Autologous Blood Predeposit for Elective Surgery: An Italian Experience

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A program of predeposit autotransfusion in elective surgery was implemented with the main purpose of decreasing the incidence of posttransfusion hepatitis and of conserving homologous blood. Specific procedures and computer programs were designed to monitor the transfusion practice by key indicators, and the incidence of posttransfusion hepatitis and HTLV-III infections. Arrangements were devised to ensure the proper management of autologous and homologous units. In 1985, autologous units accounted for 13.5% of all units transfused in elective surgery. While encouraging, our results indicate that efforts have to be made to improve organization and increase awareness of the benefits of autotransfusion in the medical and lay communities.

Autologous blood predeposit for elective surgery is the donation, for one's own use, of blood during the days or weeks that precede the operation. The main advantage of this procedure is to reduce the requirement for homologous blood transfusion, which carries the risk of several immunological and infectious complications [1, 2]. Of the latter, the most frequent is posttransfusion hepatitis (PTH), which has been shown to occur in 7–10% of the patients transfused in the United States [3], and in even higher percentages in other countries [4]. Other blood-transmissible infections like AIDS, although far less frequent, are also a matter of concern. Furthermore, the withdrawal of some units of blood in a short period of time induces a condition of slight anemia, or moderate hemodilution, which is reputed to improve blood flow in the microcirculation and could protect against perioperative deep vein thrombosis (DVT) [5].

The safety of autologous blood predeposit is supported by several recent studies in different surgical areas: orthopedic [6–12], plastic [13–17], gynecologic [11, 18, 19], vascular [10, 20], urologic [21, 22], cardiac [23], and miscellaneous [24–26]. The problem of dealing with potentially "high-risk" patients was studied by Mann et al. [24], who found no dangerous complications associated with predonation in a group of 342 patients including subjects with severe heart disease, elderly patients, children, and pregnant women. Although not all authors agree on the feasibility of predeposit autotransfusion in children [27], in most programs absolute contraindications to autologous blood predeposit are limited to bacteremia, severe coronary disease, and anemia [24, 28].

If autotransfusion offers all the above advantages, the question arises as to why this practice has, so far, not met the expected success. There are a number of possible explanations, including: (a) awareness of potential morbidity associated with homologous blood transfusion has, until now, been scanty in both patients and physicians. In particular, since PTH is a late complication, surgeons and anesthesiologists do not generally see it; (b) collecting blood from patients instead of normal donors is often outside the usual practice of the blood bank physician and requires a close connection between the clinical setting and blood bank, which often does not exist; and (c) the necessity of inserting a procedure for a "different" type of blood to be managed together with donor blood can create a number of difficulties.

AIDS, with its great psychological and medical burden, has recently stimulated new interest in autotransfusion [29–31]. This is also indicated by the 1985 Institutional Membership Questionnaire of the American Association of Blood Banks, which shows that from 1983 to 1984 there was a 19% increase in the number of hospitals offering predeposit programs in the United States [32].

The Milan Experience

Our interest in autotransfusion started in 1981 when we became aware of its potential in conserving homologous blood, and in reducing the frequency of PTH and, possibly, of perioperative DVT. Since then, we have increasingly promoted both the technique of preoperative predeposit and that of intraoperative red cell recovery; the latter is discussed elsewhere in this issue (Glover et al.) and will not be dealt with in this article. We report our experience with predeposit autotransfusion during the period 1982–1985.

Structure of Our Local Blood System

The blood transfusion center of Ospedale Maggiore Policlinico, a 1,200 acute-bed university hospital with 15 surgical divisions
located in 6 buildings, consists of 3 sections: a blood donor service, which manages about 16,000 regular volunteer blood donors who give 32,000 blood donations/year, a blood component section producing 85,000 blood components/year, and a blood transfusion section performing 35,000 pretransfusion tests/year and issuing blood products for 2,500 acute beds of its own and 5 neighboring hospitals, including Istituto “Gaetano Pini,” a 500-bed university orthopedic hospital.

Self-sufficiency in blood procurement was achieved with our in-hospital blood donor service by the end of the 1970’s. Since 1980, efforts have mainly been directed toward ensuring an appropriate use of blood and improving the safety of blood transfusion. The first step in this direction was to provide an advisory service to evaluate blood requests and to tailor the transfusion therapy for individual patients’ needs. The next step was a pilot study for the development of autotransfusion.

