

INCOMPLETE OCCLUSION OF THE INTERNAL CAROTID ARTERY TREATED BY THROMBOENDARTERECTOMY

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A fatalistic and hands-off policy in the management of both little strokes and frank cerebrovascular accidents previously was justified in as much as little could be done in the treatment of most of these patients. Within the past decade, however, advances in the surgical treatment of incomplete carotid artery obstruction has made such a policy untenable and both physicians and surgeons should recognize those patients with such neurologic disorders that may be amenable to surgical benefit.

The purpose of this paper is to describe the correct status of selection of patients for such surgery on the carotid artery and to illustrate with two case reports. Emphasis is placed on the discovery of patients with incomplete carotid artery obstruction who are amenable to correction prior to complete carotid obliteration with its frequent irreversible neurologic damage.

CASE 1

C.A.N., a Chinese housewife, aged 70 years, was admitted into hospital on 22nd March, 1960 complaining of weakness of the left limbs which came on suddenly soon after a meal four days prior to admission. She could still walk up a flight of stairs to her bed following the episode. On waking the following morning she was worse and could not walk. She had had no past history of any severe illness. On examination she was found to be hemiparetic on the left side and could not stand unsupported. Her B.P. was 180/80; the heart was slightly enlarged and a systolic murmur was audible over the aortic and mitral areas. A systolic bruit was also heard over both carotid arteries and over the left eyeball. Her peripheral pulses were normal. There were no abnormalities in the other systems.

Investigations revealed that she was not anaemic. The X-ray film of the chest showed a slightly enlarged heart and a dilated thoracic aorta. A lumbar puncture yielded clear C.S.F. under a pressure of 200 mm. (water) but otherwise normal. Bilateral carotid and angiography done a week after admission showed, on the right, a narrowing at the origin of a markedly tortuous internal carotid

artery (see Fig. 1); the left carotid arteries had normal appearances.

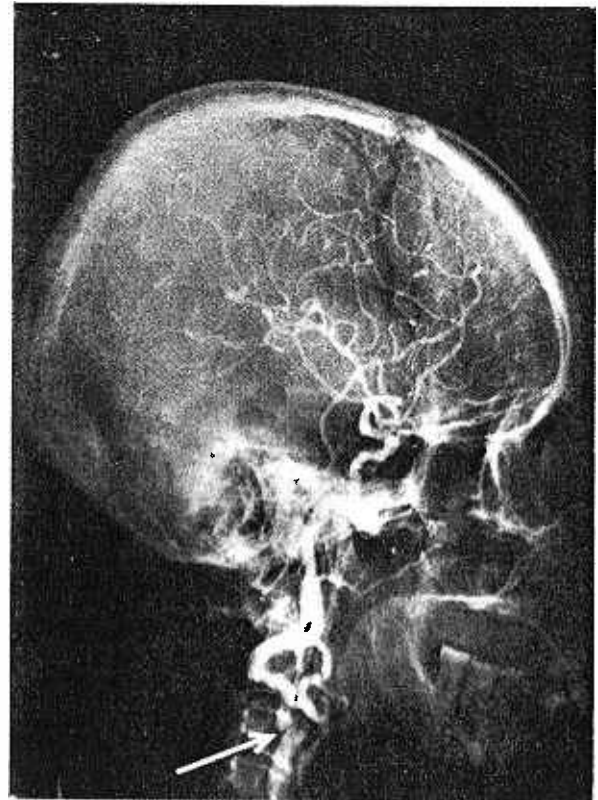


Fig. 1. Right carotid arteriogram (Case 1) demonstrating markedly tortuous internal carotid artery with severe constriction at its origin.

In view of the arteriographic findings demonstrating the insufficiency of the right internal carotid artery and good patent contralateral arteries she was thought to be suitable for operation. It was found that she could withstand ipsilateral carotid artery compression for more than 5 minutes.

OPERATIVE FINDINGS

At operation which was done under local anaesthesia, marked thickening of the wall of the right common and internal carotid arteries was felt. An extensive atheromatous plaque measuring 1.5 cm. long was removed from the internal carotid artery. Part of this extended into the common

carotid artery. Total occlusion time was 9 minutes towards the end of which the patient became drowsy and her speech slurred. She remained drowsy for several hours after operation after which her mental state and speech returned to normal.

