# THE RELATION BETWEEN ABO BLOOD GROUP AND SPONTANEOUSLY ABORTION IN DERNA CITY

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## Abstract

There is a strong relationship between ABO blood groups and repeated abortion and we do this study to find out this relationship. Sixty-two couples from Derna city, suffering from spontaneous repeated abortion have been investigated for the ABO blood groups system to see the frequency of ABO blood group and ABO incompatibility as a cause of abortion and 50 couples were taken as control group. In husband group maximum number of individuals had blood group O. In wife group, also blood group O showed the highest number of individuals. The frequency of ABO blood group of husband/wife mating was highest in blood group A/B, and Lowest in blood group AB/AB. The large number of abortion group was from blood group O and the small number of abortion group was from blood group AB while in control group, blood group O shows high frequency and blood group AB show low frequency.

**Key Words:** ABO; Abortion; incompatibility; Derna; Libya.

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## Résumé

## LA RELATION ENTRE LES GROUPES SANGUINS (ABO) ET L'AVORTEMENT SPONTANÉMENT À LA VILLE DE DERNA

Il existerait une forte relation entre l'appartenance à certains groupes sanguins (système ABO) et les avortements répétés, raison pour laquelle on a opté pour la réalisation de cette étude. Soixante-deux couples (mari et femme) de la ville de Derna souffrant d'avortements spontanés répétés ont été étudiés dans le but d'examiner la fréquence des différents groupes sanguins et de l'incompatibilité du groupe sanguin ABO dans le couple afin de pouvoir vérifier si l'appartenance à ces groupes constitue une cause d'avortement, en parallèle 50 couples ont été pris comme groupe témoin. Dans le groupe des époux, la fréquence maximale concernait le groupe sanguin (O). Dans le groupe des femmes, le groupe sanguin (O) présentait également le plus grand nombre d'individus. La fréquence des accouplements du groupe sanguin ABO entre mari/femme était la plus élevée dans le groupe sanguin A/B et la plus faible dans le groupe sanguin AB/AB. L'effectif modale des avortés concernait le groupe sanguin (O) et le moins important était associé au groupe sanguin (AB), tandis que dans le groupe témoin, le groupe sanguin (O) présentait une fréquence élevée alors que le groupe sanguin (AB) avait une faible fréquence.

**Mots clés :** Groupes sanguins ABO ; Avortement ; incompatibilité ; Derna ; Libye.

## ملخص

### العلاقة بين الزمرات الدموية (ABO) والإجهاض غير الإرادي بمدينة درنا

لقد أفضت الملاحظة إلى وجود علاقة قوية بين فصائل الدم (ABO) والإجهاض المتكرر وهذا ما دفعنا للقيام بهذه الدراسة. لتحقق من صحة هذه العلاقة تم إجراء مسح غطى 62 زوجًا من مدينة درنة، يعانون من الإجهاض المتكرر التلقائي، وذلك لمعرفة مدى تواتر فصيلة الدم ABO وعدم توافق الزمر لدى الزوج (الزوج ومرأته) والتأكد إن كان الانتماء لمجموعات معينة يشكل سببا للإجهاض، بالمقابل تم أخذ 50 زوجًا كمجموعة ضابطة. في مجموعة الزوج، كان التكرار الأكبر لعدد الأفراد الذين لديهم فصيلة الدم (O)، في مجموعة

الزوجات، أظهرت فصيلة الدم (O) أيضًا أعلى تكرار. كما أن تواتر فصيلة الدم (A/B) عند الجمع بين الزوج/الزوجة كان الأعلى، بينما التكرار الأقل عنى مجموعة (AB/AB). وقد كان عدد الإجهاضات الأكبر لدى فصيلة الدم (O) في حين كان عدد الإجهاضات الأصغر من نصيب فصيلة الدم (AB)، بينما أظهرت فصيلة الدم (O) في المجموعة الضابطة تواترًا عاليًا لعمليات الإجهاض واستحوذت فصيلة الدم (AB) على التواترً المنخفضً.

