Angiography in Cerebrovascular Disease*

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The role of the extracranial vessels in cerebrovascular disease was suspected as long ago as the end of the nineteenth century but it remained for Hutchinson and Yates\textsuperscript{4,5,10} to define the incidence and segmental nature of arteriosclerosis in these vessels. Eastcott \textit{et al.}\textsuperscript{3} reported the first successful attempt of carotid surgery in 1954 and later concluded that the best results were obtained in cases of partial occlusion.\textsuperscript{3} The importance of early diagnosis thus becomes manifest.

Many well known clinical findings have, however, proved unreliable and often misleading. Thus, palpation of the carotid artery is not only uninformative but potentially dangerous. Vigorous and bounding pulsation may conceal an occlusion whilst often one is unable to distinguish between the external and the internal carotid artery. Ophthalmodynamometry frequently fails to detect stenosis of the carotid artery which, contrary to established occlusion, has been shown to be amenable to surgery.

The presence of a bruit in the neck usually is caused by disease of the carotid artery but sometimes may be produced by excessive blood flow in collateral vessels or be a normal finding in young adults. Occasionally stenosis is confined to the external carotid artery. Inequality of blood pressure, or of the radial pulses, will correctly incriminate the subclavian or axillary arteries and often implies associated disease of the carotid artery. Plain roentgenograms of the neck may show calcification of the carotid arteries but this has not been found to be any guide as to the presence or absence of stenosis in these vessels.

In the investigation of cerebrovascular disease angiography remains the only definitive diagnostic procedure available. It is in these cases, however, that we expect a higher morbidity than in any other group of patients because arteriosclerosis commonly affects more than one vessel so that even minor and temporary disturbances of circulation may cause major signs and symptoms. We are, therefore, reluctant to puncture a vessel suspected to be diseased particularly when there is known occlusion or insufficiency of other vessels (Fig. 1). At the same time the work of Hutchinson and Yates\textsuperscript{4,5,10} has indicated the need to study the origins of all vessels supplying the brain.

In our search for a safe method we may consider intravenous techniques but these do not give us adequate contrast particularly in the intracranial vessels, and since too many

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FIG. 1. Left carotid arteriogram in male, aged 71, with right hemiplegia. The internal carotid artery has been punctured and the needle has penetrated an arteriosclerotic plaque.
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are opacified at any one time interpretation is difficult if not impossible. Other indirect methods include catheterization of the brachial artery which, in my view, is contraindicated in the very cases in which one might consider using it, for we find arteriosclerotic plaques in the brachial and axillary arteries that may be stripped by the passage of a catheter. Furthermore, the frequent complication of loss of the radial pulse, the possibility of an arteriovenous fistula between the brachial artery and vein, or damage to the median nerve render it an unsuitable procedure which we employ only when other methods have failed. Catheterization of the femoral artery is a good technique but again the catheter has to be passed for a very long way and in many cases there is coincident disease of the aorta, the iliac and the femoral vessels. It is thus we come to consider the subclavian artery.

Puncture of the subclavian artery is simple and safe.\(^1\) With a right subclavian arteriogram one usually demonstrates the right carotid and the right vertebral arteries and sometimes also the left carotid artery\(^7\) (Figs. 2 and 3). Occasionally one fails to obtain adequate contrast in the right carotid artery and when this occurs a catheter is introduced and passed into the innominate artery.\(^6\)\(^,\)\(^7\)\(^,\)\(^8\) It may later be advanced into the ascending aorta to demonstrate the left carotid and the left subclavian arteries. Unfortunately, whilst the contrast obtained in the left carotid artery is good that of the intracranial vessels is inadequate so that it is often impossible to avoid direct puncture of the left carotid artery. To minimize complications the artery is punctured low in the neck, preferably in the reverse direction. We need, therefore, to develop a technique of catheterizing the left carotid artery via the right subclavian.

**Fig. 2.** Right subclavian arteriogram showing stenosis of right internal carotid artery (right arrow) and complete occlusion of left internal carotid artery at the bifurcation (left arrow). A normal right vertebral artery is shown. Male, aged 64.

**Fig. 3.** Right subclavian arteriogram showing stenosis of internal and external carotid arteries in a male, aged 74. The vertebral artery is occluded at its origin.