**Predeposit Pilot Study**

In 1981, a group of blood bankers, hematologists, surgeons, anesthesiologists, hospital officers, administrators, and epidemiologists formed an Autotransfusion Team [25]. The group included representatives of 18 of the 21 teams operating in the surgical divisions at both Ospedale Maggiore Policlinico and Ospedale “Gaetano Pini.” The Autotransfusion Team started an education program on the risks of homologous blood transfusion with its clinical, economic, and legal aspects, and on the theoretical and practical aspects of hemodilution. At the same time, a Maximum Surgical Blood Order Schedule (MSBOS) was prepared, and pre- and postoperative patient hematocrit levels were retrospectively evaluated to ascertain if the indication for blood transfusion, although requested according to MSBOS, was correct [33]. The results of this survey indicated that postoperative hematocrit levels were frequently above 38%, showing a tendency of the clinicians to overtransfuse surgical patients [34, 35].

After this initial evaluation, a predeposit pilot study was carried out, which demonstrated that this procedure was feasible and safe in our environment [25]. In fact, the most active surgical team was able to cover about 40% of the patients’ blood needs with autologous units; moreover, a review of the anesthesiological records revealed no significant differences in critical parameters like pulse rate and blood pressure between “autologous” and “nonautologous” patients. Finally, a prospective pilot study was performed to evaluate the frequency of hepatitis in autotransfused, homotransfused, and nontransfused surgical patients. In this study, transfused patients received a mean of 4.3 units, all collected at our blood donor service and issued only if they were HBsAg-negative with alanine aminotransferase (ALT) levels below 1.5 times the upper reference limit. The frequency of hepatitis in the 3 groups, as determined by ALT evaluation at 15-day intervals for 6 months after transfusion, was 0, 7.5, and 0%, respectively, the most frequent type being non-A, non-B. This study indicated that with this blood donor population, the risk of PTH was 1.7 per every 100 units transfused. Based on these findings, the Autotransfusion Team decided on the routine use of predeposit autotransfusion in 1984. In 1985, moreover, 2 prospective studies were implemented: (a) a surveillance system of all the transfused patients to monitor the incidence of PTH and HTLV–III infection (as determined by serial determinations of transaminases and anti-HTLV–III antibody, respectively) for 6 months after transfusion; and (b) a system for monitoring blood transfusion practice, based on key indicators (Table 1) [36]. For these programs, 2 junior assistants joined the staff of the advisory service of the blood transfusion center and formed a mobile team [11], visiting all hospital wards each day and performing 2 main tasks: (a) reviewing patients scheduled for surgery with surgeons and anesthesiologists in order to enroll the patients in the predeposit program; and (b) collecting the pertinent data on patients. For proper management of both studies, the computerized patient system was enlarged so that each transfused patient could be monitored for blood-transmitted diseases and the above key indicators calculated. Since then, results have been reviewed regularly and confidentially with each surgical team; this form of medical audit was found to be useful in promoting autotransfusion and improving the proper use of blood.

<table>
<thead>
<tr>
<th>Quality of the blood request:</th>
<th>No. of units (or patients) transfused/No. of units (or patients) requested</th>
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<tbody>
<tr>
<td>Blood overtransfusion:</td>
<td>No. of patients (or units) transfused over 35% PCV/No. of patients (or units) transfused</td>
</tr>
<tr>
<td>Conservation of homologous blood:</td>
<td>No. of autologous units (or patients) transfused/No. of units (or patients) transfused</td>
</tr>
<tr>
<td>Prevention of blood-transmitted diseases:</td>
<td>No. of patients transfused ONLY with autologous units/No. of patients transfused</td>
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**Table 1. Key indicators in monitoring blood transfusion practice developed at Ospedale Maggiore Policlinico (to be applied to each type of surgical procedure and team).**

**Present Organization of Predeposit**

Patients are asked to give their informed consent to enter the predeposit program and are evaluated for enrollment by their physician before hospital admission or in the ward. Contraindications to enrollment are fever, severe coronary disease, and hematocrit level below 38%. A simple form is used to record the pertinent patient data. Patients are bled in the donor room of the blood donor service at the end of the homologous donor blood collection. In the case of patients confined to bed, blood is drawn in the ward by a member of the mobile team. After giving blood, the patients do not receive any replacement fluid. Iron is not administered on a regular basis. The number of donations, which are given at intervals of 2 to 7 days, is calculated assuming that the target preoperative hematocrit level is 35% and that the average expected hematocrit decrease per donation (usually 350 ml) in adults is approximately 2%. Autologous blood is collected into CPDA-1, and the units are split into packed red cells and fresh plasma, the latter being stored frozen. Recently, a CPD-SAG Mannitol system (Terumo, Japan) has been introduced, in which packed red cells are suspended with 100 ml of a solution containing saline, adenine, glucose, and mannitol. This system results in better red cell preservation and in a lower hematocrit level, which permits a higher infusion rate.

Special arrangements are made for selected cases such as