PROGRESS

She has made good progress and sixteen months after the operation there has been no recurrence of symptoms. She walks unaided. It was interesting to note on follow-up that the systolic bruit audible pre-operatively over the right common carotid artery has since disappeared. Similar bruits over the left carotid artery and eyeball remained unchanged.

CASE 2

Q.T.S., a Chinese male, aged 62 years, was admitted on 18th August, 1960 with the following history. 14 months ago whilst lying down at rest he felt drowsy followed soon after by numbness and weakness of his right limbs. The next event he recalled was to find himself in hospital that same afternoon completely paralysed over the right half of the body.

He gradually improved and in about 2 months' time he was able to walk although still weak in his right leg. At about the same time he noted the onset of an unsteadiness of his right upper limb.

He had fallen from a roof about 20 years ago sustaining a fracture of the left femur; otherwise he had never been seriously ill in the past.

On examination he was afebrile; but in a poorly nourished state. His B.P. was 160/80 and his heart was within normal limits. He had a glass eye on the right side. A machinery-like murmur was heard on auscultation over the left carotid artery. There was no bruit heard over the left eyeball. Over the right carotid artery and the right eyeball (glass) a systolic murmur was heard disappearing at both sites after proximal compression.

He walked with a stiff right lower limb and was weak in the right upper limb. The tendon reflexes were exaggerated bilaterally but the plantar responses were flexor. Parkinsonian movements were observed in the right forearm and hand.

Investigations showed that he was not anaemic; his blood urea normal and the blood serology negative. The X-ray film of the chest revealed no abnormalities. Bilateral carotid angiographic examination was done a week after admission. On the left side there was shown a stenotic

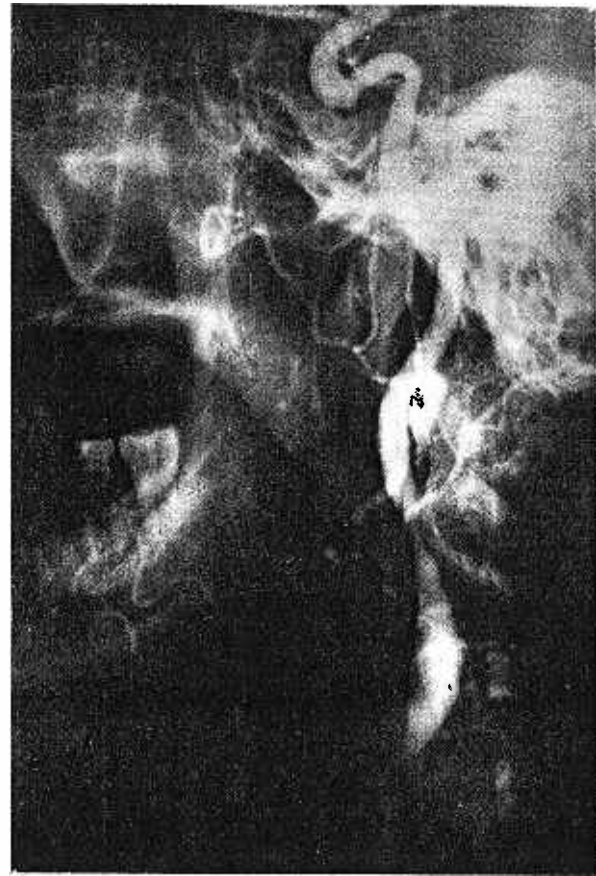


Fig. 2. Left carotid arteriogram (Case 2). The stenotic segment in the internal carotid artery is clearly visualised, beginning an inch from its commencement.

segment of the internal carotid artery about an inch after its commencement (see Fig. 2). The right carotid artery system had normal appearances.

In the ward whilst under symptomatic treatment he developed four attacks of clonic movements of the right limbs which were probably hysterical in origin. Soon after he developed mental changes consisting of refusal to eat and to talk when spoken to.

