BLOOD TRANSFUSION REACTIONS: WHAT NURSES NEED TO KNOW

The goal of this continuing education activity is to provide nurses and nurse practitioners with knowledge and skills to recognize and manage blood transfusion reactions. Below is an introduction of the topic. Read the article in full online. After reading this article you will be able to:

- Identify risk factors, signs, and symptoms of blood transfusion reaction
- Describe goals of care for a patient with a blood transfusion reaction
- Describe evidence-based nursing and medical management of a blood transfusion reaction

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Blood transfusion therapy can be a life-saving measure for patients; however, there are a variety of complications that can occur both during and after a transfusion that pose serious risk to the patients receiving this therapy. Some of the risks associated with blood transfusions can be life-threatening, and it is for this reason the Food and Drug Administration, the American Association of Blood Banks, and the Joint Commission regulate how blood products are procured, stored, prepared and administered to the recipient.

Historically the largest risk posed to a patient receiving a blood product transfusion was the potential for an infectious disease being transmitted. However, with the implementation of nucleic acid testing (NAT) and other advanced infectious disease screening methods, this risk has significantly decreased[1]. Currently, the risk of Hepatitis B virus (HBV) transmission is estimated to be 1 in 282,000 to 1 in 357,000; the risk of Hepatitis C virus (HCV) transmission is estimated to be 0.03–0.5 in 1,000,000; and for Human Immunodeficiency virus (HIV) the transmission risk is estimated to be 1 in 1.5 to 1 in 4.3 million[2]. With the decline in the infectious disease transmission risks, the focus on blood transfusion therapy complications has shifted to those of a non-infectious nature, such as blood transfusion reactions. The role of nursing in the identification and management of non-infectious complications related to blood transfusion therapy is absolutely crucial.

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WHAT IS A BLOOD TRANSFUSION REACTION?

Any major change in a patient's condition during and/or after a blood product transfusion should be considered a transfusion reaction and warrants further investigation[3]. Blood product transfusion reactions are best classified as either immune mediated or non-immune mediated[1]. Examples of non-immune mediated transfusion complications include iron overload, transfusion associated sepsis, and mistransfusion. While non-immune mediated transfusion reactions have serious implications, the more classic transfusion reaction picture is that of an immune mediated response resulting from the interaction of the recipient's antibodies (either inherited or acquired) with the foreign antigens in the cellular components of the transfused product[4]. The most common immune mediated transfusion reactions are outlined in Table 1, with the most common of all being febrile nonhemolytic transfusion reactions (FNHTR)[4]. For the scope of this article we will focus on the most common and the most dangerous immune mediated transfusion complications – hemolytic transfusion reactions, febrile nonhemolytic transfusion reactions, and transfusion-related acute lung injury (TRALI).

HEMOLYTIC TRANSFUSION REACTIONS:

A hemolytic transfusion reaction occurs when there is rapid destruction of the donor erythrocytes by preexisting recipient antibodies[4]. These reactions are most commonly due to transfusion of an ABO incompatible product, often resulting from clerical or procedural error[4]. Acute hemolytic reactions occur during or within a few hours of the transfusion, and have an estimated incidence of 1 in 10,000 to 1 in 50,000 transfused blood products[1]. Delayed hemolytic reactions generally occur 3 to 10 days after the transfusion of the incompatible product[1].

SIGNS & SYMPTOMS OF HEMOLYTIC TRANSFUSION REACTIONS:

Patients experiencing a hemolytic transfusion reaction commonly present with nonspecific symptoms such as fever, chills, rigors, chest and/or flank pain, pain at the infusion site, dyspnea, hypotension, hemoglobinuria, and diffuse bleeding[1]. Due to the nonspecific nature of these symptoms it is important that hemolytic transfusion reactions are considered first before assuming the symptoms are related to a more common less severe transfusion reaction.

PREVENTION & TREATMENT OF HEMOLYTIC TRANSFUSION REACTIONS:

Hemolytic transfusion reactions are considered medical emergencies and immediate treatment should include stopping the transfusion, beginning an infusion of normal saline, and close monitoring of the patient's airway, blood pressure and heart rate[4]. Adequate fluid replacement is crucial and should be initiated at a rate of approximately 100 to 200 ml/hour to support adequate urine output and avoid the development of acute renal failure[4]. Depending on the severity of the hemolysis other clinical and pharmacological measures such as heprinization, administration of vasopressors, and coagulation function monitoring may be required[4].

FEBRILE NONHEMOLYTIC TRANSFUSION REACTIONS (FNHTRS):

FNHTRs are the most common of all transfusion reactions[1,4], and are typically defined as a 1°C increase in temperature (greater than 38°C) during or within one to six hours after a blood product transfusion[1]. FNHTRs are considered to be caused by cytokines, often derived from the collection and storage of blood products[4]. Research has demonstrated a relationship between the age of the product and the risk of a patient experiencing a FNHTR, with the risk increasing the longer a blood product is stored[4].

SIGNS & SYMPTOMS OF FNHTRS:

The clinical signs and symptoms of a FNHTR include fever, chills, and at times mild dyspnea4. While FNHTRs are benign, and do not pose long term risks to the patient, they can be uncomfortable and frightening while they are occurring[4]. It is also important to note that a diagnosis of FNHTR should not be made until other causes of the fever and chills, including sepsis and hemolysis, have been ruled out[1,4].

