Blood Transfusion: Administering – an Overview

What Is Administration of a Blood Transfusion?
› Administering a blood transfusion is the process of intravenously infusing whole blood or blood components (i.e., the major products of whole blood: RBCs, WBCs, also known as leukocytes, fresh plasma, and platelets) into a patient. Fractions of the major components of blood can also be transfused (for more information about blood fractions, see What You Need to Know Before Administering a Blood Transfusion, below)

- **What:** Most commonly, a blood transfusion involves infusion of blood from an unrelated donor, commonly known as an *allogeneic* transfusion or *homologous* transfusion. However, a blood transfusion can involve infusion of a patient’s own blood, termed an *autologous* transfusion, either from a donation made before a procedure or from blood recovered from drains during or immediately following surgery. A directed donation is a donation of blood directed to a specific recipient instead of a donation made to a community blood bank

- **How:** Blood/blood components are transfused using general aseptic non-touch technique (ANTT; i.e., a form of aseptic technique that utilizes measures to prevent the sterile part of equipment or medication/solution from contacting anything that is not sterile before introduction into the patient). For details about the steps employed in administering blood, see How to Administer a Blood Transfusion, below

- **Where:** Blood transfusions are most commonly administered in the acute care setting. Patients who require frequent, routine transfusions can receive them in outpatient settings, including independent infusion centers, ambulatory care centers, and physicians’ offices

- **Who:** Blood transfusions can be administered by physicians, advanced practitioners, emergency medical first responders, and registered nurses (RNs) who have been educated on proper transfusion policy and trained in monitoring for adverse reactions. A licensed vocational nurse (LVN) is permitted to check blood (i.e., verify the compatibility of the patient’s blood with the blood or blood component to be transfused) with an RN, if according to facility protocol, but an LVN is not allowed to assume responsibility for transfusions. Properly trained support staff (e.g., nursing assistants) can assist in the detection of symptoms of transfusion reaction (e.g., hives, itching, and fever), but they are not independently responsible for identifying or intervening in response to transfusion reactions. Any assistive staff member involved in the care of a patient during a blood transfusion should be instructed to notify the nurse clinician immediately for thorough patient evaluation if the patient reports or is observed to have abnormal signs/symptoms

What is the Desired Outcome of Administering a Blood Transfusion?
› The desired outcome of administering a blood transfusion is the replenishment of blood or a specific blood component without complications

Why is Administering a Blood Transfusion Important?
› Blood transfusion is used to correct abnormally low levels of blood components due to trauma, surgery, or pathology (e.g., anemia, thrombocytopenia [i.e., abnormally low platelet count], sickle cell disease, hemophilia)
Blood serves numerous critical life functions, including
• cellular support
  – Delivery of oxygen, nutrients (e.g., glucose, amino acids, fatty acids) to body cells
  – Transport of waste products (i.e., carbon dioxide, urea, lactic acid) from the cells
• immune support (e.g., delivery of granulocytes to an infection site)
• coagulation support
• regulation of body pH
• transportation of hormones
• regulation of core body temperature

Facts and Figures
• The average adult body contains ~ 14–18 pints of blood (Hajjar et al., 2010)
• More than 2 million units of RBCs are transfused in the United Kingdom each year, for a transfusion rate of ~ 45 units per 1,000 population per year (Brunskill et al., 2015)
• During the period 1996–2008, 125 persons in the United Kingdom died because of blood transfusions. The most common causes of death following a transfusion are acute lung injury (32%) and transfusion of the wrong blood component (19%) (Farrell et al., 2010)
• Death due to acute hemolytic transfusion reaction (i.e., rapid destruction of donor RBCs by host antibodies, also known as immediate transfusion reaction) occurs in 1 out of every 100,000 units transfused (see, What You Need to Know Before Administering a Blood Transfusion, below). Typically, a hemolytic reaction to blood transfusion is evident before the transfusion is completed but onset of symptoms can occur up to 1–2 hours post-transfusion. Patients are at highest risk for adverse reactions during the first 15 minutes of the transfusion, which underscores the importance of administering blood at a low rate at the beginning of the transfusion (Kardon, 2016)
• Cochrane reviewers found evidence to support a restrictive transfusion strategy (i.e., limiting transfusion to patients with Hgb concentration below 7–8 g/dL) in most patients. They analyzed data from 31 trials involving 12,587 patients across a range of clinical specialties and reported that implementation of a restrictive transfusion strategy reduced the rate of RBC transfusion by 43% overall and had no significant effect on 30-day morbidity or mortality rates. They were, however, unable to assess the safety of restrictive transfusion practices in various subgroups of patients, including those with acute coronary syndrome, myocardial infarction, stroke, cancer, and brain injury (Carson et al., 2016b)
  – The AABB (formerly known as the American Association of Blood Banks) recommends a restrictive RBC transfusion threshold of 7 g/dL for hemodynamically stable patients, including those who are critically ill, and 8 g/dL for those undergoing orthopedic or cardiac surgery and those with preexisting cardiovascular disease (Carson et al., 2016)
  – National Institute for Health and Care Excellence (NICE) recommends a restrictive RBC transfusion threshold of 7–9 g/dL (NICE, 2015)
• The risks of acquiring a bloodborne infection from blood processed within the U.S. are as follows (American Cancer Society, 2017; McIntyre et al., 2013):
  • Hepatitis A virus (1:2,000,000 donations)
  • Hepatitis B virus (1:800,000–1:1,000,000 donations)
  • Hepatitis C virus (1:1,000,000 donations)
  • Human T-lymphotropic virus (HTLV); (1:4,300,000 donations)
  • HIV (1:1,000,000–1:1,500,000 donations)
• Researchers studied intraoperative transfusion practices in 126 European centers and found that the overall rate of intraoperative transfusion was 1.8%. Hypotension (55.4%) and tachycardia (30.7%) were the most common clinical triggers for transfusion. Low Hgb concentration alone triggered only 8.5% of transfusions (Meier et al., 2016)
• Investigators who conducted a retrospective analysis of 30-day morbidity and mortality in 10,100 patients who underwent noncardiac surgery found that intraoperative blood transfusion was associated with a 29% increase in mortality. It is unclear whether the increased mortality was because of adverse effects of blood transfusion or because of complications of blood loss (Glance et al., 2011)
• Currently, there are no oxygen-carrying blood substitutes that have been approved by the U.S. FDA (Alayash, 2017)

