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CLINICAL DILEMMAS

ABO-incompatible living-donor lobar lung transplantation

Tsuyoshi Shoji, MD,[a] Toru Bando, MD,[a] Takuji Fujinaga, MD,[a] Fengshi Chen, MD,[a] Kimiko Yurugi,[b] Taira Maekawa, MD,[b] and Hiroshi Date, MD[a]

From the Departments of [a]Thoracic Surgery and [b]Transfusion Medicine and Cell Therapy, Kyoto University, Kyoto 606-8507, Japan.

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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 underwent 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. J Heart Lung Transplant 2011;30:479–80

ABO-incompatible organ transplantation, especially kidney and liver transplantation, have been performed in an effort to overcome the donor organ shortage. However, very few cases have been reported involving ABO-incompatible lung transplantation, and there has been only one intentional lung transplant reported so far. 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 acute myeloid leukemia (AML) in 2005 and was treated with chemotherapy. In May 2008, at 9 years of age, he underwent BMT from an unrelated, HLA-identical, ABO-mismatched donor for recurrent AML. His blood type was originally AB(+) and, after receiving BMT from a blood type O(+) donor, his blood type changed to O(+). In early 2009, at 9 of age, he began complaining of dyspnea and was diagnosed with BO, with the presumption that the cause was pulmonary graft-vs-host disease (GVHD). Respiratory distress continued to worsen with respiratory *Pseudomonous aeruginosa* infection despite home oxygen therapy.

In January 2010, at 10 years of age, the patient was transferred to Kyoto University Hospital. On admission, his vital capacity was 0.72 liter (39.6% predicted), forced expiratory volume in 1 second (FEV_1) was 0.27 liter (16.3% predicted), and arterial blood gas showed pH 7.40, PaO_2 = 87.0 mm Hg and $PaCO_2$ = 55.8 mm Hg, with 2 liters/min oxygen administered via a nasal cannula.

Cadaveric lung transplantation was not a realistic option because brain death is accepted only for persons >15 years of age in Japan. His parents, a 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 careful discussion, we concluded that the risk of an ABO-incompatible lung transplant in this particular case would be equivalent to that of an ABO-compatible transplant, because the production of anti-A and anti-B antibody would be unlikely even if new A and B antigen was presented from the donor after lung transplantation.

In February 2010, the patient 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 described previously by Starnes and colleagues.[1] For peri-operative transfusion, type O red blood cells and type AB fresh-frozen plasma and platelets were used for the recip-

Reprint requests: Tsuyoshi Shoji, MD, Department of Thoracic Surgery, Kyoto University, 54 Shogoin-Kawahara-cho, 54 Shogoin Kawahara-cho, Sakyo-ku, Kyoto 606-8507, Japan. Telephone: +81-75-751-4975. Fax: +81-75-751-4974.

E-mail address: tshoji@kuhp.kyoto-u.ac.jp

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ients. Post-operative immunosuppression included cyclosporine, mycophenolate mofetil and prednisone.

Post-operative course was relatively uneventful. The patient was completely weaned from the ventilator on post-operative 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) post-operatively. Because there was no clinical finding suggesting rejection, no lung biopsy was performed post-operatively.

He was discharged from the hospital on POD 75. At that time, arterial blood gas in room air showed pH 7.43, PaO_2 = 92.6 mm Hg and $PaCO_2$ = 37.6 mm Hg. FVC was 1.53 liters (83.2% predicted) and FEV_1 was 1.12 liters (67.9% predicted) (Table 2). Five months post-operatively, 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. Our 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, because the recipient had no anti-A/B antibody in serum, we could perform this surgical procedure with ABO-incompatible donors. Other possible hematologic changes that could occur in the recipient after lung transplantation were carefully discussed. Theoretically, the lymphocytes derived from the type B lung donor could 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 post-operatively.

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

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 determine whether this procedure is ultimately justified.

Table 1 Serologic Analysis of Anti-A and -B Antibody for Recipient

		Days post-transplant					
	Pre	7	12	19	26	54	82
Aggregation to type A RBC	0	W^{+a}	0	W^+	W^+	0	0
Aggregation to type B RBC	0	0	0	0	0	0	0

RBC, red blood cells.
[a]Very weak aggregation.

Table 2 Time Trend of Pulmonary Function Test for Recipient

	Days post-transplant		
	Pre	82	188
Height (cm)	127.0	127.4	128.0
Body weight (kg)	24.0	25.0	28.0
VC (liters)	0.72	1.62	1.61
FVC (liters)	0.72	1.53	1.60
FEV_1 (liters)	0.27	1.12	1.09

Disclosure statement

The authors have no conflicts of interest to disclose.

References

1. Starnes VA, Barr ML, Cohen RG, et al. Living-donor lobar lung transplantation experience: intermediate results. J Thorac Cardiovasc Surg 1996;112:1284-90.
2. Aikawa A, Ohara T, Arai K, et al. Clinical outcome and accommodation in ABO incompatible kidney transplantation. Clin Transpl 2004:135-42.
3. Takahashi K, Saito K, Takahara S, et al. Excellent long-term outcome of ABO-incompatible living donor kidney transplantation in Japan. Am J Transplant 2004;4:1089-96.
4. Struber M, Warnecke G, Hafer C, et al. Intentional ABO-incompatible lung transplantation. Am J Transplant 2008;8:2476-8.
5. Pierson RN III, Moore J, Merion RM, et al. ABO-incompatible lung transplantation. Amsterdam: Elsevier; 2006:63-9.