضى السكري في فصيله الدم B و Rh^+. فيما يتعلق بالأفراد الأصحاء ومرضى ارتفاع ضغط الدم كانت هناك فروقات معنوية في فصيله الدم B و Rh^+، ايضا كانت هناك فروقات معنوية في فصيله الدم O^+. هناك فروقات معنوية بين أفراد الـذكور الأصحاء وذكور مرضى ارتفاع ضغط الدم في فصيله الدم B^-.

Introduction

The membrane of human red blood cell (RBC) contains a variety of blood group antigens. The most important and best known of these are A and B antigens, which are actually complex oligosachride that differ in their terminal sugar on RBCs, they are mostly glycosphingolipids (Ganong 2003). The antibodies against red blood cell antigens are called agglutinins and individual are divided into four major blood groups A, B, AB and O, according to the presence of these antigens and agglutinins (Conteras and Lubenko 2001; Ganong 2003). In addition, if human RBCs contain antigen D, the blood is known as rhesus (Rh-positive), while those persons without antigen D in their RBCs called rhesus negative (Green 1989; Hughes-Jones and Gardner 2002), immunological characteristics determine and classify the differentiation of blood by type (Morgan and Watkins 2000).

The main ABO alleles that create familiar A, B, AB and O blood groups exhibit broad sequence heterogeneity and extensive sequence variation in both the coding and non-coding region of the gene, given that a minimum of 70 ABO alleles are reported (Yip 2002).

The ABO histo-blood system includes three antigens (ABH). Unlike people of A, B and AB groups can convert the H antigen into A or B antigens, people of O blood group having guanine (258) deleted in the O gene produce an inactive protein incapable of converting the H antigen (Yamamoto et al.1990).

Studies have demonstrated the implication of different blood group phenotypes in disease pathogeneses. The ABO and (Rh) blood groups have been implicated in increased susceptibility to certain diseases (Blackwell 1989) for instance, *Helicobacter pylori* and the increased risk of peptic ulcer (Alkout et al. 1997; Alkout et al. 2000), haemolytic uremic syndrome and *Escherichia coli* (Blackwell et al. 2002), elevated serum antibody titer levels to *vibrio cholera* (Swerdlow et al. 1994), carcinomas (Su et al. 2001) and infertility in women (Lurie et al. 1998).

Aim of The Study

The aim of this study is to confirm any significant association between each of ABO and Rh blood groups with diabetes mellitus and hypertension in Basrah city.

Methods

Study Population

A clinical prospective randomized study in Basrah city from November 2004 to July 2005. This study included 2890 subjects (1496 (51.76%) males and 1394 (48.23%) females). The total population of healthy subjects was 2480 (1356 (54.67%) males and 1124 (45.32%) females) there age ranged between (8-66) years. There were 259 diabetic patients (95 (36.67%) males and 164 (63.32%) females) age ranged (7-80) years, while 151 hypertensive patients composed of (45 (29.8%) males and 106 (70.19%) females) age ranged (34-85) years.

Laboratory Blood Tests

Diabetes mellitus means fasting blood sugar ≥140 mg/dL, and hypertension means systolic blood pressure (SBP) more than 140 mm Hg or diastolic blood pressure (DBP) more than 90 mm Hg in both races (Braunwald et al. 1987).

Blood samples were obtained from healthy subjects and patients (1 ml from each healthy subject and hypertensive patient, while 3 ml from diabetic patient after 12 hours of fasting). The samples were tested immediately following collection. Anti-A, anti-B and anti-D monoclonal blood grouping reagents were used to determine the ABO and Rh (D) phenotype by slide method at room temperature. ABO and Rh blood groups were taken for all patients, and a comparison group (healthy subjects) was taken. Fasting blood sugar (FBS) measurement was carried out using the colorimetric method.

Blood pressure was measured by a mercury sphygmomanometer in the sitting position after rest for 5 minutes.

Statistical analysis

Statistical analysis was using Chi square test, P-value of <0.05 was considered to be statistically significant.

Results

Table (1) summarizes distribution of ABO and Rh blood groups in Basrah city for all individuals, also the table shows the number and percentage of blood groups according to gender.

Table (2) shows the number of individuals (control and diabetic patients) and percentage of ABO and Rh blood groups, there was a significant difference between diabetic patients and control group in blood group B (P= 0.02), also there was a significant difference in Rh^{+ve} (P= 0.02). The frequency of Rh^{+ve} among diabetics in this study was 93.05%. The most frequent blood group among diabetics was O^+ blood group (42.47%).

Table (3) shows the numbers of healthy and hypertensive subjects and percentage of ABO and Rh blood groups, there was a significant difference between hypertensive patients and healthy subjects in blood group B (P= 0.05) and Rh^{+ve} (P= 0.02).

