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"BOMBAY BLOOD GROUP- DETECTION AND STUDY OF PREVALENCE OF THIS RARE PHENOTYPE ALONG WITH THE TRANSFUSION RECOMMENDATIONS"

Medicine

Dr. Smita Mahapatra* M.D., Associate Professor, Department of Transfusion Medicine, S.C.B. Medical College, Cuttack, Odisha. *Corresponding Author

Dr Rashmita Panigrahi Junior Resident, Department of Transfusion Medicine, S.C.B. Medical College, Cuttack, Odisha.

Dr Debasish Mishra Senior Resident, Department of Transfusion Medicine, AIIMS, Bhubaneswar, Odisha.

Dr Gopal Krushna Ray Junior Resident, Department of Transfusion Medicine, S.C.B. Medical College, Cuttack, Odisha.

Dr Pankaj Parida Professor, Department, of Transfusion Medicine, S.C.B. Medical College, Cuttack, Odisha.

ABSTRACT

Four main blood types routinely identified are A,B,AB and O. Bombay phenotype individuals are typed as group O on forward ABO typing. Their red cells lack A,B,H antigens and their sera contain anti-A, anti-B and anti-H. It is important to correctly type individuals who are Bombay phenotypes because these individuals require autologous blood donation or blood from another Bombay individual. The present prospective study was conducted over two years to study the prevalence of Bombay phenotype with transfusion recommendations to the blood recipients. All the donor and patient's blood group were confirmed by tube method. All blood samples showing O blood group on froward grouping and agglutination with O cell in reverse grouping, were tested for Bombay blood group using anti-H.Out of 76,204 cases constituting 49,604 donors and 26,600 patients, Bombay phenotype was detected in 12 cases (0.015%) constituting 4 number of donors and 8 number of patients. All cases were further ruled out to be para Bombay phenotypes and were found to be non secretor by agglutination inhibition test. Four cases out of 12 patients requiring blood transfusion 3 could be issued Bombay blood group and but death occurred in one case due to delay in the surgery for the unavailability of this rare phenotype. Thus, it is recommended that all blood group donors and patients should be routinely screened by both forward and reverse grouping for screening of Bombay phenotype to reduce the risk of hemolytic transfusion reaction resulting from issue of O blood group to Bombay blood group recipients

KEYWORDS

Bombay Oh phenotype, Hemolytic transfusion reaction, H antigen

INTRODUCTION:

In the last two decades the focus was on the screening of transfusion transmitted infections for the supply of safe blood for transfusion. However, the reports of laboratory errors continue to be the main causes of incompatible, thus in inappropriate blood transfusion resulting in mortality and severe morbidity of the patients. Thus, rare blood groups need to be identified both in donors and patients for the life saving situations.

Bombay phenotype is extremely rare, since it occurs in about 1 in 10,000 individuals in india, I in 1,000,000 individuals in Europe [1] and 1 in 2,50,000 in Caucasian.[2,3] This phenotype was first discovered in Bombay, India in 1952 by Bhende et al. [4] In this blood group, no A,B and H antigens are identified on red blood cells and anti-A, Anti-B and anti-H are present in serum reacting with all O group blood. These individuals are genetically termed as homozygous hh or Bombay phenotype and are non-secretors of ABH. The difficulty with Bombay phenotype is that individuals having this group (Oh) can either receive autologous blood donations or blood from an individual with Bombay phenotype only: no other blood will match emergency blood transfusion. Thus, in the present study we aimed at the detection of this rare Bombay phenotype in both the healthy blood donors and the patients with recommendations of blood transfusions in recipients with Bombay blood group.

MATERIALS AND METHOD:

The study was carried out from January 2015 to December 2016 in the Department of Transfusion medicine in Sriram Chandra Bhanja(SCB) Medical College and Hospital,Cuttack in the state of Odisha in India on 76,204 cases comprising of both healthy donors(49,604) and patients (26,600). Routine blood grouping of blood donors and patients was done using tube technique for both forward and reverse grouping. Anti-A, anti-B and anti-AB for forward reaction were used and agglutination of plasma with A,B and O(H) red cells (reverse reaction) were also tested for presence or absence of antibodies in the serum. All blood samples showing O blood group with agglutination with O cell were tested for Bombay blood group by both slide and tube methods. In slide method, one drop of commercial available anti-H and negative control (normal saline) were placed on a slide, mixed and checked for agglutination. In tube method, one drop of anti-H lectin and one drop of 5% red cell suspension, washed in isotonic saline solution were mixed, shaken to homogenize, then centrifuged and checked for agglutination.