What You Need to Know Before Administering a Blood Transfusion
• Before administering a blood transfusion, the nurse should be familiar with the following:
• The major components of whole blood. The primary component of whole blood is plasma (~ 55% of total volume). The remaining components are RBCs (~ 45% of the total volume of a unit of whole blood) and WBCs and platelets (together accounting for < 1 % of total volume). The typical volume of a unit of whole blood equals ~ 550 mL (~ 480 mL of whole blood plus 70 mL of anticoagulant preservative solution). Typically (due to age and processing), there are no functional platelets or neutrophils in whole blood so, therapeutically, a unit of whole blood is equivalent to a unit of RBCs and a unit of plasma. For more information, see Nursing Practice & Skill ... Blood Transfusion: Administering Whole Blood

A unit of RBCs, also known as packed RBCs, typically consists of 250–300 mL of volume, only 150–200 mL of which is RBCs (Figure 1). The remaining volume (100 mL) is composed of anticoagulant and storage solution and a small volume of plasma. For more information, see Nursing Practice & Skill ... Blood Transfusion: Administering Red Blood Cells in Children and Nursing Practice & Skill ... Blood Transfusion: Administering Red Blood Cells in Adults

Figure 1: Unit of red blood cells prepared for transfusion. Copyright© 2014, EBSCO Information Services.

- A unit of leukocyte-poor (also known as leuko-reduced) RBCs is blood that has been filtered or washed to remove nearly70% of WBCs, and it can cause transfusion reactions
- A full-size unit of RBCs can, depending on the patient’s needs, be aseptically divided into as many as eight smaller units called aliquots containing ~ 30–43 mL. The smaller units, called Pedi-Packs or assigned aliquots, are created when only a limited transfusion volume is required or if the unit must be administered over an extended period beyond the maximum transfusion period of 4 hours. This product is typically used for infants who require several small volume transfusions. The aliquots are viable for 42 days after being packaged from the single unit of RBCs. The typical pediatric dose of RBCs is 5–15 mL/kg
- The most common type of WBC used in transfusion therapy is the granulocyte, a type of WBC characterized by the presence of granules in the cytoplasm. Types of granulocytes include neutrophils, eosinophils, and basophils. A typical unit of WBCs includes 20–50 x 10^9 of granulocytes, 20–50 RBCs, and 200mL of plasma. A unit of WBCs for a neonate, contains ~ 5 x 10^9 granulocytes in 30 mL of plasma. WBC concentrates are always irradiated to prevent transfusion-associated graft versus host disease (GVHD; i.e., life-threatening condition occurring when donor WBCs attack the recipient’s body tissues; for more information, see Quick Lesson About ... Graft-Versus-Host Disease)
- Plasma (fresh or fresh frozen noncellular blood components) is administered in units of ~ 200–250 mL in volume. A unit of plasma consists of water (91%); plasma proteins, including clotting factors (7%); and carbohydrates (2%); (Figure 2). For more information, see Nursing Practice & Skill ... Blood Transfusion: Administering Fresh Frozen Plasma
– Each unit of platelets contains a minimum of $5.5 \times 10^{10}$ platelets suspended in 50–400 mL of plasma (Figure 3). Platelets are stored at room temperature with constant agitation for 5 days; storage time is limited to 5 days because warmer storage conditions increase the risk of bacterial growth. Platelet units from several donors are often pooled when transfusion is required (see Nursing Practice & Skill ... Blood Transfusion: Administering Platelets)

- Fractions of major blood components, which include the following:
  – WBC fractions (e.g., interferons, interleukins)
  – Plasma fractions (e.g., Plasmanate [i.e., protein solution comprised of ~ 88% of human albumin, 12% alpha and beta globulins, and not more than 1% gamma globulin], albumin, globulins, natural clotting factors, cryosupernatant [cryo-poor plasma], cryoprecipitate)
  - Cryoprecipitate is prepared from plasma and contains certain clotting factors (i.e., factor VIII, fibrinogen, factor XIII, fibronectin, and von Willebrand factor). Cryoprecipitate is available in prepooled concentrates of six units, each of which is collected from a separate donor. Each unit is suspended in 15 mL of plasma before pooling. A single unit of cryoprecipitate provides ~ 350 mL of fibrinogen. For more information, see Nursing Practice & Skill ... Blood Transfusion: Administering Cryoprecipitate
  – Platelet fractions (e.g., platelet derived wound healing factors)

