Blood Transfusion Therapy

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KEYWORDS

• Anemia • Red blood cell transfusion • Clinical decision support
• Restrictive transfusion practices

KEY POINTS

- Transfusion of red blood cells (RBCs) is a balance between providing benefit for patients while avoiding risks of transfusion.
- Randomized, controlled trials of restrictive RBC transfusion practices have shown equivalent patient outcomes compared with liberal transfusion practices, and meta-analyses have shown improved in-hospital mortality, reduced cardiac events, and reduced bacterial infections.
- This body of level 1 evidence has led to substantial, improved blood utilization and reduction of inappropriate blood transfusions with implementation of clinical decision support via electronic medical records, along with accompanying educational initiatives.

INTRODUCTION

Blood transfusion therapy is frequently used in the supportive care for treatment of anemia. The transfusion of red blood cells (RBC) is a balance between the benefits of maintaining oxygen delivery and the inherent risks from blood transfusion. The signs and symptoms of anemia vary based on the acuity of the anemia, compensatory change in blood volume, and the compensatory change in cardiac output from the patient's cardiovascular system. Chronic anemia is generally well tolerated due to compensatory expansion of intravascular plasma volume, increased cardiac output, vasodilatation, increased blood flow due to decreased viscosity, and not least, increased RBC 2,3 diphosphoglycerate, with a right shift of the oxygen dissociation curve, so that oxygen is unloaded to the peripheral tissues more readily. Symptoms of anemia are often nonspecific and can include fatigue, pallor, dizziness, headaches, vertigo, tinnitus, dyspnea, and inactivity. Fatigue particularly has been associated with poor quality of life.[1]

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The traditional therapy for chronic, medically related anemia has been RBC transfusions. However, transfusion therapy has been identified as one of the most overused (and inappropriate) therapeutic interventions by national accreditation (Joint Commission) and medical societies, such as the American Board of Internal Medicine,[2] the American Medical Association, the American Society of Hematology (ASH), and the American Association of Blood Banks (AABB; http://www.choosingwisely.org/doctor-patient-lists/american-society-of-hematology/). Recommendations have been published by several medical societies for RBC transfusion therapy in adult[3] and pediatric[4] patients.

The authors have previously reviewed blood transfusion practices,[3,5,6] and herein they provide an updated review of RBC therapy in adult and pediatric patients. The article summarizes current blood risks and indications for RBC transfusion. Important, alternative therapies for management of anemia, such as iron therapy and erythropoietic stimulating agents (ESAs), are outside the scope of this review, but have been published elsewhere.[7,8] Where possible, the article provides evidence-based guidelines for best transfusion practices.

RISKS OF BLOOD TRANSFUSION

Transfusion-transmitted infections prompted concern by patients and health care providers since the 1980s, with the recognition of transfusion transmission of human immunodeficiency virus (HIV) and hepatitis C virus (HCV).[9] These risks have decreased substantially, and responses to emerging pathogens transmitted by blood transfusion have been rapid (**Fig. 1**).[10] Nevertheless, emerging threats of blood-transmissible pathogens is always a concern, the most recent example of which is the Zika virus, in which potential blood donors who are acutely ill and viremic may be asymptomatic and not be deferred during donor screening.[11] For this reason, an experimental nucleic acid test (NAT) was implemented for universal donor testing by end of November 2016. Between 2007 and 2011, transfusion-related acute lung injury (TRALI) caused the highest percentage (43%) of fatalities reported to the US Food and Drug Administration (FDA), followed by hemolytic transfusion reactions (23%) caused by non-ABO- (13%) or ABO- (10%) incompatible blood transfusions.[12]

Increasing evidence suggests that a far greater number of patients now have adverse clinical outcomes (increased morbidity and mortality) associated with unnecessary blood transfusions.[13–15] **Table 1** lists risks that include not only known transmissible pathogens for infectious disease, transfusion reactions, TRALI, errors in blood administration, and circulatory overload but also potential, as yet undefined risks such as immunomodulation (eg, perioperative infection or tumor progression), unknown or emerging risks (such as the new variant Creutzfeldt-Jakob disease and Zika virus),[10,16] and potential risks associated with storage lesions from blood transfusions.[17,18]

Awareness of blood risks and costs[19] has led providers to develop institution-based initiatives in Patient Blood Management, including the adoption of recommendations that limit the use of blood transfusion.[3] Patient Blood Management encompasses an evidence-based approach that is multidisciplinary (transfusion medicine specialists, surgeons, anesthesiologists, and critical care specialists) and multiprofessional (physicians, nurses, pump technologists, and pharmacists).[20] Preventative strategies are emphasized to identify, evaluate, and manage anemia in medical[6] and surgical[21] patients, use of pharmacologic interventions,[7,8] and the avoidance of unnecessary diagnostic testing to minimize iatrogenic blood loss[22]; and to establish clinical practice recommendations for blood transfusions.[3] For anemic patients being evaluated for

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