Introduction to Transfusion Therapy

1

Introduction to Transfusion Therapy

IMPORTANT NOTICE

The facility must ensure that all nurses responsible for the care and management of patients receiving blood and blood products are knowledgeable and competent in the administration procedures and the potential complications associated complications associated with this therapy.

2

Introduction to Transfusion Therapy

Objectives

Upon completion of this course, the participant will be able to:

- Explain the blood grouping systems and their importance in transfusion therapy.
- List available blood components and indications for each.
- Describe the activities required in preparation for transfusion.
- Identify equipment used to administer a transfusion and its proper usage.
- Describe the clinical management of a blood component infusion.
- Describe signs and symptoms of transfusion reactions, and appropriate interventions for each.
- Explain appropriate patient education related to transfusion therapy.
- Identify the required documentation for a blood transfusion.

3

Introduction to Transfusion Therapy

Definitions

Blood Type - any of the various types of human blood whose antigen characteristics determine compatibility in transfusion.

Crossmatch - Testing the compatibility of a donor's and a recipient's blood or tissue.

Coagulant Factor - any of a number of substances in blood plasma which are involved in the clotting process, such as factor VIII.

Aphaeretic - Any procedure in which blood is withdrawn from a donor, a portion (such as plasma, leukocytes, or platelets) is separated and retained, and the remainder is transfused back into the donor.

Hypoxia - Oxygen deficiency in a biotic environment.

Neutropenia - The presence of abnormally few neutrophils in the blood, leading to increased susceptibility to infection.

Febrile Reaction - A fever greater than or equal to 101.4° F (38° C) oral and a change of at least 1.8° F (1° C) from the pretransfusion temperature or chills or rigors that occurs during or within 4 hours of cessation of transfusion.

Coomb Test - Antiglobulin testing, also known as the Coombs test, is an immunology laboratory procedure used to detect the presence of antibodies against circulating red blood cells (RBCs) in the body, which then induce hemolysis.

4

Introduction to Transfusion Therapy

General Guidance and Considerations

It is recommended that the facility obtain a copy of the American Association of Blood Banks standards prior to the administration of blood/blood products.

Hemoglobin and hematocrit levels designating need for blood transfusion are not universal. Recommendations to transfuse an individual are based on:

- Patient age
- Underlying medical condition
- Symptoms resulting from tissue hypoxia
- Rate of change of the hematocrit level.

Licensed nurses caring for patients receiving transfusion therapies are expected to follow infection control and safety compliance procedures.

The only solution/medication that may infuse with blood/ blood products is normal saline.

5

Introduction to Transfusion Therapy

General Guidance and Considerations

Administration of blood/blood products requires informed consent from the patient or legally authorized representative. The patient or representative must be informed of benefits as well as potential complications associated with blood/blood products administration.

STAT orders for blood/blood products transfusions in the long-term care setting are not acceptable. Patients requiring blood warmers or rapid transfusions should be transferred to the acute care setting.

Vascular access must be verified prior to transfusion. Blood and blood products may be transfused through a 20–24-gauge catheter, though infusion time will be slower with a smaller gauge catheter

Two licensed nurses will verify patient identification by matching blood/blood product label with the bracelet placed on the patient at the time of the type and crossmatch.

Blood and blood products should not hang longer than recommended by AABB standards.

6

Introduction to Transfusion Therapy

Significance of Blood Group Systems in Transfusion Therapy

The term "blood group" refers to the entire blood group system comprising red blood cell (RBC) antigens whose specificity is controlled by a series of genes which can be allelic or linked very closely on the same chromosome. "Blood type" refers to a specific pattern of reaction to testing antisera within a given system.

Among blood group systems, ABO is the most important in transfusion since any person above the age of 6 months possess clinically significant anti-A and/or anti-B antibodies in their serum. Blood group A contains antibody against blood group B in serum and vice-versa, while blood group O contains no A/B antigen but both their antibodies in serum.

The Rhesus-system is the second most important blood group system after ABO. The RBC surface of an individual may or may not have a Rh factor or immunogenic D-antigen. Accordingly, the status is indicated as either Rh-positive (D-antigen present) or Rh-negative (D-antigen absent).

While transfusion is typically a low-risk procedure, the possibility of serious complications due to incompatible or "wrong blood" necessitates the routine practice of blood typing and crossmatching blood products to prevent adverse transfusion reactions.

