Case Report

Perioperative management of patient with Bombay blood group undergoing mitral valve replacement

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ABSTRACT

Bombay red blood cell phenotype is an extremely rare blood type for which patients can receive only autologous or Bombay phenotype red blood cells. We report a case of stenotic mitral valve with Bombay phenotype who underwent minimal invasive right lateral thoracotomy for the replacement of the mitral valve. A male patient from Bangladesh presented to the hospital with New York Heart Association III symptoms. His medical evaluation revealed severe mitral valve stenosis and mild aortic valve regurgitation. The patient received erythropoietin, intravenous iron succinate and folic acid tablets. Autologous blood transfusion was carried out. The mitral valve was replaced with a prosthetic valve successfully. After weaning off from cardiopulmonary bypass, heparinisation was corrected with protamine. Post-operatively, the patient received autologous red blood cells. The patient recovered after 1-day of inotropic support with adrenaline and milrinone, and diuretics and was discharged on the 5th post-operative day.

Key words: Autologous blood donation, Bombay blood group, cardiac surgery

INTRODUCTION

Bombay blood group is a rare autosomal recessive phenotype within the ABO blood group.[1] The estimated prevalence is 1 in 10,000 in India and 1 in 1,000,0000 outside of India.[2] We discuss a patient with Bombay blood group who had severe mitral stenosis with New York Heart Association (NYHA) class III symptoms. The patient required surgery and was planned for a minimally invasive mitral valve replacement with prior autologous blood donation. Red blood cell transfusions for persons with Bombay phenotype must be either autologous or from another Bombay phenotype donor.[3]

CASE REPORT

A 45-year-old male patient hailing from Bangladesh presented with complaints of progressively increasing dyspnoea of NYHA class III. The patient was diagnosed to have rheumatic mitral stenosis that required valve replacement surgery. During the pre-operative evaluation, the patient was found to have Bombay blood group. A transthoracic echocardiogram was done which confirmed the diagnosis of mitral stenosis with a valve area of 0.8 cm^2. Laboratory investigations were unremarkable. Pre-operative preparation included autologous blood donation. Prior to the collection, the patient was given erythropoietin 4000 IU subcutaneously twice a week, intravenous (IV) iron succinate 100 mg every 3 days, and folic acid tablets 5 mg/day. The baseline haemoglobin level was 10.9 g/dl. The first autologous blood donation was done after 1-week of therapy when the haemoglobin level was 11.4 g/dl. The second autologous blood donation was performed after 2 weeks when the haemoglobin level was 11.2 g/dl. After receiving 3 weeks of therapy, the patient was posted for surgery. Two Bombay blood group donors were kept on standby for emergency.

On the day of surgery, the patient's haemoglobin was 11.6 g/dl. Cannulation of the peripheral vein, radial artery, and right internal jugular vein was performed prior to induction. General anaesthesia regime included

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the use of midazolam 2 mg IV, fentanyl 5 μg/kg IV, propofol 1mg/kg IV, and rocuronium 1 mg/kg IV. It was followed by intubation with a double-lumen tube for one lung ventilation. Post-induction haemodynamics were stable. Third autologous blood was collected in the operating room after inducing the patient. Tranexamic acid 15 mg/kg IV bolus was administered followed by a continuous infusion at the rate of 2 mg/kg/h. Anaesthesia was maintained with sevoflurane, vecuronium, and fentanyl. Intraoperative transoesophageal echocardiography confirmed the pre-operative findings.

Through a right lateral thoracotomy under femoro-femoral bypass, the mitral valve was replaced with 31 mm tissue prosthesis after giving 4 mg/kg of heparin. Non-pulsatile, normothermic cardiopulmonary bypass (CPB) was maintained with haemoglobin of 8.4 g/dl. After weaning off from CPB, heparin was reversed with protamine. Post-CPB, the haemoglobin level was 9.2 g/dl.

One unit of autologous blood was transfused after weaning off from CPB. Another unit of autologous blood was transfused in cardiac surgical Intensive Care Unit. Following the transfusion, the haemoglobin level increased to 10.5 g/dl. Post-operatively, erythropoietin was given for 1-week. On the 3rd post-operative day, the haemoglobin level increased to 11.7 g/dl and the patient was discharged on the 5th day from the ICU. During the perioperative period, 2 units of autologous blood and 2 units of fresh frozen plasma were transfused.

