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CASE REPORT

# Acute Hemolytic Transfusion Reaction in a Patient with Bombay Phenotype: Implications for ABO Grouping

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**Abstract** Bombay blood group is a rare phenotype that is characterized serologically by absence of H, A and B antigens on red cell surface and presence of corresponding antibodies in the serum. We report a case of 45-year old patient having Bombay blood group phenotype who experienced an acute reaction due to transfusion of mismatched blood unit.

**Keywords** Bombay blood group · Transfusion reaction · ABO discrepancy

## Introduction

The Bombay phenotype, transmitted as an autosomal recessive trait was first described by Bhende et al. [1]. It is characterized serologically by absence of H, A and B antigens on red cell surface and presence of corresponding antibodies in the serum. Based on the genetic defect, it has been further classified into Bombay and para-Bombay phenotype [2]. In the former, there is a missense or nonsense mutation in the genes coding for enzymes α-2 and α-4 fucosyltransferase (*FUT1* gene and *FUT2* gene) whereas in the latter, there may either be a silenced *FUT1* gene present together with an active *FUT2* gene, or a mutated *FUT1* gene in which the encoded enzyme activity is greatly diminished. Bombay phenotype is characterized by red cells that are not agglutinated by antisera anti-A, anti-B and anti-H and serum that agglutinates red cells of 'O' group individuals through a wide thermal range due to presence of strongly reactive anti-H antibodies. We report a case of a patient having Bombay blood group, mistyped as O group.

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## Case Report

A blood requisition of a 45-year old Nepalese male patient was received at our institute with severe anaemia as the indication of transfusion (hemoglobin—2.7 g/dl). The patient was being treated at a peripheral hospital where he was typed as O Rh D positive. For the correction of anaemia, it was planned to transfuse one unit of packed red blood cell (PRBC) but due to the lack of adequate blood-bank facilities at the same hospital, a request was sent to another hospital which issued the unit typed as O Rh D positive. After transfusion of about 5–10 ml of blood, the patient developed marked sweating all over the body, chills and rigor, chest pain and dyspnea. Transfusion was stopped immediately and injectable steroid (hydrocortisone 100 mg stat) was administered which improved the clinical symptoms. After this, the sample of patient was sent to yet another hospital for cross-matching. At this hospital, the blood grouping was done on gel card and again interpreted as O Rh D positive. Indirect Coomb's Test and antibody screening was 4+, direct Coomb's Test (DCT) of patient was negative. Cross-match was put up with at least 12 units of O Rh D positive PRBC but all units were found to be incompatible with strength of 4+ agglutination. Finally the request for blood was sent to our institute, which is a tertiary healthcare centre in the region.

Transfusion work up at our institute was done both on tube and gel. The results as observed on tube are summarized in Table 1. Forward grouping on tube showed the

blood group to be O Rh (D) positive. However, on reverse grouping reaction was observed with $O_{cells}$. Antibody screen and ID panel showed 4+ reactivity with all the cells. Autocontrol and DCT of the patient was negative. The results of screen and ID panel on gel were consistent with those on tube. Reaction with anti H lectin (*Ulex europaeus*) was negative. The blood group was finally interpreted as *Bombay blood group with naturally occurring anti-H antibodies* in plasma. The anti-H antibodies were present in a titre of 1:16, were IgM in nature and had wide thermal amplitude (4 °C, room temperature and 37 °C).

One PRBC was collected from a known Bombay blood group donor and cross matched with the patient's serum and found to be compatible. The patient was successfully transfused without any reaction. He recorded a gradual rise in hemoglobin to 4 g/dl. An immunohematology report was prepared stating his blood group so that he is transfused blood from a Bombay blood group donor in future. Secretor studies could not be done as the patient was not fit to give saliva sample. Blood group of the patient's son was A Rh D positive.

