may be given when platelet counts are lower than 20,000/μL, although this threshold is not rigorously based on clinical trial evidence.

For patients undergoing invasive procedures (e.g., surgery) or those with trauma, it is reasonable to transfuse platelets when counts are lower than 50,000/μL. Higher platelet counts are suggested for patients undergoing neurologic or ophthalmologic operations; platelet counts greater than 100,000/μL are recommended, if possible, because of the catastrophic nature of bleeding in these anatomic locations. The thresholds of 50,000 and 100,000/μL are based primarily on experience and nationally published guidelines, and clinical trials are lacking in these settings.

For the acutely bleeding patient, the decision to transfuse platelets depends on several factors, of which thrombocytopenia is the most straightforward and useful criterion. Platelet counts higher than 50,000/μL are a reasonable goal for most cases of acute bleeding, whereas counts higher than 100,000/μL may be necessary for neurologic bleeding.

Congenital or acquired platelet dysfunction must be considered for acutely bleeding patients. Those with significant bleeding who have taken an antiplatelet drug such as aspirin may benefit from platelet transfusion regardless of baseline counts. Another consideration is the volume of blood products and fluids received. Trauma patients may receive more than 10 units of transfused red blood cells in addition to plasma, volume expanders, and saline. Resuscitation with large fluid volumes (≥10 units transfused) reduces the platelet count to less than 50% of baseline, resulting in a significant dilutional coagulopathy. In these scenarios, repeated platelet counts must be obtained and platelets liberally transfused to maintain adequate hemostasis.

When the decision to transfuse platelets has been made, platelet units can be requested from the blood bank or transfusion service. Blood banks provide random-donor pooled platelets and apheresis platelets (E-Fig 51-1). Random-donor pooled platelets consist of platelet concentrates from four to six donors combined (pooled) into one large dose. For the adult patient with uncomplicated thrombocytopenia, a single random-donor platelet concentrate unit typically raises the platelet count by about 8000 to 10,000/μL. Between 4 and 6 units pooled together can be expected to raise counts by 30,000 to 60,000 platelets/μL. Apheresis platelets are collected from one donor using automated apheresis instruments. The dose of these *single-donor platelets* is almost equivalent to that of a 6-unit platelet pool and is estimated to increase platelet counts by up to 50,000/μL in the uncomplicated patient.

Based on the expected increments and typical transfusion goals outlined previously, one random-donor platelet pool or one apheresis platelet product should sufficiently raise platelet counts to correct thrombocytopenia and prevent spontaneous bleeding. These doses should also be sufficient to stop or prevent bleeding associated with thrombocytopenia in the setting of invasive procedures, mild to moderate trauma, or bleeding associated with platelet dysfunction. For the complicated patient (e.g., thrombocytopenia with intracranial hemorrhage, massive trauma), additional platelet doses may be necessary over time to achieve adequate hemostasis.

Platelet Transfusion Failure and Platelet Refractoriness

Platelet transfusions in thrombocytopenic patients are not successful in all cases. Uremia causes an acquired dysfunction of transfused platelets, limiting their hemostatic capabilities in vivo. Patients who are thrombocytopenic due to conditions such as ITP usually do not show increased platelet counts after transfusion because circulating autoantibodies cause rapid destruction of both endogenous and infused platelets. This phenomenon, known as *platelet transfusion refractoriness*, can be caused by many other recipient problems, including fever, sepsis, splenomegaly, and DIC. Although the pathophysiology of refractoriness is well understood for conditions such as ITP or DIC (in which platelets are cleared from the circulation), few data are available to suggest why individuals with conditions such as fever or infection have an inappropriate response to platelet transfusion.

When approaching a patient with platelet transfusion refractoriness, the physician should consider whether it is mediated by nonimmune or immune factors. Immune refractoriness indicates antibody-mediated clearance. For nonimmune-mediated refractoriness, as in the setting of fever or DIC, the underlying conditions usually decrease transfused platelet survival over time but do not affect immediate platelet recovery.

A standard diagnostic approach to platelet refractoriness involves measuring the platelet count 10 minutes to 1 hour after completion of the platelet transfusion. The patient with non–immune-mediated refractoriness typically shows an initial but blunted increase in the platelet count 1 hour after transfusion, with a subsequent decline at a steeper rate than expected because of the underlying disorder. For patients with this type of platelet refractoriness, addressing the underlying illness often increases the effectiveness of platelet transfusions.

For patients with immune-mediated platelet refractoriness, there is virtually no increase in the platelet count, even minutes after completion of a transfusion. The antiplatelet antibodies are most frequently encountered in individuals who have been chronically transfused. Repeated exposures to transfused products can induce alloantibodies, most commonly to HLA antigens. Over time and with multiple transfusion exposures, the titer of alloantibodies can increase sharply and cause rapid clearance of incompatible platelets after infusion.

For the alloimmunized patient, immunosuppression fails to decrease platelet alloantibodies, and efforts to improve platelet recovery after transfusion are focused on finding compatible platelet units. The first step in managing transfusion of the alloimmunized patient is to provide ABO antigen–matched platelets to minimize clearance caused by naturally occurring ABO antibodies; this is often helpful because platelets express A and B antigens on their surface. If this step fails to yield increases in platelet counts, donor platelets that lack target antigens for the detected alloantibodies should be pursued. One strategy is to use the patient's serum to crossmatch platelet donor units, with selection of those units demonstrating compatibility for subsequent transfusion.

If crossmatch-compatible platelets fail to induce adequate platelet recovery, blood banks should provide platelets that are matched to the recipient's HLA system in the hope of evading