Blood Transfusion Therapy in Critically Ill Patients : A Literature Review

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Abstract

Blood transfusion is a common intervention in critically ill patients to correct anemia from primary blood losses such as trauma, surgery, gastrointestinal bleeding, and other etiologies. While it can be life-saving, it also carries some risks of developing adverse reactions. Several studies revealed an increase of morbidity and mortality following blood transfusion hence it must be done properly and according to the right indications. This literature study aims to identify the indication for blood transfusion in critically ill patients as well as the complications that may arise from it.

Keywords: Blood Transfusion; Critically Ill Patients; Indication

1. Introduction

Blood transfusion is a medical intervention where whole blood or blood components are transferred from a person into another through an intravenous line (IV) [1]. One of the most frequent indications for blood transfusion in critically ill patients is anemia. As much as one-third of the patients in the Intensive Care Unit (ICU) received a blood transfusion to provide adequate oxygen delivery [2]. Anemia in the critically ill patients can be caused by several conditions such as blood loss, sepsis, chronic disease, and iron-deficiency anemia [3]. In country like the United States, packed red blood cells are administered to most ICU patients where majority are given to treat anemia with an average of 4 to 5 units [4]. The purpose of blood transfusion is to increase oxygen delivery to tissues hence it can prevent tissue hypoxia [2]. Moreover, blood products transfusion such as platelet concentrates and plasmas are used in patients with platelet or coagulation factors and other plasma proteins deficiency [5].

Clinically, blood transfusion can be prepared as whole blood and can also be separated into several blood products as replacement therapy such as packed red blood cells (RBCs), fresh frozen plasma (FFP), platelet concentrates, and cryoprecipitate. Red blood cells transfusion in patients in the critical care with anemia or acute blood loss is frequently given to improve oxygen transfer to tissue. While fresh frozen plasma, platelets, and cryoprecipitate are commonly used in ICU to prevent and treat bleeding [6]. Most of the patients admitted to critical care units usually need one or more blood components transfusion [7]. While transfusion of blood and blood products are generally safe, it does not necessarily rule out the possibility of adverse reactions and complications to arise [6]. Thus, blood transfusion should be done to treat life-threatening conditions that could not be prevented by other procedures. Unnecessary and unsafe transfusion will further exposed patients

to the risk of adverse reaction and infections which can be transmitted through transfusion such as HIV, hepatitis B, hepatitis C, and syphilis [5].

2. Indication of blood transfusion

As mentioned above, blood and blood product transfusion can improve the general condition of the critically ill patients in ICU. However, several studies reported increasing evidence of potential harm following blood transfusion. Moreover, other studies revealed that transfusion of platelets and fresh frozen plasma are given for other indications outside the agreed-upon guidelines [6]. To prevent patients from developing transfusion-related complications and potential harm, blood and blood component therapy must be prescribed according to the patient's requirement [7]. The most common blood products used in ICU are packed red blood cells, whole blood, platelet concentrate, and fresh frozen plasma [6]. This section of review will focus on the indication of blood and blood products transfusion particularly in critically ill patients.

2.1. Whole blood

By description is a 450 mL of blood without separating its component, and preserved in a 630 mL of anticoagulant solution where each unit contains hemoglobin of approximately 1.2 g/dL and hematocrit (Hct) of 35-45%. It generally does not contain functional platelets or coagulation factors such as factor V and VIII. Ideally, whole blood is stored at a temperature of at +2°C to +6°C [5]. In patients with critical illness, whole blood is commonly used in patients with hemoglobin of ≤7 g/dL, early resuscitative phase of severe sepsis with inadequate oxygen delivery, and later phases of severe sepsis with the aim of increasing hemoglobin level to 7-9 g/dL. In ICU patients who experienced cardiac disease, especially stable angina, whole blood is used to maintain hemoglobin level at >7 g/dL. In addition, patients in the critical care with neurotrauma or neurological diseases, particularly traumatic brain injury, whole blood is given to increase hemoglobin level to 7-9 g/dL, subarachnoid hemorrhage patients with the hemoglobin level of 8-10 g/dL, and acute ischemic stroke patients in which the hemoglobin is maintained above 9 g/dL [8].

2.2 Packed red blood cells

In a unit of packed red blood cells consists of about 300 mL, with a hematocrit about 70% and only about 20 to 30 mL of plasma [9]. It is prepared by removing approximately 250 mL of plasma from whole blood. Every transfusion of packed red blood cells, the hemoglobin level will increase by approximately 1 g/dL and hematocrit will increase by 3% [10]. Red blood cells transfusion is indicated for patients with blood loss due to trauma, hemorrhage, or other conditions with the volume of more than 1,500 mL or 30% of blood volume, and significant anemia (hemoglobin level <7-8 g/dL unless age, illness, or cardiopulmonary disease mandates a higher hemoglobin level) [11]. In general critical care, patients with hemoglobin level of less than 7 g/dl were given transfusion with the target hemoglobin level of 7-9 g/dL. In patients with traumatic brain injury, hemoglobin level is maintained at 9 g/dL. While for patients with acute coronary syndrome, the target hemoglobin is more than 8-9 g/dL and patients experiencing stable angina is more than 7 g/dL [6].

2.3 Platelet concentrates

Platelet concentrates are prepared as a pooled unit from four to six whole blood. It can also be obtained by separating a particular blood component from a single donor [10]. One unit of platelets obtained from

apheresis generally contain 200-400 x 109 platelets in 200–300 ml plasma and expected to increase the platelet count by 25,000 to 30,000 per microliter [12]. The transfusion of platelet concentrates in critically ill patients is indicated as a prophylaxis to prevent bleeding in thrombocytopenia patients or patients with defect in platelet function [10]. In critically ill patients, moderate thrombocytopenia (>50x10^9/L) often associated with sepsis and disseminated intravascular coagulation (DIC) [13]. Platelet concentrates can also be administered to prevent bleeding in patients with severe sepsis or hemostatic abnormalities.

2.4 Fresh frozen plasma

One unit of fresh frozen plasma generally consists of all the coagulation factors, fibrinogen, and plasma proteins. One unit of FFP is approximately 300 mL and contain about 70% of labile factors VIII and V [10]. Each FFP unit typically increases coagulation factors by 2-3% in adults. The aim is to achieve 30% normal coagulation factor [6]. In patients with coagulopathy caused by multiple coagulation factors such as DIC, fresh frozen plasma transfusion is indicated to treat hemorrhage [13].

3. Adverse reactions of blood transfusion

An adverse reaction is an unwanted reaction or complication which occurs in the patient after administrating the blood or blood components. Transfusion-related reactions can be categorized into acute which occur in 24 hours and delayed which occur 24 hours after transfusion or later [14]. There are multiple adverse reactions of blood transfusion including infections due to bacterial contamination, hemolytic and non-hemolytic febrile reactions, IgE-mediated allergic reactions, transfusion-related lung injury (TRALI), acute respiratory distress associated with transfusion, and electrolyte abnormalities [6]. The clinical presentation of transfusion reactions usually associated with fever, shivering, respiratory distress, hypertension or hypotension, pain at the infusion site, urticarial, jaundice or hemoglobinuria, nausea/vomiting, and oliguria/anuria [15]. If a transfusion reaction occurs, it is suggested to stop the transfusion immediately and provide supportive therapy [16].

4. Conclusion

It can be concluded from the literatures that blood transfusion is commonly used for supportive treatment of critically ill patients in the ICU. However, unnecessary transfusion can bring harm to the patients, thus blood transfusion must only be given according to the right indication to prevent transfusion reactions.

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