Myocardial and Cerebral Injury After Off-Pump Coronary Artery Surgery

To the Editor:

Van Dijk and colleagues are to be congratulated on the contribution of their randomized trial to the on-pump versus off-pump coronary artery bypass surgery debate and, in particular, the discussion of the high proportion of patients undergoing total arterial revascularization. Most of the pertinent points are covered in Dr Yacoub’s balanced accompanying editorial. Two methodological flaws may, however, invalidate the authors’ conclusions regarding myocardial and cerebral injury.

First, the reduction in creatine kinase (CK)-MB release in the off-pump group compared with the on-pump group is based on measurements taken within the first 20 hours postoperatively. Release of biochemical markers of myocardial injury over this period may reflect turnover of cytosolic pools and increased membrane permeability as a consequence of cardiopulmonary bypass rather than true myocardial necrosis. Demonstration of rising CK-MB levels up to 48 hours would have helped to resolve this issue.

Second, the observation of a similar stroke rate in both groups is difficult to interpret without knowing precisely what proportion of patients had composite arterial grafts without needing to fashion a “top-end” on the aorta. Atherosclerosis of the ascending aorta is a major risk factor for cerebral macroemboli, and the benefits of avoiding aortic cannulation and cross-clamping are negated by the use of the partial occlusion clamp to construct proximal anastomoses. Consequently, we consider the use of a “no touch” technique for the aorta, with use of composite arterial grafts based on internal thoracic arteries, to be the best method of eliminating the risk of stroke.

We have previously reported similar severity of neuropsychological injury in “low-risk” patients undergoing on-pump and off-pump surgery. In the on-pump group, such injury results from the microembolization of particulate debris, whereas in the off-pump group, this is almost certainly due to a reduction in cardiac output during manipulation of the heart.

The major benefits of off-pump surgery are likely to be seen in the elderly who are most susceptible to the damaging effects of cardiopulmonary bypass. Indeed, practice is moving rapidly in this direction.

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Response

We thank Drs Mussa and Taggart for their comments on the 1-month results of the Octopus trial, which compares on-off-pump and on-pump coronary bypass surgery. With regard to the monitoring of creatine kinase (CK)-MB release, we agree that measurements up to 48 hours postoperatively may reflect myocardial necrosis more accurately.

In the off-pump and on-pump group, a partial occlusion clamp for proximal anastomoses on the ascending aorta was used in 36% and 50% of the patients, respectively. This difference may indicate that cardiac surgeons are more inclined to completely avoid manipulation of the ascending aorta when cross-clamping is not necessary, ie, when an off-pump technique is used. We agree that a “no touch” strategy is probably the best method for decreasing the risk of stroke. It is unclear, however, whether high rates of neuropsychological injury after off-pump coronary artery bypass grafting are due to intra-operative reduced cardiac output. It is conceivable that major surgical trauma and anesthetia are other sources of cognitive decline. Moreover, commonly used definitions of neuropsychological injury appear to have limited precision, and a “cognitive deficit” may well be caused by natural fluctuations of a patient’s performance during repeated neurocognitive testing. The true incidence of neuropsychological injury, both after off-pump and on-pump bypass surgery, may therefore be lower than generally assumed. The neuropsychological outcome 3 months after surgery is the primary endpoint of the Octopus trial and may soon be published.

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