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Neuropsychological Evaluation of the Results of Surgical Treatment of Cerebrovascular Disease

Melvin L. Schwartz, PhD*

The neuropsychologist evaluating patients before and after carotid endarterectomy or EC-IC bypass faces a perplexing clinical and scientific situation. Because neuropsychological evaluation is available primarily in large medical centers where good medical screening can be utilized to select patients most likely to benefit from surgery, test results might be expected to reveal postsurgical improvement in mentation. Although the problem of providing appropriate control groups has been emphasized in these papers, other important issues complicate the assessment of the surgical contribution to recovery of mental function. These include: 1) the natural course of the disease; 2) the purpose of surgery; 3) alternative nonsurgical treatments; 4) precision of the preoperative evaluation; 5) operative procedures and technique; 6) mechanisms of improved mentation; and 7) the patient's outlook.

1. Natural course of the disease
Patients with carotid atherosclerosis usually face a progressive disease which is very difficult to reverse, particularly at the advanced age when the disordered circulation begins to produce symptoms. Although appropriate dietary and medical measures may slow the disease process, cholesterol plaque formation usually continues in one or another of the arteries. Genetic factors are strong determinants of the incidence and progress of cerebral atherosclerotic disease. In patients with a strong family history, genetic determinants may outweigh the ameliorative effects of the best available therapeutic endeavors. Moreover, the diseases often associated with cerebral atherosclerosis may present the patient with a battle on several fronts. Despite success in the struggle against one or two of these conditions, the patient may be undermined by the complications of hypertension, diabetes, obesity, or cigarette smoking. Usually older, patients who are candidates for arterial surgery face declining mentation as a result of their cerebrovascular disease. In this complex setting, surgical success may be merely the maintenance of the preoperative mentation level. Unchanged test scores postoperatively could therefore be considered a successful outcome.

2. Purpose of surgery
The usual goal of neurosurgical treatment for cerebrovascular disease is to reduce the number of transient ischemic attacks and/or decrease the risk of occlusive disease with completed stroke. At present, vascular specialists lack the evidence essential to recommend surgery for the purpose of improving mentation. Obviously, improved mentation is a desirable result secondary to increased cerebral blood flow, but this benefit cannot be offered as the primary health purpose of the procedure.

3. Alternative treatments
Available studies comparing the results of cerebrovascular surgery with those of medical treatment with antihypertensive and/or antiplatelet aggregation drugs present many problems of experimental design and are not conclusive. Unfortunately, many of these conservative treatment studies have not included assessment of mental function. Recommendations for changes in diet and exercise, decreased smoking, and in the use of alcohol usually accompany any other therapeutic measures.

4. Preoperative evaluation
Despite remarkable advances in technique, vascular radiologic findings lack a very precise relationship to neurological or neuropsychological findings. Moreover, the reliability of radiographs to define what the surgeon may find at the surgical site is uncertain. While radiologic studies may not provide totally reliable information, some well known clinical signs have similarly uncertain significance. For example, the issue of surgery for the

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"asymptomatic bruit" is not solved. Of course, the term "asymptomatic" is inaccurate if used to describe patients whose deficits in mentation have escaped detection in the neurological evaluation.

The importance of the patient's general health, the influence of age and education, and the ability to change lifelong habits during postoperative convalescence are issues that have not yet been adequately considered.

5. Operative procedures and technique
For cerebrovascular surgery, success rates in community hospitals may differ from those of large medical centers. Acceptable morbidity and mortality rates have been cited for these surgical procedures, but variations in technique as well as in success rates are reported from different institutions.

6. Mechanisms of improved mentation
A most interesting aspect of the changes in mentation associated with cerebrovascular surgery is the mechanisms by which improvement occurs. Some data suggest that increased cerebral blood flow results from surgery, but this is far from certain. Conceivably, however, increased cerebral blood flow activates a feedback loop which incites lower brain centers to maintain and/or enhance the level of activation.

Similarly, the manner in which cerebral "steal" is modified by increased cerebral blood flow has not been delineated. In all of these patients, the placebo effect of dramatic cerebral surgery is difficult to evaluate, and patients are often under considerable pressure to see themselves as improved. Therefore, objective methods of measurement are required; these must replace subjective reports of patient recovery provided by attending surgeons and their staff.

7. Patient's outlook
Some patients who are candidates for cerebrovascular surgery may be too impaired mentally to give fully informed consent. These circumstances require extensive consideration of the rationale of the procedure and the expected outcome. Many feel that prevention of a stroke is sufficient purpose for the elective procedure. Others, willing to accept the risk of stroke, hope for increased mental ability even for a short time after surgery. Some patients and their families may not be aware that loss of mentation has already occurred, since its onset may have been so insidious.

Suggested Solutions
The need for further research in this area is great, given the many variables which affect the patient's mental function after cerebrovascular procedures have been performed. Adequate control for any single study is probably impossible to obtain. Lacking this, detailed reporting of each study is essential, and a depository for data from carotid endarterectomy and EC-IC bypass reports should be developed.

Minimal standards for the preoperative evaluation of patients with cerebrovascular disease should be established. Neuropsychological evaluation should include quantification of the traditional limited assessment of mental status. Postoperatively, lifestyle factors contributing to the patient's vascular status should be evaluated and appropriate counseling offered. These factors may be as important to the ultimate outcome for the patient as the direct manipulation of the vascular system.

Analysis of these factors should contribute to our understanding of mental function and the variable effects of cerebrovascular surgery. It should provide a better basis for selecting candidates for each type of surgery, more appropriate technical procedures, and for better management of patients after surgery.