

## Underinvestigation and undertreatment of carotid disease in elderly patients with transient ischaemic attack and stroke: comparative population based study

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### Abstract

**Objective** To identify any underinvestigation of older patients with transient ischaemic attack (TIA) and stroke.

**Design** Comparative population based studies.

**Setting** Routine clinical practice in all secondary care services in Oxfordshire and a nested population based study of incidence of transient ischaemic attack and stroke (the Oxford vascular study—OXVASC).

**Participants/population** All patients undergoing carotid imaging for ischaemic retinal or cerebral transient ischaemic attack or stroke from 1 April 2002 to 31 March 2005 in the Oxford vascular study (n=91 105) and from 1 April 2002 to 31 March 2003 in routine clinical practice (n=589 899).

**Main outcome measures** Age specific rates of carotid imaging, diagnosed  $\geq 50\%$  symptomatic carotid stenosis, and subsequent endarterectomy, in patients with recent transient ischaemic attack or stroke.

**Results** Of patients with recent carotid territory transient ischaemic attack or ischaemic stroke, 575 in routine clinical practice and 402 in the Oxford vascular study had carotid imaging, with similar rates up to the age of 80. The incidence of  $\geq 50\%$  symptomatic stenosis increased steeply with age, particularly in those aged  $\geq 80$ . Compared with investigations in patients in the Oxford vascular study, the rates of carotid imaging (relative rate 0.36, 95% confidence interval 0.28 to 0.46,  $P < 0.0001$ ), diagnosis of  $\geq 50\%$  symptomatic stenosis (0.33, 0.16 to 0.69,  $P = 0.004$ ), and carotid endarterectomy (0.19, 0.06 to 0.63,  $P = 0.007$ ) in this age group in routine clinical practice were all substantially lower.

**Conclusions** Incidence of symptomatic carotid stenosis increases steeply with age, but, despite good evidence of major benefit from endarterectomy in elderly patients and a willingness to have surgery, there is substantial underinvestigation in routine clinical practice in patients aged  $\geq 80$  with transient ischaemic attack or ischaemic stroke.

### Introduction

Several audits have shown lower rates of treatment to prevent stroke in older people.<sup>1-4</sup> Similar observations in several other specialties have led to accusations of ageism.<sup>5-9</sup> Lower rates of treatment in older people, however, might legitimately reflect a lack of applicable randomised evidence of effectiveness,<sup>10 11</sup> increased frequency of contraindications to treatment, or patients' choice. To distinguish between ageism and legitimately reduced use of stroke prevention in older people we studied

rates of imaging and endarterectomy for recently symptomatic carotid stenosis. This intervention is unusual in that there is strong evidence of benefit in elderly patients,<sup>12</sup> and good evidence that data from trials are probably generalisable to routine clinical practice.<sup>13</sup> Nevertheless, lower rates of treatment in elderly patients could be due to a reduction in incidence of symptomatic carotid stenosis with age, contraindications to surgery, or reluctance by patients to consider surgery. To identify any evidence of inappropriate underinvestigation or undertreatment, or both, we compared age specific rates of carotid imaging,  $\geq 50\%$  symptomatic carotid stenosis, and subsequent endarterectomy in patients with recent transient ischaemic attack or stroke in a population based audit of routine clinical practice in Oxfordshire with rates in a nested population based incidence study of transient ischaemic attack and stroke in which all patients were investigated as per published guidelines.<sup>14-16</sup>

### Methods

Our overall study population (a one year mid-study estimate of 680 772) comprised individuals registered with the 87 primary care practices in the Oxfordshire Primary Care Trusts (routine clinical practice). Nested within this population are the participants of the Oxford vascular study (OXVASC) from nine primary care practices (three year mean 91 105). The age and sex structure and the deprivation profile of the vascular study population closely matched the remainder of the population in routine clinical practice. The methods and results of the Oxford vascular study have been published elsewhere.<sup>17-20</sup> Case ascertainment has been shown to be extremely high for both transient ischaemic attack and stroke.<sup>18 19</sup> Carotid imaging was obtained in 95% of patients with transient ischaemic attack and non-disabling ischaemic stroke, and all patients were interviewed and examined so that the potential appropriateness of carotid surgery could be determined. We compared three years of ascertainment in the Oxford vascular study (1 April 2002 to 31 March 2005) with one year in routine clinical practice (1 April 2002 to 31 March 2005).

