

Delays to Surgery and Procedural Risks Following Carotid Endarterectomy in the UK National Vascular Registry

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WHAT THIS PAPER ADDS

This paper demonstrates that, on a national level, the pathway from most recent symptom to surgery for patients with symptomatic carotid stenosis, can be shortened to maximise the benefit of intervention, without increased peri-operative risk in the period from 3 to 14 days. There may be a slight increase in peri-operative risk of stroke and death in the first 48 h.

Objective: Guidelines recommend that patients suffering an ischaemic transient ischaemic attack (TIA) or stroke caused by carotid artery stenosis should undergo carotid endarterectomy (CEA) within 14 days.

Method: The degree to which UK vascular units met this standard was examined and whether rapid interventions were associated with procedural risks. The study analysed patients undergoing CEA between January 2009 and December 2014 from 100 UK NHS hospitals. Data were collected on patient characteristics, intervals of time from symptoms to surgery, and 30-day postoperative outcomes. The relationship between outcomes and time from symptom to surgery was evaluated using multilevel multivariable logistic regression.

Results: In 23,235 patients, the median time from TIA/stroke to CEA decreased over time, from 22 days (IQR 10–56) in 2009 to 12 days (IQR 7–26) in 2014. The proportion of patients treated within 14 days increased from 37% to 58%. This improvement was produced by shorter times across the care pathway: symptoms to referral, from medical review to being seen by a vascular surgeon, and then to surgery. The spread of the median time from symptom to surgery among NHS hospitals shrank between 2009 and 2013 but then grew slightly. Low-, medium-, and high-volume NHS hospitals all improved their performance similarly. Performing CEA within 48 h of symptom onset was associated with a small increase in the 30-day stroke and death rate: 3.1% (0–2 days) compared with 2.0% (3–7 days); adjusted odds ratio 1.64 (95% CI 1.04–2.59) but not with longer delays.

Conclusions: The delay from symptom to CEA in symptomatic patients with ipsilateral 50–99% carotid stenoses has reduced substantially, although 42% of patients underwent CEA after the recommended 14 days. The risk of stroke after CEA was low, but there may be a small increase in risk during the first 48 h after symptoms.

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INTRODUCTION

Stroke is the second largest cause of death in the world causing 6,700,000 deaths each year,¹ and is the fourth largest cause of death in the UK.² There are more than 150,000 new strokes in the UK each year. Of these, one in eight are fatal within 30 days, while one in four are fatal within a year.² Approximately 15% of ischaemic strokes are preceded by a transient ischaemic attack (TIA).²

Thromboembolism from an ipsilateral carotid artery stenosis is responsible for about 20% of all strokes.^{2,3}

Two landmark randomised trials; the North American Symptomatic Carotid Endarterectomy Trial (NASCET)⁴ and the European Carotid Surgery Trial (ECST),⁵ demonstrated the benefit of performing carotid endarterectomy (CEA) in symptomatic patients with a 50–99% internal carotid artery (ICA) stenosis. An individual patient meta-analysis of data from NASCET and ECST showed subsequently that maximum benefit was conferred if CEA was performed within 14 days of randomisation.⁶ Based on these findings, international guidelines increasingly recommend that CEA be performed within 2 weeks of an ischaemic cerebrovascular event (TIA or minor stroke) in symptomatic patients

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with ipsilateral high- (70–99%) or moderate-degree (50–69%) carotid artery stenoses.^{7–10}

In addition, there is growing evidence that the natural history risk of stroke in the first few days after TIA onset is much higher than previously thought in patients with 50–99% ICA stenoses. In a review of the published literature, eight natural history studies observed that the risk of stroke in the hyperacute period was 5–8% at 48 h, 17% at 72 h, 8–22% at 7 days, and 11–25% at 14 days¹¹ again emphasizing the need for expedited CEA.

