NEUROLOGICAL SIGN

Figure 1 Where to listen for a bifurcation/internal carotid artery origin bruit – high up under the angle of the jaw.

The carotid bruit

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INTRODUCTION

When faced with a patient who may have had a stroke or transient ischaemic attack (TIA), one needs to ask oneself some simple questions: was the event vascular?; where was the brain lesion, and hence its vascular territory?; what was the cause? A careful history and focused physical examination are essential steps in getting the right answers. Although one can learn a great deal about the state of a patient's arteries from expensive vascular imaging techniques, this does not make simple auscultation of the neck for carotid bruits redundant. In this brief review, we will therefore define the place of the bruit in the diagnosis and management of patients with suspected TIA or stroke.

WHY ARE CAROTID BRUITS IMPORTANT?

A bruit over the carotid region is important because it may indicate the presence of atherosclerotic plaque in the carotid arteries. Thromboembolism from atherosclerotic plaque at the carotid artery bifurcation is a major cause of TIA and ischaemic stroke. Plaques occur preferentially at the carotid bifurcation, usually first on the posterior wall of the internal carotid artery origin. The growth of these plaques and their subsequent disintegration, surface ulceration, and capacity to throw off emboli into the brain and eye determines the pattern of subsequent symptoms. The presence of an arterial bruit arising from stenosis at the origin of the internal carotid artery may therefore help to clarify whether an event was vascular or not, identify the cause as likely to be due to atheromatous stenosis, and the possibility that the stenosis may be severe enough to justify carotid endarterectomy. However, not all noises in the neck indicate serious arterial disease. So, we need to review: how bruits arise, how to identify arterial bruits, to identify which noises in the neck matter, and what to do once you find an arterial bruit.

HOW BRUITS ARISE

Carotid bruits generally result from turbulent, non-laminar flow through a stenotic lesion, which causes arterial wall vibrations distal to the stenosis. The vibrations are transmitted to the body surface, where they can be detected with a stethoscope. A bruit can develop when the arterial lumen is reduced to less than 50% of its original cross-sectional diameter.

HOW TO LISTEN FOR BRUITS

Before you get out your stethoscope to listen for a bruit, you need to have a clear idea of what you will do if you find one! Table 1 gives our view of when listening to the neck is likely to be useful in

Table 1 When is neck ausculation clinically useful?

Situations when the presence or absence of a carotid bruit can be helpful
In patients over 50 years of age with recent carotid territory TIA or stroke
– a bruit over the symptomatic carotid artery suggests the possibility of an underlying severe stenosis, likely to benefit from surgery
– a bruit may indicate stroke or TIA is more likely due to atherosclerosis than some other nonatheromatosis pathophysiological process
In patients with history of sudden onset of focal neurological signs (transient or persistent)
– the presence of a bruit increases the probability that the symptoms were vascular in origin
In younger patients with sudden focal symptoms (transient or persistent) where a vascular cause is thought unlikely (e.g. clinical syndrome of migraine aura without headache)
– absence of a bruit makes underlying vascular disease even less likely.
Situations where it may be better not to auscultate the neck
Asymptomatic individuals
Patients with nonfocal neurological symptoms
– blackouts
– dizzy turns
– headaches
Patients with pulsatile tinnitus

neurological practice. Then, get the patient into a quiet room, in a relaxed and comfortable position. We use the diaphragm of the stethoscope, because it detects the higher frequency sounds of arterial bruits rather better than the bell. Ask the patient to breathe in and hold their breath. Listen over an area beginning from just behind the upper end of the thyroid cartilage to just below the angle of the jaw, in other words over the line of the common carotid artery leading up to the bifurcation into the internal and external carotid arteries. Apply only sufficient pressure to ensure the diaphragm rests squarely on the skin (Fig. 1). Excessive pressure can compress the underlying artery enough to cause a bruit even when the artery is normal.

THE BRUIT THAT MATTERS: THE ONE DUE TO CAROTID STENOSIS

Bruits at the bifurcation of the common carotid artery are best heard high up under the angle of the jaw (Fig. 2). At this level the common carotid artery bifurcates and gives rise to its internal branch. If one hears a bruit only in the base of the neck, or along the course of the common carotid artery, it is referred to as 'diffuse'. Diffuse bruits are not a very specific indicator of internal carotid artery disease. Bruits heard only at the bifurcation are more specific for internal carotid artery origin stenosis, but lack sensitivity. Unfortunately bruits at this location can also arise from disease of the external carotid artery.