**الكلمات الدالة:** الزمرة الدموية؛ الإجهاض؛ عدم التوافق؛ درنة؛ ليبيا.

## 1. Introduction:

Prior to the discovery of the ABO blood groups, high rates of mortality resulted from using animal and human blood sources for transfusion due to lack of knowledge of the differences in blood composition observed between animals and humans and within the human population (1). Since the discovery of the ABO blood groups in 1900 (Landsteiner, 1900), humans and many other primates can be typed for ABO blood group based on the presence or absence of surface antigens on the red blood cells (RBC)(1).

The four human ABO groups, A, B, AB, and O, are based on the inheritance of genes on chromosome 9. A person's ABO phenotype does not change as a result of environmental influences during his or her life except in cases of bone marrow transplantation or certain disease states (2). Previous research has revealed associations between ABO blood groups and disease (3). Some of these associations include malignancy, thrombosis, pepticulcers, bleeding and infectious diseases (4). Although ABO blood group is determined by inheritance, natural selection may have influenced the current frequencies of ABO types among populations based on susceptibility to particular diseases or disorders (4).

Three blood groups (A, B and O) were discovered in 1900 by Landsteiner. He tested blood samples from himself and several colleagues by combining serum specimens with a suspension of RBCs from each person(5). By observing agglutination in some mixtures but not in others, he was able to classify the blood samples into three

groups. Two years later, indications of a fourth group (AB) were found by two of Landsteiner's students (6). Consequently, humans can be divided into four ABO groups according to the reactions with which their RBCs exhibit with normal human sera. These serological reactions depend on the presence or absence of A and B substances on the surface of the RBC, the active parts of which are polysaccharide in nature (7). In serological terms, the A and B substances are described as antigens or agglutinins. Group A RBCs carry only the A antigen, B cells only the B antigen, AB cells carry both, and O cells carry neither (5) (Table 1).

The antigens of the ABO blood group remain the most well-known and medically important group of red cell antigens. These antigens are defined by carbohydrate epitopes on glycoproteins and glycolipids located on the extracellular surface of the RBC membranes and inother tissues, body fluids and organs (8). An ABO antigen is identified by a series of carbohydrates attached to a lipid or protein component on the RBC membrane. These antigens are produced by a series of reactions in which enzymes catalyze the transfer of sugar units. A person's genotype determines the type of enzymes present, and therefore, the type of antigens that are on the RBCs. ABO blood types are inherited through genes on chromosome 9 (9). Although they can be detected on the RBCs of five-to six-week-old embryos, A and B antigens are not fully developed at birth, presumably because the branching oligosaccharide structures develop gradually. By two to four years of age, A and B antigen expression is fully developed and remains fairly constant throughout life. A human serum contains either, both or neither of the corresponding antibodies or hemagglutinins, anti-A and anti-B. Landsteiner concluded from his experiments that human plasma contains A and B antibodies when the corresponding antigen(s) is/are absent from the host red cells (8) (Table 1). ABO antibodies are present in human sera after the first few months of life (7). Even in 2014, over 100 years after Landsteiner's discovery (1900), human blood is typed by the antigens on the surface of RBCs for certain medical indications (7).

**Table 1. Antigens and Antibodies Found in the ABO Blood Groups.**

| Blood Group | Antigens on the surface of RBCs | Antibodies in the plasma or serum |
|---|---|---|
| O | neither A nor B | Anti-A; Anti-B; Anti-A, B |
| A | A | Anti-B |
| B | B | Anti-A |
| AB | A, B | None |

The serological activity of anti-A and anti-B forms the basis of ABO testing, which uses known sera containing anti-A and anti-B and known A and B cells as reagents to test blood of an unknown blood group. Anti-A in serum can attach to the A antigen on A or AB cells and cause agglutination. Anti-B behaves similarly with B or AB cells (7). The ABO blood group system remains most significant for transfusion practice since it is the only system for which the reciprocal (or antithetical) antibodies are consistently and predictably present in the sera of most people who have had no exposure to human red cells (7).

In 1943, Levine had identified ABO incompatibility as a cause of early abortions and stillbirths. From this time onwards numerous workers produced data suggesting, mainly on the grounds of a deficiency of A children, and an excess of abortions, in the families of O women married to A men, that the A fetuses produced by such mating were especially liable to be aborted (10-12).