- Blood/blood component transfusion requires a dedicated line. If the dedicated line must be used for medication administration during the transfusion, the transfusion must be stopped, the line flushed with normal saline (NS; i.e., 0.9% sodium chloride in sterile water), the medication administered, and the line flushed again with NS before the transfusion is restarted
  – Transfusion guidelines published by the Infusion Nurses Society (INS) do not address the issue of interrupting a blood transfusion for medication administration and some facility protocols prohibit this practice
• Adverse effects or complications associated with blood transfusions, which range in severity from uncomfortable symptoms such as fever or hives to life-threatening conditions such as vascular collapse, acute kidney injury, and disseminated intravascular coagulation (DIC) secondary to hemolysis (i.e., rupture) of donor RBCs
  – Acute hemolytic transfusion reaction (AHTR) is the most serious complication of blood transfusion. It is the result of blood type incompatibility and occurs when the patient’s antibodies combine with donor antigens on RBCs, resulting in low back pain, cellular hemolysis, tachycardia, tachypnea, and/or hypotension. The reaction can occur with the transfusion of as little as 10 mL of incompatible blood or blood components
  – Other transfusion reactions include the following:
    - Transfusion-associated circulatory overload (TACO), which is associated with the rapid administration of a large volume of blood and/or administration of a volume greater than the circulatory system can tolerate. Risk for TACO is increased in patients with cardiac problems, particularly heart failure. Symptoms include dyspnea, cyanosis, jugular venous distension, crackles, and precordial chest pain
    - Allergic reaction, which manifests as a skin rash or flushing, urticaria, or asthmatic wheezing and can progress to laryngeal edema and anaphylaxis
    - Febrile nonhemolytic reaction, which occurs as a result of sensitivity to WBCs, plasma proteins, or platelets in donated blood. It manifests as headache, chills, fever, nausea, and general discomfort
    - Delayed hemolytic reaction, which occurs days or weeks after a transfusion when the body slowly attacks the antigens on the transfused blood cells. It is evidenced by ↓ Hct, fever, and jaundice
    - Transfusion-related acute lung injury (TRALI), which is believed to be caused by an interaction between the patient’s leukocytes and antileukocyte antibodies in the transfused blood product, resulting in complement activation and increased pulmonary vascular permeability. TRALI is associated with the presence of bioactive lipids that accumulate in donor blood during storage. This life-threatening complication is characterized by signs/symptoms of pulmonary edema (e.g., respiratory distress, hypoxemia) beginning within 6 hours after transfusion in patients with no history of lung injury. Symptoms can mimic those of circulatory overload (e.g., respiratory difficulty, acute pulmonary edema, hypotension, hypoxemia). The incidence of TRALI is ~ 1 out of every 5,000 transfusions
    - GVHD
    - Bloodborne infection (e.g., HIV, HTLV, hepatitis B and C viruses, West Nile virus, and sepsis)
    - Bacterial sepsis, which results from contaminated blood products and manifests as fever, chills, shock, and rigors, and can lead to death
    - Whole blood should appear deep red in color. Discoloration, sediment, or particles indicate bacterial contamination
  – Complications resulting from transfusing multiple units of blood include the following:
    - Hypocalcemia can occur because the citrate in blood (as much as 3 g/unit) binds ionized calcium
    - Hyperkalemia can result if the blood has been stored for a long period—extended storage time can increase the plasma potassium concentration by more than > 30–40 mmol/L
    - Acid/base disturbances occur because lactic acid levels in blood can rise to 30 mmol/L
    - Hypothermia if blood is not allowed to warm to room temperature before transfusion (see below)
• Methods of reducing the risk of specific transfusion-associated reactions
  – Risk for TACO can be reduced by use of an electronic volumetric pump to deliver the blood/blood component at a steady, consistent rate. If TACO occurs, the transfusion should be stopped, and the patient should be positioned upright with the feet in the dependent position. Prescribed oxygen, diuretics, morphine, and/or other medications are administered
  – Allergic sensitivities can be treated by medicating patients with diphenhydrAMINE (Benadryl) or other antihistamine before beginning the transfusion. Anaphylaxis requires administration of EPINEPHrine
  – Risk for febrile nonhemolytic reaction can be managed by premedicating the patient with an antihistamine or acetaminophen before the transfusion, administering leukocyte-reduced blood products, stopping the transfusion at the first sign of the reaction, and treating symptoms (e.g., administering an antipyretic to control fever)
  – Risk for immune reactions can be minimized by using irradiated or leukocyte-depleted blood components. Antigenic proteins can be removed from RBCs and platelets by washing the cells with saline. (Note: Donated blood can be irradiated before transfusion to reduce the risk of immune response to WBCs [e.g., GVHD]). Radiation will cause WBCs to become nonfunctional but will not affect RBCs
  – Hypothermia can be avoided if blood/blood components are warmed to room temperature before administration. Transfusion of chilled blood products can alter cardiac conduction and result in ventricular arrhythmia. Typically, refrigerated blood components will warm to > 10 °C (50 °F) within ~ 30 minutes following removal from refrigeration. If immediate emergency transfusion is necessary, blood/blood components can be warmed with a blood warming device (for more information, see Nursing Practice & Skill ... Blood and Fluid Warmers: Using)
• Steps to take in the event of an adverse reaction. The transfusion should be stopped immediately and
  – the appropriate interventions implemented, depending on the transfusion reaction observed
  – the blood bank and treating clinician notified
  – the administration set and remaining blood returned to the blood bank
  – (if either whole blood or RBC was transfused) a sample of the patient’s posttransfusion urine should be forwarded to the
    laboratory for evaluation for the presence of Hgb, which is an indication of hemolysis of donor RBCs

• Steps to be taken before ordering blood/blood components from the blood bank. Cross-matching is the term commonly
  used to refer to the testing performed before blood transfusion to confirm compatibility of autologous blood. A specimen of
  the patient’s blood is forwarded to the lab, where it is tested to determine blood type (e.g., O, A, B, AB) and blood factors
  (e.g., Rh, Kell [antigen system test]). In an emergency, blood that has not been cross-matched can be used—Type O and Rh
  negative blood is administered if the recipient’s blood group is unknown and the benefit of transfusion outweighs the risks
  of an antibody-mediated transfusion reaction

