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# Management Strategies

## How to Modify Transfusion Practice

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The reduction of donor blood use is still important due to the residual risks of blood transfusion and the problem of blood shortage. This can be achieved through rationalization of blood component utilization and the reduction of allogeneic transfusion requirement in surgical patients by adopting methods that reduce perisurgical blood loss (e.g., accurate surgical hemostasis; optimal anesthesiological techniques; topical hemostatic agents; acute normovolemic hemodilution; intra- and postoperative blood salvage) and that decrease the amount of blood the patient can loose by increasing his circulating RBC mass (correction of preoperative anemia, preoperative autologous blood donation (PABD), rHuEPO).

A program for the optimal use of transfusion alternatives has been developed by adopting the following measures: (1) candidates for elective surgery are evaluated by the transfusion specialists at least 20-25 days before surgery; (2) the transfusion requirement of the specific patient, expressed in mL of RBCs, is calculated using a mathematical approach; and (3) the efficacy of each alternative strategy, expressed in mL of RBCs conserved through reduction of perioperative blood loss or stimulation of erythropoiesis, is defined.

Utilizing this program it is possible to personalize the use of transfusion alternatives, alone or in combination, while taking into consideration: type of surgery, time to surgery, applicability

of each alternative strategy, clinical condition of the patient and cost-effectiveness considerations.

**Results:** 74% of all the candidates for elective surgery were enrolled in the program. In 92% of them PABD was performed. 21% had altered iron parameters: 6% were anemic (Hb < 11 g/dL) and were treated with intravenous (IV) iron before enrolment in the PABD program; 15% of patients had iron deficiency (ID) with no anemia and were treated with IV iron during PABD. A further 3% of the patients had non-ID anemia and were treated with rHuEPO. Approximately 60% of blood used was autologous. From 80% to 100% of patients enrolled in the PABD program, depending on the type of surgery they underwent, completely avoided donor blood transfusion. The wastage of predonated units was less than 15%.

# Optimizing Transfusion Practices: Organizational Challenges

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Infectious risks of transfusion, but also cost and resource considerations have triggered continuing efforts to reduce blood transfusion. Despite different national consensus guidelines, several American and European multicenter studies demonstrate a substantial variability in perioperative transfusion practice. Reasons for the large variability in transfusion practice remain elusive, but clinicians' practice and attitude may be entrenched and slow to change.

Optimizing blood transfusion practice, however, represents only one aspect of the "blood conservation approach," which involves all possible strategies aimed at reducing patients' exposure to allogeneic blood products. Numerous techniques have been developed to reduce allogeneic blood exposure in major surgery. Autologous predonation, pre-bypass isovolemic hemodilution, minimizing the priming of cardiopulmonary bypass circuit, intraoperative and postoperative cell salvage, and the use of pharmacological agents in addition to careful surgical hemostasis have all been associated with a significant reduction in allogeneic blood use. These techniques, however, vary in efficacy, timing, mechanism of action and in the level of knowledge required to use them. In addition, the cost-effectiveness ratio of these different alternatives will largely depend on the surgical procedure and technique, the patient's limitations, the health care environment and the immediate and long-term costs.

Avoidance of unnecessary blood transfusion can be achieved by adopting a standardized blood conservation strategy. A multidisciplinary approach to blood conservation has been progressively developed by the department of cardiac anesthesia in our institution from September 1997. This strategy involves a standardized blood conservation program and a multidisciplinary allogeneic blood transfusion policy in the pre-, intra-, and post-operative periods. The transfusion trigger used not only depends on the hemoglobin concentration, but also on the clinical status of the patient (age, estimated blood volume, cardiovascular and respiratory functions), and on the relative risk of postoperative complications. All patients undergoing cardiac surgery over a two-year period were included. Procedures consisted of coronary artery revascularization, single or multiple valve replacement, complex aortic reconstructions, and combined operations. Emergency procedures were excluded. Data obtained in a first group of patients (n = 321), when the transfusion strategy was progressively developed, were compared to those obtained in a second group (n = 315), when the strategy was applied uniformly.