Although the relation of ABO blood group system to disease is well established, it may not is of great genetic importance, because the disease concerned usually affect people in middle or later life, after the peak reproductive period (11).

The relation of early abortion and ABO blood type incompatibility has been reported in some studies. The analysis of wife-husband joint ABO blood group distribution in couples with habitual abortions

showed an excess of A compared with expected proportions assuming random mating (3, 11, 12).

Levene and Rosenfield then give a highly critical and detailed analysis and recalculation of all available published data on the ABO groups of parents and offspring. Most of the information on possible loss of children from materno-fetal incompatibility can be derived from the frequencies of A and O children in A/O mating, comparing those mating where the mother is O with those where she is A. The combined data show a significant deficiency of 25% of children in the incompatible mating. Other mating, involving B, are less conclusive because of small numbers, but the overall conclusion is that 'there is a loss of between 14% and 32% of all A or B children from mating of an A, B (and presumably AB) father and an O mother, as compared with the reciprocal mating, and that the most likely value for this loss is 25%. Some authors suggest that ABO-related infertility be due to the action of antibodies, in the secretions of the mother's genital tract, on incompatible spermatozoa. It is difficult to explain the marked discrepancies between the results of the different infertility studies, and there is a need for further data (2, 3).

The papers cited above show, on the whole, very strong evidence that in mating where the husband has an A antigen which the wife does not possess, there is a marked selection against the birth or survival of A (i.e. heterozygous) offspring. In a study by nunzio botiny et al, the possible differential effects of A and B blood group materno-fetal incompatibility on human fertility through a comparative analysis of couples with recurrent spontaneous abortion (RSA) and healthy mothers in two population (Rome & Sassari) has been reported (10). A low number of "B" incompatible mother (women) A/infant (husband) B in RSA couples and a high number of "B" incompatible in healthy mothers was observed. The phenomenon is much more evident in women aged 24-28 years, a period of maximum fecundity (3, 10, 13).

Relationships between maternal-fetal ABO compatibility and both human fertility and fetal growth parameter have been observed (14,

15). It may be better to investigate the possibly different roles of anti-A and anti-B antibodies in repeated abortion patients and in normal groups, especially because Bakacs et al., suggest different complement-binding capacities between anti-A and anti-B monoclonal IgM antibodies (16, 17). It is possible that anti-B immunoglobulins could have, at least in some mother-infant joint types, a specific protective effect against abortion (17, 18).

The aim of the study is to find out whether there is any correlation between ABO blood groups and spontaneously repeated abortion.

## 2. Material and Methods:

The present study was done at Derna teaching hospital from 6/February/2018 to 03/February/2019. Sixty-two women with history of spontaneously repeated abortion with their husband (mixed) were tested by ABO blood group at laboratory department at Derna Teaching hospital.

Fifty normal women with their husband (mixed) were tested by ABO blood group at laboratory department at Derna Teaching hospital.

All the blood samples were tested immediately after collection. The principle of ABO grouping is based on a specific agglutination reaction between antigens on the red cells and IgM antibodies in the typing serum. The antisera used for blood grouping in this study were provided by monosera, which give more specific reactions and are very sensitive for weaker reaction.

## 3. Results

In our study 62 couples have been investigated for the ABO blood group incompatibility to see if the frequency of specific ABO blood types in these patients has any effect in their repeated abortion. Two mode of analysis has been used, one is the individual ABO blood group to evaluate the frequency of each blood groups in each category

(male, female and mix), and the second one is the joint ABO blood group mating between husband and wife.

Table 1 show, the highest frequency of blood group was blood group O (husband, wife and mixed) the lowest frequency of blood group was blood group AB (husband, wife and mixed).