DISCUSSION

Bombay (Oh) red cell phenotype is one of the rarest blood groups in India. It is a blood group that shows the absence of A, B, H antigens on red cells and presence of anti-A, anti-B and potent wide thermal range anti-H antibodies in serum reacting with all O blood groups. Dr. Y.M. Bhende first discovered Bombay blood group in 1952 at Bombay (now "Mumbai"). Those anticipating need for blood transfusion (e.g., for scheduled surgery) may bank blood for their own use, that is, an autologous blood donation.[4]

It is fortunate that patients with Bombay phenotype can receive fresh frozen plasma and cryoprecipitate from any group for the treatment of coagulopathies. However, platelet transfusion should probably be limited to type A2 because ABH antigens are also expressed on platelets, and most platelet preparations also contain a small amount of donor red blood cells.[5] There is no well-documented disease association with Bombay phenotype. However, all patients with type O blood, including Bombay phenotype, have been described with higher rates of bleeding complications.[6]

In a study by Yamawaki *et al*., all patients were able to donate 1200 ml of autologous blood prior to hysterectomy, and anaemia did not result despite phlebotomy 3 times each week. Elevation in haemoglobin concentration was calculated at 0.78 ± 0.37 g/dl over the first 7 days, and 2.12 ± 0.35 g/dl over the first 14 days.[7] It was shown that recombinant human erythropoietin (rHuEPO) was effective in ameliorating the anaemia associated with pre-operative autologous blood collection, and the effect was further enhanced with IV supplementation of iron preparations. A study was carried out on 18 patients undergoing coronary artery bypass operations; 400 mL of autologous whole blood was taken from each patient 2 weeks before operation and was subsequently used in the operation and rHuEPO (100 U/kg/day) was administered IV for 2 weeks before operation and for 1-week after operation.[8] For patients who donate blood for autologous use and undergo major orthopaedic surgery, low basal haematocrit (Hct) is the major cause of allogeneic blood exposure.[9] To determine whether rHuEPO could increase autologous blood procurement and reduce allogeneic blood exposure, a prospective randomised study was conducted in 50 women undergoing total hip replacement who had basal Hct <40%. Patients were randomly placed in three groups: those receiving placebo, those receiving 300 U of rHuEPO per kg, and those receiving 600 U of rHuEPO per kg every 3–4 days for 21 days. Oral iron (125–270 mg/day) was administered; in the last 24 patients, 100 mg of iron saccharate was administered IV at each donation. At each visit, 350 mL of blood was collected if Hct was ≥34%. Patients receiving rHuEPO donated a greater amount of blood for autologous use than did patients in the placebo group (4.5 ± 1.1 vs. 2.8 ± 0.6 units; $P < 0.05$) and received a significantly lower amount of allogeneic blood (1.2 ± 1.4 vs. 0.4 ± 0.8 units; $P < 0.05$). Iron support was a critical factor in the efficacy of treatment.[9]

Based on our experience, we believe that mitral valve repair through a right mini-thoracotomy provides a

durable and safe alternative to a traditional sternotomy with the benefits of improved cosmesis, reduced post-operative pain, less blood loss with fewer blood transfusions, fewer infections, shorter length of stay, and faster return to activity.[10]

Jonnavithula *et al*. reported a rare case of Para-Bombay blood group who underwent coronary artery bypass graft with pre-operative autologous blood donation.[11] For elective cases, autologous transfusion is a good proposition, as in such cases we can plan ahead and collect blood from the patient herself well ahead of the operation. However, in case of emergency, it is very difficult to find Bombay blood group at ready stock in any blood bank. Blood banks can maintain a rare blood type donor file and develop exchange programmes in times of need among themselves. Facilities for cryopreservation can also be beneficial for rare blood groups.[12]

CONCLUSION

Patients with Bombay phenotype red blood cells present as type O, but they are unable to receive red blood cells from any phenotype other than Bombay phenotype. A patient with Bombay blood group undergoing cardiac surgery can be prepared by giving erythropoietin and by arranging autologous blood pre-operatively. Minimally invasive surgery leads to less blood loss. There must be good coordination among transfusion medicine, surgery, anaesthesia specialities and the Bombay blood group organisation in managing these patients.

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