Case Report

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A rare Bombay (Oh) phenotype to 'A' blood group – Live donor liver transplant

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Abstract:

Bombay (Oh) phenotype is the rarest blood group in India characterized by the absence of A, B, and H antigens and the presence of anti-H antibodies besides anti-A and anti-B. There is no literature predicting the safety of Oh blood group organ donation to non-Oh blood group recipient. We present the first reported case of successful live donor liver transplantation from an Oh-positive liver donor to an A-positive blood group recipient with hepatitis B virus-related chronic liver disease. The case highlights the need for proper immunohematological workup, national registry of rare group blood donors and need of protocol for perioperative monitoring and blood management in ABO-incompatible organ transplants involving Oh group donor or recipient.

Keywords:

Bombay, incompatible transplant, Oh, rare group, registry

Introduction

Bombay (Oh) red cell phenotype is one of the rarest blood groups in India. It differs from O blood group by lacking H antigen on red blood cells and the presence of anti-H, anti-A, and anti-B antibodies in serum.[1] There is no literature involving Oh phenotype organ donation to predict the safety of the same in non-Oh blood group liver recipient. We present the first case of successful live donor liver transplantation from an Oh-positive liver donor to an A-positive recipient with hepatitis B virus (HBV)-related liver cirrhosis at multi-organ transplant center in South India.

Case Report

A 52-year-old male from Andhra Pradesh diagnosed with HBV-related liver cirrhosis (Model for End-Stage Liver Disease 18, child C) was evaluated at our institute for liver transplantation as a definitive curative option. The prospective donor was his nephew, a 35-year-old healthy male.

Blood grouping for both recipient and donor samples was performed using Biorad Gel technology. The recipient's blood group was A_1 positive. While the donor's blood group showed discrepancy with forward grouping O positive and reverse grouping showed discrepancy with 4+ reaction with O cells. The grouping was further confirmed by testing with H lectin. It did not show any agglutination with H lectin. Hence, the blood group was confirmed as Bombay (Oh)-positive blood group. The anti-H titer of donor in immunoglobulin G (IgG) and IgM phase was 1:64 and 1:32, respectively. The saliva inhibition test confirmed the absence of A, B, or H substance in saliva. He was informed to be having Bombay (Oh)-positive blood group and underwent detailed counseling

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about the procedure and then successfully completed evaluation to be a liver donor.

After complete Preoperative workup and counselling, the team agreed to go ahead with Oh to A group Liver transplantation. Additional pretransplantation investigations were carried out. As per our bank transfusion support protocol in transplantation, the search of Bombay blood group donors was initiated from our in-house blood donors to small registries from other blood banks from Chennai. Sankalp Foundation, a national registry for Bombay group donors, was contacted.[2]

Preoperative autologous blood donation was planned at a gap of every 7 days was initiated as a necessity to support the donor in case of any blood loss during the surgery.[3] Before the collection, the patient was given erythropoietin 4000 IU subcutaneously twice a week, intravenous iron succinate 100 mg every 3 days, and folic acid tablets 5 mg/day.

The baseline hemoglobin level was 15.4 g/dl. A total of Three units of autologous blood donation were collected at the weekly interval with the last unit collection 5 days before hepatectomy surgery and preoperative hemoglobin was 12.6 g/dl. Leukodepleted packed red blood cell (LDPRC) and fresh frozen plasma (FFP) blood components were prepared, labeled, and reserved for donor. The liver donor did not require any blood transfusion intraoperatively and in the postoperative period. His postoperative hemoglobin was 11.3 g/dl.

The patient received cross-matched (recipient group) A-positive red cells during intraoperative and postoperative period. Intraoperative red cell salvage was carried on for both the donor and recipient to minimize the blood loss.

The pretransplant recipient hemoglobin was 9.3 g/dl, platelet count was 51400/µl, and international normalized ratio was 1.79. The recipient required four units of A-positive LDPRC, one unit of Group A FFP, two units of A group single donor platelets, and ten units of cryoprecipitate intraoperatively.