• Equipment used for administering blood/blood components
  – Vascular access device (VAD). Blood and blood components can be transfused through a 14–24-gauge short peripheral
    catheter or a central vascular access device (CVAD) with a gauge as small as 1.9 Fr
  – Administration set. Either a single-line (also known as straight line [Figure 4] ) or Y-type tubing (Figure 5) can be used
    for administration of blood/blood components
  - INS standards of practice state that administration sets should be changed every 4 hours and after the completion of each
    unit
  - AABB standards state that a second unit of blood can be administered using the same tubing if the second unit will be
    completely transfused within 4 hours of starting the initial transfusion

![Single Line Blood Administration Set and Filter](image)

**Figure 4:** Single-line blood transfusion administration set. Copyright© 2014, EBSCO Information Services.
Figure 5: Y-type blood administration set. Copyright© 2014, EBSCO Information Services.

- Filter (e.g., standard, microaggregate, leukocyte-depleting filters) with filtering capability (20–260 microns). The standard blood filter is a 170-micron filter. Filters can be in-line or attached to the administration set (“add-on filter”). The INS Standards of Practice state that an individual filter should not be used more than 4 hours.

- NS. Blood and blood components should be administered with NS only and no solutions or medications should be added to the infusion.

- Do not use dextrose (5%) in sterile water (D5W) with blood/blood components. D5W will cause RBCs to hemolyze.

- Lactated Ringer’s or Ringer’s lactate solution (i.e., a crystalloid electrolyte solution) should not be administered simultaneously with blood through the same IV tubing due to the risk of calcium-related clot formation.

- Electronic infusion device (volumetric infusion pump).

- A blood warmer for transfusions that must be completed rapidly, such as in emergency situations (for more information, see Nursing Practice & Skill ... Blood Transfusion: Massive -- Administering and Nursing Practice & Skill ... Blood and Fluid Warmers: Using, referenced above).

- Rapid infusion system (i.e., a device designed to supply uniform pressure to fluid/solution during infusion) for quick infusion in emergency circumstances. Blood/blood components should not be administered under pressure due to the risk of cellular hemolysis. Do not use a BP cuff to force transfusion of blood products because a BP cuff cannot supply uniform pressure to liquid contents and significantly increases the risk for hemolysis.

• Aseptic technique, including an understanding of the method required to disinfect catheter hubs. One of the National Patient Safety Goals (NPSGs) issued by The Joint Commission (TJC) requires that applicant healthcare facilities have in place a standardized protocol to disinfect catheter hubs and injection ports before accessing the IV line (NPSG.07.04.01). A component of the NPSGs supports the recommendation of a vigorous 15-second “Scrub the Hub” proposed by the joint practice commissions of the Society for Healthcare Epidemiology of America and the Infectious Diseases Society of America (TJC, 2013; TJC, 2017).

• In 1999, TJC issued a Sentinel Event Alert regarding blood transfusion errors that included the following recommendations, which have become standard practice in many communities:
  - Use of a unique patient identification band for blood transfusions
  - Use of computerized verification (e.g., bar code identification for units of blood/blood components)
  - Avoiding use of the patient’s room number to identify blood samples taken for cross-match or for transfusion units
  - Prohibiting simultaneous crossmatching of multiple patients by the same laboratory technologist

• One of the NPSGs established by TJC in 2012 included the elimination of blood transfusion errors that occur because of patient misidentification (NPSG.01.03.01) and stated three specific elements of performance (EP; i.e., implementation requirements). EPs are measurable evidence- and expert-based strategies for achieving the NPSG (for more information, see Evidence Based Care Sheet: National Patient Safety Goals (The Joint Commission, 2016): Blood Transfusion Errors). The three EPs utilize the concept of a two-person, three-way check (i.e., a check in which two qualified staff members verify the patient’s identity at the bedside using at least two separate sources of information and the label on the blood/blood component itself) and are outlined below:
- Before transfusing any blood or blood component
- match the blood component to be transfused with the treating clinician’s order
- match the patient identification with the label on the blood component
- use a two-person verification system to identify the patient and to match the appropriate information
- Both persons must identify the patient and match the medical order and blood component to be transfused; the second
  person cannot simply witness the first person’s actions
- When using a two-person verification system, one of the persons must be the RN who will administer the blood
  component
- When using a two-person verification system, the second person must be qualified to participate in the verification
  process according to facility protocol

