Severe aplastic anemia (SAA) patients without an HLA-matched sibling donor need alternative treatment options. Umbilical cord blood transplantation (UCBT) has become an alternative means for treating various diseases, but it has not been proved to be a satisfactory method to treat SAA. Here, we report the case of a girl who underwent successful two-unit UCBT after engraftment failure with a single unit. Two-unit UCBT is proposed to have better engraftment potential and to offer a better chance of survival, according to some reports. Increased cell dose and graft-versus-graft reaction could contribute to these advantages. With this promising result, two-unit UCBT could be an alternative treatment option for patients with SAA without an HLA-matched donor.

**INTRODUCTION**

Bone marrow transplantation (BMT) from an HLA-matched related donor is the treatment of choice for children and young adults with severe aplastic anemia (SAA). Patients without an appropriate sibling donor usually receive immunosuppressive therapy, and those who fail it, undergo BMT from an HLA-matched unrelated donor. Umbilical cord blood transplantation (UCBT) has become an alternative option in various diseases since the first transplantation to treat a patient with Fanconi anemia was successful in 1988 (1). However, unrelated donor UCBT has not yet been recommended for SAA patients due to the high risk of graft failure and complications (2). Here we report the case of a girl who successfully underwent two-unit UCBT after engraftment failure with a single unit.

**CASE REPORT**

A 3-yr-old girl, whose blood type was A+, was admitted to our hospital for easy bruising. Her initial peripheral blood cell count showed $3.28 \times 10^9/L$ white blood cell (WBC) with 2% neutrophils, 96% lymphocytes, 1% monocyte and 1% eosinophil, 7.0 g/dL hemoglobin with 19.2% hematocrit, 0.8% reticulocyte and $5 \times 10^9/L$ platelet. A bone marrow study revealed hypocellular marrow (10% to 20% cellularity) with a marked decrease of normal hematopoietic cells. This led to the diagnosis of SAA. As the patient had no siblings, she underwent immunosuppressive therapy with anti-thymocyte globulin and cyclosporine A for six months without response. Then she received oxymetholone and prednisolone for three years with intermittent transfusions of more than 30 units of packed red blood cell (RBC) and 30 units of plateletpheresis. However, oxymetholone was stopped because she developed a hepatic adenoma. At seven years of age, a single-unit UCBT from an AB+ male donor was performed with 5/6 HLA-matched unit, which contained $2.06 \times 10^7/kg$ nucleated cells with $0.64 \times 10^5/kg$ CD34+ cells (Table 1). The conditioning regimen was composed of fludarabine (180 mg/m²), busulfan (6.4 mg/kg), anti-thymocyte globulin (10 mg/kg) and total lymphoid irradiation (2 Gy). Graft-versus-host disease (GVHD) prophylaxis was done with cyclosporine A and methylprednisolone. The first UCBT failed due to an engraftment failure.

Three months after the first UCBT, two-unit UCBT was
Two-unit Cord Blood Transplantation in Aplastic Anemia

Table 1. Cell doses and HLA types of cord blood units

| Blood type/sex | First UCBT | Second UCBT |
|---------------|------------|-------------|
|               | Engrafted unit | Disappeared unit |
|               | AB+/male | A+/male | B+/male |
| HLA match     | 5/6 HLA matched | 6/6 HLA matched | 5/6 HLA matched |
| Cell dose     | 2.06 × 10^7 | 2.27 × 10^7 | 2.21 × 10^7 |
| CD34+ (kg)    | 0.64 × 10^7 | 0.57 × 10^7 | 1.15 × 10^7 |

UCBT, umbilical cord blood transplantation; NC, nucleated cell.

In some studies, two-unit UCBT is proposed to have better engraftment potential and to offer a better chance of survival than single unit UCBT (4, 6). Recently, there was a report of a successful second transplantation with two unrelated cord blood units for early graft failure after first hematopoietic stem cell transplantation (7). The mechanisms of these additional advantages of two-unit UCBT are not fully understood. Increase of the cell dose could be a contributing factor, and graft-versus-graft reaction between two units also could be another factor. In previous reports on two-unit UCBT, results showed the dominancy of one unit in most of the cases. The mechanism of determining the dominancy is not known yet, but the number of CD3+ cells and degree of HLA mismatch has been reported as related factors (4, 6).

In our case, the patient underwent a successful two-unit UCBT after engraftment failure with a single-unit UCBT. With this promising result, two-unit UCBT could be an alternative treatment option in SAA patients without an HLA-matched donor. Also, further investigation about the mechanism of engraftment in two-unit UCBT may extend the field of stem cell transplantation.

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