There was no significant difference between healthy subjects and diabetic patients in A^+, A^-, B^+, B^-, AB^+, AB^-, O^+ and O^- blood groups, as shown in (table 4).

Regarding table (5) there was a significant difference between healthy subjects and hypertensive patients in blood group O^+ (P= 0.05). The frequency of O^+ was significantly higher among hypertensive patients (P= 0.001).

Table (6) represents number of individuals (healthy subjects and hypertensive patients) percentage of blood groups according to the gender, there was a significant difference between healthy male subjects and hypertensive male patients (P= 0.02).

Table (1) Distribution of ABO and Rh blood groups

Blood groups	No. of subjects	% of subjects	No. of Males	% of Males	No. of Females	% of Females
A	731	25.29	369	24.66	362	25.96
B	781	27.02	404	27.00	377	27.04
AB	231	7.99	120	8.02	111	7.96
O	1147	39.68	603	40.30	544	39.02
Rh^+	2650	91.69	1372	91.71	1278	91.67
Rh^-	240	8.30	124	8.28	116	8.32
Total	2890	100	1496	100	1394	100

Table (2) Comparison between the ABO and Rh blood groups of healthy subjects and diabetic patients

Blood groups	No. of Healthy subject	% of Healthy subject	No. of Diabetic patients	% of Diabetic patients	P-value
A	635	25.60	59	22.77	0.32
B	659	26.57	76	29.34	0.02
AB	211	8.50	14	5.4	1.90
O	975	39.31	110	42.47	1.92
Rh^+	2268	91.45	241	93.05	0.02
Rh^-	212	8.54	18	6.94	0.39

Table (3) Comparison between the ABO and Rh blood groups of healthy subjects and hypertensive patients

Blood groups	No. of Healthy subject	% of Healthy subject	No. of Hypertensive patients	% of Hypertensivepatients	P-value
A	635	25.60	37	24.5	0.17
B	659	26.57	46	30.46	0.05
AB	211	8.50	6	3.97	2.45
O	975	39.31	62	41.05	1.69
Rh^+	2268	91.45	141	93.37	0.02
Rh^-	212	8.54	10	6.62	0.40

Table (4) Comparison of ABO and Rh blood groups between healthy subjects and diabetic patients

Blood group	No. of Healthy subject	% of Healthy subject	No. of Diabetic patients	% of Diabetic patients	P-value
A^+	579	23.34	53	20.46	0.29
A^-	56	2.25	6	2.31	0.62
B^+	602	24.27	72	27.79	0.32
B^-	57	2.29	4	1.5	0.08
AB^+	200	8.06	14	5.4	1.39
AB^-	11	0.44	0	0	0.34
O^+	887	35.76	102	39.38	0.12
O^-	88	3.54	8	3.08	0.17
Total	2480	100	259	100	

Table (5) Comparison of ABO and Rh blood groups between healthy subjects and hypertensive patients

Blood groups	No. of Healthy subject	% of Healthy subject	No. of Hypertensive patients	% of Hypertensive patients	P-value
A^+	579	23.34	37	24.5	0.18
A^-	56	2.25	0	0	1.69
B^+	602	24.27	42	27.81	0.26
B^-	57	2.29	4	2.64	0.21
AB^+	200	8.06	5	3.31	2.44
AB^-	11	0.44	1	0.66	1.62
O^+	887	35.76	57	37.74	0.05
O^-	88	3.54	5	3.31	0.18
Total	2480	100	151	100	

Table (6) Comparison between the ABO and Rh blood groups of male and female healthy subjects and hypertensive patients

Blood group	No. (%) of Male Healthy subjects	No. (%) of Male Hyperte-nsive patients	P-value	No. (%) of Female Healthy subjects	No. (%) of Female Hyperte-nsive patients	P-value
A^+	301 (22.19)	13 (28.88)	1.34	278 (24.73)	24 (22.64)	0.11
A^-	30 (2.21)	0 (0)	1.68	26 (2.31)	0 (0)	1.68
B^+	331 (24.41)	12 (26.66)	0.17	271 (24.1)	30 (28.3)	0.27
B^-	33 (2.43)	1 (2.22)	0.02	24 (2.13)	3 (2.83)	0.31
AB^+	109 (8.03)	2 (4.44)	1.60	91 (8.09)	3 (2.83)	2.30
AB^-	4 (0.29)	0 (0)	0.66	7 (0.62)	1 (0.94)	2.63
O^+	500 (36.87)	16 (35.5)	0.66	387(34. 43)	41 (38.67)	0.36
O^-	48 (3.53)	1 (2.22)	0.66	40 (3.55)	4 (3.77)	0.41
Total	1356	45		1124	106	

Discussion

The study was composed of 2890 subjects, constitutes the first data on ABO and Rh blood groups in Basrah city. The findings of present study constitute baseline data for population of Basrah city, given record for the distribution of the blood groups in the general population. The ABO blood groups system is the most important and the most common human alloantigen system in blood transfusion (Yamamoto et al. 1992).