We identified all patients in routine clinical practice who had carotid imaging during the study period for a new ischaemic cerebral or retinal event by screening all NHS and private referrals for carotid ultrasonography (the main investigation for carotid disease), magnetic resonance angiography, computed tomography angiography, and conventional arterial or venous angiography in the four relevant centres in Oxfordshire and in the seven surrounding counties to ascertain cases investigated out of our primary care trust region. The detailed methods and

results of this search have been reported previously.<sup>21</sup> JFF searched reports, referral letters and forms, and attendance records at each imaging centre. Out of all imaging episodes for investigation of possible transient ischaemic attack or stroke, we identified those relating to probable or definite events within the six months before the date of referral, at least one of which was consistent with carotid territory ischaemia. In all cases in which the diagnosis and indication for carotid imaging was not completely clear after assessment of the referral letters and forms, JFF summarised the hospital notes and these were then reviewed by PMR blind to population. Data on all carotid endarterectomies performed during the study period and the following year were obtained from all relevant centres in Oxfordshire by hospital diagnostic coding data and the departmental operation registers. Statistical comparisons between the two populations refer to Poisson probability.

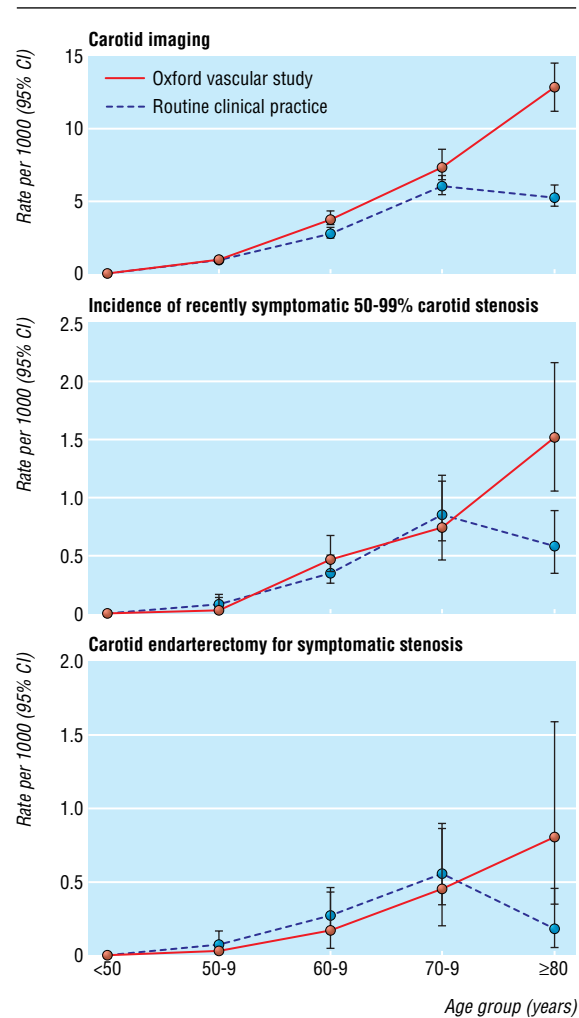
## Results

Within routine clinical practice, 875 patients were referred for carotid imaging during the year long study period, of whom 44 did not attend. Two patients had scans after two separate events, and each was included as two patient episodes. A further 194 patients were excluded on the basis that the indication was unrelated to the investigation of a possible transient ischaemic attack or stroke, leaving 639 patients investigated. Fourteen others (1.5%) were excluded: one Oxfordshire resident who was not registered with a primary care practice and 13 patients investigated outside Oxfordshire for whom clinical data were unavailable. Of these, 581 (91%) were referred from secondary care, 19 (3%) from primary care, and 38 (6%) from accident and emergency departments. After further review of hospital notes, blinded to study population and results of carotid imaging, to exclude presentations that were not probable or definite carotid territory transient ischaemic attack(s) or stroke(s) within the six months before the date of referral for imaging, 575 presentations remained. These investigations identified 65 individuals with symptomatic 50-99% stenosis, of whom 42 underwent carotid endarterectomy.