The entire operative and postoperative phases were uneventful for both Bombay blood group liver donor and Bombay liver recipient (A+). The liver graft was flushed generously to remove anti-H and anti-A antibodies to minimize the postreperfusion immediate hemolysis. In case of post-transplant hemolysis due to any possibility of donor-derived antibodies, option of Oh blood group red cell transfusion or desensitization option using therapeutic plasma exchange was discussed and planned. Bombay blood group donors were contacted, and two donors were kept in reserve in case of emergency requirement for 2 weeks. However, there was no evidence of hemolysis in intraoperative or postoperative period. Direct Coombs test was checked between 7 and 14 days postoperative period and remained negative. The hemoglobin of donor was 12.6 g/dl and was discharged in 9 days. The recipient was discharged after 21 days with hemoglobin 9.5 g/dl.

His three units of autologous blood were kept until discharge of both donor and recipient. The autologous units remained unused and were discarded after expiry.

Discussion

Bombay blood group phenotype is very rare reported first in India by Bhende, *et al*., in 1952.[4] Estimated prevalence is 1 in 10,000 in India and 1 in 1,000,0000 in Europe.[5] In India, the prevalence is reported as 0.004% and 0.005% in Tamil Nadu and Karnataka, respectively.[6,7] Another study from Andhra Pradesh estimated the prevalence as 0.048 with the majority showing the history of consanguineous marriage.[8] More than 179 people are known to have Bombay blood group in India.

The Bombay group (HH) results from the inheritance of two rare recessive H genes occurring at the HH locus. In the Bombay phenotype, fucosyltransferase, which conveys H antigen specificity, is lacking. Since the H antigen is the main precursor for the formation of A and B antigens, therefore, neither A nor B can be produced, even in the presence of their respective transferase enzymes. Thus, red cells of the Bombay phenotype lack A, B, and H antigens. These individuals naturally produce anti-A, anti-B, and broad thermal range anti-H antibodies, and they can only be transfused with autologous blood or from other individuals of the Bombay phenotype.[9]

H antigens are present in all the tissues in which A and B antigens are demonstrated. H antigens are also demonstrated to be present in all body fluids and secretions. Hence, it is essential to perform the salivary testing to differentiate between Bombay and parabombay blood group. The Bombay (O_h) phenotype includes all H-deficient ABH nonsecretors and is typed as HH/sese in both erythrocytes and in secretions. Whereas a parabombay phenotype lacks ABH antigens on erythrocytes, but they contain ABH active substances in their secretions and is typed as HH/sese.[9]

If the organ donor is Bombay blood group, then the donor liver should be devoid of A, B, and H antigen. Theoretically, Bombay blood group donor can donate liver to any blood group (universal donor), however, is not published yet. Furthermore, if the recipient should receive Bombay blood group, packed red cells

(compatible with both donor and recipient) are not clear. As per the blood transfusion protocol in minor ABO incompatible organ transplant, it is preferred to give packed red cells compatible to both donor and recipient.

Liver transplant surgery consumes a significant amount of blood and blood products compared to other surgeries. The arrangement of matched donors and blood is mandatory before surgery. It is important to have an up-to-date database of donors with rare blood groups at level to support transplant programs. The pretransplantation arrangement of allogenic Bombay blood group blood units was cumbersome. Only two donors could be reserved for blood donation in case of emergency. On other side, patients with Bombay phenotype can receive FFP and cryoprecipitate from any group for the treatment of coagulopathies. Response to platelet transfusion could be less due to ABH antigens expression on platelets and probably be limited to type A2 with minimum red cell contamination.

Although rare, the Oh phenotype patients can have severe or fatal hemolytic reaction if the blood group is missed and necessitates routine reverse grouping and antibody screening to determine the need for exploration of rare blood types. ABO blood type mismatch or incompatibility between donor and recipient can result in allograft hyperacute rejection. Therefore, it is important to accurately type the blood group of the donor and recipient to avoid a preventable, detrimental outcome. Townamchai, *et al*. reported a case of nearly mistaken AB Parabombay blood group donor kidney transplanted to a Group O recipient.[10]

We have reported first successful Oh liver graft to non-Oh liver transplant and its perioperative management. Although there are guidelines available for ABO-incompatible liver transplant, it remains a question if an Oh phenotype liver recipient can undergo ABO incompatible transplant with non-Oh blood groups without any anti-H-induced hemolytic reaction or hyperacute rejection. A national rare donor registry with better coordination among blood banks, cryopreservation facilities for rare blood groups, continuous monitoring of antibody titer pre- and post-transplantation, and improvement in desensitization strategies including therapeutic plasma exchange might pave the way for incompatible liver transplant surgery involving Oh phenotype.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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