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Research Article

UNEXPECTED IDENTIFICATION OF BOMBAY (OH) PHENOTYPE IN A VOLUNTARY BLOOD DONOR FROM NORTH INDIA: A CASE REPORT

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Abstract

The Bombay (Oh) phenotype is a rare blood group characterized by absence of H antigen on red cells and the presence of naturally occurring anti-H antibodies in serum. Because routine forward ABO typing may resemble group O, failure to perform reverse grouping can lead to misclassification and potentially dangerous transfusion decisions. We report the incidental detection of the Bombay phenotype in a 30-year-old voluntary blood donor during routine compatibility testing. Initial forward typing suggested group O; however, incompatibility during crossmatching prompted further evaluation. Reverse grouping demonstrated agglutination with O cells, and confirmatory testing using anti-H lectin established the diagnosis. Early identification allowed appropriate donor counseling and registration in the rare donor registry. This case highlights the importance of resolving ABO discrepancies and maintaining vigilance for rare phenotypes in donor screening.

Keywords

Bombay phenotype; Oh blood group; rare donor; anti-H antibody; ABO discrepancy; transfusion safety

INTRODUCTION

Accurate blood grouping remains fundamental to transfusion safety. While the ABO and Rh systems are routinely assessed in donor screening, rare phenotypes may escape detection if unexpected discrepancies are not thoroughly investigated. The Bombay (Oh) phenotype, first described in India in 1952, represents one such clinically significant entity [1].

In individuals with this phenotype, red cells lack the H antigen due to mutations affecting the FUT1 gene responsible for H antigen synthesis [2]. Since the H antigen

acts as the structural precursor for A and B antigen expression, its absence prevents formation of A or B determinants even when ABO genes are present. Consequently, forward grouping may resemble group O. However, these individuals produce naturally occurring anti-H antibodies that react with all conventional ABO groups, including O [2,3].

If not recognized, transfusion with standard group O red cells can result in acute hemolytic reactions. Although reported across India, the frequency varies geographically, with fewer documented cases from northern regions [4]. We describe the unexpected detection of the Bombay phenotype in an apparently healthy voluntary donor from North India during routine blood grouping.

CASE REPORT

A 30-year-old male weighing 54 kg presented to our blood centre for voluntary blood donation. He had no prior donation history and denied any systemic illness. Standard donor selection procedures were followed, including medical history review, physical examination, hemoglobin estimation, and informed consent.

Initial ABO forward grouping using anti-A, anti-B, and anti-AB antisera showed no agglutination, suggesting blood group O. However, during routine compatibility testing, cross matching with O group red cells demonstrated unexpected incompatibility.

To resolve this discrepancy, repeat forward grouping and reverse grouping were performed. Reverse typing revealed agglutination of the donor's serum with A cells, B cells, and O cells. The reaction with O cells raised suspicion of the Bombay phenotype (Figure 1).

Figure 1. Showing routine ABO Blood Grouping by gel card

Confirmatory testing was conducted using anti-H lectin, which demonstrated absence of agglutination, confirming lack of H antigen expression. All procedures were performed using standardized reagents and internal quality controls.

The donor was informed about the rare blood group status and counseled regarding its clinical implications. He was enrolled in the institutional rare donor registry for future reference.

DISCUSSION

This case underscores the importance of resolving ABO discrepancies encountered during routine donor screening. The donor initially appeared to be group O on forward typing; however, incompatibility during cross matching prompted further evaluation. Without reverse grouping, this phenotype could have remained undetected. The Bombay phenotype results from absence of functional H antigen synthesis, typically due to mutations affecting the FUT1 gene [2]. Because H antigen is required for A and B antigen formation, red cells lack detectable ABO antigens and may mimic group O. The distinguishing feature is the presence of anti-H antibodies in serum. These antibodies are usually IgM and capable of complement activation,

thereby posing a risk of intravascular hemolysis if incompatible transfusion occurs [3].

From a laboratory standpoint, this case highlights several critical principles:

1. **Reverse grouping must always accompany forward typing**, particularly in donor screening.
2. **Unexpected cross match incompatibility requires systematic evaluation.**
3. **Testing with anti-H lectin remains essential** when serum reacts with O cells.
4. **Rare donor registries play a vital role** in ensuring availability of compatible blood in emergencies.

The estimated prevalence of the Bombay phenotype in India is approximately 1 in 10,000, although regional variation exists [4]. While western India reports comparatively higher frequency, documentation from northern states is limited. Identification in our donor from Haryana adds to regional data and emphasizes the need for continued vigilance.

In addition to clinical implications, early detection during voluntary donation allows preemptive counseling and registry inclusion, reducing delays during potential future transfusion needs. The case reinforces that even in the era of automated grouping systems, adherence to fundamental immunohematological principles remains indispensable.

CONCLUSION

The Bombay (Oh) phenotype may be misinterpreted as group O if reverse grouping is omitted. This case highlights the necessity of comprehensive ABO testing protocols, including reverse typing and anti-H lectin testing when discrepancies arise. Early recognition during donor screening not only prevents incompatible transfusion but also facilitates rare donor registry enrolment, thereby strengthening transfusion preparedness.

Conflict of Interest

Authors declared no conflict of interest.

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