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Five Cases of ABO Non-Identical Red Blood Cell Transfusion during Surgery in an Urban Emergency Hospital

Chihiro Takamatsu*, Masanori Kujyo*, Shotaro Sakimura*, Misa Okamura*, Hayashi Yoshimura*, Sumio Hoka**, Kazuhisa Matsuda*

Abstract

We experienced five cases of ABO-compatible, ABO non-identical red blood cell transfusion during emergency surgery in our hospital between April 2010 and September 2011. Although nadir hemoglobin levels were below the safety margin, prompt O-type red blood cell transfusion could save two B-type female patients. However another three patients, whose massive bleeding occurred during neurosurgery, could not be saved postoperatively.

Key words; ABO non-identical red blood cells, transfusion, emergency operation

Introduction

Hemorrhage is a major cause of cardiac arrest developing in the operating room[1]. The Japanese Society of Anesthesiologists (JSA) and the Japanese Society of Blood Transfusion and Cell Therapy established "Guidelines for Action Against Intraoperative Critical Hemorrhage" in 2007[2]. The guidelines show practical strategies for managing life-threatening hemorrhage, which include that when time is urgent, cross-matching tests are omitted, and ABO-identical red blood cells (RBCs) are used, and that if supplies of ABO-identical RBCs are not available, ABO-compatible, non-identical RBCs are used[2].

The guidelines, however, have been insufficiently recognized and unsatisfactorily utilized, by surgeons and even by anesthesiologists. We experienced five cases of ABO-compatible, non-identical RBC transfusion during emergency surgery according to the guidelines in a modest size-city hospital between April 2010 and September 2011. Here, we present those cases and discuss the reasons and outcomes of patients received ABO non-identical RBCs.

Case Report

A. Case 1

A 58 year-old female, blood type B, underwent urgent surgical hemostasis for postoperative massive bleeding two and half hours after a gynecological surgery for ovarian cancer. Since whole B-type RBCs stored in our hospital and those carried from a blood bank had been used at the recovery room before starting the second surgery, O-type RBCs were transfused intraoperatively. Total amount of intraoperative blood loss was approximately 8,000 ml, and the lowest hemoglobin level reached at 1.7 g/dl. Ten units of O-type RBCs were used. Although systolic blood pressure could be maintained above 100 mmHg, tachycardia more than 110 beats/min continued over 30 min with severe anemia, resulting in a transient ST depression on ECG (**Fig. 1**). After successful hemo-

*Department of Anesthesia, Saiseikai Fukuoka General Hospital, Fukuoka, Japan
**Department of Anesthesiology and Critical Care Medicine, Kyushu University, Fukuoka, Japan

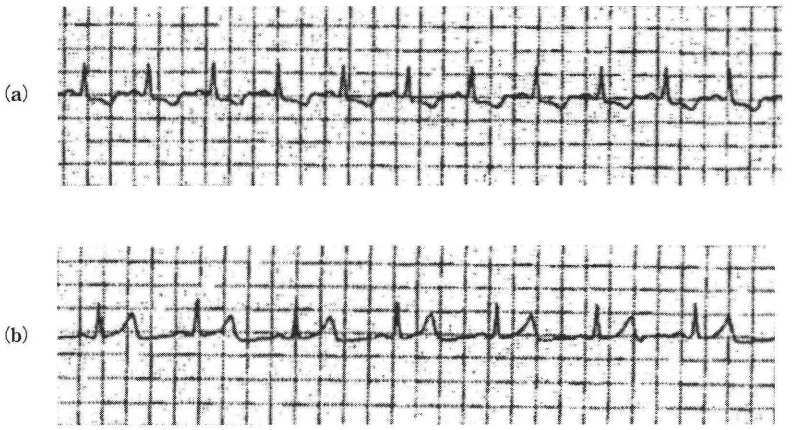

Figure 1

Electrocardiogram in **case 1** shows ST depression (**a**) when the hemoglobin was 1.7 g/dl with blood pressure of 100/60 mmHg and heart rate of 120 beats/min, and normalized ST (**b**) after 10 units of O-type RBC transfusion when the hemoglobin was 10 g/dl with blood pressure of 110/70 mmHg and heart rate of 80 beats/min.

stasis was achieved, her hemodynamics became stable. The patient had an uneventful recovery.

B. Case 2

A 38 year-old female, blood type B, underwent urgent surgical debridement for her severe burn. During surgery, bleeding at the surgical site could not be controlled, resulting in 7,000 ml of the blood loss. Since there were no more available B-type RBCs at hand, 8 units of O-type RBCs were transfused intraoperatively. The lowest hemoglobin level reached at 3.3 g/dl. After successful hemostasis was achieved, the patient had an uneventful recovery.