We assessed completeness of ascertainment of the retrospective search strategy for carotid imaging episodes by comparison with the prospectively collected data in the first year of the Oxford vascular study (OXVASC). Only 1.3% of patients in that study were not identified.

Within the Oxford vascular study, 472 patients were referred for carotid imaging during the three year study period. Of these, 402 were investigated for definite or probable carotid territory transient ischaemic attack or ischaemic stroke within the previous six months. This yielded 40 patients with symptomatic 50-99% stenosis, of whom 21 had carotid endarterectomy. There was no increase in rates of carotid imaging, incidence of symptomatic 50-99% stenosis, or carotid endarterectomy over the three years of the study.

The rates of carotid imaging increased with age in both populations (figure), but decreased at age  $\geq 80$  years in routine clinical practice (relative rate 0.36, 95% confidence interval 0.28 to 0.46,  $P < 0.0001$ ). The incidence of diagnosed 50-99% symptomatic carotid stenosis (figure) followed the same pattern, with a fall in routine clinical practice at age  $\geq 80$  years (0.33, 0.16 to 0.69,  $P = 0.004$ ). There were no significant differences between the populations in the age specific rates of endarterectomy for recently symptomatic carotid stenosis  $< 80$  years (figure), but the rate in patients aged  $\geq 80$  in the patients from routine clinical practice was substantially lower than that in the vascular study



Age specific rates of carotid imaging, incidence of recently symptomatic 50-99% carotid stenosis, and carotid endarterectomy for symptomatic stenosis in the Oxford vascular study (OXVASC) and in routine clinical practice. Numbers indicate cases represented at each data point

(0.19, 0.06 to 0.63,  $P = 0.007$ ). There were no operative strokes or deaths identified in either population among the 12 patients aged  $\geq 80$  years who underwent endarterectomy, despite assessment by a neurologist before and 30 days after the operation in all cases.

## Discussion

Rates of symptomatic carotid stenosis increase steeply with age. Patients aged  $\geq 80$  with transient ischaemic attack or ischaemic stroke, however, are substantially underinvestigated in routine clinical practice. The lower rate of imaging in patients aged  $\geq 80$  could be due to lower rates of referral by general practitioners to secondary care or lower rates of referral for imaging at the secondary care level (or both). We cannot differentiate between the two. The steep rise in rates of endarterectomy in patients aged  $\geq 80$  in the Oxford vascular study (OXVASC), however, indicates that the fall in rates in this age group in routine clinical practice is unlikely to have been due to contraindications to treatment or to patients' choice. There was no absolute requirement that patients in the Oxford vascular study should have carotid imaging and the rate of non-attendance for imaging was, in fact, slightly higher in that study than in routine clinical practice. Moreover, the high rates of endarterectomy in patients aged

≥ 80 in the vascular study were the result of discussions between patients and surgeons who were not involved in the study. The two populations were comparable in age, sex, and deprivation and the similar rates of investigation in those aged < 80 suggest that disease rates were similar. We used the same methods of ascertainment of imaging data in both routine clinical practice and the vascular study and exclusion criteria were applied blinded to population source.

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### What is already known on this topic

The incidence of transient ischaemic attack and stroke increases with age

Carotid imaging is an important part of the investigation of transient ischaemic attack or stroke and is recommended in all current guidelines

Elderly people benefit from carotid endarterectomy with little evidence of an increased risk of surgery

### What this study adds

Transient ischaemic attack and minor stroke in elderly patients are underinvestigated, which results in undertreatment

The incidence of symptomatic carotid stenosis increases steeply in those age ≥ 80

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