ABO-incompatible living-donor lobar lung transplantation

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Abstract

ABO-incompatible living-donor lobar lung transplantation was performed in a 10-year-old boy with bronchiolitis obliterans (BO) after bone marrow transplantation (BMT) for recurrent acute myeloid leukemia (AML). His blood type had changed from AB to O since he received BMT and he had no anti-A/B antibody, and received type B and AB donor lobar lungs. To our knowledge, this case represents the first successful living-donor lobar lung transplantation from ABO-incompatible donors.

Introduction

ABO-incompatible organ transplantation, especially kidney and liver transplantation have been performed to overcome donor organ shortage. However, very few cases have been reported involving ABO-incompatible lung transplantation, and furthermore, an intentional lung transplant has been reported only one case. Herein, we report ABO-incompatible lung transplantation in a 10-year-old boy with bronchiolitis obliterans (BO) after bone marrow transplantation (BMT).

Case Report

A 6-year-old boy was diagnosed with AML in 2005 and was treated with chemotherapy. In May 2008, at the age of 9, he underwent BMT from an unrelated, HLA-identical and ABO-mismatched donor for recurrent AML. His blood type was originally AB (+) and after receiving BMT from blood type O (+) donor, his blood type changed to O (+). In early 2009, at the age of 9, he began complaining of dyspnea and was diagnosed as having bronchiolitis obliterans, with the presumption that the cause was pulmonary GVHD. Respiratory distress continued to deteriorate with respiratory *Pseudomonous Aeruginosa* infection despite home oxygen therapy.

In January 2010, at the age of 10, the patient was transferred to Kyoto University Hospital. On admission, his vital capacity was 0.72 L (39.6% predicted), FEV1 was 0.27L (16.3% predicted), and arterial blood gas demonstrated a pH of 7.40, PaO_2 of 87.0 mmHg, and $PaCO_2$ of 55.8 mmHg with 2L/min oxygen administered via a nasal cannula.

Cadaveric lung transplantation was not a realistic option because brain death is accepted only for persons over than 15 years old in Japan. His parents, mother, 43 years old, ABO type AB (+) and father, 44 years old, ABO type B (+) each offered to be lung donors. The patient's ABO type had changed to type O according to ABO testing of red cells, but ABO serum test did not detect any anti-A/B antibody in his serum and tolerance to A and B antigens had been established. After carefully discussion, we thought that the risk of ABO-incompatible lung transplant in this particular case would be equivalent to ABO-

compatible transplant since the production of anti-A and anti B antibody would be unlikely even if new A and B antigen was presented from donor after lung transplantation.

In February 2010, he underwent living-donor lobar lung transplantation with a left lower lobe from his mother and a right lower lobe from his father. The surgical aspects of the donor lobectomy, donor back table preservation technique, and recipient bilateral pneumonectomy and lobar implantation have been previously described by Starnes' group [1]. For perioperative transfusion, type O red blood cells and type AB fresh frozen plasma and platelets were used for the recipients. Postoperative immunosuppression included cyclosporine, mycophenolate mofetil, and prednisone.

The postoperative course was relatively uneventful. The patient was completely weaned from the ventilator on postoperative day (POD) 3. There was transient very weak detection of anti-A antibody (Table 1). However, there was no apparent acute cellular rejection (ACR) or antibody-mediated rejection (AMR) postoperatively. Since there is no clinical finding suggesting rejection, No lung biopsy was performed postoperatively.

He was discharged from the hospital on POD 75. At that time, arterial blood gas in room air demonstrated a pH of 7.43, PaO_2 of 92.6 mmHg, and $PaCO_2$ of 37.6 mmHg. FVC was 1.53 L (83.2% predicted) and FEV1 was 1.12 L (67.9% predicted) (Table 2). Five months postoperatively, he returned to a normal life without oxygen inhalation and is able to perform daily activities.

Discussion

After bone marrow transplantation, if the patient has received marrow from a compatible but dissimilar ABO type, serum antibodies will not agree with red cell antigens. The present pediatric patient, who was originally type AB received type O marrow, had circulating type O red cells but produced no anti-A/B antibody in the serum at the time of lung transplantation. According to ABO testing of red cells, recipient (type O)-donors (B and AB) ABO type matching was incompatible, however, since the recipient had no anti-A/B antibody in serum, we could perform this surgical procedure with ABO incompatible donors. Other possible hematological change that may occur in the recipient after lung transplantation was

carefully discussed. Theoretically, the lymphocytes derived from type B lung donor might produce anti-A antibodies in the recipient, and not only attack the recipient's other organs which were originally type AB, but also attack contralateral type AB donor lung. However, there was only transient weak detection of anti-A antibodies and no AMR occurred postoperatively.

Recently, many cases of ABO-incompatible organ transplantation, especially kidney and liver transplantation have been performed to overcome donor organ shortage. Japanese groups reported excellent patient and graft survival of ABO-incompatible kidney transplantation using regimens including plasmapheresis, immunosuppression, immunoabsorption and splenectomy, which showed a similar outcomes to those of ABO-compatible donor transplants[2, 3]. However, intentional ABO-incompatible lung transplant was reported in only one case. [4] Pierson et al. reported 42 cases (0.4%) of accidental ABO-incompatible lung transplants among 9,804 primary lung transplants according to the database of the Organ Procurement and Transplant Network in the United States [5] and the outcome was acceptable compared with those of ABO-compatible lung transplants when the intensive therapy described above has been used.

Although the present case showed a unique blood type background because of prior bone marrow transplantation, to our knowledge, this case represents the first successful living-donor lobar lung transplantation from ABO-incompatible donors. Although the short-term outcome was satisfactory, long-term follow-up is needed to assess whether this procedure is ultimately justified.

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Table 1. The serological analysis of anti-A and anti-B antibody in the recipient

POD after transplant	pre	7	12	19	26	54	82
Aggregation to type A RBC*	0	w+**	0	w+	w+	0	0
Aggregation to type B RBC	0	0	0	0	0	0	0

* Red blood cells, ** very weak aggregation

Table 2. The time trend of pulmonary function test in the recipient

POD after transplant	pre	82	188
Height (cm)	127.0	127.4	128.0
Body Weight (kg)	24.0	25.0	28.0
VC (L)	0.72	1.62	1.61
FVC (L)	0.72	1.53	1.60
FEV1.0 (L)	0.27	1.12	1.09