Anemia is not yet an indication for off-pump coronary artery bypass grafting

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In business school, I learned that the answer to every question is, "It depends." The trick is in knowing on what it depends. This seems particularly true when it comes to defining the role of off-pump coronary artery bypass grafting (OPCAB) in myocardial revascularization. In this issue of the *Journal*, Paparella and colleagues¹ make an effort to help us take one step closer to that end point.

"On-Pump Versus Off-Pump Coronary Artery Bypass Surgery in Patients With Preoperative Anemia" offers a fresh perspective by examining the effect of off-pump coronary bypass in the patient with anemia. After a propensity-matched analysis, Paparella and colleagues¹ conclude, "In patients with low levels of preoperative hemoglobin, OPCAB was associated to lower early morbidity and mortality but to a greater risk of mortality during follow-up compared to on-pump." On the basis of their data, this is a reasonable conclusion.

Paparella and colleagues¹ also do a very good job of framing their results within contemporary reports. There are some observations that support what is emerging as "accepted" associations with OPCAB, including the following: a lower blood transfusion rate, fewer grafts, and a higher late mortality. A finding that is somewhat unique is the lower perioperative mortality in the OPCAB group (3.1% vs 6.1% on-pump). Although there are clearly some risk factors that yield perioperative benefit after OPCAB, the challenge is to determine whether anemia is one of them.

Anemia was classified as follows: (1) mild anemia if hemoglobin was 11.0 to 12.9 g/dL in male patients and 11.0 to 11.9 g/dL in female patients, (2) moderate anemia if hemoglobin was 8.0 to 10.9 in patients of either sex, and (3) severe anemia if hemoglobin was lower than 8.0 g/dL in patients of either sex. Anemia was mild in 651 patients (69.3%), moderate in 283 (30.1%), and severe in

5 (0.5%). Only 36.2% of the entire population of patients undergoing coronary artery bypass grafting had anemia.

Preoperative anemia has been established as a factor that increases the perioperative risk of cardiac surgery.² Previously, this group has reported the detrimental effect of preoperative anemia and its contribution to mortality above and beyond the euroSCORE II, with mortalities of 3.4% in patients without anemia, 7.7% in patients with mild anemia, and 15.7% in patients with moderate to severe anemia.³ They also cite Boening and colleagues' report⁴ of a 12.9% 30-day mortality in patients with anemia who have undergone on-pump coronary artery bypass grafting versus 2.2% of those without anemia.⁴

Even with this report, however, it is not clear whether the mortality increase is due solely to the anemia. Most of my patients have anemia according to these definitions. In the cited Danish On-pump Versus Off-pump Randomization Study (DOORS) trial, the median patient had moderate anemia (8.4 g/dL in the on-pump group and 8.6 g/dL in the OPCAB group).^{5,6} Thirty-day mortalities were 1.6% in the OPCAB group and 1.8% in the on-pump group; 6-month mortalities were 4.2% in the OPCAB group and 4.7% in the on-pump group. In the current report of Paparella and colleagues,¹ 6-month mortalities approached 10% in both groups. It is not clear that this elevated mortality can be attributed solely to anemia.

I am concerned that the mortality in the on-pump group may be related, at least in part, to other confounding factors. The euroSCORE II–predicted mortality was only 3.4% in the on-pump group. The actual mortality of 6.1% was higher than expected. Although the causes of death are not listed, it is conceivable that some of the deaths were due to myocardial failure. In the report of Paparella and colleagues,¹ it appears that only 11.2% of patients received retrograde cardioplegia. Especially in the patient with anemia, this could have accounted for some of the difference in outcomes. If all other data are accurate, the message may be that OPCAB yields lower early mortality than on-pump coronary artery bypass grafting performed with only antegrade cardioplegia. Comparisons taking into account different myocardial protection strategies are needed before definitive conclusions can be drawn.

The assertions of Paparella and colleagues,¹ however, do warrant attention. Anemia may be an even higher risk factor than previously appreciated, and optimal techniques should be defined in this population. OPCAB may be one of them.

After reading this article, I try to answer the core question: How does this change my practice? To respond

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appropriately, I look to other thought leaders and their interpretation of other recent reports and use them to “calibrate” my perspective. Recently, Craig Smith, in response to the Danish On-pump Versus Off-pump Randomization Study trial, acknowledged that OPCAB is likely to lead to early graft failure,⁷ which most of us believe is the reason for its late survival disadvantage. Joe Sabik,⁸ in his review of the reports by Takagi and colleagues⁹ and Houlind and colleagues,⁶ declared that on-pump should be our preferred surgical myocardial revascularization strategy. Harold Lazar¹⁰ declared that on-pump coronary artery bypass grafting continues to be the criterion standard.

Paraphrasing an earlier statement of Bernard of Chartres, Sir Isaac Newton claimed, “If I have seen further it is by standing on the shoulders of giants.” Although this report by Paparella and colleagues¹ may have allowed me to see slightly further, my view, like those of the giants, remains unaltered. In my practice, OPCAB remains reserved for highly selected patients. Anemia is a risk factor that merits closer investigation, but this article will not change my practice of on-pump, arrested revascularization with cold blood cardioplegia delivered both retrograde and through vein grafts with septal temperature probe confirmation of adequate cooling, even in the patient with anemia. Unless and until further research makes the view a bit more clear, this will remain for me the standard of care.

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