References


Risks and Benefits of Shunting in Carotid Endarterectomy

In his article in Stroke, Halsey1 reported the results of a multicenter, retrospective study that included 1495 carotid endarterectomies. The study was conducted to assess the severity of ischemia during clamping of the carotid artery using transcranial Doppler (TCD) as a basis for analysis of complications in patients operated on with or without a shunt. The study did not reveal any benefits concerning neurological outcome and morbidity where routine shunting was favored. He concluded that a shunt should be used selectively depending on the intraoperative neurological monitoring (eg, TCD).

In contrast to this multicenter study, we conducted in our institution a prospective, randomized study to answer the question of whether routine shunting is necessary during carotid endarterectomy. In 503 cases evaluated preoperatively and postoperatively by an independent neurologist, the use of a Javid shunt was prospectively randomized. Surgery was performed under general anesthesia, and intraoperative neuromonitoring included an eight-channel electroencephalogram (EEG) and somatosensory evoked potentials (SEP) monitoring. Of 250 patients designated for shunting, 35 (14%) could not be shunted for technical reasons; among 253 patients not designated for shunting, 10 (4%) underwent operation with a shunt because of severe alterations revealed by EEG and SEP monitoring after carotid cross-clamping. After carotid endarterectomy the arteriotomy was closed by direct suture in 20 patients and with a saphenous vein patch in 483 patients. After completion of the surgical procedure, the quality of blood flow was assessed by Doppler spectral analysis to detect technical failures, eg, intimal flaps. In 143 cases intraoperative quality control necessitated reclamping of the carotid artery, and further reconstructive means were necessary to achieve laminar blood flow. In 220 cases (43%) an additional resection and end-to-end reanastomosis was necessary to straighten the internal carotid artery to achieve an optimal hemodynamic result.

Multivariate analysis of our data revealed an overall stroke rate of 4.0%, which included neurological deficits from the nonoperated hemisphere. The incidence of a perioperative neurological deficit did not differ significantly between the patients primarily shunted (4.2%) and those operated on without a shunt (3.3%). Patients who could not be shunted for technical reasons had a neurological deficit of 2.9%, whereas those secondarily shunted had a stroke rate of 20%.

As a result of our study, the following four subsets of patients with a significantly increased risk of perioperative stroke could be identified: (1) Patients with occlusion of the contralateral internal carotid artery (ICA) (11.3% vs 2.5% with a patent ICA; P<.01). (2) Of the patients who had a preoperative stroke, 8.6% developed a recurrent or new stroke versus 1.3% of asymptomatic patients or patients with a history of transient ischemic attacks (P<.001). (3) A pathological preoperative computed tomographic (CT) scan (in 246 patients) was a strong predictor for developing a perioperative stroke (16 patients), with a probability of 6.5%. This group differed significantly (P<.005) from patients with a normal CT scan. (4) Of the 142 patients in whom Doppler spectral analysis revealed technical problems that required correction, 8.5% developed a stroke (P<.05).

Although not statistically significant, experienced surgeons had fewer complications than those still in training. One hundred sixty-seven procedures were performed by the most experienced surgeon, with a stroke rate of 1.8% (shunted, 2.3%; not shunted, 1.3%), whereas 336 reconstructions were carried out by surgeons in training, with a stroke rate of 5.1% (shunted, 4.9%; not shunted, 5.2%; P<.1). Derived from these data, no recommendation can be given for less-experienced surgeons to routinely use a shunt.

In our series of patients, significant changes of the EEG or SEP registrations (in 19 patients) were followed in eight cases (42%) by a perioperative stroke (P<.00002).

We agree with Dr Halsey that a shunt should be used on a selective basis according to neuromonitoring. In addition to his findings, we believe that certain subsets of patients are at an increased risk of suffering from a perioperative neurological deficit. The experience of the surgeon and the quality of the hemodynamic result assessed (eg, by spectral Doppler analysis) may determine the outcome of the operation. In institutions where neuromonitoring equipment is not available, routine shunting of the above-mentioned risk groups might be beneficial. The use of a shunt did not reduce the neurological morbidity of patients operated on by surgeons in training, which underlines the necessity of an experienced surgeon performing or at least assisting in these delicate surgical procedures. Further clinical studies have to prove whether TCD is superior to other neuromonitoring techniques such as EEG, brain mapping, SEP monitoring, or a combination of several methods.

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Reference


Response

Drs Sandmann, Kolvenbach, and Willeke present observations that should be considered by all who share the goal of making the operation safer. I agree with their conclusion that shunting should be selective, based on monitoring to demonstrate the hemodynamic need for it, and if monitoring is not available, the risk of hemodynamic stroke in cases with contralateral occlusion should be high enough to justify it. It does not follow that it is indicated in other high-risk groups (with prior clinical stroke or CT lesions) without evidence elucidating the mechanism by which these occur. In my own cases, patients with recent stroke have had, or not had, hemodynamic complications according to the adequacy of residual blood flow (judged by TCD and EEG) during clamping, from
Risks and benefits of shunting in carotid endarterectomy.
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Stroke. 1993;24:1098-1099
doi: 10.1161/01.STR.24.7.1098

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