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Rotational Cerebral Angiography: Procedure and Value

A. Thron¹ and K. Voigt¹

Rotational cerebral angiography provides continuously changing projections and correspondingly excellent visualization of aneurysms or other vascular malformations requiring special or oblique views. Rotation angiography as part of the routine angiography gives a three-dimensional impression with one injection and series of films. Although additional subtraction technique is not possible and the injection time has to be prolonged, the technique is nevertheless advantageous compared with magnification angiography and angiotomography in the preoperative evaluation of cerebral vascular malformations.

Since computed tomography (CT) is generally available, angiography is no longer necessary for many diagnostic problems, including some that also require special projections, stereoscopic studies, or tomographic examinations. Comparable progress has not been achieved in the precise demonstration of small vascular structures. Despite subtraction technique [1, 2], different special and oblique projections are usually needed for sufficient preoperative documentation of arterial stenoses, aneurysms, arteriovenous fistulae, and angiomas.

Many efforts have been made to increase the diagnostic value of contrast injections, for example, magnification angiography [3] or angiotomography [4, 5]. Another way to overcome these difficulties and to simplify the examination procedure at the same time is a rotation technique first proposed by Cornelis et al. [6] in 1972.

Technical Procedure

Our initial experience with rotational angiography was with a C-arch x-ray unit and 70 mm camera connected to the image intensifier. The region of interest was placed in the isocenter and the tube-camera unit rotated around it in a semicircle from left lateral to right lateral. During the 5–6 sec rotation time sequential films were obtained every 5°. Previous studies confirming the principles of cerebral rotation angiography have been reported [7, 8].

After some years of clinical experience we have altered the technical equipment and examination procedure. We now perform the rotation series as part of the routine angiography with full-size film of 10 × 12 inches (25.4 × 30.5 cm) (fig. 1). With a film speed of two to three films/sec a rotational run of 90–120° is carried out, beginning with left lateral or left oblique to the corresponding right view. With 90° rotation in 6 sec and a film speed of three films/sec successive frames follow each other at 5° intervals, which moreover can be viewed as stereoscopic pairs. Automatic exposure control with short exposure time is necessary in order to obtain sharp contours during rotational radiography. Operation of the x-ray

equipment is simple, and the risk of collision between x-ray unit and table or floor is excluded by numerous special contacts. Any sector can be selected for the rotation run; the limitation to 90–120° is determined by the length of injection time for the contrast volume, which should be restricted to 10–12 ml. Usually, a rotational run of about 90° is adequate for routine clinical work. An additional inclination angle of the rotating unit for a more half-axial plane can be performed for special queries.

Diagnostic Findings

The applicability of this technique in clinical diagnosis has been verified in more than 100 examinations over several years. It has become part of routine angiography, being used in every diagnostic condition requiring special or oblique x-ray projections. Above all, this technique is advantageous in the evaluation of cerebral aneurysms. If conventional studies in frontal and lateral projections do not provide sufficient preoperative information one more rotation series is carried out. Generally, it gives an excellent visualization of size, shape, origin, direction, and neck of even small aneurysms (figs. 2–4). A three-dimensional impression of the malformation obtains from the constantly changing view. In many cases distinction of an aneurysm or junctional dilatation could only be made after rotation. Likewise, differentiation between an aneurysm and an overprojected vessel or a vascular loop is always possible by rotational filming.

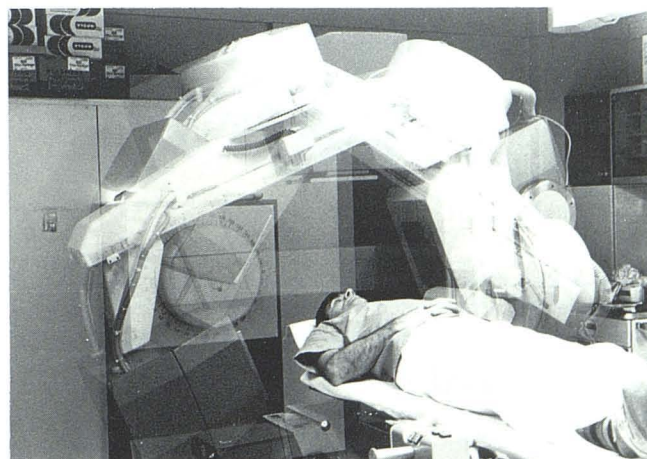


Fig. 1.—Rotation procedure with neuroscope on full-size film.

