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THE IMPORTANCE OF ACCURATE BLOOD TYPING: A CASE OF BOMBAY BLOOD GROUP MISDIAGNOSIS

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Abstract

The unique Bombay blood group system is characterized by the lack of A, B, and H antigens on red blood cells and A, B, and H proteins in saliva. Antibodies against A, B, and H are found in the serum and result in the clumping together of blood cells in all blood types within the ABO system. Therefore, there is a substantial danger associated with receiving blood transfusions from incompatible blood types. We provide a case study of an elderly male who was initially classified as having the O blood type without undergoing additional testing. This case highlights the challenges associated with identifying and managing rare blood types.

Keywords: Blood Group, Red Blood Cells, Phenotypic, Uncommon, and Transfusions.

INTRODUCTION

The Bombay and Para-Bombay blood groups are atypical phenotypes observed throughout Asia. The Bombay phenotype is more widespread in Asia, while the Para-Bombay phenotype is more prevalent in East Asian countries.[1] The classic Bombay phenotype is caused by a silent mutation in FUT1 (H gene) and FUT2 (Se gene), which causes insufficient production of fructosyl transferase, which is required for H antigen synthesis [2]. As a result, in the Bombay phenotype, H antigens are completely absent from both red blood cells (RBCs) and bodily secretions. Therefore, when patients with the Bombay blood group receive a transfusion of A, B, or O blood types, they may experience severe hemolytic transfusion reactions due to the production of anti-H antigen antibodies [3]. Consequently, individuals with the Bombay blood group can exclusively receive blood or blood components from donors who possess the identical blood type.

In a blood centre, distinguishing between the O and Bombay blood groups begins with reverse grouping. Unlike the O blood group, Bombay individuals exhibit O cell agglutination due to the existence of anti-H [3]. Therefore, reverse grouping is vitally crucial in establishing the proper ABO blood typing and addressing any discrepancies in ABO blood groups. This case report documents the first misdiagnosis of the patient's

blood type as O. Later, when the patient's cells were treated with anti-H lectin, no agglutination occurred. Furthermore, secretor investigations demonstrated the absence of A, B, and H components in saliva, supporting the Classical Bombay phenotype.

Case Report

A 77-year-old male patient was hospitalized due to a fracture in the femur bone. He showed no signs of losing consciousness or bleeding in his ears, nose, or throat. He had no prior medical record of bleeding disorders and was not currently on any medication. In our laboratory, he was diagnosed as having O positive blood. This patient's blood was divided into groups. Cell grouping was performed, and there was there is no agglutination observed in the Anti-A, Anti-B, and Anti-H. [Figure 1]. Therefore, we inferred that it was the Bombay blood group. We conducted serum grouping and observed agglutination with a combination of A, B, and O cells. Upon observing a discrepancy between forward and reverse grouping, we reached the conclusion that the patient possesses the Bombay blood group. We choose to assess the patient's secretor status by employing the Wieners hemagglutination inhibition test [2] to identify a substance present in the saliva. Our findings revealed that the patient exhibited a lack of H substance secretion in the saliva [Figure 2]. The patient was found to be Rh positive. The blood typing of his family member was also conducted. His son's and his wife's blood groups were O Rh positive, and all showed 4+ agglutination with Anti-H reagent.

DISCUSSION

Bombay is an exceedingly rare blood group, with only a handful reported examples. ABH antigens are absent on both RBCs and bodily secretions in the Bombay phenotype. The H antigen acts as a precursor for the A and B antigens, and is present on all red blood cells except in the uncommon Bombay and para-Bombay phenotypes, where it is either absent or deficient. The Para-Bombay phenotype is characterized by the absence or limited presence of ABH antigens on red blood cells (RBCs) and the occurrence of ABH compounds in body secretions.