Bombay blood group was confirmed by adsorption elution technique to rule out para Bombay phenotype which carry weak subgroups of A or B. Red cells of Bombay blood group persons were washed, anti-A/anti-B mixed, incubated and centrifuged to pack the red cells. After washing thoroughly, it was eluted and the elute was tested with A/B cells.

To check the secretory status of Bombay group persons, inhibition test was performed. Fresh saliva of these cases were collected, boiled, centrifuged and supernatant was used used for testing. In two tubes marked one and two, two drops of each of anti-H lectin was taken. Saliva and normal saline (each 100µl) were taken in each tube, mixed well and incubated. To this, 50 µl of 5% cell suspension of known O red cells were added, mixed ,incubated and centrifuged. History of any consanguineous marriage was recorded.

RESULTS:

Of the total 49,604 blood donors constituting 47,681 male donors and 1923 female donors, O blood group was found in maximum number (19,383) followed by group B(16,292), A(10,428) and AB(3501) (FIG 1). Bombay blood group was found in four cases (0.008%) who were males in the entire donor study group(FIG 3). Out of 26,600 patients constituting 15,960 male patients and 10,640 female patients, O blood group had the highest prevalence of (10,108) followed by group B(8797), A(5598) and AB(2157) (FIG 2). 8 cases each of 4 male and 4 female patients were detected of having the Bombay blood group out of 26,600 patients (0.03%) (FIG4). Total prevalence in the present study was found to be 12 out of 76,204 cases (0.015%) (FIG 5). In

adsorption elution technique, there was no agglutination with A/B cells confirming it to be Bombay and not para Bombay phenotype. Saliva testing of these cases by inhibition assay showed agglutination and proved them to be non-secretor of H antigen. Consanguineous marriage was observed in none of these 12 cases. Out of 8 patients, blood transfusion was required in 4 cases where Bombay blood group blood could be arranged for 3 cases and one patient died due to unavailability of this rare phenotype blood.

DISCUSSION:

The discovery of Bombay phenotype in three unrelated donors in Mumbai, India by Bhende in 1952 was a milestone in the field of immunohematology. [4] This phenotype is characterized by absence of A, B & H antigens on red cells and the presence of anti- A, anti-B and anti-H. These individuals are genetically termed as homozygous recessive 'hh'. They phenotype as blood group O on normal ABO blood grouping, but cross matching shows incompatibility to O blood group. [7] They are Lewis antigen positive (Lea+) [4]

The H locus contains the FUT1 gene expressed on the red cells. The Se locus contains FUT2 gene expressed on secretory glands. FUT1 and FUT2 genes are located on chromosome 19 q 13.3. H null Bombay phenotype depends on a nonsense mutation at G695A of the FUT1 or h1 gene. [8] Their salivary nonsecretor phenotype is due to a point mutation in C357T in FUT2 gene. The para Bombay phenotype is due to four inactivated H gene alleles,h2, h3, h4 and h5. [8]

In the present study we found 12 cases of Bombay phenotypes out of 76,204 cases that is One in 6350 (0.015%) in our tertiary care hospital in Odisha, India which varied from the previous studies on Bhuyan tribe in Odisha showing incidence of Bombay blood group one in 278 [9] and one in 33 in Kuntia Kondh tribe in khandhamal district in the state of Odisha, India. [10] The author had concluded that the high prevalence of Bombay blood group in these tribes was due the practice of endogamy and consanguinity which result in the increased homozygous expression of rare recessive genetic characters like Bombay phenotype. But, even one case of consanguinity was not found in our study. The incidence is also higher in those states of India where consanguineous mating is more prevalent especially in Southern and Western states like Andhra Pradesh , Tamil Nadu, Karnataka, Maharashtra, Gujarat etc than other states. [9,10,11] Varying incidence of Bombay phenotype is found in different parts of India; 1in 7,600 individuals in Mumbai, [12] (our study also shows 1 in 6350 cases),1 in 4500 in the rural population from Ratangiri and Sindhudurg districts of Maharashtra. [13]

Although the Bombay phenotype seems mostly confined to South-East Asian countries cases have been detected in Sri Lanka, [14] Thailand [15] Japan [16] and Malaysia. [13] Seven cases have been detected in two generations of an Indian family who had settled in USA. [17] The individuals were native of the sate of Odisha India. Twenty four cases have been reported in natal in South Africa among 11 unrelated Indian families who were either Tamil or Telugu speaking.