**Table 2: frequency of ABO blood group in spontaneous repeated abortion**

| Blood group | Husband | Wife | Mixed |
|---|---|---|---|
| A | 17 | 14 | 31 |
| B | 14 | 20 | 34 |
| AB | 12 | 7 | 19 |
| O | 19 | 21 | 40 |
| Total | 62 | 62 | 124 |

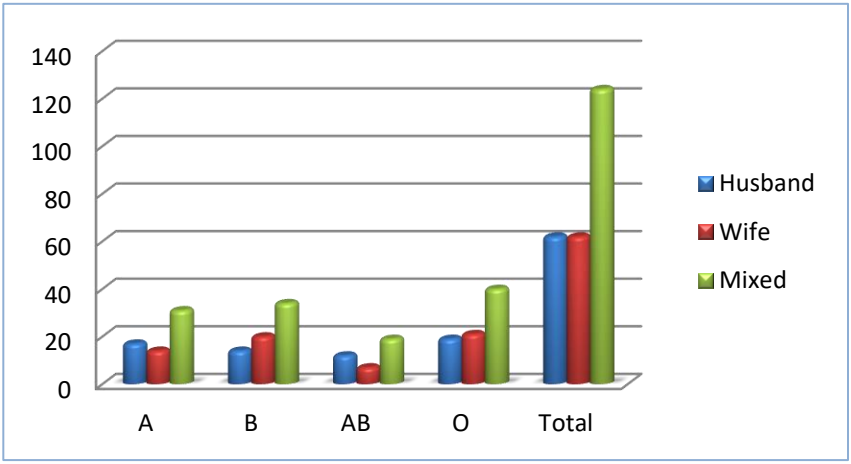


**Figure 2: frequency of ABO blood group in spontaneous repeated abortion.**

While, table 2 shows the frequency of ABO blood group of husband/wife mating was highest in blood group A/B, and Lowest in

blood group AB/AB. However, table 3 show the highest number of abortion group was from blood group O and the lowest No. of abortion group was from blood group AB. In addition to, the highest number of control group was from blood group O and the lowest number of control group was from blood group AB.

**Table 3: Frequency of ABO joint blood group according to husband/wife mating**

| Number | Joint blood group | No. of couples |
|---|---|---|
| 1 | A/A | 6 |
| 2 | A/B | 13 |
| 3 | A/O | 10 |
| 4 | A/AB | 5 |
| 5 | B/B | 3 |
| 6 | B/O | 8 |
| 7 | B/AB | 4 |
| 8 | O/O | 9 |
| 9 | O/AB | 2 |
| 10 | AB/AB | 1 |
| Total | | 62 |

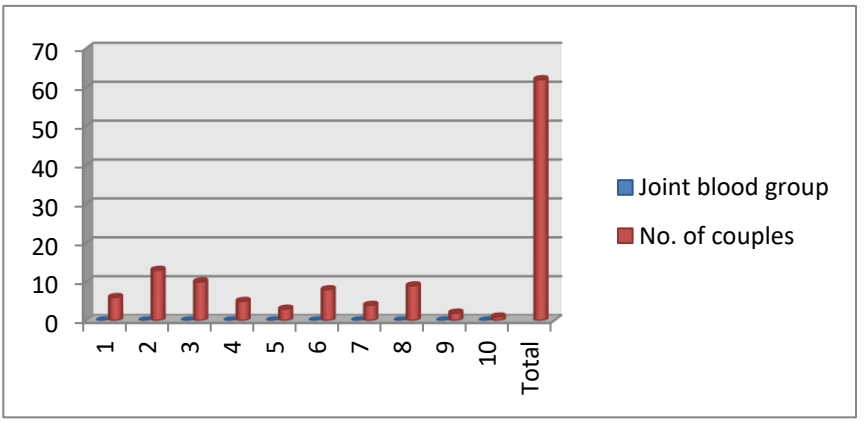


**Figure 2: Frequency of ABO joint blood group according to husband/wife mating.**

In table 3 shows the second group in frequency in aborted group was blood group B while in normal group was blood group A.

