

Department of Transfusion Medicine

Tetsunori Tasaki, *Professor*

Yoko Kato, *Associate Professor*

General Summary

The mission of the transfusion department is the rapid supply of safe blood products and education regarding their proper use. Even though pre-transfusion testing has been established, we sometimes encounter test results that are difficult to interpret. Thus, increasing the ability to solve problems improves not only analytic skills but also the safety of blood transfusion. Although the introduction of transfusion ordering and electronic medical records contribute to efficient blood transfusion, regular review and improvement of these systems are also necessary for transfusion safety.

Education regarding issues pertinent to transfusion is also an important role of a department of transfusion medicine in a university hospital. We are actively working on transfusion education for medical students, nursing students and laboratory technicians at our university.

Apheresis techniques using a cell separator are well established and commonly used for the collection of mononuclear cells (MNCs) for the treatment of patients with hematological disease. Recently, the technique has been used to collect patients' MNCs for dendritic cell immunotherapy.

Research Activities

Current issues in the collection of MNCs by apheresis techniques from patients with a brain tumor

Apheresis techniques for collecting autologous MNCs for the treatment of glioblastoma were introduced in our hospital in 2013. Our experience is based on 33 apheresis patients (26 of whom had some neurological symptoms) treated over the last 5 years. We have encountered 19 patients (58%) with adverse events such as numbness due to hypocalcemia during the procedure. Difficulties in communicating with a patient with a central nervous system disorder is likely a contributing cause. Although none of the events was serious, more careful observation and treatment are desired for apheresis of patients with neurological disease. This was reported by Dr. Kato at the annual meeting of the Japan Society of Transfusion Medicine and Cell Therapy in 2017.

Survey of adverse events during hematopoietic stem cell transfusion

Various adverse events (AEs), including nausea, fever, allergic reactions, arrhythmia, encephalopathy and respiratory distress occur in patients who undergo hematopoietic stem cell transplantation (HSCT). It is speculated that these events are probably due mainly to the simultaneous transfusion of anticoagulant and cryoprotectant (dimethyl sulfoxide). However, as the details of events or causes are obscure, Dr. Ohto (Fukushima Medical University) formed a study group consisting of 20 investigators in 2015 to gather

detailed information on HSCT. As of July 31, 2016, data from 1,125 HSCT patients were collected, including 50 patients from our hospital. The main results were as follows: 1) In allo-HSCT, AEs were most often observed in bone marrow transplants (BMT) (37.7%) compared with allo-peripheral blood stem cell transplants (PBSCT) (26.4%, $P = 0.004$) and cord blood transplants (CBT) (19.3%, $P < 0.001$). 2) Among AEs, hypertension was observed most frequently in BMT. However, nausea/vomiting, fever and allergic reactions occurred in PBSCT. 3) Life-threatening AEs were reported in 2 (0.18%) recipients: 1 CBT (anaphylaxis, hypoxia) and 1 allo-PBSCT with a cryopreserved product (hypoxia, hypotension). 4) Multivariate analysis with logistic regression showed that the history of transfusions was the only risk factor of AEs (odds ratio (OR) 1.459, $P = 0.045$). These results were reported by Dr. Ikeda (Fukushima Medical University) at the 59th annual meeting of American Society of Hematology in 2017.

Improved safety in the collection of PBSC from children

PBSC harvest (PBSCH) for pediatric patients should be carried out very carefully because of the low corporeal blood volume and vulnerability to hypocalcemia-related complications, hypovolemic shock and hypervolemic cardiac overload. Dr. Ohara (Fukushima Medical University) retrospectively investigated a total of 267 apheresis procedures that were conducted from 1990 to 2013 on 93 children between 0 and 10 years of age with body weights of 6.3 to 44.0 kg. Adverse events occurred in 31 procedures (11.6%), including a 9.6 kg one-year-old boy probably due to citrate hypocalcemia and dilutional hypoalbuminemia. Since then, continuous injection of calcium gluconate, ionized calcium monitoring and circuit priming with albumin have been routinely introduced in pediatric apheresis and these contribute to improved safety in PBSCH, even for children weighing <10 kg.

Other studies, including multicenter collaborative research

Currently, 3 multicenter collaborative research projects are in progress. The first is children's alloimmunity against red blood cell antigens. In Japan, little data are available regarding the production of alloantibodies in children, especially in neonates. Revealing the characteristics of alloantibodies (such as antigen affinity) and their clinical significance will improve the safety of blood transfusion in children. The second is focused on revealing the current trigger Hb level of red blood cell (RBC) transfusion in patients with hematological disease. Current transfusion practice is evaluated by the "Guidelines for the Use of Blood Products" revised in 2017 by the Ministry of Health, Labour and Welfare. The third is to clarify the frequency of TACO (transfusion-associated circulatory overload) in Japan as well as that of TRALI (transfusion-associated acute lung injury). The results will lead to prevention of TACO and proper use of blood products.

Two studies independently carried out at our facilities are as follows: (1) the evaluation of cryoprecipitate made from allogeneic fresh frozen plasma in terms of its clinical significance and cost-effectiveness; (2) the relationship between the breakage of blood bags when connecting a transfusion set and bacterial contamination of blood products.