Patient populations and surgical procedures were similar in both groups. The uniform application of the multidisciplinary blood transfusion strategy resulted in a 45 % reduction in the number of patients receiving allogeneic blood and in a 53% reduction in the number of allogeneic blood units transfused. These results were essentially related to a reduction in transfusion in the postoperative period, in the Intensive Care Unit and on the ward. Postoperative hemoglobin concentrations, mortality and morbidity were not different among groups.

This study demonstrates that the development of a <standardized multidisciplinary approach to blood conservation markedly reduces the exposure of cardiac surgery patients to

allogeneic blood products. In view of these results, it may be suggested that the real efficacy of any novel blood conservation technique can only be evaluated when an institutional multidisciplinary approach of blood transfusion has been previously achieved. Developing a blood conservation strategy starts with the establishment of a reliable system of data collecting, both at the surgical team level and at the hospital level. The choice of the different techniques to be applied will primarily depend on the specific conditions existing in the daily routine practice. Because the interests of patients and actors may change over time, the whole process of continuously adapting blood conservation strategy to the needs of a specific surgical population requires a continuous monitoring that will be best accomplished by a multidisciplinary team involving blood providers, blood users and operators, e.g., a transfusion committee.

# How I Individualize My Transfusion Practice

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The process of individualizing transfusion practice involves preoperative assessment and intervention, intraoperative monitoring and appropriate therapeutic application, and postoperative monitoring and therapy.

In the preoperative setting, a detailed patient history, accompanied by selected laboratory assays, will provide ample information for the majority of patients. Patients with an unusual history of bleeding, bruising, hemorrhage, or thrombosis, or those on heparin, oral anticoagulant, or antiplatelet therapy may require a more comprehensive evaluation. Preoperative therapeutic options include the use of erythropoietin to increase red blood cell mass, or preoperative autologous blood donation.

In the intraoperative setting, the use of isovolemic hemodilution, cell salvage, platelet-pheresis, hemoconcentrating, hemofiltration, and/or controlled hypotension techniques all facilitate conservation of red cells, platelets, and/or coagulation factors with varying degrees of success in different patient and surgical populations. Of paramount importance is the appropriate application of laboratory tests of coagulation, thrombosis, and fibrinolysis. The thromboelastogram (TEG) is an excellent measure of thrombosis and fibrinolysis. This and other laboratory tests coupled with a transfusion algorithm will provide the most objective method to transfuse blood products. Unfortunately, to this date there is no other reliable and rapid point-of-care test of platelet function. Therapeutic options include the use of antifibrinolytic agents, DDAVP, and perhaps in the future a platelet preservation agent.

In the postoperative setting, laboratory monitoring of the hemostatic axis, the use of cell salvage (tube drainage) devices, and continued use of antifibrinolytic or DDAVP therapy may be of benefit.

Throughout the perioperative period, a detailed understanding of the surgical procedure, the surgeon's techniques, and the anticipated and ongoing blood loss are also important factors to consider. One of the most important factors is the tolerance of a reduced hemoglobin value. Traditionally, most clinicians overtransfuse in order to avoid complications of anemia. Today, however, we appreciate the substantial known and emerging risks and complications associated with transfusion of allogeneic blood products. Aggressive transfusion has been associated with numerous complications in multiple clinical trials. Furthermore, the direct and indirect individual, hospital, and societal costs of transfusion are substantial!

The complex mechanisms of blood loss limit the efficacy of a single therapeutic option. Strategies to reduce blood transfusion must almost always be multimodal in order to achieve substantial efficacy. The use of one or more of these therapeutic options, when applied with foresight and the understanding of the patient, procedure, and anticipated postoperative course, will yield the best clinical results with the least transfusion exposure. Limiting or avoiding transfusion of allogeneic blood products will serve you, your patients, and society well. The best transfusion is no transfusion!