RACE to protect brains

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ABSTRACT

INTRODUCTION Rapid-access carotid endarterectomy (RACE) is an evidence-based treatment for symptomatic carotid stenosis. Our vascular centre aims to provide this service within 48 h of symptoms in appropriate patients. This study audits safety and efficacy of the first year of RACE.

SUBJECTS AND METHODS A clear trust protocol was publicised for the RACE pathway. A prospective database was established for all carotid endarterectomies (CEAs) performed. Outcomes were compared between elective (ECE) and rapid-access operations.

RESULTS In 1 year, 96 patients received CE; 20 were performed urgently. There were no significant differences in age or gender between ECE and RACE groups. Twenty-three (30%) of ECE were for asymptomatic stenoses; no other significant differences in surgical indication were seen. Of symptomatic ECE, 43% were for completed stroke versus 55% for RACE. Median delay between diagnosis and surgery was 113 days for elective and 2 days for RACE patients. There was one death following ECE (1.3%) and one stroke after RACE (5%), all not significant. Anaesthetic method did not influence outcome. The main reasons for delaying surgery in RACE patients were optimisation of patient fitness and availability of theatre time.

CONCLUSIONS The RACE pathway dramatically reduces delay without compromising patient safety. In the first year of service, we have treated 50% of suitable patients within 48 h. Further education of patients and colleagues should reduce delay and improve outcomes for symptomatic carotid disease.

KEYWORDS

Rapid-access carotid endarterectomy – RACE – Carotid endarterectomy

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Transient ischaemic attacks (TIAs) and minor ischaemic strokes are precursors of major strokes. The Oxford Vascular Study¹ quantified the risks of major stroke within 90 days of a TIA or minor stroke as 17.3% and 18.5%, respectively. Half occurred within the first week.

Carotid endarterectomy (CEA) reduced the stroke risk in two large randomised trials^{2,3} and attention is shifting to reducing the delay before surgery.⁴ Analysis of data on timing of surgery, from two large carotid studies, predicts that, for every 1000 CEA performed, 185 strokes could be prevented by surgery within 2 weeks.⁴ This protective effect diminishes with time until, by 12 weeks, only eight strokes are prevented by 1000 operations. Delay renders surgery ineffective and probably harmful, considering that CEA has a national complication rate of 2.7% for postoperative stroke, death or myocardial infarction and 4.5% for cranial nerve injury.⁵

Despite these figures, 19% of CEAs are currently performed after 12 weeks;⁵ only 37% within 2 weeks and 10% within 48 h.⁵ There is movement in the UK to set a target for delay before CEA to 2 weeks,⁶ with 48 h a future target.⁷

Performing early CEA must not compromise safety. A systematic review of the literature by Fairhead and Rothwell⁸ and a study of the pooled ECST and NASCET data by the same group⁹ have shown that surgery within 2 weeks of first symptom is no more risky than after 2 weeks. Current evidence supports early surgery as long as patients with ischaemic stroke have a modified Rankin score¹⁰ less than 3,¹¹ an American Society of Anesthesiology (ASA) score¹² of 1 or 2¹³ and do not have progressive symptoms suggestive of unstable lesions.⁹

The aims of this study were to introduce an urgent CEA service, with the target of treating all suitable patients within 48 h of diagnosis, and to audit the first year of urgent CEA, comparing outcomes with electively treated patients over the same period. We called the new service RACE – rapid-access carotid endarterectomy.

Subjects and Methods

East Kent NHS Trust serves 630,000 people. It includes three district general hospitals with stroke services at each, and

one vascular surgery centre. Evidence-based indications for including a patient on the RACE pathway (as outlined above) were agreed by all specialists involved in stroke management. Referral pathways were publicised locally and referrals began in August 2007.

Patients with TIA symptoms were referred by their general practitioner (GP), ophthalmologist or the emergency department to a daily TIA clinic. Those diagnosed with TIA had an ABCD2 score¹⁴ created, the best predictor of stroke risk after TIA.¹⁵ Patients with ABCD2 score of 4–7 were considered for RACE and underwent a T2-weighted magnetic resonance (MRI) head scan and angiogram (MRA) to detect stroke and carotid disease. Any carotid stenosis on MRA triggered a duplex ultrasound to measure internal carotid artery (ICA) stenosis. ICA stenosis of 50–99% was considered suitable for surgery in patients graded ASA 1–2 where MRI showed limited or no acute brain changes.

