

• Carotid endarterectomy - editorial

A half-century ago the first surgical procedure to prevent stroke was reported in *The Lancet*.¹ The patient in this epochal advance had had neurological symptoms in the carotid territory of the brain and angiography of the relevant carotid artery, which revealed stenosis. The concept proved eruptive: within 25 years an estimated 1 million carotid endarterectomies had been done, mainly on patients with neurological symptoms (stroke or transient cerebral arterial ischaemia) who were then investigated angiographically, revealing stenosis. Ultrasonography extended the procedure to the potentially much larger population with asymptomatic lesions. The notion was explored that patients with only vertebral/basilar symptoms might benefit from carotid endarterectomy performed on asymptomatic carotid stenosing lesions. The results failed to be convincing of secondary benefit transferred from one arterial territory to another. Interest dwindled.

From the mid-1950s until 1981, claims of benefit were anecdotal with inexact historical comparisons. Ultimately patients with symptomatic and, later, with asymptomatic lesions entered large randomised trials. The North American Symptomatic Carotid Endarterectomy Trial (NASCET)² and the European Carotid Surgery Trial (ECST)³ proved that with hemisphere or ocular neurological symptoms associated with over 70% carotid stenosis, identified by angiograms, benefit from careful carotid endarterectomy was unequivocal, despite a 6% perioperative risk of stroke or death. The greatest gain was in men, the elderly, and patients with hemisphere and not solely retinal symptoms. Only six patients needed to be treated to prevent one stroke in 2 years. For symptomatic patients in NASCET with only 50-69% carotid artery stenosis (in whom stroke risk is less than in patients with greater stenosis) and with perioperative risk of 6% the number needed to treat to prevent stroke was 15. By comparison, in ECST, an 8% perioperative risk nullified the net benefit, which is a stark reminder that operative risk is critical in carotid endarterectomy where the complications are the same as what one is attempting to prevent.⁴

In patients with 60-99% carotid artery stenosis but, as yet, no neurological symptoms (such as stroke or transient cerebral ischaemia), the Asymptomatic Carotid Atherosclerosis Study (ACAS),⁵ from North America, detected only modest benefit favouring carotid endarterectomy. The 30-day combined risk of stroke and death from angiography and surgery was 2-3%. The absolute risk-reduction projected to 5 years was 5-9%. The number needed to treat to prevent one stroke in 2 years was at least 67. The benefit did not seem to depend on the severity of the stenosis, as measured by ultrasound alone. Small numbers of events in ACAS probably explain the lack of demonstrable benefit for women or for disabling stroke.

Today's *Lancet* presents results of the latest and largest asymptomatic trial, the Asymptomatic Carotid Surgery Trial (ACST). With increased numbers of patients and outcomes, modest benefit extended to women and disabling stroke. Surgical morbidity and mortality was 3-1%. The absolute risk reduction at 5 years was 5-4%.

Before concluding that the route has been cleared to the operating room for most patients with asymptomatic carotid stenosis, several factors require careful consideration. First, patients must recognise that with good medical care they face only a 2% annual stroke rate, which falls below 1% after successful carotid endarterectomy. But the benefits will exceed the risks only if the operative hazards remain low, otherwise they could be obliterated. Contemporary reports suggest that the rates of operative complications often exceed by 1 or 2% the low rates achieved by trial surgeons (3%).^{6,7} Thus, if such surgery is to be offered, audited results of surgeon's operative records should be readily available to referring physicians and patients. Institutions and departments should require totally independent audits of surgical morbidity rates and ensure their ready availability. Experts in examining the nervous system should be required to evaluate the postoperative condition of all patients who have carotid endarterectomy.

Second, despite the disclaimers in the ACST report, scrupulous and compliant regulation of lipids, glucose, blood pressure, cigarette smoking, and appropriate platelet inhibition would narrow the medical/surgical gap. Evaluation of this possibility requires a stricter protocol than has yet been used.

Third, uncertainty surrounds the failure of both of the trials in asymptomatic patients to find any difference between the higher and lower deciles of stenosis, as assessed by ultrasound. By contrast, both of the trials in symptomatic patients found strikingly greater risks from unoperated lesions, and correspondingly greater benefits from successful carotid endarterectomy in patients with the higher (>70 %) degrees of stenosis.. All the patients in the symptomatic trials had their stenosis assessed by conventional angiography, suggesting that failure to detect the relevance of the stenosis in the asymptomatic trails might merely reflect the imperfections of ultrasound as a sole technique of measurement.^{8,9} The search for those asymptomatic individuals who are, if untreated, at highest risk must continue on several fronts, including the use of modern non-invasive imaging methods. Patients with reliably identifiable severely stenosing lesions will probably be found to benefit the most.

Fourth, unlike all the other large trials, in ACST the main analyses of the effects of surgery involved not only ipsilateral but also contralateral strokes. No comparative curves were presented for just ipsilateral carotid territory ischaemic strokes, which are the type most expected to be reduced by operating on one diseased artery. The striking statistical observation that contralateral strokes were significantly reduced by ipsilateral carotid endarterectomy cannot yet be promised to patients as a bonus benefit. Detailed imaging observations on the contralateral artery, perfusion studies both preoperatively and postoperatively, study of the collateral blood flow, and careful surveillance for potentially embologenic lesions of heart and aorta must be part of an ongoing evaluation of this unexpected but intriguing observation.

Problems persist, but the investigators of the ACST are to be congratulated for performing well a monumental task. They are to be commended for their cautionary concluding remarks. Carotid endarterectomy with any less skill than exhibited by ACST and ACAS surgeons quickly casts the procedure into the list of "risk factors for stroke".

I have no conflict of interest to declare.

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