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Preoperative Autologous Blood Donation & Orthopedic Surgery

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Preoperative autologous blood donation (PAD) is one of several blood conservation techniques clinicians utilize to reduce the need for allogeneic blood transfusions. This procedure gained great popularity when the infectious disease risks associated with allogeneic blood use were much larger than they are now, particularly before the advent of HIV and hepatitis C virus testing.¹

The decision to use PAD rests upon several factors including the: (1) type of surgery; (2) operative bleeding risk; (3) applicability and availability of intra- and postoperative blood salvage and measures to reduce bleeding; (4) patient's baseline hemoglobin/hematocrit; (5) presence of alloantibodies (and, when applicable, their specificities); and (6) patient's desire to avoid allogeneic blood transfusion.

PAD is not recommended for surgeries with <10% risk for requiring allogeneic red blood cell (RBC) transfusion. One reason for this is that, in such instances, the probability that the collected autologous blood will be wasted increases substantially.¹ In fact, many studies have demonstrated a high likelihood of PADs being discarded, with reported wastage rates ranging from 40-90% of units collected.^{2,3,4} Furthermore, the use of PAD, when applied to at-risk patients, causes iatrogenic anemia and increases the need for perioperative transfusions – especially if collection occurs close to the operative date. This is supported by studies conducted by Kanter *et al.* and Pottgiesser *et al.*

In the former, “[p]atients who donated autologous blood had significantly lower mean admission hemoglobin levels than patients who did not donate (119 g/L vs 132 g/L; P<.05),” thereby leading to increased rates of perioperative transfusions for the PAD group; in the latter study, the average allogeneic whole blood donor required a mean of 36 days to replenish his or her total hemoglobin level following a one unit donation.^{5,6}

Key Points

- After the implementation of appropriately conservative transfusion triggers and perioperative blood management strategies, preoperative autologous donation (PAD) may be considered for patients requiring elective surgeries that are associated with $\geq 10\%$ likelihood of requiring an allogeneic blood transfusion.
- The risks, benefits, and costs associated with PAD should be assessed on an individual patient basis.
- Patients requiring common orthopedic surgeries such as total knee arthroplasty (TKA) and total hip arthroplasty (THA) are generally not ideal candidates for PAD.
- The blood management support of orthopedic surgery patients should be augmented by optimizing intrinsic hematopoiesis through iron supplementation, vitamin B12/folate replacement, and/or erythropoietin therapy; utilizing a tourniquet with surgery (where appropriate); and providing intra- and/or postoperative blood salvage along with pharmacologic options like anti-fibrinolytic agents.

In addition, autologous blood transfusions are not without risk, such as bacterial contamination, febrile non-hemolytic transfusion reactions, patient misidentification (potentially causing the administration of incompatible blood), and transfusion-associated circulatory overload. Given these factors, the choice of whether or not to apply PAD needs to be considered carefully and on an individualized basis.

PAD use for elective surgeries, such as total joint arthroplasty, reached its height of popularity in 1996, making

up more than 6 percent of all the blood transfused in the US.⁴ Since then, there has been a steady decline in its use because of improvements in blood safety related largely to donor infectious disease testing. Moreover, the use of minimally invasive surgical techniques and recognition of the clinical equivalence – and in some cases superiority – of restrictive (vs. liberal) transfusion strategies have reduced the overall use of RBC transfusions. Other patient blood management techniques to minimize blood use include the early identification and treatment of preoperative anemia as well as improved intra- and postoperative blood salvage and the use of hemostatic drugs like tranexamic acid.

Although there has been a significant decline in PAD requests for most elective surgeries, major orthopedic surgical procedures, such as total hip arthroplasty (THA) and total knee arthroplasty (TKA), seem to be the exception in some parts of the country.⁴ It is this author's experience that most requests for PAD are for such cases.

Several researchers have studied the practice of PAD for major joint arthroplasty by examining the risks and benefits for the patient as both a blood donor and recipient, paying close attention to health economic outcomes. In a recently published, randomized controlled trial by Blazekovic *et al.*, the authors investigated whether there is any real need for PAD for TKA patients and, if so, for whom. They demonstrated that patients who did not donate autologous blood had similar lengths of hospital stay as two groups of patients who donated autologous blood 72 hours or 14 days before their scheduled surgeries, respectively ($p=0.346$). Moreover, the wastage rate of this study was approximately 40% for each PAD patient group, which invariably increased the cost of treatment.²

In another prospective study of 81 consecutive TKA patients, in which none gave PAD, all were operated on and transfused under the following conditions: surgeons used femoral tourniquet and post-operative blood salvage along with institutional transfusion guidelines to direct their transfusion decisions. Here the authors showed that 14 patients who received allogeneic blood transfusions belonged to the group having risk factors that rendered them unable or unsuitable for PAD. None of the patients in the group who met all criteria for PAD required any allogeneic blood transfusions; nor did they experience untoward clinical outcomes attributable to their not being transfused.⁷

According to published evidence, PAD for common major orthopedic surgeries, such as TKA and THA, is not appropriate for the majority of patients. Patients who receive autologous blood transfusion have not been shown to have statistically significant improvement in recovery, as measured by length of stay. Patients who do not receive iron replacement therapy tend to be more anemic and less capable of a robust reticulocyte response, even if they have not donated autologous blood. Moreover, patients who are most at risk of receiving blood transfusion are also the group that is least

likely to qualify for PAD. Lastly, the consistently high level of wasted PAD exacerbates the soaring costs of medical care.^{2,4}

In conclusion, PAD may be an appropriate option for elective surgeries under various permutations of the following conditions: (1) the combination of surgical procedure and patient characteristics is associated with $\geq 10\%$ chance of requiring blood transfusion; (2) the patient has an adequate red cell reserve without history of iron deficiency; (3) there is sufficient time between the autologous collection and the planned surgery for hematopoiesis to replace a substantial portion of the patient's lost blood; (4) the patient is known to have a single rare alloantibody or multiple alloantibodies, which makes locating allogeneic blood challenging; (5) intra- or postoperative blood salvage is not available (or is not expected to sufficiently reduce the risk for allogeneic transfusion); (6) the patient has a strong desire to avoid allogeneic blood exposure; and (7) oral iron supplementation, if appropriate for the patient, is available and tolerated in conjunction with autologous donation, as to maximize the patient's intrinsic hematopoietic ability.

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