Case Report

Bombay Blood A Rare Entity

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Abstract

The aim of blood bank is safe transfusion of the blood from donor to recipient without harming both. Landsteiner discovered ABO blood group system in 1901 and Rh system in 1940. After this, blood transfusion became much safer.

Determining blood grouping and cross-matching is an essential prerequisite for blood transfusion. Nearly 400 red cell antigens have so far been discovered. Among the available blood group systems, ABO blood group system was first to be identified and Rh blood group system was the fourth one. Both are important for safe blood transfusion.

If proper blood grouping or testing practices are not followed, it can lead to people with Bombay blood group not being detected. This group would be categorized as the O group because it would not show any reaction to anti-A and anti-B antibodies, similar to the O group. When a cross matching with O group is done, then it would show cross-reactivity or incompatibility. Therefore reverse grouping or serum grouping has to be performed to detect this group.

We present one such rare case which was diagnosed in our hospital.

Key Words: *Bombay phenotype, Oh blood group, rare blood type, blood antigens*

INTRODUCTION

When we say someone has blood group A, it means that the person has antigen of type 'A' antibody of type 'B' in his /her blood. People with AB have both antigen A and B in their blood and no antibodies. People with O blood group have only antibodies A and B and no antigens. However what is not generally known is that all these groups have an antigen H in the blood as well. There are very few people who do not have this antigen H also in their blood. Instead they have antibody H because of which no other blood can be given to them. Such people are believed to have the Bombay blood group.

People of the Bombay blood group produce antibodies against H, A and B antigen to protect themselves. Since they have antibodies against H, A and B antigens, they can only receive blood transfusion from with Bombay blood type. Receiving blood transfusion from the other ABO

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blood groups can be fatal. The antibodies of the Bombay blood react with the red blood cells of the donor and causes cell death.

CASE HISTORY

We report a case of 19 year female with bad obstetric history having intra-uterine death with anemia (Hb-8gm %) which was referred to our hospital. Blood transfusion was advised and her blood sample was sent to the blood bank for grouping and cross matching. The ABO and Rh-D typing were performed as per the AABB Technical Manual. Both cell and serum grouping were done. Red cell typing was done with commercial anti-sera and serum grouping was done using known cells from pooled blood units.

The red cells grouped like the O group, while her serum reacted with all O group cells available in the blood bank during cross matching or compatibility test, making us realize that the patient is carrying the rare Bombay Blood Group. Reverse grouping or serum grouping was performed to confirm this group. The difficulty with the Bombay blood group (Bombay phenotype Oh) is that the individuals having this group can either receive autologous donation or blood from an individual of Bombay phenotype only; no other blood will match in case of an emergency blood transfusion. As this blood group is very rare we could not find a single unit of this blood group in Kolar and immediate blood transfusion could not be undertaken.

In the present case we could not detect the Bombay blood group of the patient's parents as they were not alive and her younger brother was found to be Bombay phenotype negative. Ultimately, after about 8 hrs, through the help of voluntary organization we could get 2 units of this blood group from Bangalore After transfusion, the patient's Hb improved to 10.5 gms% and was discharged on request with regular follow-up.

DISCUSSION

The prevalence of Bombay blood group (Oh Pheotype) in Kolar district of Karnataka, is not precisely known. Reported prevalence in Karnataka and that of Tamil Nadu is 0.004 & 0.005% respectively[1]. The probability of finding a person with Bombay blood type is 1 for every 2,50,000 people[2]. India has the highest number of people with the Bombay blood group where there is 1 Bombay blood type per 7,600 people[2]. Geneticists believe that the high number of Bombay blood group people in Indian is the result of consanguineous marriage among members of a caste class[3]. Higher caste class allows consanguineous marriage to maintain their position in the society and to protect their health[4].

The Bombay Blood Group is the rarest of the rare in blood groups. It is so called because Bhende et al. reported it first in Bombay, India[5]. People bearing this blood group will not possess A, B, and H antigens in their red cells. They have anti-A, anti-B and anti-h antibodies. Their sera are incompatible with all red cells except those with same rare blood groups. During cell grouping or routine grouping, Bombay blood group would be categorized as O group because they wouldn't show any reaction to anti-A and anti-B antibodies just like a normal O group. When a cross matching is done, then it would show

cross- reactivity or incompatibility. Therefore reverse grouping or serum grouping has to be performed to detect the Bombay blood group[5].

A person of the Bombay blood group inherits the recessive form of the allele for the H antigen from each of his patents. He carries the homozygous recessive (hh) genotype instead of the hemozgous dominant (HH) or heterozygous (Hh) genotype of the ABO blood group[2]. As a result, the H antigen is not expressed in the red blood cell surface; consequently, the A and B antigens are not formed[2].

The h allele is a result of the mutation of the H gens (FUTI) that would express the H antigen in the red blood cells of ABO blood group. Scientists found that people of the Bombay phenotype are homozygous (hh) for the T725G mutation (Leucine 242 is changed to Arginine) in the FUT1 coding region[1]. The consequence of this mutation is the production of an inactivated enzyme that is incapable of producing the H antigen.

All human red blood cells, with exceedingly rare exceptions (Bombay blood group), carry the red cell H antigen. It is present in greatest amount on type O red cells and least on type A1B cells[5]. This H substance is bio-chemically produced by the binding of Fucose to the surface glycoproteins, the process being catalyzed by Fucosyl transferase. If N-Acetyl galactosamine binds to the H substance, it forms the blood group A, whereas if galactose binds to it, it forms the group B. Absence of any binding substance to H produces the O blood group. The Bombay phenotype is characterized by mutations or deficiency is Fucosyl transferase[5].

There is a para-Bombay phenotype (denoted Ah, Bh, and ABh). These are observed in individuals with weakly expressed A or B, but not H, on their red cells; no A or B antigens are found in the plasma transferase is not detectable, but appropriate A and B transferases are present[6]. It is though that the small amount of H substance synthesized is transformed completely to A or B by the respective transferase[6]. Many of the European cases, which were initially labeled as typical Bombay phenotypes turned out to be para - Bombay phenotypes after absorption-elution studies[6].

Balgir has the incidence of 1 in 278 of the Bombay phenotype among the Bhuyan tribal population of Orissa[9]. Balgir has also reported an incidence of 1 in 33 among the Kutia Kondh primitive tribe from Kandhamal district of Orissa[7]. According to Balgir the practice of endogamy and consanguinity amongst the Bhuyan and Kutia Kondh primitive tribe are the major factors for the relatively high prevalence of recessive rare alleles like Bombay phenotype[7].

There is no published data available in the literature on the caste/tribe-wise distribution of the Bombay phenotype in India. Moreover, most of the reported cases were either referred cases or were hospital cases seeking blood transfusions. Hence, the prevalence of the Bombay phenotype, based on random population screening is only available in India[1]. It is interesting to note that the incidence of the Bombay phenotype is high in those states of India where consanguineous marriages are more prevalent than in the other states[3].

Since the Bombay blood group is the rarest blood group, it is desirable to develop cryopreservation

facilities for rare donor units. Every blood bank can easily maintain a rare blood type donor file from amongst their regular voluntary donors, If the blood banks can borrow or exchange rare blood units in times of need, a lot of problems related to rare blood groups like the Bombay blood group can be solved. This is only possible if each blood bank has a large number of committed regular voluntary donors. Persons with Bombay blood group should get all the family members and relatives of the patients tested for the blood group. Its's very likely that one or the other relative has this group. They should also register themselves with leading blood banks or hospitals so that in case of emergency they can be contacted.

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