Occult carotid artery disease in patients who have undergone coronary angioplasty

Nicholas Fassiadisa, Kate Adamsb, Hany Zayeda, David Gossb, Colin Deanc, Phillip MacCarthyc,*

aDepartment of Vascular Surgery, King’s College Hospital, London, UK
bDepartment of Vascular Laboratory, King’s College Hospital, London, SES 9RS, UK
cDepartment of Cardiology, King’s College Hospital, London, UK

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Abstract

Objectives: The aim was to evaluate the prevalence of asymptomatic mild (30–49%), moderate (50–69%) and severe (70–99%) ICA stenosis in patients who underwent previous coronary angioplasty (PTA). Methods: After obtaining ethics committee approval, 144 consecutive patients aged between 65 and 75 years were invited for carotid Duplex evaluation with a linear 6 MHz array transducer by trained vascular sonographers within a single unit. A peak systolic velocity > 230 cm/s in the ICA was considered as significant (>70% stenosis). Results: Of the 144 patients approached, 117 (81%) attended (male:female ratio 3:2:1, age range 65–75 years, median age 71 years). Duplex ultrasound revealed one occlusion, 70% or more ICA stenosis in three patients (2.6%), 50–69% stenosis in 12 patients (10.3%) and 30–49% stenosis in 29 patients (24.8%). Conclusions: Carotid artery disease with a luminal stenosis of 30% or more is common in patients who underwent previous PTA. The yield of significant ICA stenosis (70% or more), which would benefit from carotid endarterectomy according to the Asymptomatic Carotid Surgery Trial is low. Recommendation for initial screening and subsequent follow-up Duplex examination for evaluation of disease progression of such cohorts remains debatable.

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Keywords: Carotid artery stenosis; Coronary angioplasty; Screening

1. Introduction

The North American Symptomatic Carotid Endarterectomy Trial (NASCET) and the European Carotid Surgery Trial (ECST) have clarified the indications and benefits of carotid endarterectomy (CEA) in preventing ipsilateral strokes in recently-symptomatic patients with significant (70–99%) internal carotid artery (ICA) stenosis [1, 2]. Until recently, the role of CEA in patients with asymptomatic carotid artery disease was unknown and the evidence for intervention was controversial. Several asymptomatic endarterectomy trials including the Mayo Clinic Trial (MACE) [3], Carotid Artery Surgery Asymptomatic Narrowing Operation vs. Aspirin (CASANOVA) trial [4], the Veterans’ Administration trial [5], the Asymptomatic Carotid Atherosclerosis Study (ACAS) [6] and the Asymptomatic Carotid Surgery Trial (ACST) have been conducted [7]. Now that the benefit of CEA for patients with asymptomatic carotid artery disease has been demonstrated, in particular by the ACAS and ACST, the issue of screening for occult carotid artery disease has become significant.

The association of coronary artery disease with carotid artery disease is documented, with a prevalence of significant ICA stenosis ranging from 1.3–8.5% in patients undergoing cardiac surgery [8–10]. The prevalence of carotid artery disease (stenosis >50%) has been investigated and found to be high (26%) in patients with chronic stable angina, silent ischaemia and acute coronary syndrome, as well as patients with one-, two- or three-vessel coronary artery disease [11]. But the prevalence of asymptomatic carotid artery disease in patients with coronary artery disease who have undergone coronary angioplasty has not been well evaluated. Therefore, the present study was conducted to analyse the prevalence of asymptomatic carotid artery disease in patients who underwent previous coronary angioplasty.