Patients presenting with stroke underwent computed tomography (CT) (to exclude intracerebral bleeding) and carotid duplex. Referrals were made for RACE once investigations were complete. Surgery was indicated by ICA stenosis of 50–99%, in patients without signs of haemorrhage, a Rankin score less than 3, and an ASA score of 1 or 2.

During the same period, elective CEA (ECE) was offered to symptomatic patients (stroke in preceding 6 months, TIA, amaurosis fugax or pulsatile tinnitus) with 50–99% ICA stenosis. Patients with asymptomatic stenoses of 60–99% were also considered for surgery.^{16,17} Patients with symptoms more than 6 months before referral were treated as asymptomatic. The NASCET criteria² were used to measure ICA stenosis; 50% was used as a threshold for surgery in symptomatic disease, guided by the Combined Endarterectomy Trialists' Collaboration data.¹⁸

Two consultant vascular surgeons performed the operations. A surgeon was available 6 days in every 10 days. If unavailable, surgery was planned on the next available list. Operations were performed on emergency lists, which meant competition from other emergencies, requiring co-operation with other specialties, anaesthetic and theatre teams. Meetings were held to engage enthusiasm for RACE.

Standard CEA was performed in all cases. Consultant anaesthetists with elective vascular lists performed the anaesthesia. All patients were offered a choice of local or general anaesthetic (LA, GA). During carotid clamping, an intraluminal shunt (Javid shunt, Bard USA) was placed for all patients under GA and selectively under LA if signs of cerebral ischaemia occurred during verbal testing. All arteriotomies were closed with a Dacron patch.

A prospective database was compiled, collecting data on age, gender, degree of ICA stenosis, anaesthetic method, complications and the delay between diagnosis of significant carotid stenosis and surgery. All patients were reported to the National Vascular Database. The chi-squared test was used to

compare total complications between ECE and RACE groups and Fisher's exact test for individual complications.

Results

During the first year of RACE, 23 patients were referred for urgent surgery. Three suitable patients declined surgery; 20 underwent RACE. Seventy-six patients underwent elective CEA during the same period. Of 96 total operations: 68 were in men; 57 were performed under GA. 23 (30%) of elective patients had asymptomatic stenosis; there were no other significant differences in surgical indication between the groups.

The median delay between diagnosis and surgery was 2 days in the RACE group (range, 0–49 days) and 113 days in the ECE group (range, 4–352 days). The commonest reason for delay in the RACE group was to optimise fitness. The short delays in some ECE patients were due to elective theatre slots becoming vacant at short notice. Patients remained in their intended treatment group for analysis.

There were two serious complications; one death in the elective group and one postoperative stroke after RACE. The patient who died was a 73-year-old man with asymptomatic disease. After routine surgery and early discharge, he was re-admitted on day 4 with headache and uncontrollable hypertension. Brain imaging was normal and hyperperfusion syndrome was diagnosed. He was treated on the stroke unit but died from pneumonia after 6 weeks. The single patient with stroke on the RACE pathway was a 78-year-old man scheduled for urgent surgery within 48 h of a TIA, but postponed due to bronchopneumonia. He suffered an intra-operative myocardial infarction and postoperative stroke.

Table 1 shows lesser complications. There were no statistically significant differences in postoperative complications between the ECE and RACE pathway groups. Anaesthetic method had no effect on rate of complications, neither did patient age or gender.

Table 1 Postoperative complications after CEA

	ECE (n = 76)	RACE (n = 20)	P-value
Death	1	0	0.791
Stroke	0	1	0.208
Haematoma	4	1	0.722
Nerve injury	3	0	0.492
Seizure	1	0	0.791
Total	9	2	0.869*

*Chi-squared test. All other P-values using Fisher's exact test.

Discussion

We are reporting the first year of a RACE service to prevent strokes in patients with significant TIA and minor stroke. Recent literature suggests that CEA will be more effective at preventing stroke within 2 weeks of a cerebral event.⁴ Even earlier surgery should not increase postoperative complications, if patients are selected carefully and prompt investigations to exclude brain haemorrhage or strokes in evolution are performed.

