

PLATELETS: Platelet products include Random Donor units (Whole blood-derived Platelets), each prepared by centrifugation from a single unit of whole blood, and Single Donor packs (Apheresis-derived Platelets), collected from a single donor by apheresis. Random Donor units may be transfused singly, or as a 'pooled product' (usually requested as a pool of five or six Random Donor units). One Single Donor pack contains approximately the same number of platelets as contained in six to eight pooled Random Donor units. Blood Banks prefer that Platelet orders correlate the patient's current platelet count with the expected rise in platelet count (See Platelet dosages below). Most Blood Banks will attempt to fill orders for Platelet products as written, but will substitute between Single Donor packs and pooled Random Donor packs, depending on Blood Bank inventory, anticipated hospital needs, and the patient's clinical status. If an invasive procedure is planned, platelets should be transfused close to the start-time, and definitely within six hours of the start of the surgery or procedure.

If indicated, Special Attributes (leukoreduced, CMV negative, irradiated, volume reduced, or washed Platelets) may also be requested (see **Special Attributes**). A Blood Bank Pathologist must be on-call at all times, and can be reached through the Blood Bank.

PLATELETS definitions: One Random Donor unit of Platelets contains at least 5.5×10^{10} platelets in approximately 50 to 60 mL citrated plasma, including about 80 mg fibrinogen. One Single Donor pack of Platelets contains at least 3.0×10^{11} platelets in approximately 250 to 400 mL citrated plasma, including about 150 mg fibrinogen. Platelets also contain variable amounts of Factors V and VIII.

ABO antigens are weakly expressed on platelet cell membranes, and the plasma component of Platelet Packs contain the corresponding ABO antibodies of the donor. Rh antigens are not expressed on platelets, although Rh antigens are present on the 'passenger' RBC's carried along in the Platelets. If Rh prophylaxis is indicated due to Rh incompatibility, then 1 vial of RhIG will provide prophylaxis for up to 30 Random Donor units or up to 5 Single Donor Platelet packs, which can be confirmed as effective as long as anti-D antibodies can be detected by serological testing.

Class I HLA antigens are expressed on platelets, as well as platelet-specific antigens (See hazards below). Both Random Donor and Single Donor Platelets contain 'passenger' lymphocytes, so consideration of the patient's clinical status may warrant modification of a platelet order to select for leukoreduced and/or CMV-negative and/or irradiated Platelet units. (see **Special Attributes**.) HLA alloimmunization is the most frequent cause of refractoriness to Platelet transfusion, so leukoreduced Platelets and RBCs should be requested for all patients with a likelihood of multiple future Platelet transfusions. For the prevention of HLA alloimmunization, including HLA alloantibody-mediated refractoriness to platelets, there is no difference between leukoreduced pooled Random Donor and leukoreduced Single Donor Platelets (N Engl J Med, 1997;

337:1861-9). Prevention of HLA alloimmunization is also of concern for patients with likelihood of needing future organ transplantation.

Both Random Donor and Single Donor Platelets are stored at 20 to 24 °C for up to 5 days, and outdate at midnight of the 5th day. Pooled Random Donor Platelets outdate four (4) hours after pooling; so if the patient is not ready for transfusion, then one should indicate when ordering when the platelets will be needed. Pooling of Random Donor units takes 15 to 30 minutes in the Blood Bank. Please note that: 1) Platelets must never be refrigerated and 2) NO unused Platelet packs can be returned to inventory if they have been out of the Blood Bank more than thirty (30) minutes.

PLATELETS dosages: The usual dosage for neonates, children, and adults is one Random Donor unit per 10 Kg body weight. The average 70 Kg adult patient is usually ordered 5 or 6 pooled Random Donor unit or one Single Donor pack. Neonates and children commonly are ordered 10 to 15 mL/Kg platelet aliquots. Transfusion is given over 1 to 2 hours via a standard 180 to 260 micron filter. Drugs or medicines must NOT be infused via the same intravenous line during the transfusion.

The expected transfusion effect in an adult patient is a rise of 5000 to 10,000 in platelet count for each Random Donor unit, or a rise of 30,000 to 60,000 for each Single Donor pack. Please correlate the patient's current platelet count with the expected rise in platelet count when ordering. Platelet transfusion effect is assessed by a platelet count drawn one hour after transfusion, so one should obtain a repeat platelet count one hour after transfusion of pooled Random or Single Donor Platelet packs before requesting additional Platelets. The half-life of transfused platelets is approximately 3 or 4 days.

Less than expected increment in platelet count is called refractoriness to Platelet transfusion, and may be due to non-immune-mediated causes, such as splenomegaly, fever/sepsis, DIC, or certain drugs, e.g. Amphotericin. On the other hand, immune-mediated refractoriness may occur if the patient has HLA or platelet-specific antibodies (See hazards below). More frequently refractoriness to transfused Platelets is non-immune in etiology.

