Introductory lecture / Uvodno predavanje

PERIOPERATIVE BLOOD MANAGEMENT

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The management of perioperative bleeding is one of the most important factors for operative survival. In the surgical field, many new therapies that were unthinkable just a few decades ago are now routinely performed. In general, operative procedures are becoming more complex, and the patients who undergo them are older and more critically ill. Although laparoscopic and minimally invasive techniques have expanded even to cardiovascular surgery, diminishing blood supplies are an increasing problem.

Clearly, there is a growing need for blood conservation because the gap between supply and demand is escalating. In 2003, according to the National Blood Data Resource Center, 14 million units were collected in the United States (US), and 27 million blood components were transfused to 4.5 million patients. The demand for blood is increasing by 3% to 5% per year. From 1994 to 2001, it increased by 27%. [1-3]

Contributing factors in this crisis include the complexity of today's surgical procedures and the expanding elderly population that uses half of the blood supply. In addition, the available supply is not always used optimally. It is estimated that 20% of patients undergoing uncomplicated coronary artery bypass (CABG) surgery receive unnecessary red blood cell (RBC) transfusions.[4,5] In perspective, an estimated 30% of the 14 million units of RBCs transfused annually is given to CABG patients, suggesting that at least 170,000 units of RBCs are unnecessarily administered annually in the US.

It was the outbreak of acquired immunodeficiency syndrome (AIDS), in the early 1980s, that radically changed transfusion practices. Although, since that time, new blood tests have been developed and the blood supply has become "safer than ever," public concern remains. Owing to considerations of safety, economics, or shortages, pressure to avoid or limit transfusions have persisted. Despite all the efforts made to improve and restrict blood utilization, blood is often given inappropriately, with consequent risks for patients and wastage of limited and expensive resources. When the blood supply is sufficient, adverse consequences are generally limited to transfusion-related complications. In recent years, improved blood screening and stricter control before transfusion have minimized these risks. On the contrary, when the blood supply is limited, the consequences may be more serious.

Various methods and tools have become available to improve blood conservation. Multiple studies, utilizing different methods, have demonstrated a significant decrease in the blood transfusion volume. [6-13] However, the results of these studies may be hard to reproduce in regions where blood usage must be minimized because of a limited supply. Practical tools to improve blood management include:

- Education through presentations
- Establishment of a Transfusion Committee
- Use of maximum surgical blood order schedules
- Transfusion triggers
- Transfusion algorithms and near-site testing.

During the perioperative period, surgeons or anesthesiologists are in charge of making decisions. They are often unfamiliar with the basic organization, mechanisms, limitations, and motivations of the blood-banking system. Therefore, the role of the transfusion specialist should be to assure proper blood utilization. This role should be primarily through theoretical and practical education, presentations of peer-reviewed publications, improvements in laboratory monitoring, promotion of new blood components, medications, and devices, etc.

The hospital transfusion committee plays an important role in controlling and changing transfusion practice. As a multidisciplinary group of anesthesiologists, surgeons, hematologists, nephrologists, and pathologists specializing in transfusion medicine, the committee disseminates and enforces transfusion protocols based on national guidelines and published evidence. A transfusion subcommittee, which comprises a delegated body of 8 to 10 practitioners, is responsible for analyzing and evaluating everyday transfusion practice and reporting at monthly meetings.

Efficient transfusion-service activity involves understanding surgical case requirements so that appropriate resources are applied. This task has customarily been accomplished through the use of the maximum surgical blood order schedule (MSBOS). By establishing and disseminating MSBOS data hospital-wide, the efficiency of blood-ordering practices is maximized. Data regarding blood usage for specific surgical procedures need to be periodically collected. Documented data should be shared with the appropriate service for discussing and implementing the MSBOS.

A blood order form with detailed indications is a good means of forcing physicians to reconsider their decisions

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and compare those decisions to guidelines. A concurrent blood audit system should be approved by hospital medical staff and implemented by the transfusion service to improve resource utilization and chart documentation. Forms that fail to meet the necessary criteria or that are otherwise incomplete are referred to a transfusion service physician /quality assurance team for prompt management.

In addition to simple collection of data, which provides accurate information about blood utilization, transfusion service should encourage physicians who make transfusion decisions to actively participate in studies designed to change and improve transfusion practice.

At the Texas Heart Institute at St. Luke's Episcopal Hospital, in Houston, cardiovascular surgery patients account for 50% of blood use.[14] Based on analyses of blood-use patterns, in February 1997 the hospital undertook an intervention intended to modify RBC use, based on standardized indications for transfusion.[15] The goal was to determine whether the use of a lower hemoglobin transfusion threshold of 8 g/dL in the postoperative period would reduce blood use without adversely affecting patients undergoing CABG. The study enrolled 561 consecutive patients undergoing elective primary CABG surgery. Whereas the study group (n=212) received RBC transfusions only if their hemoglobin level was <8 g/dL, the hemoglobin transfusion threshold for the control group (n=216) was <9 g/dL, as reflected by the institution's guidelines at that time.

The following outcome measures were analyzed: duration of mechanical ventilation, intensive-care-unit stay, and postoperative hospital stay; the incidence of postoperative myocardial infarction, neurologic deficit, renal failure, or serious infection; the incidence of transfusion; and a patient self-assessment (the postoperative Health Survey Questionnaire, which was administrated on the 3rd and 5th postoperative days).