The Bombay phenotype has a substantial clinical significance particularly in developing countries. When a patient with the Bombay phenotype need blood transfusion, they can receive only autologous blood or blood from Bombay donor. A previous report has been described where a patient of Bombay phenotype who was wrongly grouped as group O and developed severe hemolytic transfusion reaction after receiving group O donor blood. [18] But, in the present study, all the four patients of Bombay phenotytpe requiring blood transfusion were crossmatched with O group blood as they depicted the patient as O group and found incompatible in the presenting hospitals and referred to us. This observation highlights the need to carry out both forward and reverse typing in ABO blood grouping before blood is selected and cross-matched in hospital blood banks.

The concern with Bombay blood group is that the individuals having this group can only receive either autologous blood donation or blood from an individual with Bombay phenotype. [9] It is important to identify it in emergency situations, because any other type of blood being used can have lethal effects on the recipient. This happened in one patient in our study who died due to the unavailability of this rare phenotype for blood transfusion. It is recommended that individuals with Bombay blood group should get all their family members and relatives tested for the blood group. They should also register themselves in with leading blood banks so that in case of emergency they can be contacted. [9] Few others have suggested about the cryopreservation facilities for rare donor units. If blood banks can borrow or exchange rare blood units at the hour of requirements, a lot of problems related to rare blood groups like Bombay group can be solved. In the absence of blood donor registry, transfusion management of patients requiring immediate surgery can be challenging. [19] Acute normovolumic hemodilution (ANH) is a blood conservative technique where blood is removed from a patient shortly after induction of normovolumia using crystalloid and or colloid replacement. The blood is infused into the patient during or shortly after the surgical procedure. [20] If ANH is available, it is cost effective and reduces the blood viscosity. [19] Newer research with stem cell has provided an opportunity to produce an universal blood group donor, in vitro, thus enabling cellular replacement therapies, once the safety issue is resolved. [21]

Thus, it is recommended that all blood group O donors and recipients should be routinely screened for Bombay phenotype to reduce risk of a patient with this rare phenotype to be transfused with O blood group causing a blood transfusion reaction.

FIGURE 1: Distribution of gender in the donor population

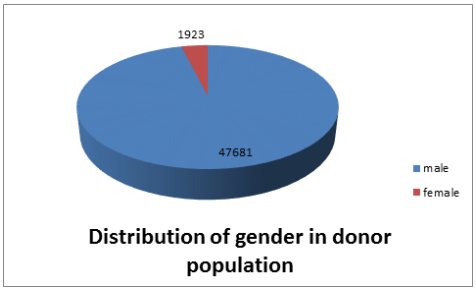


FIGURE 2: Distribution of gender in the patient population

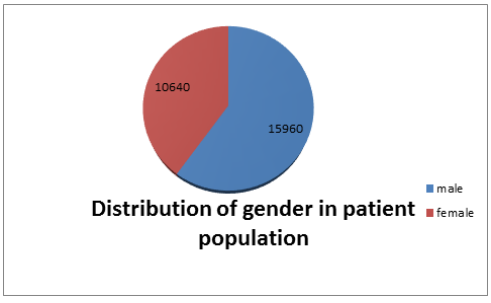


FIGURE 3: Number of Bombay phenotype in donor

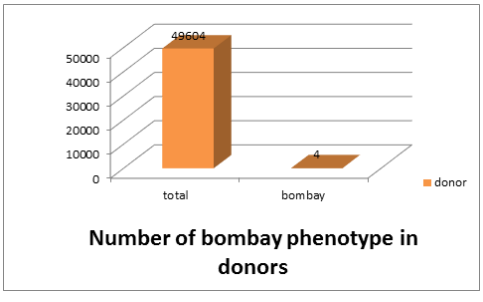


FIGURE 4: Number of Bombay phenotype in patient population

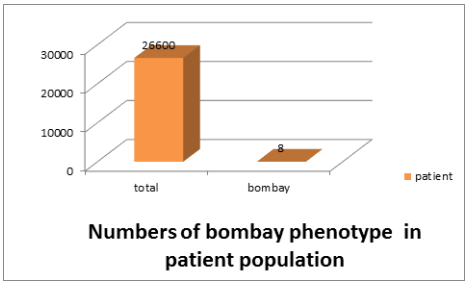
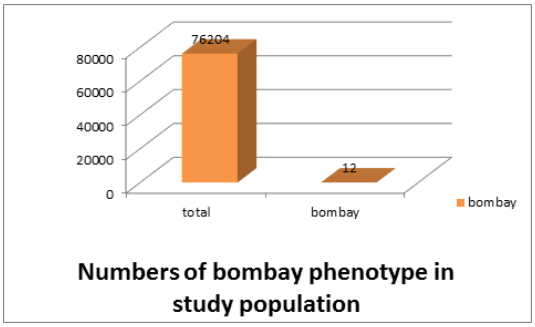


FIGURE 5: Number of Bombay phenotype in study population



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