

Do carotid bruits predict disease of the internal carotid arteries?

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Summary: A carotid bruit is often thought of as a reliable sign of extracranial carotid artery disease. In addition finding a bruit may precipitate a referral to hospital. Carotid endarterectomy has now been shown to be beneficial in patients with symptomatic carotid territory ischaemia and 70–99% stenosis of the relevant carotid artery, therefore it is important that such patients are detected and referred.

In this study of 331 consecutive patients referred to a specialist cerebrovascular clinic we examined the practical value of a carotid bruit mentioned by the referring practitioner. All patients underwent clinical assessment, evaluation of risk factors and Doppler duplex scanning of the carotid arteries. A bruit was stated in the referral letter of 110 (33%) patients. Moderate (30–69%) or severe (70–99%) stenosis was present in 37% of patients with, and 17% of those without a carotid bruit ($P < 0.001$). We found a carotid bruit was a poor predictor of such disease (positive predictive value, 37%). The false negative rate for severe disease was 43%. Normal carotid arteries were found in 32% of patients with a bruit. We therefore suggest that all patients with suspected carotid territory ischaemia should be referred for assessment whether there is a bruit present or not.

Introduction

Carotid endarterectomy has been shown to benefit patients with symptomatic cerebral ischaemia and greater than 70% stenosis of the relevant carotid artery.^{1,2} The European Carotid Surgery trial² also reported that patients with mild (0–29%) stenosis did not benefit from surgery, while the results for those with moderate stenosis (30–69%) are awaited. The detection of internal carotid artery (ICA) disease in patients with symptomatic carotid territory ischaemia is, therefore, of importance.

Fisher³ described the association of a carotid bruit and cerebrovascular disease in 1957. In 1980 Barnes⁴ concluded that bruits were the most common sign of extracranial carotid artery disease and that they rarely occurred in the absence of carotid artery disease. This conclusion has subsequently been challenged^{5,6} and we therefore decided to examine the practical value of a carotid bruit. We looked at the predictive value of a carotid bruit as mentioned in the referral letter, both for carotid territory symptoms and/or disease of the internal carotid artery. The presence of such a bruit is likely to precipitate a referral.

Subjects and methods

Three hundred and thirty-one consecutive patients referred to a specialist cerebrovascular clinic were assessed. A carotid bruit was stated in the referral letter in 110 (33%) patients, (56 (51%) male, median age 63 years, range 28–80 years) of whom 36 had bilateral bruits. The other 221 patients (126 male (57%), median age 60, range 18–87 years) had been referred for assessment of possible carotid territory symptoms but did not have a carotid bruit. All patients underwent clinical assessment, screening for vascular risk factors and Doppler duplex scanning (Kranzbuhler Doppler 761, 4 mHz and 8 mHz transducers, Dasonics CV 400, 10 mHz transducer) of the internal carotid arteries.

Statistical methods

Data are described as median (range). Statistical analysis was performed with chi-square test with Yates correction where appropriate. A P value of 0.05 was considered significant.

Results

Forty-five (41%) of the 110 patients referred with a bruit had symptoms of carotid territory disease

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compared to 149/221 (67%) of the group without a bruit ($\chi^2 = 21.28$, $P < 0.001$). The positive predictive value of a bruit for patients with carotid symptoms was 41% (sensitivity 23%, specificity 53%).

The presenting symptoms for the two groups (those referred with a bruit versus those without) are shown in Table I. There was a significant difference in the presenting complaints for those with carotid symptoms. There was a higher frequency of stroke and lower frequency of transient ischaemic attack (TIA) in those without a bruit ($\chi^2 = 5.3$, d.f. = 3, $P = 0.02$). The findings on Doppler duplex scanning are shown in Table II. The findings were abnormal in 75/110 (68%) with a bruit versus 134/221 (61%) (NS). The positive predictive value of a bruit for any disease of the ICA was 68% (sensitivity 36%, specificity 71%).

Moderate or severe ICA disease was present in 41/110 (37%) with a bruit and 37/221 (17%) without a bruit ($\chi^2 = 17.2$, d.f. = 3, $P < 0.001$). The positive predictive value of a bruit for moderate or severe ICA disease was 37% (sensitivity 53%, specificity 73%). The false negative rate (the percentage of patients with stenosed arteries and no bruit) was 47%. For severe disease (70–99%

stenosis) only, the sensitivity was 57%, the specificity 70% and the false negative rate 43%.

In patients with moderate or severe disease, 41/78 (53%) had a bruit; 35 (85%) of these patients were 55 years or over. The positive predictive value of a bruit for any disease of the ICA was 48% for patients less than 55 years ($n = 96$) but increased to 75% for patients 55 years and over. In those patients with normal findings on Doppler duplex scan 35/122 (29%) had a bruit.

Discussion

The importance of a carotid bruit in predicting atherosclerosis of the ICAs has been disputed for more than 30 years, long before the value of carotid endarterectomy was confirmed.^{1,2} Early reports showed the value of a carotid bruit in patients with symptomatic carotid territory ischaemia^{7,8} but Hennerici *et al.*⁵ and Lusiani *et al.*⁶ found the sign to be insufficiently specific. The two most recent large studies^{9,10} have suggested that in selected populations the presence of a carotid bruit increases the likelihood of finding disease of the extracranial carotid arteries, but not necessarily severe stenosis. Both of these studies depended on cerebral angiography to confirm disease.