Preliminary steps that should be performed before administering a blood transfusion include the following:
• Review the facility/unit-specific protocol for administering a blood transfusion
• Review the treating clinician’s order
  – Verify that the order contains
    - the recipient’s name
    - indication for transfusion
    - the type of blood/blood components to be transfused
    - the number of units or volume to be transfused
    - any special processing (e.g., irradiated)
    - flow rate or any orders specific to the infusion time
    - pre-procedural medications to be administered
• Review the manufacturer’s instructions for all equipment to be used and verify that the equipment is in good working order
• Verify that the patient executed a general consent for treatment that authorizes transfusion of blood/blood components
  at the time of admission or, if required by facility protocol, has completed a separate consent to transfuse blood/blood
  components
  – Note: One signed informed consent document can cover the administration of many transfusions if they are part of a
  single course of treatment and one document can remain in effect for a predesignated length of time (e.g., 3–7 days).
  Consent is often waived in emergent situations, but it is important to consider whether the patient has a religious or
  personal objection to blood transfusion
• Contact the blood bank to verify the availability of the blood/blood components. (Note: This step assumes that a
  specimen of the patient’s blood has been forwarded to the laboratory for typing and cross-matching, the tests have been
  completed, and the appropriate blood/blood component has been ordered [see steps to be taken before ordering blood/blood
  components from the blood bank in What You Need to Know Before Administering a Blood Transfusion, above])
  – Confirm that all autologous blood or directed donation blood is used before other sources
• Review the patient’s medical history/medical record for
  – laboratory test results (e.g., CBC, coagulation profile, Hgb, Hct, calcium)
  – the patient’s blood type and Rh factor
  – previous blood transfusions and information about any transfusion-related adverse reactions
  – any allergies (e.g., latex, medications, or other substances); use alternative materials, as appropriate
• Collect the supplies necessary to administer a blood transfusion, which typically include the following:
  • Nonsterile gloves; additional personal protective equipment (PPE; e.g., gown, mask, eye protection, cap) can be necessary
    depending on facility/unit-specific protocol and the potential for exposure to body fluids
  • Facility-approved pain assessment tool
  • Blood/blood component to be transfused
  • Electronic infusion pump
  • Administration set. Either a single-line administration set or a Y-type blood administration set can be used
    – If using a Y-type administration set, 250 mL NS will be needed to prime and flush the tubing. Typically, use of a volume
      of NS > 250 mL requires an order by a treating clinician—confirm facility protocol and evaluate the patient’s fluid/volume
      status before using additional NS
  • Filter
    – Either an in-line or add-on filter can be used
      - An add-on filter, such as a leukocyte reduction filter can be attached to the administration set if the blood component has
        not been leukocyte-reduced
- Microaggregate filters are not used when infusing whole blood or platelets
- A standard 170-micron filter is commonly used for administering granulocytes

• Slot (“female”) Luer adaptor/valve (to connect the administration set to the patient’s peripheral catheter or CVAD) if the existing adaptor is scheduled for replacement during the transfusion or there is visible remaining residue within the adaptor/valve
• Facility-approved antiseptic wipe (e.g., chlorhexidine gluconate)
• Preprocedural medication (e.g., diphenhydramine[Benadryl]), if prescribed
• Blood warmer, if appropriate
• Two 5-mL Luer-style syringes and NS to be used for flushing the patient’s VAD before and after the transfusion
• Equipment for assessing vital signs (e.g., stethoscope, sphygmomanometer, thermometer)
  –Emergency resuscitation equipment (e.g., “crash cart”) should be readily accessible
• Written information, if available, to reinforce verbal education

How to Administer a Blood Transfusion
› Perform hand hygiene and don nonsterile gloves and other PPE, as necessary
› Identify the patient using at least two identifiers, according to facility protocol
› Establish privacy by closing the door to the patient’s room and/or drawing the curtain surrounding the patient’s bed
› Introduce yourself to the patient and family member(s), if present; explain your clinical role; assess the coping ability of the patient/family and for knowledge deficits and anxiety regarding administration of the blood transfusion
  • Determine whether the patient/family requires accommodations for communication (e.g., due to literacy, language barriers, or deafness); arrange to meet these needs, if present
    –Use a professional certified medical interpreter, either in person or via phone, to resolve a language barrier
• Assess the patient’s understanding of, and previous experience with blood transfusions. Explain the procedure for blood transfusion and its purpose; answer any questions and provide emotional support, as needed
  –Confirm the patient has no religious or personal objections to the transfusion of blood/blood components. Notify the treating clinician if the patient refuses the transfusion and document the patient’s refusal in the medical record (for more information, see Quick Lesson About … Legal Issues … Blood Transfusion: Conscientious Objection)
  –Ask the patient if he or she has ever experienced any transfusion-related reactions or adverse effects
  –Provide literature to enforce patient teaching—many facilities require that patients be supplied with written information before receiving a blood transfusion
  –For more information, see Nursing Practice & Skill … Communication: Communicating with a Patient Who is Anxious
› Assess the patient’s vital signs and general health status, including pain level using a facility-approved pain assessment tool
› Obtain verbal consent for the transfusion, if the intervention is non-emergent
› Assess the patient and verify the VAD is patent and is appropriate for blood transfusion
  • If using a short peripheral catheter, verify the gauge is 14–24 Fr
  • If using a CVAD, verify the lumen is no smaller than 1.9 Fr
› Premedicate the patient, as prescribed
› Obtain the blood/blood component from the blood bank
  • Verify that a person qualified by the facility to obtain the blood obtains the blood/blood component from the blood bank and transports it to the nurse who is to transfuse it. The blood should be transported in a resealable bag in case of accidental breakage
  • Record the date and time the blood was received from the blood bank on the blood transfusion record/delivery form.
  **Infusion of blood/blood components must be initiated within 30 minutes of release by the blood bank or removal from a controlled environment**
  –If more than 30 minutes have elapsed since the time the blood/blood component was released by the blood bank (see the time stamp on the blood delivery form),
    - the transfusion can go forward if the blood/blood components will be used for an immediate transfusion that will be completed with 4 hours of release
    - the blood/blood components must be returned to the blood bank for proper disposal if the blood/blood components will not be used for an immediate transfusion that will be completed within 4 hours. If a unit of blood/blood components is released by the blood bank but is not transfused, documentation of the uncompleted transfusion must be recorded in the patient’s medical record. **It is not acceptable to store blood/blood components on the nursing unit in a refrigerator**
that is not designated for this purpose if the blood/blood component cannot be transfused within 4 hours of release from the blood bank

• Check for normal appearance and color and for the absence of bubbles and any indication of contamination (e.g., discoloration, sediment/particles)
• Allow the blood/blood component to warm to room temperature or use a blood warmer to heat the blood/blood component if the unit is to be rapidly infused (see Nursing Practice & Skill ... Blood and Fluid Warmers: Using, referenced above). Do not exceed the 30-minute time restriction noted above