7

Introduction to Transfusion Therapy

Indications for the use of Transfusion Therapy

Guidelines on red blood cell transfusion from the American Association of Blood Banks advise a restrictive approach for stable patients with non-hemorrhaging anemia. This means that while anemia is usually defined as a hemoglobin level of less than 13 g/dL in males and less than 12 g/dL in females, 7 g/dL is the agreed-upon value for the transfusion of red blood cells to be indicated in healthy and asymptomatic patients. The guidelines recommend a value of 8 g/dL as the threshold in patients with coronary artery disease or those undergoing orthopedic surgeries.

Transfusion may also be indicated in patients with active or acute bleeding and patients with symptoms related to anemia (for example, tachycardia, weakness, dyspnea on exertion) and hemoglobin less than 8 g/dL.

8

Introduction to Transfusion Therapy

Fresh frozen plasma (FFP) contains normal levels of the stable clotting factors, albumin and immunoglobulins. It contains at least 70 % of the original coagulant factor VIII and at least similar quantities of the other labile clotting factors and natural inhibitors of coagulation.

Specific Indications for the Transfusion of FFP include:

- Ongoing bleeding in patients with liver disease
- Together with vitamin K and 3-factor prothrombin complex concentrate (used for severe bleeding) for reversal of prolonged INR in patients with Coumadin related bleeding
- Patients with acute disseminated intravascular coagulation (DIC) and active bleeding
- Prevention of bleeding in patients undergoing surgery or invasive procedures in whom the INR > 1.8
- Aphaeretic treatment of thrombotic microangiopathies (TTP)
- Hereditary angioedema due to deficiency of the inactivator of C1 esterase, in the absence of the specific plasma derivative
- Damage control resuscitation together with RBCs

9

Introduction to Transfusion Therapy

Other Components Used in Transfusion Therapy

Platelet transfusion may be indicated to prevent hemorrhage in patients with thrombocytopenia or platelet function defects. Contraindications to platelet transfusion include thrombotic thrombocytopenic purpura and heparin-induced thrombocytopenia. Transfusion of platelets in these conditions can result in further thrombosis.

Cryoprecipitate is prepared by thawing fresh frozen plasma and collecting the precipitate. Cryoprecipitate contains high concentrations of factor VIII and fibrinogen. Cryoprecipitate is used in cases of hypofibrinogenemia, which most often occurs in the setting of massive hemorrhage or consumptive coagulopathy.

Packed red blood cells are infused to prevent the manifestation of anemia-related tissue hypoxia. The administration of packed red cells is the “ultima ratio” of anemia treatment, employed to achieve the primary treatment goal in cases where causal treatment of the anemia is either not feasible or inadequate.

Granulocytes are indicated when a patient has severe neutropenia due to bone marrow failure, has a proven or probable fungal or bacterial infection that is unresponsive to appropriate antimicrobial therapy, and is anticipated to recover neutrophils after treatment.

10

Introduction to Transfusion Therapy

Contraindications for the use of Transfusion Therapy

There are no absolute contraindications, but some patients or their patients (in pediatric cases) may refuse to receive transfusions on religious grounds. Whole blood transfusion is not indicated when component-specific treatment is available, such as using red blood cells to treat anemia or using fresh frozen plasma to treat coagulopathy. Whole blood transfusion could lead to many complications, for instance, volume overload, which is why it is advisable to use component therapy whenever possible.

11

Introduction to Transfusion Therapy

Before the Transfusion

ALWAYS find a patient's current blood type and crossmatch before transfusion therapy. This involves collecting the sample, sending it to the blood bank with correct date, timing, and labeling, then receiving the prepared units from the blood bank. Transfusing the wrong blood into a patient can cause a hemolytic transfusion reaction which can prove fatal.

Obtain informed consent from the patient by discussing the procedure with patient or authorized representative, confirming the patient's health history and allergies, and ensuring the supervising doctor has acquired signature consent.

Obtain base vital signs from the patient, including heart rate, blood pressure, temperature, pulse oximeter, and respiratory rate. Document lung sounds and urinary output as well. Notify the doctor if patient's temperature is higher than 100 degrees Fahrenheit.