Doppler duplex scanning in experienced hands is as accurate as this invasive technique and is currently preferred for screening purposes.¹¹ In this study of unselected patients referred to our clinic, all of whom had Doppler duplex studies, a carotid bruit was a poor predictor for moderate or severe ICA disease, furthermore, even in those patients with symptoms compatible with carotid territory disease, the predictive value was only 41%. A bruit appears to be a better marker for any ICA disease (including atheroma or mild stenosis) which concurs with the findings of other authors.^{9,12} The finding of localized asymptomatic carotid arterial bruits increases with age;¹³ we have shown that a carotid bruit is of greater predictive value in those over 55 years.

Ingall *et al.*⁹ reviewed previous studies and suggested a predictive value of carotid bruit for moderate to severe ICA disease varying between 51 to 90%. Most of the studies reviewed were of selected patient groups undergoing expert evaluation of the arterial bruits and having cerebral angiography for diagnosis. In comparison our study was in an unselected group of patients and carotid bruits were noted by the referring doctors. This may explain the discrepancy in the value of a carotid bruit between this and other studies⁹ but is likely to be of greater practical relevance. Ingall *et al.*⁹ also showed that only 3% of patients with a bruit had normal vessels, whereas we found normal vessels in 33%. Hankey and Warlow¹⁰ found that if

Table I Presenting symptoms on referral to cerebrovascular clinic

ICA symptoms	Bruit present (n = 110)	No bruit (n = 221)
None	65 (59%)	72 (32%)
TIA (eye/brain)	28 (25%)	63 (29%)
Stroke	15 (14%)	77 (35%)
CRAO	2 (2%)	9 (4%)

ICA = internal carotid artery; TIA = transient ischaemic attack; CRAO = central retinal artery occlusion.

Table II Doppler duplex scan results all patients. Findings described on side of bruit or symptomatic side in those without a bruit

Doppler/duplex result ICA	Bruit present (n = 110)	No bruit (n = 221)
Normal	35 (32%)	87 (39%)
Atheroma/mild stenosis ($<30\%$)	27 (25%)	72 (33%)
Moderate stenosis (30–69%)	17 (15%)	19 (9%)
Severe stenosis (70–99%)	24 (22%)	18 (8%)
Occlusion	6 (5%)	21 (10%)
Reduced flow/syphon disease	1 (1%)	4 (1%)

ICA = internal carotid artery.

only patients with a carotid bruit were investigated by angiography, 20% with more than 50% stenosis and 9% of patients with greater than 75% stenosis would be denied investigation and hence the possibility of treatment. Our finding of a false negative rate of 56% for severe stenosis agrees with these findings.

In conclusion, the finding of severe atheroma-

tous disease in patients without a bruit and the poor predictive value of a bruit for moderate or severe disease means that all patients with suspected carotid territory ischaemia should be referred for assessment whether there is a carotid bruit present or not and particularly older patients. Referring only patients with a bruit will result in many being deprived of a treatment of proven value.

References

1. North American Symptomatic Carotid Endarterectomy Trial Collaborators. Beneficial effect of carotid endarterectomy in symptomatic patients with high grade stenosis. *N Engl J Med* 1991, **325**: 445-453.
2. European Carotid Surgery Trialists Collaborative group. MRC European Carotid surgery trial; interim results for symptomatic patients with severe (70-99%) or with mild (0-29%) carotid stenosis. *Lancet* 1991, **337**: 1235-1243.
3. Fisher, C.M. Cranial bruit associated with occlusion of the internal carotid artery. *Neurology* 1957, **7**: 299-306.
4. Barnes, R. Noninvasive evaluation of the carotid bruit. *Annu Rev Med* 1980, **31**: 201-218.
5. Hennerici, M., Aulich, A., Sandmann, W. & Freund, H.J. Incidence of asymptomatic extracranial arterial disease. *Stroke* 1981, **12**: 750-758.
6. Lusiani, L., Visona, A., Castellani, V., Ronsisvalle, G., Bononome, A. & Pagnan, A. Prevalence of atherosclerotic lesions at the carotid bifurcation in patients with asymptomatic bruits: an echo-Doppler (duplex) study. *Angiology* 1985, **36**: 235-239.
7. Harrison, M.J.G. & Marshall, J. Indications for angiography and surgery in carotid artery disease. *Br Med J* 1975, **1**: 616-617.
8. Wilson, I.A. & Ross-Russell, R.W. Amaurosis fugax and carotid artery disease: indications for angiography. *Br Med J* 1977, **2**: 435-437.
9. Ingall, T.J., Homer, D., Whisnant, J.P., Baker, H.L. & O'Fallon, W.M. Predictive value of carotid bruit for carotid atherosclerosis. *Arch Neurol* 1989, **46**: 418-422.
10. Hankey, G.J. & Warlow, C. Symptomatic carotid ischaemic events: safest and most cost effective way of selecting patients for angiography, before carotid endarterectomy. *Br Med J* 1990, **33**: 1485-1491.
11. Humphrey, P., Sandercock, P. & Slattery, J.A. Simple method to improve the accuracy of non-invasive ultrasound in selecting TIA patients for cerebral angiography. *J Neurol Neurosurg Psychiatry* 1990, **53**: 966-971.
12. Pessin, M.S., Panis, W., Prager, R.J., Millan, V.G. & Scott, R.M. Auscultation of cervical and ocular bruits in extracranial carotid occlusive disease: a clinical and angiographic study. *Stroke* 1983, **14**: 246-249.
13. Sandok, B.A., Whisnant, J.P., Furlan, A.J. & Mickell, J.L. Carotid artery bruits. Prevalence survey and differential diagnosis. *Mayo Clin Proc* 1982, **57**: 227-230.



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