PREVENTION & TREATMENT OF FNHTRS:

The most widely accepted preventative measure for FNHTRs is leukoreduction of the blood product to minimize cytokine accumulation and the number of leukocytes transfused[4]. While leukoreduction of blood products is a common practice, patients may still demonstrate signs and symptoms of FNHTRs. Effective clinical management includes stopping the transfusion and ruling out other causes of the presenting symptoms. Considerations for effective pharmacological management include administration of antipyretics, most commonly acetaminophen, as aspirin should be avoided in patients with thrombocytopenia, and possibly meperidine for patients presenting with severe chills and rigors.

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TRALI:

TRALI is defined by the National Heart, Lung, and Blood Institute (NHLBI) as a new acute lung injury that develops during or within 6 hours of a transfusion, of one or more products, in patients without any other risks factors for acute lung injury[1, 5, 6]. The incidence of TRALI is not clearly identified in the literature, however it has been identified as the leading cause of transfusion related morbidity and mortality[1,5]. This is thought to be related to underreporting of the syndrome, and the uncertainty surrounding the TRALI definition[6]. However, in 2006 the FDA did report TRALI as the leading cause of transfusion-related mortality, accounting for 35 deaths, 50.7% of that years reported transfusion-related fatalities[1]. The overall mortality risk associated with TRALI is 5% to 8%, and with adequate supportive care survivors are able to make a complete recovery and even receive blood products in the future[6]. It is important to note that the fatal risks associated with TRALI further emphasize the need for nurses to understand the signs and symptoms of TRALI, allowing for accurate identification, assessment and early intervention.

RISKS FACTORS FOR TRALI

The pathophysiology behind the development of TRALI is not well understood and has only been hypothesized in the literature. The leading theory is that anti-white blood cell (WBC) antibodies, found in the plasma of the donated blood product, react with antigens on the recipient's white blood cells causing an inflammatory immune response within the pulmonary vascular system[6]. This theory has been supported by researchers who have identified anti-leukocyte antibodies in samples of donor or recipient serum after an identified episode of TRALI[6,7,8]. In addition, researchers have found that anti-leukocyte antibodies are more likely to be found in blood products donated by multiparous women than in those donated by men, as there is an increased risk of sensitization to fetal antigens during pregnancy[6].

Other identified risks factors for TRALI include age of the blood product when infused, multiple blood product transfusions for one individual, and underlying conditions such as recent surgery, active infection, and hematologic malignancies[5, 6,8].

SIGNS & SYMPTOMS OF TRALI:

The typical clinical presentation of a patient with TRALI is sudden onset of respiratory distress during or shortly after a blood product transfusion. Consistent with the TRALI definition, symptoms may be delayed for up to 6 hours, however, typically they occur within 1 to 2 hours following the transfusion. Other common symptoms related to TRALI include fever, tachycardia, tachypnea, and hypotension, though this is less common than the others[6]. Some patients who require intubation have been noted to have elevated peak airway pressures and frothy pink airway secretions, classic signs of pulmonary edema. TRALI often resolves rapidly, with a majority of patients being extubated within 48 hours, and resolution of chest radiographic changes within 96 hours[6].

If the nurse identifies dyspnea or hypoxemia upon assessing a patient within 6 hours of any blood product transfusion, a potential diagnosis of TRALI should be considered[6].

PREVENTION & TREATMENT OF TRALI:

The ambiguity related to the pathophysiological process for TRALI makes it difficult to implement and validate preventative measures. Most measures identified in the literature relate to donor management strategies, such as screening previously pregnant donors for WBC antibodies and excluding those donors who are identified as having high levels of WBC antibodies[6].

USE OF PREMEDICATIONS FOR TRANSFUSION REACTIONS:

There has been a long standing debate over the use and effectiveness of premedications for blood product transfusions. The most common medications prescribed prior to blood product transfusions include antihistamines to prevent allergic/anaphylactic reactions and acetaminophen to prevent FNHTRs[1,4,9]. The most recent study to look at the effectiveness of premedications for these types of reactions was a randomized, double-blind, placebo controlled study that found there was no clinically significant difference in the overall risk of transfusion reactions between the treatment (premedicated with acetaminophen and diphenhydramine) and placebo groups[10.]

There is no current evidence to support the use of premedications as a preventative measure for TRALI.

CONCLUSION:

Key Points:

1) Any adverse reaction to a blood product transfusion should be considered a transfusion reaction
2) There are two main types of transfusion reactions, non-immune mediated, and immune mediated
3) Hemolytic transfusion reaction symptoms are nonspecific and

diagnosis should be considered before more common less severe transfusion reactions

4) FNHTRs are the most common transfusion reaction
5) TRALI is a potentially fatal immune mediated transfusion reaction
6) here is no solid evidence to support the use of premedications for transfusion reactions

Table 1.
COMMON IMMUNE MEDIATED TRANSFUSION REACTIONS

- Acute /Delayed Hemolytic
- Febrile Non-Hemolytic
- Allergic/Anaphylactic
- Posttransfusion Purpura (PTP)
- Transfusion-related acute lung injury (TRALI)
- Transfusion-associated graft versus host disease (TA-GVHD)
- Transfusion-related immunomodulation (TRIM)
- Alloimmunization
- Microchimerism

Box 1.
MANAGEMENT OF TRALI TRANSFUSION REACTION

- If transfusion not complete, stop transfusion immediately and infuse normal saline to maintain IV access
- Notify physician upon identification of TRALI signs and symptoms
- Implement hospital transfusion reaction policy
- Supportive care including diuretics and supplemental oxygen or intubation

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