Analysis of the frequency of second events during the week after TIA or minor stroke¹⁹ suggests that the earlier surgery is performed the better – with the above provisos. Daily TIA clinics are part of achieving this goal, in addition to public education on TIA symptoms and co-operation with GPs so that patients are referred on the day symptoms begin.⁷

Within the first year of our RACE pathway, we achieved our 48-h target for half the patients referred. This is a dramatic reduction in delay compared to the median delay of 113 days in our elective group and compares well with the national carotid audit.⁵

Our median delay of 2 days from diagnosis to surgery compares favourably with results from the UK (Fig. 1). Studies of urgent CEA from Glamorgan²⁰ and Gloucester²¹ reported median delays of 22 days and 38 days from first symptom to surgery and Leicester recently reported a median delay of 28 days by fast-tracking urgent cases.²² Although our data report the delay from diagnosis to surgery, we believe that the use of one-stop TIA clinics during the study will have minimised hidden delays between first symptom and diagnosis. Waiting for CEA increases the risk of stroke – in a recent audit of 118 patients undergoing CEA,²⁶ the median delay before surgery was 97 days, during which time 11 patients had a second cerebral event. Our median delay before elective surgery of 113 days is similar to other results in the literature (Fig. 1).^{20–26}

Asymptomatic patients comprised 30% of elective patients in this study, compared with 16% in the latest UK national audit.²⁷ The benefits of surgery for asymptomatic disease are questionable,²⁸ and one weakness of our study is the comparison of symptomatic patients in the RACE group with a mixture of symptomatic and asymptomatic patients in the ECE group, introducing possible bias. However, there is no evidence from the large CEA trials that postoperative complications are commoner after CEA for either indication.^{2,5,16,17} Asymptomatic patients should have fewer complications, so their inclusion in the ECE group should bias results towards RACE appearing riskier than it really is.

How many patients will need RACE? We were referred 23 patients during the first year of service. Reviewing the 76 ECE patients, 24 actually met criteria for the RACE pathway. Once the service is established, we anticipate an increased demand to one case per week. It has been suggested that an urgent CEA service may require 1 or 2 ‘ring-fenced’ theatre

Figure 1 Median delays from symptoms to surgery. Note East Kent data show delay from diagnosis to surgery.

sessions per week²² and our findings would support that. However, carotid disease is under-treated: of 120,000 people who have TIA or stroke in the UK every year, 10,000 might be suitable for CEA; less than half receive it.²⁷

We did not find any significant differences in complication rates between elective and RACE operations. Our numbers are small, but this finding is supported by larger audits of CEA performed before and after 2 weeks following TIA and minor stroke⁸ and by the one randomised study in the literature.²⁹ The only postoperative stroke in this study was a patient on the RACE pathway and, although non-significant statistically, this may represent a Type 2 error. Other studies have shown that postoperative stroke is commoner after urgent CEA because of the unstable nature of carotid plaque in some patients with TIA.⁵⁰ When CEA was first introduced, a 6-week period was advocated before surgery in symptomatic patients³¹ and urgent surgery was tried in unselected patients with poor outcomes.^{52,53} By selecting stable patients without brain haemorrhage on imaging, these risks can be minimised.

It is important to note that, without surgery, up to 20% of patients will go on to develop a stroke after TIA or minor stroke,¹ in which context a postoperative stroke rate of even 10–15% might be acceptable. Vascular surgeons should not be deterred by a limited increase in postoperative strokes after urgent CEA compared to elective cases. If patients know that this risk will be higher without surgery, and that strokes may represent the progress of their disease, surgeons can still be seen to be reducing the overall burden of stroke on society and preventing individual catastrophes for a significant group of patients under their care.

Conclusions

We report the introduction of a rapid-access pathway to prevent strokes after TIA and minor stroke. Urgent CEA is a

crucial part of the race to protect brains in patients with these warning signs and we believe that it is feasible and safe to attempt this within 48 h of diagnosis for carefully selected patients. National targets for urgent CEA should be supported.

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