## Discussion

In India, the prevalence of Bombay phenotype has been reported as 0.004 and 0.005 %, from Tamil Nadu and Karnataka respectively [3, 4]. In another study from Andhra Pradesh, the prevalence was estimated as 0.048 % with majority of these people showing a history of parental consanguinity [5]. Another case report from South India documented a para-Bombay phenotype in an individual with a history of consanguinity in the family [6]. In addition, there is one report of Bombay phenotype in two North Indian brothers, one of whom donated blood to the index patient [7]. As such there are no prevalence studies of Bombay blood group from North India. Balgir [8] studied the prevalence of Bombay phenotype among the Bhuyan tribe in Orissa (Eastern India) and found it to be 0.48 %. Chakraborty et al. [9] reported two more subjects with Bombay phenotype from Calcutta. In India, prevalence of Bombay phenotype is higher in southern India possibly due to the custom of consanguineous marriages in many regions which predisposes to inheritance of recessive traits. The index patient hailed from Nepal; from where there have been no previous reports of Bombay phenotype.

Despite its rarity in the population, its clinical significance should not be underestimated due to its role in transfusion reactions, hemolytic disease of newborn and in transplantation surgery. Schricker et al. [10] reported successful autologous transfusions in a patient undergoing heart surgery with Bombay blood group. Okamoto et al. [11] reported a patient with acute myeloblastic anaemia who was treated with chemotherapy and multiple transfusions without any adverse event. Lin-Chu and Broadberr [12] opined that the weak isoagglutinins in para-Bombay phenotype may not be very clinically significant and that when para-Bombay blood is not available, the compatibility testing for $O^{A}_{Hm}$, persons should be performed with group A and group O packed RBC; $O^{B}_{Hm}$ with group B and group O packed RBC; and $O^{AB}_{Hm}$ with groups A, B, AB and O packed RBC. For cross matching, the indirect antiglobulin test by a prewarmed technique should be used.

Bombay blood group has been reported to be the cause of hemolytic disease of newborn (HDN) requiring exchange transfusion [13]. However, Bhattacharya et al. [14] reported a young female with Bombay blood group who had two successful and uncomplicated pregnancies. The patient had potent high titre anti-H antibodies and the author expected the newborns to suffer from HDN which did not occur, probably due to weak expression of H antigen on infant's RBC. A similar observation was made by Jain et al. [15] at our institute.

Our patient developed transfusion reaction due to the transfusion of mismatched blood unit. Such a complication could have been avoided by screening the patient's blood for Bombay blood group, especially when there was a difficulty in getting a suitable cross matched blood unit. This case was identified due to discrepancy in forward and reverse grouping. Hence we re-emphasize screening for Bombay blood group in all cases of blood group discrepancies. This case highlights importance of both forward and reverse grouping in ABO typing. At the peripheral

**Table 1** Forward and reverse grouping on tube (pooled cells from three voluntary donors of A, B and O blood groups were used)

| Forward grouping on tube | | | | Reverse grouping on tube | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Anti-B | Anti-A | Anti-AB | Anti-D | A Cells | | | B Cells | | | O Cells | | |
| | | | | RT | 4 °C | 37 °C | RT | 4 °C | 37 °C | RT | 4 °C | 37 °C |
| Neg | Neg | Neg | 4+ | 4+ | 4+ | 4+ | 4+ | 4+ | 4+ | 4+ | 4+ | 4+ |

Auto control—negative

Reaction with anti H lectin—negative

Interpretation: Bombay blood group with naturally occurring anti-H antibodies

hospital, reverse grouping with O cells was not included. Blood grouping was done on Diamed Gel cards (Germany) which contains columns for anti-A, anti-B and anti-D antisera. For reverse grouping, it contains columns for A cells and B cells. For O cells, there is no column. There is one column for control in which autocontrol (patient's red cells and serum) is tested. Hence, for this reason, that O cells were not included in the reverse typing.

In India, the blood transfusion services are still not centrally co-ordinated and blood centres do not adhere to uniform testing standards. This could be a reason for issuance of O (Rh) D positive PRBC unit which resulted in acute haemolysis. We recommend that reverse grouping should include testing with O cells routinely in all the cases and in cases of ABO discrepancy; cell grouping should include testing with anti-H antisera. This can be done by using an appropriate gel card or alternatively by utilizing one column for O cells. Finally it may be emphasized that the time is opportune to develop rare blood group donor registries in our country with improved co-ordination among various transfusion centers.

**Conflict of interest** None.

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