Cerebral angiography of the rat

Technical note

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An open technique of right retrograde brachial arteriography of the rat is described. With the aid of magnification radiography, this method permits high quality examinations of the extracranial and intracranial circulations. The muscular branches of the brachial artery are preserved at the initial study to allow repeat examination. A four-vessel study is also attainable by injection of contrast material immediately after death of the animal.

KEY WORDS cerebral angiography microsurgery retrograde brachial arteriography

MICROANASTOMOSES of the carotid artery and other small vessels of the rat afford good practice for the neurosurgeon to hone his skills. To test patency of the site of microanastomosis we have used retrograde brachial arteriography.1-3

Operative Technique

Male Wistar rats weighing about 300 gm are anesthetized with an intraperitoneal injection of Nembutal (sodium pentobarbital), 30 mg/kg of body weight. Each rat is laid on its back with the extremities wide apart. The hair is removed in the right axilla and forelimb by depilatory cream, and the skin cleansed. A skin incision about 1 cm long is made in the proximal anteromedial portion of the right forelimb. Dissection along the medial aspect of the biceps brachii muscle reveals the brachial artery. It usually has an outer diameter of no larger than 0.4 mm. One or two brachialis profundus arteries, and less frequently an additional superficial collateral artery, branch from the distal part of the brachial artery. The brachial artery is ligated just proximal to the brachialis profundus with 7-0 nylon suture, and another suture is passed under the brachial artery to hold it in place. A small transverse arteriotomy is placed proximal to the ligature. A thin-walled blunt tipped needle with an outer diameter of 0.25 mm is threaded gently up to the axillary artery. The animal is transferred to the radiographic table. Two adjustable opposing pins are introduced into the bilateral external auditory meatus to fix the head of the rat. Each radiograph is made with a small focal spot tube with 0.5 × 0.5 mm focal area under twofold magnification in a standard exposure of 70 KVP, 2.5 mA at 0.25 seconds.
Meglumine iothalamate (Conray 60) preheated to body temperature is used as the contrast material. Each of our animals tolerated a bolus injection of a dosage of 0.6 ml; none died immediately after injection of the contrast medium. Gentle traction applied to the syringe facilitates the bolus injection of the contrast material. The right common carotid artery, the right vertebral artery, the common carotid bifurcation, and the extra- and intracranial right carotid system, as well as the posterior circulation are well visualized (Fig. 2).

When later examinations are planned, arteriotomies are made distal to the origin of the brachialis profundus arteries to leave them patent. When we exposed the brachial arteries several months later, all of them were patent and the brachialis profundus arteries, which had been left patent at the initial study, were found to have enlarged to a size comparable with the main brachial arteries.

Injection of about 1 ml of contrast material made immediately after death opacified the ascending aorta, the aortic arch, the descending aorta, and the bilateral common carotid and vertebral arterial systems and their branches. Consequently, this procedure is particularly useful to demonstrate the occlusions in one or more of these arterial trunks (Fig. 3).

In the present method, the contrast material is injected into the common carotid artery via the brachial artery. This method obviates additional trauma to the carotid artery, and is especially suitable to visualize the common carotid arteries that have been anastomosed or replaced with grafts.

Serial arteriography by use of an automatic film changer and a powered injector might afford important information in evaluating the small extra- and intracranial circulation of the rat. Stereoscopic or biplane films would also contribute to this study.
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FIG. 2. Retrograde brachial arteriogram. Note the retrograde filling of the right subclavian artery and the innominate artery. The right common carotid artery and the vertebral artery as well as their major extra- and intracranial branches are visualized. The major arteries are indicated as follows: common carotid (a), carotid bifurcation (b), internal carotid (c), internal maxillary (d), anterior cerebral (e), middle cerebral (f), posterior cerebral (g), vertebral (h), basilar (i), superior cerebellar (j), inferior cerebellar (k), and ventral spinal (arrows). (Terminology of the intracranial artery conforms to Craigie's Neuroanatomy of the Rat.)

FIG. 3. Four-vessel study by postmortem injection. The right common carotid artery has been occluded by a ligature 6 months previously. The short initial segment of the right common carotid artery is only faintly visualized (arrowhead). The right internal carotid artery and its branches are well visualized by collateral supply from the vertebral artery (arrows) and the costocervical artery (asterisk). The circle of Willis is clearly seen.

References
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J. Neurosurg. / Volume 49 / August, 1978