Whither autologous blood predonations?

The concept of pre-operative autologous blood deposit (PAD) was born out of the scare of the beginning of AIDS era, when it seemed to be the answer to the non-safety of blood. Despite limited applicability to elective surgery and to patients who could provide the required number of units of blood, at the peak of popularity of PAD in United States in 1992, autologous units accounted for 8.5 per cent of collected, and 5 per cent of transfused units. Transfusion services and hospitals in United Kingdom remained far more reserved, despite the fears of variant Creutzfeld Jacob disease (vCJD) transmission. By 2001, the proportion of autologous donations in the USA had fallen to 4.0 per cent. This disenchantment with PAD largely coincided with the restoration of confidence in blood safety, at least in what concerns transmissible diseases. Current estimates of the frequency of infectious donations issued in the UK are 1 in 29 million for HCV, 1 in 5.2 million for HIV, and 1 in 500,000 for HBV (National Blood Service - unpublished data). In addition, blood safety and quality regulations, transposed into UK law from two European Union directives, have set standards for the collection and testing of human blood and blood components and their processing, storage and distribution, contributing to the safety of blood products.

PAD was one of the blood conservation methods introduced in the past two decades; some of them, like intra-operative cell salvage and use of erythropoietin, have stood the test of time. But it is the acceptance of lower thresholds for red cell transfusion in surgical patients that has had by far the greatest effect on blood usage. Nowadays, most surgeons and anaesthetists accept the haemoglobin of 7-8 g/dl as the “trigger” for transfusion, even in patients with cardio-respiratory disease. Therefore, why predeposit blood, if lower triggers for transfusion mean that, on the balance of probabilities, it will not be required? In a randomised study of non-anaemic patients undergoing primary hip replacement, Billote et al. showed that neither patients who deposited autologous blood, nor those who did not, received any allogeneic blood. Thus, PAD provided no benefit in this category of patients. With the triggers for transfusion identical in the two study arms, 59 per cent of pre-deposited units were transfused, indicating that PAD itself increased the likelihood of receiving a transfusion (albeit an autologous one - but this is by no means devoid of risks - see below!).

In a similar vein, our study of bone marrow donors demonstrated that haemoglobin levels decreased by approximately 1 g/dl for every pre-donated unit. After bone marrow harvest, the haemoglobin fell below 9 g/dl in 39 per cent of women and 6 per cent of men all of whom, bar one, had pre-donated blood. By contrast, haemoglobin dropped below 8.5 g/dl in only 2 per cent of bone marrow donors who had not pre-donated. Thus, in the process of autologous blood collection, the patient is often rendered anaemic and, therefore, more likely to be transfused intra- or postoperatively than he/she was in the first place.

Why do PAD patients become anaemic? Can the body compensate for the red cells removed by donations, before surgery? The extent of erythroid regeneration depends on three pivotal factors: erythropoietin response, availability of iron, and time. Under the standard conditions of one pre-donation weekly with oral iron supplementation,
The estimated red cell mass expansion is 11-19 per cent, insufficient to compensate for the red cell volume removed during PAD. If an aggressive venesection regime is applied (two donations per week), erythroid response is more substantial, resulting in 19-26 per cent red cell mass expansion. Further compensatory expansion may only be achieved with the use of exogenous erythropoietin. These considerations lead Brecher and Goodnough to equate PAD to a “chronic haemodilution”.

In this issue of the Journal, Saluja et al review their experience with 144 patients assessed for PAD in preparation for orthopaedic surgery. Their findings raise several interesting points. Firstly, 47 per cent of patients were not eligible because of anaemia, a proportion much higher than would be expected in Europe, underscoring the need for preoperative haemoglobin optimization. Only 22 patients were both eligible and willing to donate. These patients were relatively young (average age, 38 yr); despite this, the transfusion trigger was set at 9 g/dl. The highly set transfusion trigger may explain high allogeneic transfusion rates (66.7 and 18.2% for controls and study groups respectively). It is also surprising that patients in the control group (eligible patients who declined to donate) and the study group (donors) had similar preoperative haemoglobins, suggesting a possible selection bias in the control group. A clearer picture of transfusion requirements and the extent to which allogeneic transfusion is prevented by PAD, would have been obtained if the preoperative haemoglobin in the control group were similar to that of the study group before predonation.

With regard to the high (68%) utilization of autologous units in Saluja et al’s study, I suspect that the overall transfusion rate (i.e., allogeneic + autologous) was similar between the two groups. The risks of severe adverse reactions to autologous blood have been estimated to be 12-fold higher than the risks of allogeneic transfusion. Though PAD can effectively prevent viral transmission, it may not be safer regarding bacterial contamination. Furthermore, transfusion to the wrong patient, which is one of the main risks of transfusion in Western Europe and USA, can occur. In that regard, it is commendable that Saluja et al introduced additional identifying methods to prevent transfusion to unintended recipient.

The main drawback of PAD is its low cost-effectiveness. The procedure costs as much as procurement of allogeneic blood, wastage is high (40-60% units are discarded), and avoidance of allogeneic transfusion is variable. High wastage is partly due to delays in surgery, causing expiry of blood units. Logistically, PAD can be difficult, requiring repeated visits to the hospital or the blood centre and loss of patient and staff time.

So, is the death of autologous pre-donation announced? In the current circumstances, I do not forsee it rising again. PAD still continues to be an option for a patient adamant that he/she wants no allogeneic blood, capable of donating 2-4 units of blood, and undergoing an operation where transfusion is a likely outcome (for example, revision hip replacement). Likewise, it may be considered in patients with red cell antibodies where provision of allogeneic blood is difficult. Once decision is made, units should be collected as long before surgery as practically possible, with particular care to iron supplementation. In selected cases, e.g., a patient with a baseline haemoglobin of 11-12 g/dl scheduled to donate > 2 units, use of erythropoietin and intravenous iron may be warranted.

However, the scope for PAD may be much wider in countries where blood safety is not universally high. Depending on residual risks of transmissible diseases and other risks of transfusion, it may be justified to offer the possibility to donate autologous blood to more patients. Similarly, if reductions in blood supply should happen, the ensuing restrictions could severely affect the management of many patients. Such a scenario has been predicted to happen after donation testing for vCJD prion is introduced in the UK. It is easy to conceive how interest in PAD could increase again.
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References