ABO antigens are expressed on the cell membrane of platelets. Blood Banks will usually provide ABO-compatible platelets; but in some situations, if Blood Bank inventory needs require, ABO-mismatched may be given to adult patients, with minimal resultant hemolysis of recipient RBCs due to ABO antibodies in the plasma component. In these cases, the expected increment in the platelet count will be slightly less. Neonates, and in most cases all infants, 4 months or less, are always provided ABO-matched platelets.

Rh antigens are not expressed on platelets, but Platelets do contain 'passenger' RBCs. Unless inventory needs prohibit, Blood Banks provide "Rh-negative" platelets for all Rh-negative females who are less than 45 years of age. In an extremely urgent situation, if Blood Bank inventory dictates that "Rh-positive" positive platelets must be given to a female less than 45 years of age,

then one vial of RhIG, e.g. Rhogam, can be expected to provide anti-sensitization prophylaxis for up to 30 Random Donor units or 5 Single Donor packs, and can be confirmed as effective as long as anti-D antibodies can be detected by serological testing.

PLATELETS indications: Platelet transfusion is indicated treatment for thrombocytopenia and/or platelet dysfunction, but is CONTRAINDICATED for Thrombotic Thrombocytopenic Purpura (TTP) and Hemolytic Uremic Syndrome (HUS), and is also CONTRAINDICATED for Heparin-induced Thrombocytopenia (See hazards below).

Guideline platelet count indications for Platelet transfusion of asymptomatic adults and children is 10,000/ μ L; or 20,000/ μ L if there are risk factors, such as petechial hemorrhages or infection. High risk neonates, i.e. on ventilatory support with $FIO_2 \geq 40\%$, may be transfused at 30,000/ μ L, or 50,000/ μ L if also septic. Indications for asymptomatic premature infants are 50,000/ μ L; or 100,000/ μ L for prematurity with sepsis, or extreme prematurity with risk of intraventricular hemorrhage (IVH). An adult or child who is bleeding, or who has an invasive procedure planned within 6 hours, may be transfused at 50,000/ μ L; or 100,000/ μ L if undergoing CNS or eye surgery. 100,000/ μ L is often considered an indication for patients with pulmonary or intracranial hemorrhaging.

Platelet dysfunction during or following cardiopulmonary bypass or ECMO may lead to microvascular bleeding requiring Platelet transfusion regardless of the platelet count. Bleeding or surgery in a patient with rare congenital platelet dysfunctions, e.g. Glanzmann's thrombosthenia or Bernard-Soulier disease, may require Platelet transfusion regardless of platelet count; but caution is needed because alloimmunization (See hazards below) may cause future refractoriness. Patients with acquired irreversible platelet dysfunction due to certain drugs, such as aspirin (ASA), or ADP receptor inhibitors (i.e. ticlopidine, clopidogrel), or glycoprotein IIb/IIIa inhibitors [i.e. abciximab, eptifibatide, tirofiban (which are all very short acting)], who are bleeding or have an impending invasive procedure/surgery may require Platelet transfusion. [To the contrary, the non-steroidal anti-inflammatory drugs (NSAIDs) cause mild platelet dysfunction which is reversible by stopping the drug.] When acquired platelet dysfunction is due to uremia or hyperglobulinemia, transfused platelets function no better than the patient's own platelets, and treatment of the underlying condition is paramount.

Neonatal Alloimmune Thrombocytopenic Purpura (N.A.T.P.) must be transfused with platelets lacking the platelet-specific antigen (usually HPA-1a), which is recognized by circulating maternal antibodies in the infant; and if maternal platelets are to be transfused, then they should be washed to remove maternal antibodies in the plasma component, and administered as washed, volume reduced, irradiated maternal platelets. Treatment for N.A.T.P. usually consists of intravenous immunoglobulin (IVIG), with Platelet transfusion reserved for cases with severe thrombocytopenia and/or other risk factors.

Post-Transfusion Purpura (PTP) can sometimes cause life-threatening thrombocytopenia (see **Transfusion Reactions**) because (similar to the analogous situation of hyperhemolysis syndrome following RBC transfusion) the patient's own platelets are also targeted by the immune response. If possible, Platelet transfusions should be avoided in PTP; however, if unavoidable, then (although the efficacy of transfusion for PTP is not well documented) in urgent situations, HPA-1a-negative platelets and/or HLA-matched platelets have been given empirically while specific alloantibody testing is in progress. The treatment of choice for PTP is high-dose IVIG and steroids.

PLATELETS contraindications and hazards: Platelet transfusion is CONTRAINDICATED for Thrombotic Thrombocytopenia Purpura (TTP) and Hemolytic Uremic Syndrome (HUS), and also CONTRAINDICATED for Heparin-induced Thrombocytopenia (HIT) because in all of these conditions there is risk that intravascular platelet thrombi may cause diffuse organ microinfarctions.