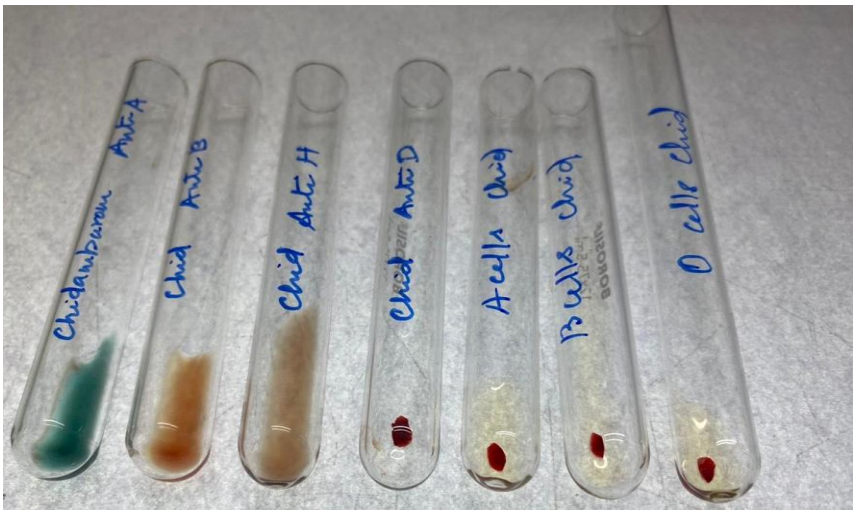

Figure 1: Forward grouping demonstrated no agglutination with Anti-A, Anti-B, or Anti-H reagents. Reverse grouping revealed agglutination with pooled A, B, and O cells. Rh typing was positive.

The A and B antigens are defined by the ABO genes, whereas the H antigen is produced by the α(1,2) fucosyltransferase (FUT) genes. FUT1 (H gene) identifies the existence of H antigen on red blood cells, whereas FUT2 (Se gene) identifies H antigen in body secretions. FUT1 enzyme synthesizes the H antigen, which is mostly found in red blood cells and vascular endothelial cells, by adding fucose molecules to the Type 2 chain oligosaccharides on glycoproteins and glycolipids [3].FUT2 is responsible for detecting Type 1 chain precursors and generating H Type I antigen in secretions and tissues, including secretory glands and digestive mucosa. The Bombay phenotype is characterized by the absence of ABH blood group antigens on red blood cells (RBCs) and in saliva. This is due to silent mutations in the FUT1 (h/h) and FUT2 (se/se) genes [6].Para-Bombay is the result of a quiet FUT1 gene (h/h), but an active FUT2 gene (Se/Se or Se/se) that produces H Type I antigen (as well as A/B antigens) in secretions (known as H deficient secretors) that can be absorbed onto red blood cells from the plasma. On the other hand, a mutant FUT1 gene can result in reduced levels of H Type II antigen (as well as A/B antigens) on the outer layer of red blood cells. These reduced levels can only be identified via adsorption and elution procedures [6].

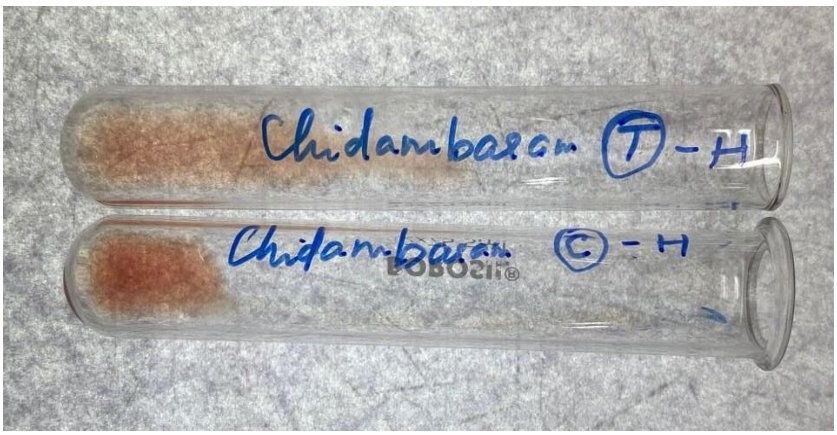

Figure 2: The patient did not secrete any H material in their saliva.

We are presenting an exceptional situation due to its exceedingly low frequency. India has documented just a limited number of cases of the Bombay blood group thus far. In addition, our case report provides details regarding this atypical occurrence at a tertiary care facility. This condition is characterized by the lack of A, B, and H antigens on red blood cells, as well as in saliva and secretions from the gastrointestinal and genitourinary tracts. The patient experienced a fracture in their femur and had no prior record of receiving blood transfusions. In our laboratory, he was identified with blood group O. It is crucial to accurately identify this phenotype to avoid mislabeling it as the O group and mistakenly transfusing it to the patient, which could lead to hemolytic transfusion events.

CONCLUSION

The Bombay phenotype was identified in both cell and serum groups. This case study emphasizes the need of forward and reverse grouping, as well as employing the Anti-H reagent on all O group members. Secretor analysis can be used to further investigate the Bombay phenotype and confirm it.

Declaration of patient consent

The authors confirm that they have obtained all necessary patient consent paperwork. The patient(s) have provided consent for the publication of their images and other clinical information in the journal. The patients are aware that their names and initials will not be disclosed, and efforts will be taken to hide their identities, although complete anonymity cannot be assured.

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Conflicts of interest

There are no instances where personal interests could potentially influence or compromise the impartiality or objectivity of the situation.

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