12

Introduction to Transfusion Therapy

Equipment Needed for the Procedure

- Emergency equipment for airway management
- Blood product as ordered
- Blood/blood product administration set as specified by facility protocol
- Filter system as appropriate
- Needless connector
- Prescribed flushing agent in 10 mL barrel diameter or larger syringe
- Alcohol pads
- Clean gloves
- Pre-medication/emergency medications as ordered by physician/LIP
- Electronic infusion device

13

Introduction to Transfusion Therapy

Transfusion Therapy Procedure

1. Verify physician/LIP order
2. Verify consent for transfusion has been obtained
3. Identify patient using appropriate identifiers
4. Explain procedure to patient/significant other
5. Instruct patient to alert the nurse to any unusual sensations experienced during or following the transfusion
6. Obtain vital signs and assess lung sounds
7. Verify with second licensed nurse, patient identification by matching blood product label with the bracelet placed on the patient at the time of the type and crossmatch
8. Perform hand hygiene
9. Assemble supplies and equipment on a clean work surface
10. Don gloves

14

Introduction to Transfusion Therapy

Transfusion Therapy Procedure

11. Verify vascular access is present and patent
12. Close all clamps on blood administration set
13. Hang blood/blood product container and normal saline (if applicable) on IV pole
14. Remove protective cover from access port on blood/blood product, maintaining asepsis
15. Prime the appropriate blood administration set with normal saline
16. Using aseptic technique, insert spike on blood administration set into blood/blood product container and access port
17. Vigorously cleanse needleless connector with alcohol. Allow to air dry
18. Maintaining asepsis, attach flush syringe to needleless connector. Aspirate the catheter to obtain positive blood return to verify vascular access patency
19. Flush with prescribed flushing agent

15

Introduction to Transfusion Therapy

Transfusion Therapy Procedure

20. Attach blood administration set to needleless connector
21. Secure blood administration set
22. Initiate transfusion per facility protocol for specific blood/blood product type
23. Verify that the solution is infusing at the prescribed rate
24. Follow all other procedures for intermittent infusions
25. Change needleless connector post infusion per procedure

16

Introduction to Transfusion Therapy

Documentation in the Medical Record Should Include but is not Limited to:

- Date and time of procedure
- Second licensed nurse verification
- Informed consent
- Prescribed flushing agent(s)
- Verification of blood/blood product by two licensed nurses
- Type and volume of blood product administered
- Vital signs
- Site assessment
- Complications and interventions encountered
- Patient response to procedure and/or transfusion
- Patient/significant other teaching

17

Introduction to Transfusion Therapy

Possible Complications Associated with Transfusion Therapy

Febrile reaction - If this occurs, the transfusion should be halted, and the patient evaluated, as a hemolytic reaction can initially appear similar and consider performing a hemolytic or infectious workup. The treatment is with acetaminophen and, if needed, diphenhydramine for symptomatic control. After treatment and exclusion of other causes, the transfusion can be resumed at a slower rate.

Transfusion-associated circulatory overload (TACO) - It is characterized by respiratory distress secondary to cardiogenic pulmonary edema. This reaction is most common in patients already in a fluid-overloaded state, such as congestive heart failure or acute renal failure. Diagnosis is based on symptom onset within 6 to 12 hours of receiving a transfusion, clinical evidence of fluid overload, pulmonary edema, elevated brain natriuretic peptide, and response to diuretics.

Preventive efforts and treatment include limiting the number of transfusions to the lowest amount necessary, transfusing over the slowest possible time, and administering diuretics before or between transfusions.

18

Introduction to Transfusion Therapy

Possible Complications Associated with Transfusion Therapy

Allergic reaction - It often manifests as urticaria and pruritis and occurs in less than 1% of transfusions. More severe symptoms, such as bronchospasm, wheezing, and anaphylaxis, are rare. Allergic reactions may be seen in patients who are IgA deficient, as exposure to IgA in donor products can cause a severe anaphylactoid reaction. This can be avoided by washing the plasma from the cells prior to transfusion. Mild symptoms, such as pruritis and urticaria can be treated with antihistamines. More severe symptoms can be treated with bronchodilators, steroids, and epinephrine.