› At the bedside, confirm with another qualified licensed clinician the following information:
  • The patient’s identity in accordance with facility protocol. Ask the patient to state his or her name if the patient is alert, oriented, and capable of responding to questions
    – AABB guidelines require that patients be issued a second wrist band that is placed on the patient’s arm at the time blood is drawn for the type and cross-match (Harm et al., 2017). This wrist band serves as a third identifier. If the second wrist band is missing at the time of transfusion, a new type and cross-match must be performed before beginning the procedure
  • The specific instructions in the treating clinician’s order for transfusion (e.g., leukocyte filtered)
  • The information on the transfusion record form issued by the blood bank (e.g., unit blood type, donor number, component type, and patient’s medical record number) is consistent with the identifying labels on the unit of blood/blood components and the patient’s blood transfusion identification band
    – Confirm that the donor blood type and Rh factor noted on the blood/blood component unit to be transfused are compatible with the patient’s blood (as identified in the patient’s medical record)
    – Confirm that the blood bank identification number listed on the transfusion record is identical to that listed on the unit of blood/blood components to be transfused
    – If autologous blood is to be transfused, whenever possible, ask the patient to identify his or her signature on the autologous donation label before administration
  • Verify that the expiration date of the blood/blood component has not passed
  • Once the bedside confirmation is complete, sign and/or initial with the other clinician the patient’s medical record/transfusion record before administering the transfusion

› Contact the blood bank and do not transfuse the blood/blood components if any discrepancy is noted

› Immediately before initiating the transfusion, assess the patient’s vital signs and oxygen saturation using pulse oximetry, auscultate the patient’s lungs, check for jugular venous distention, and note the condition of the patient’s skin, to establish a baseline to identify any changes that occur during or after the transfusion. Notify the treating clinician of any unexpected findings
  • If feasible, delay transfusion if patient’s temperature exceeds 101.7°F (38.7°C)
› Mix the unit of blood/blood components by gently inverting the blood bag
› Prepare the administration set (if using a single-line administration set)
  • Use aseptic technique to open the packaging of the single-line blood administration set
  • Move the regulating clamp close to the drip chamber and close the clamp
  • Verify the add-on filter is attached securely
  • Open the outlet tab on the unit of blood
  • Remove the protective cap from the filter piercing pin ("spike")
  • Use a twisting-pushing motion to insert the piercing pin into the outlet port of the unit of blood/blood component
  • Open the regulating clamp
  • Invert the unit of blood/blood component and hold the drip chamber and administration set vertically above the blood bag
  • Squeeze the blood bag with a single firm motion to force the blood upward through the filter into the drip chamber
    – Squeeze the blood bag, not the drip chamber. Do not squeeze the drip chamber — squeezing the drip chamber can introduce air into the filter that can reduce the rate of flow and impair filter efficiency
    – Avoid excessive manipulation of the blood bag to reduce the risk of hemolysis
  • Verify the drip chamber is filled approximately two-thirds with blood and close the regulating clamp. If a high flow rate is needed, the drip chamber should be filled to capacity to avoid air entrapment. Do not release the blood bag until it is suspended on the IV pole
  • Invert the unit of blood and suspend it from the IV pole
  • Gently tap the filter chamber to expel any air remaining within the filter. (The filter should be completely saturated with blood. The drip chamber will be partially filled with air to serve as a visual confirmation of flow)
  • Loosen (but do not remove) the cap on the Luer tip
• Open the regulating clamp and allow the blood to prime the administration set and purge any air remaining in the
downstream tubing
• Close the regulating clamp

› Prepare the administration set (if using a Y-type blood administration set)
• Use aseptic technique to open the packaging of the single-line blood administration set
• Close the on/off clamps on both arms of the Y tubing
• Position the regulating clamp close to the bulb pump and close the regulating clamp
• Open the slide clamp
• Remove the outlet tab from the bag of NS
• Remove the protective cap from the piercing pin of arm #1 of the administration set
• Use a twisting-pushing motion to insert the piercing pin of arm #1 of the administration set into the outlet port of the bag of
NS
• Suspend the bag of NS on the IV pole and allow the administration set to hang freely—loop excess tubing on the IV pole to
prevent it from touching the floor
• Open the on/off clamp of arm #1 (spiked with NS)
• Partially open the regulating clamp to control the rate of flow and elevate the regulating clamp above the drip/filter
chamber
• Gently squeeze and release the drip chamber to promote the flow of NS. Allow the NS to completely fill the non-filter
portion of the drip chamber and partially saturate the filter
• Close the regulating clamp and return the drip chamber to the upright position
• Loosen the protective cap on the piercing pin of arm #2 and open the on/off clamp on arm #2
• Invert the drip chamber and back prime arm #2. Close the on/off clamp on arm #2
• Loosen the cap on the Luer tip and open the regulating clamp to permit the NS to prime the tubing and purge any air
remaining in the downstream tubing
• Close the regulating clamp
• Gently tap the filter chamber to expel any air remaining in the filter
• Verify the filter is completely saturated with NS. The top portion of the chamber should be partially filled so that it can
serve as a drip chamber and a visual confirmation of flow
• Close the on/off clamp of arm #1 of the Y tubing
• Open the outlet tab of the unit of blood
• Remove the protective cap from the piercing pin of arm #2 of the administration set
• Use a twisting-pushing motion to insert the piercing pin into the outlet port of the unit of blood
• Suspend the unit of blood from the IV pole
  – Note: If the administration set includes a bulb pump for rapid infusion, the regulating clamp must remain open when the
bulb is compressed

