The NEW ENGLAND JOURNAL of MEDICINE

CORRESPONDENCE

◀ Previous Volume 336:1605-1607 May 29, 1997 Number 22 Next ▶

Adverse Cerebral Outcomes after Coronary Bypass Surgery

To the Editor: In their prospective, multi-institutional study of adverse cerebral outcomes after coronary-artery bypass surgery, Roach et al. (Dec. 19 issue)[1] have documented the frequency of such outcomes (6.1 percent) and their costs in terms of increases in mortality, length of hospital stay, and care after hospital discharge. It is becoming increasingly evident that atherosclerosis of the ascending aorta is one of the most important predictors, if not the most important predictor, of what the authors termed a type I outcome. Two studies, among others, have documented the importance of aortic atherosclerosis and the use of epiaortic ultrasonography or transesophageal echocardiography for its detection.[2,3] Two studies involved over 1200 patients each,[2,4] and one was prospective.[2] These studies have established that visual inspection and palpation of the ascending aorta underestimate the frequency and severity of atherosclerosis.[2,3]

A history of neurologic disease, the risk factor with the second highest adjusted odds ratio, was not defined by the authors. The definition presumably encompassed a history of stroke, previous carotid endarterectomy, or the presence of a carotid bruit. There is compelling evidence that the presence of high-grade, extracranial occlusive disease of the carotid artery is a risk factor for stroke during operations requiring cardiopulmonary bypass. Duplex imaging is a safe and cost-effective method for detecting carotid artery disease and has permitted the formulation of risk profiles to identify patients at high risk who should be screened preoperatively for serious disease.[2,5] Numerous studies have reported successful strategies for the treatment of patients with combined carotid and coronary artery disease.

We agree with the authors that further investigation is necessary to reduce the frequency of brain injury after cardiac surgery. The strong correlations among brain injury, older age at operation, and atherosclerosis of the ascending aorta, as well as the fact that increasing numbers of elderly patients are undergoing cardiac surgery, make this an issue of high priority for investigation.

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To the Editor: **Roach** et al. report a cumulative incidence of 6.1 percent for cerebral complications after coronary-artery bypass grafting. The incidence of focal or more serious (type I) outcomes was five times as high in patients with a palpable atherosclerotic plaque in the proximal aorta intraoperatively (which is often the only available site for cross-clamping and proximal anastomosis of the vein graft) as in patients without such plaques.

The internal thoracic artery is now the preferred conduit for bypass and has been shown to be associated with excellent long-term patency and increased survival with low morbidity after bypass surgery. These results have stimulated considerable international interest in using additional arterial grafts.[1] The subsequent use of bilateral internal thoracic arteries, the gastroepiploic artery, the inferior epigastric artery, and occasionally the radial artery has made total arterial myocardial revascularization possible.[2] These conduits do not necessarily require proximal aortic anastomosis, thus decreasing mechanical manipulation of the aorta and the need for long-term anticoagulation therapy. Although these grafts require more surgical creativity and skill, the distal runoff and patency rates are superior to those for traditional autologous saphenous-vein grafts. In addition, intraoperative surface aortic ultrasonography may be used to identify susceptible atheroma, and with a simple modification of the operative technique, it reduces the stroke rate after bypass surgery.[3]

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To the Editor: **Roach** et al. should be congratulated for calling attention to adverse neurologic outcomes after coronary bypass surgery. However, their definitions of outcomes make it difficult to interpret their results. For their type I outcome, deaths due to cerebral injury and perioperative strokes were combined. There have been a number of prospective studies of stroke associated with coronary bypass surgery, and we have developed a model that predicts the relative risk of stroke on the basis of preoperative data.[1] Including deaths due to cerebral injury in the type I outcome complicates such outcome models.

Of greater concern is the definition and incidence of their type II outcome, which was defined as "a new deterioration in intellectual function, confusion, agitation, disorientation, memory deficit, or seizure." The criteria for a deterioration in intellectual function are not clearly defined, and no reference is made to the availability of preoperative data that were used to make this distinction. **Roach** et al. report that some institutions found no type I outcomes and no type II outcomes, suggesting that the criteria for cognitive decline may not have been specific enough to document these outcomes. The result is a lower incidence than that reported in prospective studies by us and others. We have developed a neurologic screening tool that we administered preoperatively and on day 2 or 4 of the postoperative period. Using this tool in a pilot study, we found that 18 percent of patients had the new onset of confusion (a score greater than zero according to the Confusion Assessment Method[2]), and 34 percent had new memory deficits, as indicated by their inability to remember three words.

The characterization of patients with type II symptoms postoperatively is important, since it is not known whether these patients will have transient or persistent cognitive dysfunction after coronary bypass surgery.[3] With the prospect of neuroprotective agents soon becoming available, it is critical to the design of such studies to be able to identify patients at high risk for adverse neurologic outcomes after coronary bypass surgery.

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The authors reply:

To the Editor: Kouchoukos and colleagues note an association between proximal aortic atherosclerosis and stroke in patients undergoing coronary-artery bypass surgery. A number of studies have supported this association, as well as the superiority of echocardiography in detecting aortic atherosclerosis. Although several reports have suggested treatment strategies, such as replacing a highly diseased ascending aorta with the use of circulatory arrest,[1] these strategies have not been appropriately evaluated in randomized, prospective, controlled clinical trials. Clearly, given the importance of this problem, such a trial is needed.

We considered a history of neurologic disease to indicate a previous stroke or transient ischemic attack and did not include asymptomatic extracranial cardiovascular disease. We did, however, evaluate the relation of carotid artery disease and stroke, finding an association in the univariate analysis that did not persist in the multivariate analysis — findings consistent with those in a recent study by McKhann et al.[2]

Hariawala elaborates on whether the use of only arterial conduits reduces the incidence of neurologic sequelae. Although some reduction in the incidence of cerebral emboli may be achieved, most techniques do not obviate the need for aortic cannulation and cross-clamping. Cannulation of the femoral artery instead of the aorta has also been suggested. However, the incidence of stroke may be higher with the former cannulation site.[3]

Goldsborough and colleagues suggest that fatal cerebral injuries should not be combined with nonfatal strokes in our analysis. However, we were bound by our study design, which prospectively defined type I and type II outcomes, and we believe that both fatal and nonfatal strokes are important adverse outcomes. We agree that preoperative indexes of the risk of stroke can be constructed, and we have developed such an index.[4] However, indexes of risk must be continually refined and validated before their widespread use in clinical practice. The addition of preoperative transesophageal echocardiography or perhaps aortic angiography to detect aortic atherosclerosis may improve the stratification of risk, which will permit appropriate informed consent and a more rational allocation of resources.

Neuropsychological testing has been used extensively in patients undergoing cardiac surgery, and the incidence of neuropsychological impairments is substantial. However, only one in three impairments persists for six months, and the importance of these impairments has not been established. As Goldsborough et al. point out, neuroprotective agents may soon be available for clinical trials. Assessment of cognitive function with the use of neuropsychological testing may be more appealing than stroke trials, because of the reduced sample size and cost; however, the clinical relevance of neuropsychological dysfunction is much less certain than that of stroke. An accurate determination of cognitive end points is challenging, and further development appears to be necessary for use in the assessment of outcomes.

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