OTHER NOISES IN THE NECK

See Table 2. Bruits transmitted from the heart become attenuated as one moves the stethoscope up the neck towards the angle of the jaw. Thyroid bruits are bilateral and more obviously located over the gland. A hyperdynamic circulation tends to cause a diffuse and bilateral bruit. Venous hums are caused by flow in the internal jugular vein. They are continuous and roaring and are obliterated by light pressure over the ipsilateral jugular vein. These are found in over 25% of young people but can be distinguished from bruits by their disappearance with the Valsava manoeuvre. Venous hums are rarely heard with the patient lying down. An arterial bruit in the supraclavicular fossa suggests either subclavian or proximal vertebral arterial disease, but a transmitted bruit from aortic stenosis must also be considered. Normal young adults quite often have a short supraclavicular bruit; the reason is unknown.

DEGREE OF CAROTID STENOSIS AND CHARACTER OF THE BRUIT

With modest arterial stenosis or irregularity, any

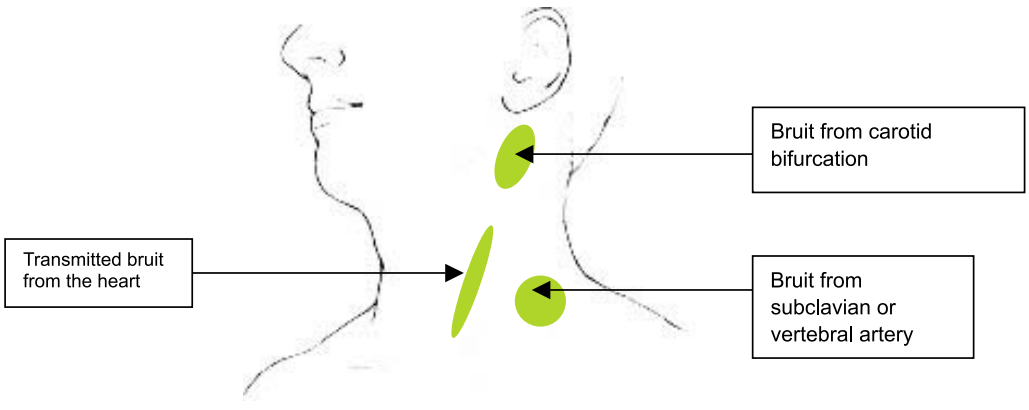

Figure 2 The sites of maximal intensity of arterial bruits in the neck. A bruit arising from the carotid bifurcation is high up under the angle of the jaw. Localized supraclavicular bruits are caused either by subclavian or vertebral origin artery stenosis. Diffuse bruits are transmitted from the arch of the aorta or the heart.

Table 2 The source of neck bruits

Carotid bifurcation arterial bruit
Internal carotid artery stenosis
External carotid artery stenosis
Supraclavicular arterial bruit
Subclavian artery stenosis
Vertebral artery origin stenosis
Can be normal in young adults
Diffuse neck bruit
Thyrotoxicosis
Hyperdynamic circulation (pregnancy, anaemia, fever, haemodialysis)
Transmitted bruit from the heart and great vessels
Aortic valve stenosis
Aortic arch atheroma
Mitral valve regurgitation
Patent ductus arteriosous
Coarctation of the aorta

bruit will be of short duration and heard just in mid-systole. As the degree of stenosis increases, the bruit is likely to become more audible and longer, expanding to be pan-systolic. Soft, long duration, high frequency bruits represent haemodynamically-severe stenosis with a large pressure gradient throughout the cardiac cycle. The intensity of the bruit correlates with the degree of stenosis to some extent. A harsher bruit implies greater stenosis, but remember that stenoses of more than 85% may be associated with low flow through the carotid artery, and hence no audible bruit at all.

SENSITIVITY AND SPECIFICITY OF CAROTID BRUITS

How reliable a sign is a carotid bruit? In symptomatic patients, Ziegler and colleagues found a sensitivity of only 0.29 and a specificity of 0.61 for detecting stenosis greater than 50% (Ziegler *et al.* 1971). The collaborators of the North American Symptomatic Carotid Endarterectomy Trial (NASCET) found that a focal carotid bruit had a sensitivity of 63% and a specificity of 61% for high-grade stenosis (Sauve *et al.* 1994). In such patients when bruits were absent, this only lowered the probability for high-grade stenosis from a pretest value of 52% to a post test probability of 40% (Sauve *et al.* 1994). When combined with four other clinical characteristics (infarction on CT brain scan, a carotid ultrasound scan suggesting more than 90% stenosis, a transient ischaemic attack rather than a minor stroke as a qualifying event, and a retinal rather than a hemispheric qualifying event), the predicted probabilities of high-grade stenosis ranged from a low of 18% (when none of the features was present) to a high of 94% (when all the features were present). Hankey and Warlow reported the most favourable of results, the presence of a bruit in patients with a symptomatic internal carotid artery had a sensitivity of 76% and a specificity of 76% for the detection of carotid stenosis (defied as diameter stenosis of the ICA of 75–99%, as measured by the ECST method) (Hankey & Warlow 1990). So, in the right kind of patients, carotid bruits are quite good (but not perfect) at identifying patients with significant stenosis. A good going bruit is also a reasonably robust clinical sign. Among 55 patients examined independently by two neurologists (both of whom had normal audiograms), the agreement beyond chance for the presence of a bruit was good, with a kappa statistic of 0.67 (Chambers & Norris 1985).