Transfusion-related lung injury (TRALI) - This is uncommon, occurring in about 1:12,000 transfusions. Patients will develop symptoms within 2 to 4 hours after receiving a transfusion. Patients will develop acute hypoxemic respiratory distress, similar to acute respiratory distress syndrome (ARDS). Patients will have pulmonary edema, normal central venous pressure, without evidence of left heart failure. Diagnosis is made based on a history of recent transfusion, chest x-ray with diffuse patchy infiltrates, and the exclusion of other etiologies. While there is a 10% mortality, the remaining 90% will resolve within 96 hours with supportive care only.

19

Introduction to Transfusion Therapy

Possible Complications Associated with Transfusion Therapy

Infections - These are potential complications. However, the risk of infections has decreased due to the screening of potential donors, so hepatitis C and human immunodeficiency virus risk are less than 1 in a million. Bacterial infection can also occur, but does so rarely, about once in every 250,000 units of red cells transfused.

Electrolyte abnormalities - They can also occur, although these are rare and more likely associated with large volume transfusion.

- Hypocalcemia can result as citrate, an anticoagulant in blood products, binds with calcium.
- Hyperkalemia can occur from the release of potassium from cells during storage. Higher risk in neonates and patients with renal insufficiency.
- Hypokalemia can result as a result of alkalinization of the blood as citrate is converted to bicarbonate by the liver in patients with normal hepatic function.

20

Introduction to Transfusion Therapy

Possible Complications Associated with Transfusion Therapy

Fatal hemolysis from hemolytic transfusion reaction - This is extremely rare, occurring only in 1 out of nearly 2 million transfusions. It results from ABO incompatibility, and the recipient's antibodies recognize and induce hemolysis in the donor's transfused cells. Patients will develop an acute onset of fevers and chills, low back pain, flushing, dyspnea as well as becoming tachycardic and going into shock. Treatment is to stop the transfusion, leave the IV in place, intravenous fluids with normal saline, and keep urine output greater than 100 mL/hour, diuretics may also be needed. Cardiorespiratory support may be provided as appropriate. A hemolytic workup should also be performed, including sending the donor blood and tubing and post-transfusion labs (see below for list) from the recipient to the blood bank.

- Retype and crossmatch
- Direct and indirect Coombs tests
- Complete blood count (CBC), creatinine, PT, and PTT (draw from the other arm)
- Peripheral smear
- Haptoglobin, indirect bilirubin, LDH, plasma-free hemoglobin
- Urinalysis for hemoglobin

21

Introduction to Transfusion Therapy

In Conclusion

Blood transfusions are a relatively common medical procedure, and while typically safe, there are multiple complications that practitioners need to be able to recognize and treat. We have reviewed these complications as well as possible interventions in the event of their occurrence. Blood typing and crossmatching are critical in transfusion therapy in the prevention of fatal hemolysis. We have reviewed the types of blood products most often used in infusion therapy along with their indications. Transfusion therapy has no absolute contraindications but whole blood transfusion should not be used if blood components are a viable option.

22

References

- Goodnough LT, Panigrahi AK. Blood Transfusion Therapy. Med Clin North Am. 2017 Mar;101(2):431-447. doi: 10.1016/j.mcna.2016.09.012. Epub 2016 Dec 24. PMID: 28189180; PMCID: PMC7094649.
- Mitra R, Mishra N, Rath GP. Blood groups systems. Indian J Anaesth. 2014 Sep;58(5):524-8. doi: 10.4103/0019-5049.144645. PMID: 25535412; PMCID: PMC4260296.
- Marik PE. Transfusion of Blood and Blood Products. Evidence-Based Critical Care. 2014 Aug 19:585–619. doi: 10.1007/978-3-319-11020-2_38. PMCID: PMC7124112.
- Lotterman S, Sharma S. Blood Transfusion. [Updated 2022 Jun 25]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK499824/
- Müller MM, Geisen C, Zacharowski K, Tonn T, Seifried E. Transfusion of Packed Red Cells: Indications, Triggers and Adverse Events. Dtsch Arztebl Int. 2015 Jul 20;112(29-30):507-17; quiz 518. doi: 10.3238/arztebl.2015.0507. PMID: 26249256; PMCID: PMC4555065.
- Gea-Banacloche J. Granulocyte transfusions: A concise review for practitioners. Cytotherapy. 2017 Nov;19(11):1256-1269. doi: 10.1016/j.jcyt.2017.08.012. Epub 2017 Sep 12. PMID: 28916227; PMCID: PMC5716890.

23