It is interesting to note that the distribution of ABO and Rh blood groups various from race to race. Among western Europeans, 42% have group A, 9% group B, 3% group AB, and the remaining 46% group O. However, some eastern Europeans have a higher proportion, up to 40% of blood group B. While pure native American Indians belong almost exclusively to blood group O (Keele et al. 1982). Americans generally have frequencies of A, B, AB, and O blood groups of 41%, 10%, 4%, and 45% respectively (Ganong 2003), but our study showed that 25.29% blood group A, 27.02% group B, 7.99% group AB and 39.68% group O. In the case of Rh groupings, existing literature indicates that 85% of Caucasians are Rh-positive and 15% Rh-negative. About 95% of African-Americans are Rh-positive, whereas indigenous Africans are virtually 100% Rh-positive (Guyton and Hall 1996). Reports indicate that although 85% of Caucasians are Rh-positive and 15% Rh-negative, over 99% of Asians are Rh-positive (Ganong 2003). Our study showed that 91.69% Rh-positive and 8.3% Rh-negative. There were small differences in the distribution of blood groupings between males and females. Genetic role in the determination of ABO and Rh blood groups system (Green 1989; Garratty et al 2000; Hughes-Jones and Gardner 2002) exhibited extensive variation in the distribution of ABO and Rh blood groups

in different population (May and du Toit 1989; Wagner et al. 1995; Falusi et al. 2000; Chiaroni et al. 2004).

In comparison with other studies on diabetes mellitus showed inconsistency in the distribution pattern of ABO and Rh blood groups. There is a strong indication of an association of diabetes mellitus with blood groups, especially with A, AB and Rh-positive blood groups. Individuals with gene p seem to be more susceptible to this disease (Sidhu et al. 1988), while the distribution of B blood group was elevated among Pakistanis, the diabetes mellitus and blood groups are interrelated because of the board genetic immunologic basis in both (Qureshi and Bhatti 2003), whereas no significant difference was established in Iranians with diabetes (Karamizadeh and Amirhakimi 1996). These differences in the frequency of ABO and Rh blood groups indicate racial and ethnic variations in persons indigenous to various parts of the world (May and du Toit 1989; Wagner et al. 1995; Falusi et al. 2000; Chiaroni et al. 2004). Gloria-Bottini et al. (2000) reported an increase in glucose and HbA1C levels among DCcEe individuals and decreased levels among those with ddccee, the Rh blood system may play some role in the process of glucose metabolism and may influence the clinical expression of diabetes. Our finding is in consistence with results reported by Qureshi and Bhatti, there is a significant associations between diabetes mellitus and blood groups B and Rh.

Several reports have evaluated the possible relationship between the blood groups and blood pressure. Kesteloot and Van Houte (1974) reported an association between the ABO blood group and blood pressure among >42,000 Belgian men. They found that those with blood type AB had the highest values of SBP and DBP, whereas no significant differences in blood pressure were noted according to Rh-positive and Rh-negative phenotype. A multiple regression analysis indicate that blood type B and AB made significant but very small contributions to DBP (Nemesure et al. 2006). Another study of 621 male and 577 female youths in Israel reported a positive association between the ABO blood group A antigen and elevated SBP and DBP among only the males, with no significant findings for the Rh system (Kark and Friedlander 1984). A third investigation suggested significant association between SBP, in particular, and the ABO B antigen among a subsample of youths of European descent (n=573) from Bogalusa and a concordant, yet not significant, effect in their Africanorigin subsample (n=325) (Borecki et al. 1985). Robinson et al. (2004) found that a significant association of SBP with Rh blood group among a population-based sample of 141 Afro-Caribbeans in Dominica. The ABO antigens play a role by influencing renin levels and affecting plasma angiotensin and aldosterone secretion, thus indirectly influencing arterial blood pressure (Nemesure et al. 2006). Our finding is in agreement with those of Borecki et al and Robinson et al., we find significant associations with hypertension and blood groups B, O^+ and Rh^+.

In conclusion, the present study demonstrates that blood group B was associated with diabetes mellitus and hypertension, also blood group O^+ was associated with hypertension, certain blood group may confer a protective effect from diabetes or hypertension.

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