2. Materials and methods

Ethics committee approval was obtained and 144 consecutive patients aged between 65 and 75 years who underwent previous coronary angioplasty were invited for carotid artery Duplex ultrasound evaluation. This age group was identified from previous studies as being a high-risk age group and one in which intervention is possible if necessary [7]. Duplex examination was performed with a linear 6 MHz array transducer on the Siemens-Acuson Sequoia and Aspen...
ultrasound machines by trained vascular sonographers within a single unit. A peak systolic velocity >230 cm/s within the stenotic ICA was defined as significant (≥70% stenosis). ICA stenosis was classified as mild (30–49%), moderate (50–69%) and severe (70–99%). Basic demographic data, risk factors and number of coronary arteries angioplastied were documented. High cholesterol was assumed if the patient was on statins. High blood pressure was assumed if the patient was on blood pressure medication. Other risk factor information relied on the patients' own knowledge of their health, by questionnaire. The number of coronary arteries angioplastied was obtained from the coronary angiography database. The Mann–Whitney test was used to determine any difference in carotid artery disease severity between males and females. The Kruskal–Wallis test was used to determine any difference in carotid artery disease severity with increasing coronary artery disease (number of vessels angioplastied).

3. Results

Out of 144 patients, 117 (81%) (male:female ratio; 3.2:1, age range; 65–75 years, median age; 71 years) were recruited for carotid ultrasound screening. Duplex evaluation demonstrated mild stenosis in 29 patients (24.8%), moderate stenosis in 12 (10.3%), significant stenosis in three patients (2.6%) and one occlusion (0.9%) (Table 1). The three patients with significant ICA stenosis of >70% were in the surgically significant bracket and underwent successful carotid endarterectomy.

Carotid disease stratification between males and females did not reveal any significant differences (P-value 0.96, significance level 0.05) (Table 2).

No significant difference in carotid artery disease severity with increasing coronary artery disease (number of vessels angioplastied) was seen (P-value 0.76, significance level 0.05) (Table 3), however, it is important to stress that only four patients in the study underwent three-vessel coronary artery angioplasty.

Risk factor data did not suggest any significant difference in risk factors between patients with mild disease (<50%) and patients with moderate to severe disease (>50%) (Table 4).

4. Discussion

The overall cost of stroke care in England has been estimated at £2.3 billion in 1995–1996 [12] and more recently the burden has been calculated to approximately £7 billion, including informal care and productivity losses each year, making up approximately 4% of direct National Health Service (NHS) health care expenditures in England [13].

Stroke is the third most common cause of death in Western countries and extracranial carotid artery disease accounts for approximately 30–40% of all ischaemic strokes [14]. Approximately 5–10% of the general population over the age of 65 years will have asymptomatic internal carotid artery stenosis of more than 50% [15].

The small but statistically significant benefit of CEA for asymptomatic patients has been demonstrated in the ACAS and ACST trials but screening of asymptomatic population groups will depend mainly on the prevalence of significant ICA stenosis (≥70%) in the population studied and the

Table 1
Carotid artery stenosis stratification and prevalence

<table>
<thead>
<tr>
<th>ICA stenosis</th>
<th>Right ICA</th>
<th>Left ICA</th>
<th>Total patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;30%</td>
<td>87 (74%)</td>
<td>87 (74%)</td>
<td>72 (61.5%)</td>
</tr>
<tr>
<td>30–49%</td>
<td>21 (18%)</td>
<td>19 (16%)</td>
<td>29 (24.8%)</td>
</tr>
<tr>
<td>50–69%</td>
<td>7 (6%)</td>
<td>9 (8%)</td>
<td>12 (10.3%)</td>
</tr>
<tr>
<td>70–99%</td>
<td>2 (2%)</td>
<td>1 (1%)</td>
<td>3 (2.6%)</td>
</tr>
<tr>
<td>100%</td>
<td>0 (0%)</td>
<td>1 (1%)</td>
<td>1 (0.9%)</td>
</tr>
<tr>
<td>Total</td>
<td>117 (100%)</td>
<td>117 (100%)</td>
<td>117 (100%)</td>
</tr>
</tbody>
</table>

ICA, internal carotid artery.