› If it is necessary, remove and replace the Luer adaptor/valve
• Scrub the Luer-activated surface of the adaptor valve (Figure 6) of the patient’s peripheral catheter or CVAD for 15
seconds with a facility-approved antiseptic solution and allow it to air dry
• Using a firm pushing and a twisting motion, connect the Luer adaptor/valve to the patient’s catheter or CVAD. Rotate the adaptor/valve until the connection is secure

› Use the syringe and NS to flush the adaptor/valve
› Connect the plug/prong type Luer end of the primed administration set to the slot type Luer adaptor/valve. Rotate the plug/prong type Luer attachment until the connection is secure
› Insert the tubing into the infusion pump, program the pump, and begin the blood transfusion

• To begin blood flow,
  – for the single-line administration set, open the regulating clamp
  – for the Y-type administration set, open the on/off clamp of arm #2 and the regulating clamp

• The rate of flow during the first 15 minutes should be approximately 2 mL/min, according to AABB guidelines. Because most transfusion reactions occur during the first 15 minutes of a transfusion, the nurse should remain at the patient’s bedside to observe for potential transfusion reactions
• After 15 minutes, reassess patient vital signs, auscultate the patient’s lungs, check for jugular venous distention, and note the condition of the patient’s skin to assess for transfusion reaction
• If no adverse transfusion reactions are observed during the first 15 minutes, the infusion rate can be increased to administer the unit of blood/blood components within 4 hours
  – The infusion time for blood/blood components varies depending on the product, the patient’s condition, the clinician’s orders, and facility protocol. The infusion time for
    - RBC transfusions average 2 hours unless the patient is unable to tolerate rapid expansion of the intravascular volume and requires a longer infusion time
    - platelets, plasma, and cryoprecipitate transfusions average 10 mL/min (~ 30 minutes) or as rapidly as the patient can tolerate
  – If the blood/blood component must be infused over a period exceeding 4 hours, the unit must be infused in divided doses (see discussion of Pedi-Pack units, above). Any blood not infused within 4 hours should be disconnected from the administration set and disposed of in a hazardous waste bin or returned to the blood bank
  – Verify that the additional infusion will not place the patient at risk for circulatory overload. In many cases, the maintenance IV solution is reduced by the flow rate of a concurrently infusing blood product

› Document the flow rate of the infusion and the patient’s vital signs, lung sounds, and appearance of the skin for urticaria, jugular venous distention, and other signs of circulatory overload or transfusion reaction, at intervals required by facility protocols and the patient’s status (for more information, see Nursing Practice & Skill ... Jugular Venous Pressure: Measuring). Many facility protocols require assessment of vital signs during the first 15 minutes of the infusion, 30 minutes thereafter, at the completion of the transfusion, and several hours following completion of the transfusion
• Guidelines of the AABB state that vital signs should be taken before the transfusion, within 15 minutes of initiating the transfusion, and when the transfusion ends (Jorgenson, 2017). Additionally, vital signs should be taken if a transfusion reaction is suspected or if there is any change in patient condition. Facility protocols that indicate that vital signs are to be taken at intervals during the procedure should be followed
• If a transfusion reaction is suspected, perform the following interventions:
• Stop the transfusion **immediately** and begin an infusion of NS to maintain venous access (a typical “keep vein open” rate is 40 mL/hr) using new tubing attached as close to the insertion site as possible; do not administer the saline attached to the blood administration set as this would involve transfusing the residual blood in the tubing. Save the unit of blood/blood component and the attached tubing
  –Place all transfusion related supplies (e.g., administration set, remaining unit of blood/blood component, NS) in a biohazard bag for delivery to the blood bank to be evaluated for compatibility with the patient’s blood and tested to determine the cause of the transfusion reaction (e.g., bacterial contamination)

• Initiate appropriate interventions according to facility protocol, which can include administration of oxygen (check the patient’s airway for patency) or epinephrine. Notify the treating clinician immediately; and in the case of anaphylactic shock, notify the rapid response team or other facility support team

• Notify the blood bank

• Closely monitor vital signs, respiratory, and cardiovascular systems

• If whole blood or RBCs were transfused, collect the patient’s first post-transfusion urine for laboratory analysis for the presence of Hgb

• Monitor the patient’s I & O to screen for oliguria or anuria because Hgb deposition in the renal tubules can cause kidney damage

• Complete an incident report as required by facility protocol

• For additional information about management of blood transfusion reactions, see *Nursing Practice & Skill ... Transfusion Reactions: Monitoring -- an Overview*

  › Investigate immediately if the flow rate slows. Consider interventions that enhance blood flow, such as
    • repositioning the patient’s arm; an arm board can be applied to prevent the IV catheter from kinking
    • elevating the IV pole, if the infusion is by gravity instead of infusion pump
    • changing the filter and tubing
  
  › Upon successful completion of the transfusion, open the roller clamp on the bag of NS (if using a Y-type blood administration set) to flush the blood/blood component remaining in the tubing
  
  › Disconnect the blood administration set and discard it and other soiled supplies per facility protocol
    • If a second unit of blood is to be administered, the same tubing can be used if the second unit will be completely transfused within 4 hours of starting the initial transfusion
  
  › Scrub the hub of the patient’s VAD with facility-approved antiseptic cleanser; allow to air dry
  
  › Flush the Luer adaptor/valve with NS
  
  › Dispose of used supplies in appropriate receptacles; remove gloves and perform hand hygiene
  
  › Continue to monitor patient closely for 1 hour following completion of the transfusion—assess vital signs, cardiopulmonary status, pain/comfort level, and tolerance of the transfusion
  