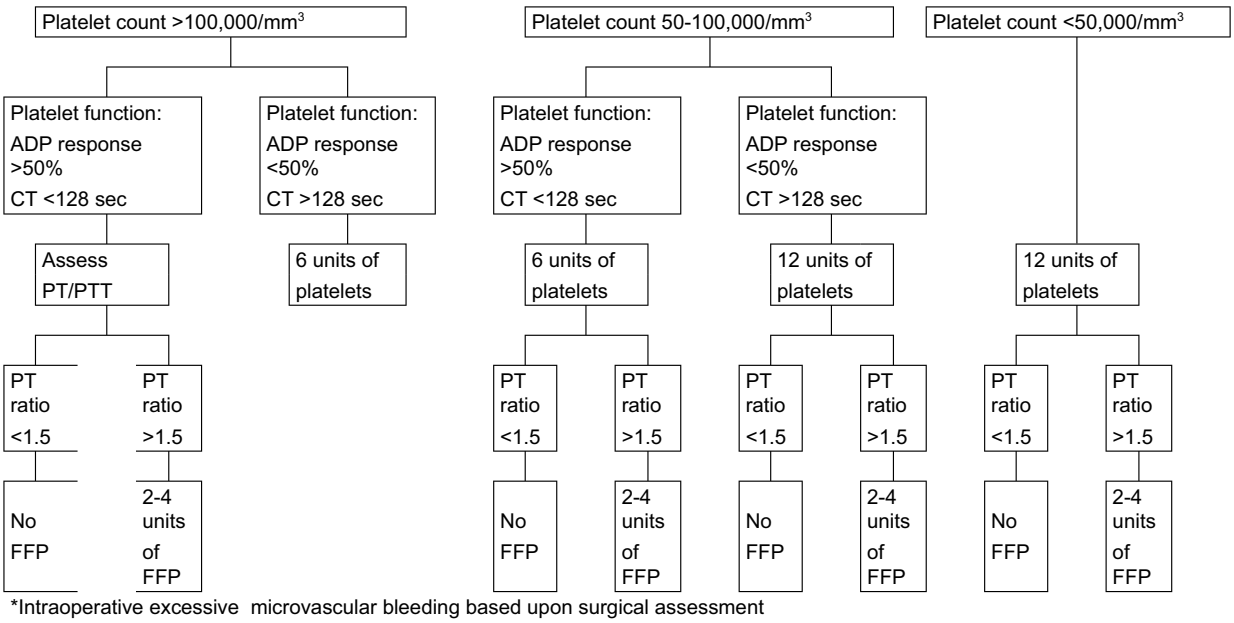
The number of RBC units transfused per patient during the postoperative period was significantly decreased (by 36%) in the study group compared to the control group (1.4±1.8 vs. 0.9±1.5 RBC units, respectively; *P*=0.006). No intergroup difference was found in any of the clinical outcome measures. The self-assessment score did not differ between the study patients and control patients.

On the basis of these results, we modified the RBC transfusion trigger on our postoperative blood order form from 9 to 8 g/dL for patients in stable, noncompromised condition. This step has preventeded unnecessary transfusions while allowing patients to receive RBCs when needed. [16] Sufficient back-up indications exist on the blood-order form e.g., blood loss >500 mL since the last transfusion; hypovolemia with hemodynamic instability and known acute blood loss; acute respiratory failure; or inadequate cardiac output and oxygenation.

Increased transfusion rates in patients treated with potent antiplatelet drugs such as clopidogrel before CABG surgery have prompted us to use a transfusion algorithm based on clinical criteria and measurement of coagulation and platelet function.[17,18] Near-site coagulation testing has resulted in more rapid availability of data for use in making transfusion decisions and has been reported to reduce blood transfusions in cardiovascular surgery patients.[19,20] A near-site coagulation testing laboratory has been implemented in our hospital, and algorithm-driven treatment of bleeding has significantly reduced the mean number of units of all blood components transfused to clopidogrel-treated patients (by about one third in comparison with current control and historical data).[21]

Although the predictive value of platelet function assays in managing clinical bleeding after cardiac surgery is uncertain, our experience suggests that laboratory assessment of platelet dysfunction has a role in improving patient management. Preheparin testing of platelet function with adenosine diphosphate aggregometry can identify patients at highest risk for perioperative bleeding and transfusions and may further reduce the need for perioperative transfusions. In our experience, such testing has predicted all but 1 case of severe coagulopathy requiring multiple transfusions. Thus, a strict transfusion algorithm can reduce the transfusion requirement for all blood components.

Transfusion algorithm when microvascular bleeding is excessive*



*Intraoperative excessive microvascular bleeding based upon surgical assessment

Postoperative unacceptable bleeding -chest tube output >250 mL/h after the first postoperative hour

The other practical measures that need to be addressed include, but are not limited to, the use of

- hemostatic drugs–antifibrinolytic therapy
- autologous predonation and intraoperative salvage
- erythropoiesis-stimulating proteins and iron in preoperative period, and
- recombinant activated factor VII. [8-10,22-28]

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