Superselective Internal Carotid Arteriography and Embolization

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Received: April 5, 1975

Summary. Superselective arteriography and superselective embolisation is the future of a part of neuroradiology. After the first realisation in the territory of the external carotid artery, it was logical to extend it to the territory of the internal carotid artery.

The technic of the balloon-catheter of Serbinenko is described and problems of embolisation in the internal carotid artery are discussed.

L'embolisation super-sélective de la carotide interne

Résumé. L’artériographie super-sélective et son corollaire l’embolisation super-sélective représentent l’avenir d’une partie de la Neuro-Radiologie. Appliquée d’abord à la carotide externe, il était logique de vouloir la réaliser au niveau de la carotide interne. Les différentes possibilités de cet examen sont décrites, la sonde à ballonnet de Serbinenko en est actuellement la seule possibilité.

Superselektive Arteriographie der A. carotis interna und Embolisierung


Introduction

The current trend in neuroradiological angiography is towards superselectivity. This has as its aim the low pressure injection of a small quantity of contrast medium into an arterial branch of the 6th or 7th order so as to visualize very fine arterioles (between 30 and 100 μm in diameter) with high definition.

Superselective Angiography Historical

Superselective angiography was first practiced in the study of the spinal cord in 1966 [5] and as a result of the quality of the pictures and the importance of the information obtained it replaced aortography. In the cervical region selective transfemoral injection of the vertebral and deep and ascending cervical arteries superseded the techniques of axillary or brachial angiography [6, 9].

In cerebral studies, selective injection of the internal and external carotid arteries may be employed instead of injection into the common carotid artery. Even this degree of selectivity, however, is inadequate for the more detailed demonstration of the branches of these arteries. Superselective external carotid arteriography [7] has allowed us to study the arteries of this territory in great detail and, by means of catheters of even smaller calibre, certain secondary branches (selective middle meningeal, transverse facial, ascending palatine arteriography, etc). Thus, using radiographic magnification with a 0.1 mm focal spot, arteries hitherto invisible, but not unfamiliar to earlier anatomists, have been shown. Moreover, superselective angiography has enabled us to perform superselective embolization of these branches with Gelfoam fragments. The effectiveness and low morbidity of such embolization would appear definitely superior to non-selective techniques utilising plastic spheres or muscle.

It seemed logical to wish to carry out superselective angiography of the branches of the internal carotid and vertebral arteries. In a small number of cases in which the carotid siphon was relatively straight we have been able to inject the middle cerebral or, more commonly, the ophthalmic arteries (Fig. 1a, b), with the use of very fine catheters. However, the tortuosities of the siphon and the loops of the vertebral artery usually prevent the passage of catheters or of straight or curved guide-wires of the smallest available size. They fail to follow the curve of the vessel, stick against an intimal fold or catch on a tortuous wall (Fig. 2a, b). In some cases, a Fogarty catheter with its inflatable balloon will pass more easily than an ordinary catheter.

It therefore appeared necessary to use even finer catheters, of very low rigidity, to be able to adapt to all the tortuosities of the vessels. The idea of using catheters with a magnetized metallic tip developed, then directing these very soft catheters by a magnetic
field outside the skull. This “intravascular navigation” was achieved by Yodh [28], Alksne [1] and Hilal [10], in animals and in several humans. The few published results do not seem as yet to have proven the effectiveness of this technique. We [8] have undertaken similar studies, with a magnetic catheter tip and a pulsed magnetic field, without the hoped-for results.

Rand [21] has used a helium “super-magnet”, which would seem to be more effective than the electromagnets previously used. Until we have evidence to the contrary, it would seem that this work is experimental rather than clinical, and does not offer a practical method for superselective internal carotid arteriography.