**Table 4: Comparison of ABO blood group frequency between repeated abortion and normal cases.**

| Sr. No. | Blood group | Normal group | Abortion group |
|---|---|---|---|
| 1 | o | 41 | 38 |
| 2 | A | 29 | 33 |
| 3 | B | 20 | 34 |
| 4 | AB | 10 | 19 |
| Total | | 100 | 124 |

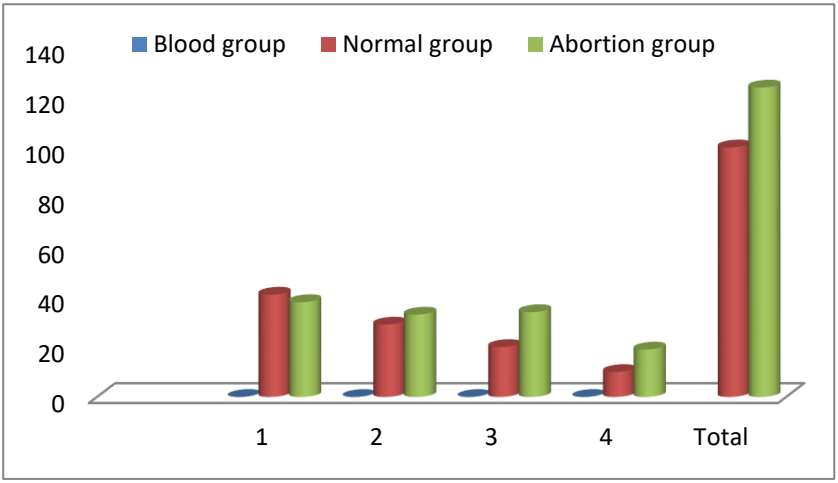


**Figure 3: Comparison of ABO blood group frequency between repeated abortion and normal cases.**

**Discussion**

ABO blood group system is one of the most commonly used factor in different investigation especially in human population genetics for its

important role and easy availability as compared with other tissues of the human body (10).

We agree with Ali Mohammed (study done in Ahvaz medical college in Iran) about the frequency of blood group AB was the lowest one. In our study the most common blood group (mixed) was blood group O, this is not similar to study done by Ali Mohammed in which the most common blood group was blood group A and this is may be due to differences in the communities.

Our study agree with previous studies (3, 10, 13), In couples with repeated spontaneous abortion (RSA), it has recently been shown that there are a high number of A incompatible couples (i.e., husband possessing A specificity of ABO system and mother possessing anti-A immunoglobulin types and a low number of B incompatible couples with respect to reciprocal mating types (3, 13).

Most of the differences between A and B incompatibility observed in RSA couples are due to a decreased proportion of couples characterized as wife A/husband B (B incompatible) with respect to reciprocal mating type, which would be wife B/husband A (A incompatible) (13).

The joint ABO bloods group of husband/ wife mating in RA patient of this study also shows an increase toward A/B and A/O individuals. In this type of analysis, most of the couples had A/B and A/O (husband/wife) joint blood group mating. In both of these joint blood groups, husbands have A phenotype and therefore have an antigens which in not present in wife's RBCs. Ali Mohammed study in 2004 and another study by Lucarini and Nicotra in 1995, the analysis of husband/wife joint ABO blood group distribution in couples with habitual abortion, an excess of A compared with expected proportions assuming random mating have been reported which agree with our analysis (3).

Our study agree with previous study done by Ali mohammed (2004), and Bhattacharjee PN (1961) in which the blood group O (mixed) was

the highest in normal and abortion group, and the blood group AB (mixed) was the lowest one in both normal and aborted group.

Blood group substances could play an important role in the organization of cell membrane structure and expression of membrane protein (15). Genetic polymorphism of blood groups might influence the function of proteins involved in substrate transport and signal transduction (3). On the other hand, maternal-fetal differences in membrane transport and signal transduction of growth factors could affect intrauterine development and survival (17).

Thus, maternal-fetal differences in ABO membrane protein structure, which is originated from wife/husband differences, could be involved in the maternal-fetal biological competition by mechanisms different than those implicated in classical immunological phenomena. The long evolutionary history of ABO and H structures, present in the cell membrane long before the appearance of immunological phenomena, argues in favour of this possibility (18).

## 4. Conclusion

The ABO is evidently an important tool for investigating human population genetics. The presented evidence demonstrates a links repeat spontaneous abortion to blood group incompatibly among couples with a high incidence of A incompatible couples compared to B incompatible couples. In the context of cell physiology, the factors of blood group composition, genetic polymorphism of blood groups and maternal-fetal differences significantly determine intrauterine development and survival of the fetus. According to this result, we recommended that ABO blood group system should be included in future investigations related to spontaneous repeated abortion.

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