Table 2
Gender prevalence of carotid artery stenosis

<table>
<thead>
<tr>
<th>ICA stenosis</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;30%</td>
<td>55 (62%)</td>
<td>17 (60%)</td>
</tr>
<tr>
<td>30–49%</td>
<td>21 (23%)</td>
<td>8 (29%)</td>
</tr>
<tr>
<td>50–69%</td>
<td>10 (11%)</td>
<td>2 (7%)</td>
</tr>
<tr>
<td>70–99%</td>
<td>2 (2%)</td>
<td>1 (4%)</td>
</tr>
<tr>
<td>100%</td>
<td>1 (1%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Total</td>
<td>89 (100%)</td>
<td>28 (100%)</td>
</tr>
</tbody>
</table>

ICA, internal carotid artery. Total number of patients = 117.

Table 3
Association of carotid artery stenosis and number of coronary vessels angioplastied

<table>
<thead>
<tr>
<th>ICA stenosis</th>
<th>1-vessel angioplasty</th>
<th>2-vessel angioplasty</th>
<th>3-vessel angioplasty</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;30%</td>
<td>51</td>
<td>19</td>
<td>3</td>
</tr>
<tr>
<td>30–49%</td>
<td>17</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>50–69%</td>
<td>10</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>70–99%</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>100%</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>82</td>
<td>31</td>
<td>4</td>
</tr>
</tbody>
</table>

ICA, internal carotid artery. Total number of patients = 117.
complication rate of surgery. Results of the ACAS and ACST cannot be implemented into routine clinical practice unless the operative risk is low (ACAS: 2.3%, ACST: 2.8%) [6, 7].

Screening should be focused on populations at risk where prevalence of significant ICA stenosis exceeds 4.5% in order to become cost effective [16]. Such population groups include patients with peripheral vascular disease with a prevalence of ICA stenosis of ≥60% as high as 36.7% [17] and patients awaiting cardiac surgery with a prevalence of significant ICA stenosis (≥70%) ranging between 1.3–8.5% [8–10], which have been fully investigated. However, there are limited studies focusing on the prevalence of asymptomatic carotid artery disease in association with coronary artery disease other than candidates for major cardiac surgery, indicating a strong link with multi-vessel coronary artery disease [18, 19]. This finding stimulated the present screening study which demonstrated a high prevalence of ACAD (38.6%) with a luminal stenosis of ≥30% in patients who underwent previous PTA. The prevalence of significant (≥70%) ICA stenosis, the group of patients that would benefit from CEA according to the findings of the ACST, is low (2.6%). This compares to a prevalence in the general population of between 1% [20] and 8% [21]. However, the power calculation using the 95% confidence interval for proportions suggests that with a sample size of 120, a sample prevalence of 2.6% could indicate a population prevalence of 5%. This was calculated using a web-based power calculator (Arsham H: http://home.ubalt.edu/ntsbarsh/Business-stat/otherappts/ConFinPro.htm). This would exceed the 4.5% prevalence deemed to be cost effective [16]. It would mean that 5% of the screening population would benefit by being offered CEA to prevent long-term stroke.

No difference in the prevalence of significant disease was found between males and females, between the number of coronary vessels angioplastied and no correlation was seen in risk factor data. The reason for the lack of correlation is very likely to be the small number of patients in the sample. The power calculation for sample size was based on disease prevalence alone and not on risk factor correlation. The lack of detailed or accurate data on patient demographics may be another reason why no significant correlations were found among the variables (these data were obtained by patient questionnaire alone). In addition, instead of simply classifying coronary artery disease as 1-, 2- or 3-vessel disease, it may be useful to employ a different measure of coronary disease severity such as complexity of the coronary lesions (eccentric plaque with irregular borders or intraluminal filling defects suggestive of thrombus). This information could be obtained by a more detailed preliminary review of the coronary artery database. On a similar theme, the degree of carotid artery stenosis is only one criteria among others. The morphology of the carotid plaque could also be investigated, such as its echogenicity, echolucency and ulcerations.

In conclusion, this small but valuable study has shown that screening of carotid artery disease in patients aged 65–75 years undergoing coronary artery angioplasty may be indicated. Further research is required, ideally with a multi-centre study using larger sample sizes, to determine whether screening in this group of patients would be beneficial and cost-effective in the future.

References