BRUITS IN SYMPTOMATIC PATIENTS WITH SUSPECTED TIA OR ISCHAEMIC STROKE

In general, the presence or absence of a bruit is clinically most useful in symptomatic people. The most relevant intervention is carotid endarterectomy for patients with severe, recently symptomatic carotid stenosis. In the majority of such patients the benefits of surgery outweigh the risks (Cina *et al.* 2001). In our neurovascular clinic, if we have a patient with a recent carotid territory nondisabling ischaemic stroke or TIA, who is fit for surgery, and is prepared to consider having an endarterectomy, we aim to perform a carotid Doppler ultrasound on the same day, whether or not the patient has a bruit. In other words, the presence of a bruit is noteworthy, but

does not have a major influence on our management

On the other hand, a bruit becomes more valuable when the clinical features of the event are less clearly those of TIA. The two case vignettes below indicate the kind of patients where the presence of a bruit was helpful in steering us towards the correct diagnosis.

- A 50-year-old-man was referred to the neurovascular clinic with six episodes of blurring of vision in his right eye. The vision would blur for between 30 and 60 s. He had a history of migraine, but there was no headache with these attacks. There were no vascular risk factors. He had a right carotid bruit. The clinical diagnosis lay between thromboembolic TIA and migraine without headache. However, Doppler ultrasound showed an 85% right internal carotid artery stenosis. He was started on aspirin, but continued to have attacks. The attacks stopped after he had a right carotid endarterectomy, which suggests the attacks were indeed thromboembolic TIAs. The presence of the bruit increased the justification and urgency for requesting a Doppler ultrasound.
- A woman aged 60 years was referred with four episodes of rather non-specific tingling of her left hand, each of sudden onset and lasting about 5–15 min. She was a smoker, but was otherwise in good health, with normal blood pressure. The only abnormality on examination was a left carotid bruit. As part of a research study, she had carotid ultrasound studies. The operator was extremely surprised to find that she had complete occlusion of the left and right internal carotid arteries. There was also stenosis of the left external carotid artery, which was probably the source of her bruit. It later became clear that her episodes of tingling were precipitated by standing up, and hence were 'haemodynamic' TIAs due to low flow in the right middle cerebral artery territory. In her case, the bruit was a pointer to the presence of vascular disease as the cause of her symptoms.

In places where noninvasive vascular imaging is not readily available, the presence of a bruit can help select which patients should have arterial imaging. However, it is important to remember that patients can have a haemodynamically-significant stenosis yet no audible bruit at all.

SHOULD ONE LISTEN FOR BRUITS IN ASYMPTOMATIC PEOPLE?

In patients with asymptomatic carotid stenosis, the balance of risk and benefit from carotid endarterectomy is far from clear (Chambers *et al*. 2001). Because finding a stenosis in a patient without cerebrovascular symptoms will therefore not usually lead to surgical treatment, we do not listen for bruits in asymptomatic people (or people with pulsatile tinnitus as their only symptom). Finding a bruit in an asymptomatic person can set in train an unstoppable series of events which engender a lot of anxiety.

Nightmare scenario

An anxious middle aged woman was referred to a medical clinic with tension headache. The keen young trainee doctor listened to the neck and heard a bruit. He ordered a Doppler scan, which identified an asymptomatic stenosis. He then told her that she was at risk of stroke and the patient's anxiety rose further. To decide whether surgery was needed, an even more anxiety-provoking referral to a vascular surgeon followed. The surgeon wisely decided that the risks from carotid surgery outweighed the benefits and the stenosis was not operated on. Unfortunately, the patient continued to worry unnecessarily that she was about to drop dead from a stroke. Moral: in asymptomatic people it's better not to listen to the neck in the first place ('if it ain't broke, don't fix it' is wise counsel!).

SUMMARY

Carotid bruits, correctly identified and sensibly employed in decision making, remain a useful part of the clinical assessment of patients with suspected TIA or ischaemic stroke.

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