C. Case 3

A 29 year-old male, blood type B, underwent urgent craniotomy and removal of epidural hematoma due to a traffic accident. Inadvertent massive hemorrhage happened intraoperatively, and the blood loss counted at 8,000 ml. Since there were no more available B-type RBCs, 10 units of O-type RBCs with 4 units of AB-type fresh frozen plasma were transfused during surgery. The lowest hemoglobin level reached at 4.4 g/dl. Successful hemostasis was achieved, but the patient died at 9 postoperative days due to multiple organ failure.

D. Case 4

An 80 year-old female, blood type B, underwent urgent clipping surgery for cerebral aneurysm after an attack of subarachnoid hemorrhage. Massive hemorrhage due to a re-rupture of the aneurysm happened intraoperatively, and the blood loss counted at 6,300 ml. After 14 units of B-type RBCs and 20 units of fresh frozen plasma were used, another 4 units of O-type RBCs were transfused during surgery. The lowest hemoglobin level reached at 6.7 g/dl. Hemostasis was almost achieved, but the patient died postoperatively due possibly to brain edema.

E. Case 5

A 70 year-old male, blood type A, underwent urgent hemostasis surgery for intracranial bleeding 4 hours after the first surgery of craniotomy and removal of cerebral hematoma. Uncontrollable bleeding happened with the blood loss of more than 4,000 ml. After 6 units of both B-type RBCs and fresh frozen plasma, 4 units of O-type RBCs were transfused during surgery. The lowest hemoglobin level reached at 4.7 g/dl. The patient died postoperatively due possibly to brain damage.

Discussion

In the survey of JSA between 2004 and 2008, cardiac arrest was found to develop in 4.38/10,000 anesthetics[1]. Hemorrhage was responsible for 33% of the cardiac arrests. It has been reported that blood loss exceeding 5,000 ml developed in 15 patients a day in the operating rooms of JSA-certified training hospitals, critical hemorrhage developed in 2.6 pa-

tients a day, and hemorrhagic death occurred in one patient a day[3]. To prevent the hemorrhage-related death, JSA and related societies recommended the use of ABO-compatible, non-identical RBCs as a surrogate for ABO-identical RBCs[1].

In spite of propaganda of the emergent use of non-identical RBCs, there are few institutions that follow it. The survey of JSA between 2006 and 2008 reported that in 2,597 patients, whose blood loss exceeded 5,000 ml and blood type was other than O-type, the overall mortality was 19%, while ABO-compatible, non-identical RBCs were transfused in only 1.7% of patients[3,4]. In 407 patients whose minimum intraoperative hemoglobin level was less than 5 g/dl, mortality was 37%, while ABO-compatible, non-identical RBCs were transfused in only 5.4% of patients[3,4]. In 164 patients who required cardiac massage in the operating room, mortality was 73%, while ABO-compatible, non-identical RBCs were transfused in only 7.9% of patients.

In our hospital, intraoperative non-identical RBCs were transfused at a rate of 5 cases per one and half year, which seems to be higher than previous surveys[4,5]. The reason of the high incidence may be due to a location and a high volume of bleeding cases and emergency cases of our hospital. Our urban hospital locating at the center of Fukuoka city with the population of approximately 1.4 millions, has 380 beds and 3,625 operations per year. Emergency operation is up to 22%. The stored amount of RBCs in our hospital is 12 units for O-type, 12 for A-type, 6 for B-type, and 2 for AB-type. These numbers are almost consistent with the mean stored amount of RBCs in regional hospitals with an accredited department of anesthesiology in Japan, which is reported as follows: 11 units for O-type, 12 units for A-type, 8 type of B-type, and 6 units for AB-type[4]. The ratio is also similar with that of population of O-, A-, B-, and AB-type in Japan as 4 : 3 : 2 : 1.

In this case report, lowest hemoglobin levels of two survived patients were 1.7 and 3.3 g/dl. These nadir hemoglobin levels seemed to exceed beyond the safety margin. In the British guidelines on massive hemorrhage, maintaining hemoglobin levels of more than 8 g/dl is recommended, while it is stated that the general indication of RBC transfusion is hemoglobin levels of less than 6 g/dl[6]. Mortality rate increases with increasing blood loss and with decreasing minimum intraoperative hemoglobin level[4]. Some authors suggested that healthy patients were able to withstand a hemoglobin level of 5 g/dl in acute isovolemic hemodilution[7]. In our cases, maintenance of circulating blood volume and prompt O-type RBC infusion as well as surgical accomplishment of hemostasis could save the two female patients with severe anemia.

By contrast, three cases died postoperatively. These three cases were commonly associated with brain surgery. It is likely that even hemostasis was accomplished and hemodynamics could be recovered, the outcome of patients with massive bleeding in the cranium might be deteriorated.

Out of 5 cases, two cases (**cases 1** and **5**) were re-operations for postoperative bleeding. Both the re-operations were done within 4 hours after the previous surgery. This early re-operation for hemostasis may contribute to shortage of ABO-identical RBCs and the use of ABO non-identical RBCs in our hospital.

In conclusion, it is suggested that ABO-compatible, ABO non-identical RBCs could save patients with intraoperative massive bleeding when ABO-identical RBCs were not available.

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