  › Complete the blood transfusion record according to facility protocol, which typically includes the following information:
    • Patient’s pretransfusion coagulation profile, Hgb, Hct, calcium, and other laboratory data
    • Date and time of transfusion; total volume of blood transfused
    • Type and gauge of the IV catheter used
    • Flow rate of the transfusion at the time a transfusion reaction was noted, if applicable
    • Patient’s vital signs before, during, and after the transfusion
    • The method of warming the blood/blood products, if applicable (see *Red Flags*, below)
  
  › Forward appropriate documentation to the blood bank
  
  › Update the patient’s plan of care, complete transfusion-related documents per facility protocol, and document the following information in the patient’s medical record:
    • Date and time transfusion was initiated and completed
    • Patient’s vital signs (at appropriate intervals as indicated by the facility protocol) and clinical assessment information, including physical assessment and assessment of IV site (e.g., skin condition, type and gauge of IV catheter)
    • Patient’s pretransfusion coagulation profile, Hgb, Hct, calcium, and other laboratory data
    • Pre-procedural medication. Complete the medication administration record
    • Type of blood/blood component transfused, including
      – total volume transfused (e.g., blood/blood component and NS)—record in the I & O record
      – if the blood was artificially warmed and the method used to warm the blood
      – rate of flow
      – duration of transfusion
• Donor identification number
• Patient’s tolerance of the procedure
• Any unexpected events or outcomes, interventions performed, and whether the treating clinician was notified
  – If a transfusion reaction was observed, note the signs and symptoms of the reaction and the flow rate of the blood/blood component
  – Document all vital signs, assessments, and interventions taken
  – Comply with all reporting requirements (e.g., filing an incident report, notifying the risk management department)
• Patient/family member education, including the topics presented, response to education provided/discussed, plan for follow-up education, and details regarding any barriers to communication and/or techniques that promoted successful communication

Other Tests, Treatments, or Procedures That Can be Necessary Before or After Administering a Blood Transfusion
› If multiple units of blood/blood components are to be administered, use the same procedure for verifying each unit before infusion, for assessing and documenting the patient’s vital signs, and monitoring for adverse effects
  • Note whether the prescribing clinician has ordered medications or supplements to be administered between units (e.g., furosemide to prevent fluid overload, calcium to compensate for the loss of serum calcium that can occur when citrate [sometimes used as a preservative in blood/blood components] binds with the patient’s calcium)
› Repeat laboratory testing (e.g., CBC) will be ordered to assess for changes in the patient’s status

What to Expect After Administering a Blood Transfusion
› Blood/blood component(s) will be administered without complication
› Any signs and symptoms of a transfusion reaction will be promptly identified and treated

Red Flags
› AHTR is the most serious type of transfusion reaction. For other types of transfusion reactions, see What You Need to Know Before Administering a Blood Transfusion, above
› Careful monitoring of the patient for any early or late adverse reactions can help to manage or prevent potentially fatal transfusion errors
  • Potential early adverse reactions include erythema, fever, shaking chills, volume overload, acute hypervolemia, dyspnea, hypoxemia, rales, pulmonary edema, elevated central venous pressure, hemolysis, hemoglobinemia (i.e., presence of free Hgb in blood plasma, usually resulting from the Hgb from lysed RBCs being released into plasma), hemoglobinuria, acute kidney injury, circulatory collapse, shock, TRALI, allergic reaction, anaphylaxis, hypocalcemia, hyperkalemia, hypo- or hyperglycemia, and coagulopathies
  – Allergic reactions (including anaphylaxis) and GVHD are evidenced by hives, skin rash, and erythema
  – TACO, TRALI, and anaphylaxis, which can progress rapidly to cardiac arrest, are associated with coughing, respiratory distress, nausea, vomiting, tachycardia, hypotension, chest pain, and loss of consciousness
  – Hemolytic reaction, anaphylaxis, and sepsis can be evidenced by nausea, vomiting, or diarrhea
  – Hemolytic reaction, febrile non-hemolytic reaction, and sepsis can result in the following signs: nausea, fever, chills, flushing, a feeling of warmth, headache, and muscle pain
  - Sepsis is associated with abdominal cramping, nausea, vomiting, and profound hypotension
  - Hypocalcemia can manifest as cardiac dysrhythmias, hypotension, and tingling
  - Hemoglobinemia and hemoglobinuria are evidenced by altered urinary output when the Hgb from lysed RBCs obstructs renal tubules. Clots lodging in the microcirculation of the kidneys can lead to renal ischemia, impaired organ perfusion, and end-organ damage
  • Potential late adverse reactions include delayed hemolysis, iron overload, immunosuppression, posttransfusion purpura, GVHD, and formation of RBC-, human leukocyte antigen (HLA)-, and platelet-specific antibodies
› An FDA-approved commercial blood warmer must be used when warming blood before a transfusion. Blood should never be warmed by using a microwave oven, placing the blood under running hot water, or immersing the blood in hot water because this can overheat and hemolyze the blood
What Do I Need to Tell the Patient/Patient’s Family?

- Explain to the patient and family members the reason for the transfusion and answer any questions; reinforce the treating clinician’s explanation of the benefits and risks associated with blood transfusion
- If laboratory testing or other diagnostic procedures are ordered, explain how these tests and/or procedures are performed and when the results will likely become available
- Educate the patient to notify the nurse for any signs or symptoms of a transfusion reaction (e.g., rash, itching, shortness of breath)
- Discuss the safety measures that reduce the risk of transfusion-associated complications; although patients and families often worry about the transmission of HIV and hepatitis during transfusions, advise that advances in donor screening, blood processing, and blood testing have greatly reduced the risk of bloodborne infections
- Explain that the patient will be closely monitored and that treatment measures will be initiated immediately if a transfusion reaction occurs

References
10. Infusion Nurses Society. (2016). Transfusion therapy. *Journal of Infusion Nursing*, 39(1S), S142-S144. (G)