Isoimmune (or Idiopathic) Thrombocytopenia Purpura (ITP) is a relative contraindication because transfused platelets are rapidly cleared by the splenic/reticuloendothelial macrophage system; however, in rare circumstances, i.e. imminent major surgery, timely platelet transfusions may be indicated. When acquired platelet dysfunction is due to uremia or hyperglobulinemia, transfused platelets function no better than the patient's own platelets.

Platelet refractoriness is a clinical condition where there is rapid destruction of transfused Platelets, and is classified as non-immune versus immune-mediated. Non-immune refractoriness is more common, and may occur with splenomegaly (splenic sequestration), sepsis, DIC, graft-versus-host disease, and some drugs, e.g. Amphotericin.

Immune-mediated refractoriness may occur with autoantibodies (ITP), or may occur with class 1 HLA alloantibodies, platelet-specific alloantibodies (usually HPA-1a), and with some drug-dependent platelet antibodies (often penicillins). HLA antigens are more weakly expressed on the cell membranes of platelets than HLA expression on lymphocytes. The most frequent cause of immune-mediated refractoriness is HLA alloimmunization (sensitization), and follows exposure to class 1 HLA antigens on platelets and/or on 'passenger' lymphocytes in transfused Platelets or RBCs. HLA alloimmunization may also occur during pregnancy by exposure to paternal HLA antigens on fetal lymphocytes, and also may occur secondary to previous organ transplantation.

Transfusion of leukoreduced Platelets and RBCs is effective for prevention of HLA alloimmunization, which is of concern for those patients with a likelihood of needing future platelet transfusions or organ transplantation. Because the quantity of antigen exposure affects the likelihood of HLA sensitization, Single Donor packs are not less likely to cause HLA sensitization than pooled Random Donor units (N Engl J Med, 1997; 337:1861-9).

A positive Class 1 HLA alloantibody screen is suggestive of immune-mediated refractoriness due to anti-HLA sensitization. If a patient is refractory due to Class 1 HLA alloantibodies, which are usually directed at high frequency

public epitopes, then HLA matched or HLA compatible platelets may be requested, based on the results of the patient's HLA Class 1 alloantibody screen and HLA typing of the patient. HLA matched or HLA-compatible platelets may be readily available, or may require one or two days to obtain, depending on the specificities of the recipient's HLA alloantibody(ies). Some hematologists consider that crossmatched platelets are more effective than HLA-matched platelets in treating platelet refractoriness.

Transfusion-associated graft versus host disease (TA-GVHD) is a rapidly fatal disease caused by engraftment of 'passenger' T lymphocytes in Platelets. Therefore, when a transfusion recipient has an HLA type 1 phenotype closely related to the donor, TA-GVHD must be prevented by irradiation of the Platelets in the Blood Bank prior to transfusion (see **Special Attributes**).

Less often, immune-mediated platelet refractoriness may be due to an alloantibody to a high incidence platelet-specific antigen (usually HPA-1a), and platelets from donors not carrying that antigen must be transfused. Immune-mediated refractoriness due to sensitization to a platelet-specific antigen (usually HPA-1a) is most often due to previous Platelet transfusions, but may also occur following transfusion of RBCs (which contain nonfunctional 'passenger' platelets), and may also occasionally be caused by maternal alloimmunization during pregnancy to a paternal platelet-specific antigen (usually HPA-1a) on fetal platelets. If refractoriness is due to anti-HPA-1a, or an antibody against another platelet specific antigen, then platelets from donors not carrying that antigen must be obtained, and major blood collection centers maintain directories of these individuals.

Platelet transfusion of patients with rare congenital platelet dysfunctions, i.e. Glanzmann's Thrombasthenia or Bernard-Soulier disease, must ONLY be given when conservative options fail because alloimmunization to missing surface glycoproteins may cause immunological sensitization with risk of life-threatening future refractoriness to Platelet transfusions.

TRALI (see **Transfusion Reactions**) is a rare but serious immune-mediated complication from the plasma component of Platelet transfusion, which can present as acute respiratory insufficiency with bilateral pulmonary infiltrates, during or shortly after the Platelet transfusion.

Hypersensitivity reactions may accompany or follow Platelet transfusion but serious allergic reactions, such as anaphylaxis, are rare. Anaphylaxis usually occurs with the rare IgA deficient patient who has anti-IgA alloantibodies, but can also be caused by pre-formed antibodies to any other proteins deficient in a sensitized recipient.

Because they are stored at room temperature, bacterial contamination, (i.e. due to donor with occult bacteremia, or contamination during collection) occurs more often with Platelets than other blood products (see **Transfusion Reactions**). Routine nucleic acid testing (NAT) of Platelet products for bacterial ribosomal markers has reduced this risk to approximately one in 50,000 to 100,000 Platelet transfusions. Donor selection and product testing have made Platelet products extremely safe, but the very rare risk of transmission of

infectious agents of disease must always be considered when ordering Platelets for transfusion.

© TransfusionOrders.com