THE VALUE OF ORBITAL ANGIOGRAPHY FOR DIAGNOSIS OF UNILATERAL EXOPHTHALMOS*

H. KRAYENBUHL, M.D.

Neurosurgical Clinic, University of Zürich, Zürich, Switzerland

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It is the aim of the Cushing tradition in neurosurgery to elaborate the preoperative diagnosis of intracranial tumor as accurately as possible. The same should be true for the diagnosis of a space-occupying lesion in the orbit. The value of the various roentgenological demonstrations of the orbit is uncontested, but in the opinion of the majority of neurosurgeons angiography has been a disappointing tool for the diagnosis of most orbital lesions. Our personal experience does not support this general opinion. The purpose of this paper is to present our experience in the differential diagnosis of space-occupying orbital lesions by the method of orbital angiography. Curtiss, Schurr, Decker, and Decker and Schlegel were amongst the first to describe arteriography of the ophthalmic artery and the choroidal plexus of the eye. But the angiographic demonstration of pathological orbital structures is a field that is still largely unexplored. In their study on unilateral exophthalmos Van Buren et al. showed tracings of arteriograms from 2 cases of proptosis indicating an unusual intraorbital vessel, one of which proved microscopically to be a vein. In addition Yaşargil first reported in a monograph the various roentgen-ray examinations for unilateral exophthalmos, and our own contribution to this subject appeared in 1958.

The disappointing study of most orbital lesions by arteriography, noted especially by Matson and by Gros et al., obviously has been caused by the use of weakly concentrated contrast medium. Since we have been using the 60 per cent contrast medium Urografin, it has been possible to demonstrate the ophthalmic artery in 98 per cent of the cases. Its course as a rule is fairly constant. It is seen to arise from the internal carotid artery as it emerges from the cavernous sinus either at the horizontal portion of the carotid artery or close to the anterior clinoid process (Figs. 1 and 2). According to Schurr, the artery pursues a slightly tortuous course largely because of the freedom of movement which must be allowed to its branches in order to permit rotation of the eyeball. Furthermore it passes along the medial wall of the orbit, at times forming a loop. It is unlikely, therefore, that displacements of the vessel by space-occupying lesions within the orbit would be easy to detect with the exception of tumors arising from the sinuses and penetrating the orbit, which always displace the artery. The recognition of the different branches of the ophthalmic artery and of the choroidal plexus is not easy, especially when it comes to distinguishing them from the outlines of the bone that overlies them. In our experience the stereoscopic views of the angiograms or the study of angiographic pictures produced by the method of Subtraktion according to Ziedes des Plantes are a great help in the demonstration of the normal or abnormal vessels. The method of subtraction consists of making a preliminary negative roentgenogram of the skull, from which a positive is made. A second roentgenogram is made after injection of Urografin into the carotid artery. The original positive is now superimposed on the negative arteriogram. The positive of the first film blots out the negative of the second film leaving, in sharp contrast, only the shadows not common to both films, namely, the vessels filled with contrast medium (Fig. 3).

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In many instances the venous phase is even more important than the arterial phase. It is obtained either by the late phase of an angiogram of the external carotid or by direct percutaneous injection of the angular vein with contrast medium (Figs. 4–6). This special method, which has been developed by Yaşargil,9 has some technical difficulties. If the angular vein is very thin it must be punctured with the head in a downward position and with compression of the facial and frontal veins. The course of the orbital veins is to be seen in the phlebogram. The displacement of the superior ophthalmic vein usually is well demonstrated in the anteroposterior view.

Case Reports

Case 1. B.L., a 15-year-old girl, had suffered from gradually increasing protrusion of the right eye for 3 years. There was marked right-sided exophthalmos of 5 mm. (Fig. 7), right papilledema of 6 diopters and right visual loss (0.2). Ocular movements were full. Roentgenogram of the right orbit and right optic foramen did not show anything abnormal. Right carotid angiography revealed a retrobulbar slightly stained tumor surrounded by a thin capsule, the size of a cherry (Fig. 8). The tumor was removed by the lateral,

Fig. 1. Diagrammatic interpretation of normal arteriogram shown in Fig. 2. (1) Internal carotid artery. (2) Ophthalmic artery. (3) Anterior and posterior ciliary arteries, choroidal and central artery. (4) Internal palpebral branches. (5) Frontal and dorsal nasal artery. (6) Choroidal plexus.

Fig. 2. Lateral arteriogram showing tortuous course of ophthalmic artery (2) and choroidal plexus (6). See Fig. 1.

Our case material on which this paper is based consists of 89 cases of unilateral exophthalmos, including 27 cases of intraorbital tumors, 8 cases of intraorbital vascular lesions and 54 cases of retro- and periorbital tumors. Intracranial lesions producing unilateral proptosis are not included. From this material the following cases have been selected for discussion as angiographic representations of the different causes of unilateral exophthalmos.

Fig. 3. Normal lateral arteriogram produced by method of subtraction according to Ziedses des Plantes:10 ophthalmic artery (2), internal palpebral branches (4), frontal and dorsal nasal artery (5).

Fig. 4. Diagram of orbital veins.