Tolerance to ipsilateral carotid artery occlusion was good after 5 minutes. Except for some slowing of the pulse no other side effects were seen or complained of. In view of his symptoms of carotid insufficiency and the subsequent angiographic findings thromboendarterectomy was performed on 13th October, 1960.

OPERATIVE FINDINGS

At operation, under general anaesthesia, the thickened stenotic segment of the internal carotid artery was found to begin 1 cm. from the bifurcation and was 1.5 cm. long. The plaque excised was 2.5 cm. long (see Fig. 3) and had extended



Fig. 3. Atheromatous plaque removed from left internal carotid artery in Case 2.

into the common carotid artery. The period of occlusion was 20 minutes.

PROGRESS

Except for a slight weakness of the right upper limb on the second post-operative day his progress was good. A week later he was walking about in the ward attending to his own needs. Two weeks after the operation, on auscultation, of the neck and the eyeballs the previously heard bruits had disappeared. He was well on discharge 10 weeks after the operation. Anti-coagulant therapy begun in the second post-operative week was withdrawn after nearly a month's duration when he developed subcutaneous ecchymoses into the left thigh. Three months later he was readmitted generally weak from severe malnutrition owing to poor care and poor socio-economic circumstances. He died soon after. Autopsy was refused.

DISCUSSION

Incidence

The incidence of atherosclerotic disease of the internal carotid artery has been studied by Fisher (1954). In a series of 432 unselected autopsies, nearly 10% had partial or complete occlusion and

it is significant that more than three quarters of these had shown neurological symptoms during life.

Arteriographic studies in 305 patients with symptoms of cerebral arterial insufficiency by De-Bakey and his co-workers (1959) showed extracranial arterial occlusions, complete or incomplete, in 122 (40%).

The clinical problem is to discover those patients with incomplete obstruction who are having neurological symptoms prior to having irreversible changes with a major stroke.

Clinical Manifestations

Carotid insufficiency may or may not cause symptoms, this being dependent largely on the efficiency of the collateral circulation mainly derived from the vertebral and external carotid arteries. Incomplete occlusion can cause symptoms and signs indistinguishable from complete obstruction when combined with a poor collateral circulation or with hypotensive states due to severe blood loss or myocardial infarction.

Edwards, Gordon and Rob (1960) have described three main clinical forms: (A) Episodic, with a typical history of "little" strokes, and little or no residual neurological deficits; (B) Apoplectic, with sudden onset of symptoms simulating an acute stroke; (C) Gradual onset with slowly progressive symptoms producing a picture simulating that of a space-occupying lesion.

When a history of "little strokes" is superimposed against a background of a progressive neurological lesion and is also associated with monocular impairment of vision, diminished carotid pulsation and a systolic bruit in the neck, the diagnosis presents little difficulty and angiography serves mainly to localise and delineate the lesion. Clinical diagnosis is, however, not often so easy. In patients with cerebral vascular insufficiency, the possibility of extracranial internal carotid occlusions should always be borne in mind. The presence of a systolic bruit in the neck is highly suggestive but not always indicative. Whenever suspicion is raised, angiography is essential.

In the two patients presented in this report, systolic bruits were audible over the stenotic arteries and diagnosis was confirmed by angiographic studies.

Radiological appearances

First-quality bilateral carotid angiograms are essential to enable accurate anatomical localisation

and assessment of the extent of the lesion, the state of the distal arterial tree as well as the contralateral arterial circulation. The internal carotid artery is classically affected at or immediately beyond its origin. The occlusion may be partial or complete and is clearly shown up in the angiogram.

It is stressed however, that such occlusions may not be solitary and may be associated with multiple stenoses involving the intracranial cerebral arteries. Of these, the middle cerebral is the most commonly affected. It should also be remembered that "angiographic lesions" may on occasion be due to artefacts.

