

## Transfusion Thresholds

Although the decision to transfuse should be individualized for each patient, clinicians can rely on a growing accumulation of evidence in the literature to guide their hemotherapy decisions. Transfusion thresholds have been evaluated in randomized controlled trials, and several professional organizations have developed consensus guidelines based on those clinical studies for some blood components. Typically, test results evaluated in clinical trials identify laboratory values that are associated with adverse patient outcomes and below which transfusion is usually indicated. Similarly, thresholds are determined above which transfusion is generally deemed inappropriate. When a patient's laboratory test results fall between the two extremes, the decision to transfuse becomes less clear. This dilemma occurs with all components and with decisions to transfuse prophylactically to prevent adverse outcomes as well as therapeutically to treat ongoing problems.

Table 1 gives a brief summary of the thresholds at which blood component transfusion should be considered.<sup>5-9</sup> More detailed discussions of appropriate situations for transfusion are found later in this *Guide* (under Transfusion Audit Criteria).

## Perioperative Assessment of the Surgical Patient

Efforts to avoid allogeneic transfusion should begin with the patient's presurgical evaluation and continue during the operative procedure and into the recovery period. Multiple activities can be undertaken to optimize patient preoperative hemoglobin and coagulation function, provide autologous product, and minimize blood loss during surgery and the postoperative period.<sup>10,11</sup> No method should be considered as a stand-alone technique. In most circumstances, a combination of techniques may be needed to minimize acute blood loss and enhance the patient's ability to compensate for that loss.

The perioperative planning phase of a patient's surgery should ensure that the patient is medically optimized for the pending surgery. Diagnosis and management of preoperative anemia is crucial

**Table 1. Common Transfusion Thresholds for Selected Blood Components<sup>5-9</sup>**

Component	Situations	Transfusion Thresholds
Red Blood Cells	Hospitalized adults	Hemoglobin <7.0 g/dL
	Orthopedic surgery, cardiac surgery, preexisting cardiovascular disease	Hemoglobin <8.0 g/dL
Platelets	Hospitalized adults	10,000/ $\mu$ L
	Central venous catheter	20,000/ $\mu$ L
	Elective diagnostic lumbar puncture	50,000/ $\mu$ L
	Major elective non-neuraxial surgery	50,000/ $\mu$ L
Plasma	Prophylaxis	INR $\geq$ 2.0

INR = international normalized ratio

in effective PBM.<sup>1,6</sup> Optimization includes management of preexisting anemia and coagulation status. Although the definition of anemia is subject to debate,<sup>12</sup> an understanding of the potential for blood loss with the planned surgery should be considered in conjunction with the patient's presenting hemoglobin.<sup>13</sup>

The prevalence of anemia in the presurgical patient population is high. Perioperative anemia has been documented to range from 5% in female geriatric hip fracture patients to over 75% in colon cancer patients.<sup>14</sup> When surgery can be delayed, anemia should be corrected using iron, vitamins, and erythropoietin, as medically indicated. With recent reports of thrombotic complications (especially when the hemoglobin level increases to >12 g/dL) and evidence suggesting adverse outcomes with higher hemoglobin levels in some patients,<sup>15,16</sup> erythropoietin should be used cautiously and judiciously.

If possible, medications that could adversely affect clotting function should be discontinued before surgery. Anticoagulation medications include warfarin, heparin, and antiplatelet agents, as well

as some herbal supplements. Approximately 20% of patients take herbal supplements and 50% take vitamin supplements.<sup>17</sup> Because the effects of many supplements are unstudied, it is advisable to discontinue all supplements 10 to 14 days before surgery.<sup>18</sup> For more detailed discussions of maximizing hemoglobin and optimizing coagulation, readers are referred to several resources.<sup>10,11,19-21</sup>

### **Intraoperative Techniques to Reduce Allogeneic Transfusion**

During surgery, PBM encompasses good surgical technique, minimally invasive procedures, advanced cauterization, use of conservative allogeneic transfusion threshold guidelines, use of medications to decrease blood loss including adhesives, and use of autologous blood [including preoperative blood donation, intraoperative blood recovery, and acute normovolemic hemodilution (ANH)].

The endpoint for clinical studies evaluating PBM methods, including autologous techniques, is most often a decrease in allogeneic transfusion. However, it may be more meaningful to use clinical outcomes such as length of stay, functional status, and quality of life to determine the real risk-benefit ratio and cost effectiveness of various techniques.

Several drugs (desmopressin, epsilon-aminocaproic acid, and tranexamic acid) have been advocated for reduction of surgical bleeding; however, these drugs should be used cautiously because of associated side effects. When a patient experiences significant hemorrhage, most anesthesiologists and surgeons transfuse blood components based on their clinical observation of bleeding and estimates of blood loss. Point-of-care testing (POCT) devices in the operating suite and thromboelastography (TEG) may allow the anesthesiologist or surgeon to make decisions based on laboratory values. Reduction of surgical blood loss by reducing the mean arterial pressure is termed "controlled" or "deliberate" hypotension. This can be achieved with the use of numerous agents. It is important to recognize the potential adverse effects that deliberate hypotension can have on patients with compromised cerebral, cardiac, or renal function. This technique should be used with caution especially when combined with ANH.