Several studies have evaluated the delay between onset of symptoms to undergoing CEA.^{12–25} Most^{12–21,23–25} have demonstrated that only a minority of symptomatic patients undergo CEA within the recommended 2-week period from the index event. The reasons for excess delays to CEA are multifactorial, including access to carotid imaging, long waiting times to theatre,^{16,17} delays in speed of referral to vascular surgeons,^{13,14,16,25} and/or delays resulting from medical comorbidities (e.g. angina pectoris, cardiac workup, etc.).^{15,16,18,21} In addition, some surgeons have raised concerns about incurring a higher peri-operative risk of stroke and/or death if CEA is performed soon after the neurological event,²⁶ especially in the first 48 h.²⁷ Conversely, studies which have reported delays of 12 weeks or more in performing CEA have observed recurrent stroke rates as high as 32%.²⁸ Because of these very high rates of recurrent stroke, it has been suggested that vascular services with excessive delays in delivering CEA probably should not perform carotid revascularisation procedures.²⁹

In the UK, around 4,000–5,000 patients undergo CEA each year. The National Carotid Interventions Audit was established in 2005 to assess the quality of care delivered to UK patients undergoing CEA, and has published annual reports on the patterns and outcomes of care since 2008.³⁰ The aim of the study was to assess how the time period from onset of symptoms to undergoing CEA has changed between 2009 and 2014 in the UK. The results for data collected between December 2005 to September 2009 have been reported previously.^{3,13}

MATERIALS AND METHODS

The study is based on data extracted from the National Vascular Registry (NVR), a national clinical audit commissioned by the Healthcare Quality Improvement Partnership (HQIP) and which incorporated the previous national carotid interventions audit in January 2013. The Registry covers five major vascular procedures and receives data from 97% of eligible National Health System (NHS) acute hospitals (hospital organisations) in England, Northern Ireland, Scotland, and Wales. The Registry supports the revalidation process for surgeons, and provides organisational level information for NHS hospitals to support the commissioning of vascular services.

The study cohort was defined to be patients undergoing CEA for symptomatic carotid disease between January 1, 2009 and December 31, 2014. Details on each patient, their treatment and postoperative outcomes are electronically

entered by their supervising vascular surgeon or other hospital staff. Patient characteristics included age, sex, and indication for surgery, degree of ipsilateral and contralateral carotid disease, comorbidities and the pre-operative Rankin score. Key dates also were collected to allow the time from occurrence of neurologic symptoms to undergoing CEA to be calculated, as well as for intervals along the care pathway. The 'index' symptom was defined as the symptom, which led the patient to seek medical advice. Defined time periods were: i) time from index symptom to first carotid imaging, ii) time from index symptom to date of referral to the medical team, iii) time from referral to the date first seen by the vascular surgical team, and (iv) time from date seen by the surgical team to undergoing CEA. The NVR also collected data relating to the operation and complications occurring within 30 days of CEA including death, bleeding, myocardial infarct, cranial nerve injury, and stroke.

Temporal changes in the time between index symptom and undergoing CEA were calculated (annually) between January 2009 and December 2014. Figures were calculated for the UK as a whole and for acute NHS hospitals individually. Data were excluded on a small number of NHS hospitals that did not perform at least one CEA for each year between 2009 and 2014, and patients missing one or more of the key dates were excluded. Also, it was examined whether changes in the time from index symptom to undergoing CEA was related to the volume of CEA activity within acute NHS hospitals. To take account of NHS hospital mergers, only those hospitals that existed on 31 December 2014 were used. Using the average annual volume for each organisation, the NHS hospitals were divided into low-, medium-, and high-volume categories such that the three CEA volume groups contained approximately equal numbers of patients. The range of annual activity covered by the three groups were: 34 or less (low volume), 35 to 54 procedures (medium volume), and 55 or more procedures (high volume).

Finally, the rates of 30-day stroke and death for various time periods between symptom onset and undergoing CEA were examined, stratifying the interval into five groups (0–2 days, 3–7 days, 8–14 days, 15–21 days, and >21 days). Multilevel multivariable logistic regression was used to estimate the crude and adjusted effect of the time from symptom to surgery on the outcome variables. The adjusted odds ratios derived from each regression model took into account patient age, presenting symptom, pre-operative ranking score, presence of diabetes or ischemic heart disease, and year of operation. The NHS hospital of surgery was included as a random-intercept to account for any lack of independence in the data because of the clustering of patients within hospitals. All statistical tests were two-sided and the level of statistical significance was set at .05. All statistical calculations were performed in STATA version 14.1 (StataCorp, College Station, TX, USA).

RESULTS

A total of 33,194 CEA procedures were performed in 124 NHS hospitals between January 1, 2009 and December 31,

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