Choice for surgery

Very careful case selection is essential for best results. Useful guidance may be derived from the reports of DeBakey, Crawford and Fields (1959), Bahnson, Spencer and Quattlebaum (1959) and Edwards, Gordon and Rob (1960). Patients with episodic, "little strokes", with minor or no residual neurological deficit are the most likely to derive the greatest benefit. Those suffering from acute and major strokes or those with slowly progressive symptoms respond less satisfactorily and most of them remain unchanged while only very few are improved (DeBakey et al, 1959; Freeman and Lippitt, 1959; Edwards et al, 1960; and Javid, 1960).

The angiographic findings provide further basis for selection. Partial occlusions tend to remain localised but in contrast, complete occlusions are complicated by extension of the thrombosis into the intracranial segment of the artery. It is in the incomplete lesion that surgery is suitable and this is exemplified by our two cases.

Complete occlusions of the internal carotid artery are generally regarded as inoperable.

Surgical management

Prior to operation ipsilateral compression is carried out to determine the duration of cerebral ischaemia which can be safely tolerated by the patient.

The operative procedure of choice, wherever possible, is thromboendarterectomy (DeBakey et al, 1959; Freeman and Lippitt, 1959; Gurdjian and Webster, 1958; Javid, 1960; Edwards, Gordon and Rob, 1960). This has replaced the initially employed method of excision and grafting (Eastcott et al, 1954). Thromboendarterectomy, or intectomy as it has been named by some, essen-

tially is accomplished by direct exposure of the affected segment of the artery and through an arteriotomy a plane of cleavage is developed between the sub-intimal layer and the media. The excised material consists of the atheromatous plaque and diseased intima. The reconstructed segment of the artery is left with a thin wall comprising adventitia and media.

RESULTS

The assessment of the results following operation has been difficult. The natural history of the disorder itself is ill-worked out and improvements consistent with the course of the disease must be taken into consideration. In an analysis of three series totalling 52 patients with incomplete occlusion (Murphy and Miller, 1959; Riishede et al, 1960; Rob and Wheeler, 1957) 13 recovered after operation, 11 showed some improvement and 6 died post operatively (B.M.J., 1961). The best results appear to have been obtained in patients with episodic symptoms with little or no neurological sequelae. Thus, Bahnson et al (1959), analysing their results in 22 patients reported that 8 out of 10 patients in this category improved while 2 were unchanged. Similarly, Javid (1960) noted excellent results in 25 out of 30 such patients, with a further 3 improved and only 2 unchanged. Freeman and Lippitt (1959) reported complete relief of symptoms in all 10 patients operated on following transient strokes.

The major problem involved in the operative procedure is the possibility of cerebral ischaemia developing during the period of complete arterial occlusion. Neurological drainage due to the operation per se is avoided by keeping occlusion times to the minimum, by the use of hypothermia or shunts as supportive measures where indicated and by the maintenance of a normal blood pressure and adequate replacement of blood loss. It should be noted however that technical success is not synonymous with a good clinical result. "A prime requisite is that a brisk and spurting back-flow should be obtained from the distal segment of the artery" (B.M.J., 1961).

ANTI-COAGULANT THERAPY

Contrary opinions are being held as regards the value of anti-coagulant therapy in the treatment of cerebrovascular disease. Millikan and his associates (1955 and 1958) reported a reduction of cerebral ischaemic attacks and mortality rate with its use. There is, however, increasing evidence that it is not only of doubtful value but that it gives a higher death rate due to intracranial

haemorrhage. Bradford Hill and his colleagues (1960) ended their controlled trial following five deaths from haemorrhage. This complication, of haemorrhage into an existing brain infarct, had been noted previously by Brain (1954) and Symonds (1956).

Its use after operations on the carotid artery has stronger advocates. Gurdjian and Webster (1958) recommend it; Javid (1960) employs anti-coagulants in the immediate post-operative period but discontinues its use as soon as the patient is ready to go home. However, Edwards et al (1960) are of the opinion that there is no evidence of significant beneficial effect, besides incurring the risk of cerebral haemorrhage.

CONCLUSIONS

1. Two illustrative cases have been described of incomplete carotid arterial occlusion which had resulted in "little strokes". Both were treated surgically.
2. A short review is given of the pathophysiology of this condition with emphasis on the proper choice of patients who may benefit by this surgical procedure.

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