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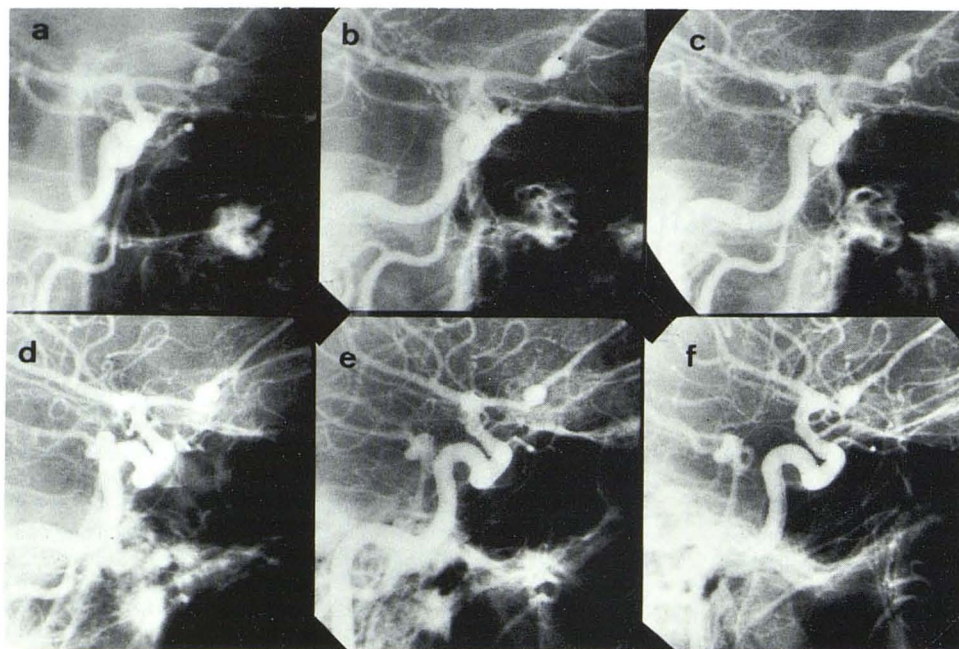


Fig. 2.—Aneurysms of anterior communicating artery and basilar artery in sequential films of rotation series by 70 mm technique.

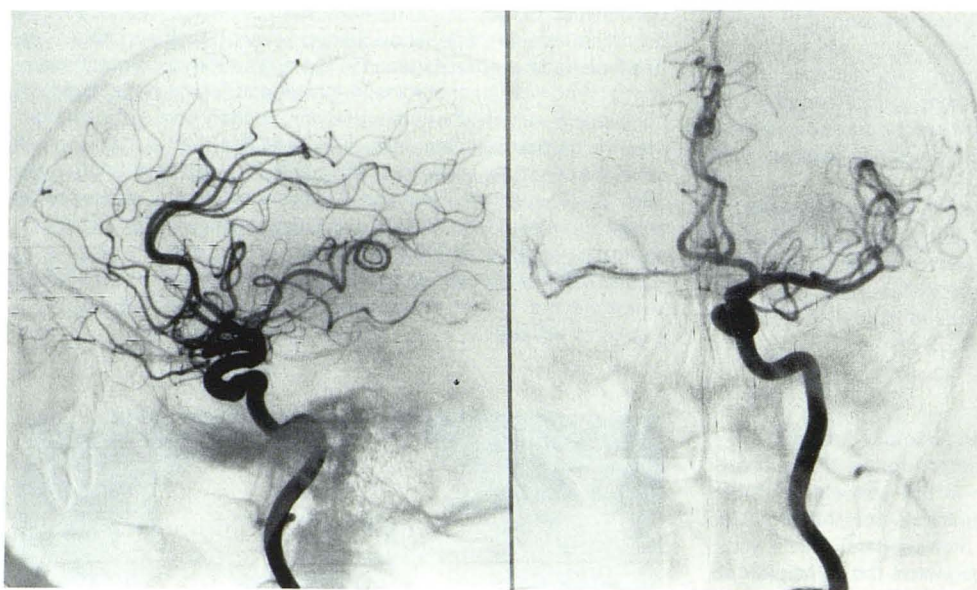


Fig. 3.—Standard projections of anterior communicating artery aneurysm.

The procedure is of comparable value in the demonstration of the angiomorphology of arteriovenous angiomas or fistulas. In some cases of arteriosclerotic lesions, extent and irregularity of stenoses are only demonstrated in special oblique views provided by a rotation series. However, in most cases subtraction technique in the standard projections is sufficient for the assessment of stenoses, and further injections should be avoided as much as possible in cerebrovascular disease.

Discussion

The mere visualization of an aneurysm, arteriovenous angioma, or fistula is not sufficient if intracranial surgery or endovascular

therapy is contemplated. For that reason many authors have stressed the necessity of oblique and special projections [9-14]. In fact, various oblique projections are generally carried out, first for the final diagnosis of an aneurysm (versus vessel loop), then for sufficient preoperative documentation of its exact origin, configuration, and size. The same is true for arteriovenous malformations and irregular vascular stenoses. Such cases demand repeated injections and it is always a matter of chance whether the chosen angular views give an optimal presentation of the required detail. Angiotomography, magnification angiography, and, of course, subtraction technique are helpful. But these measures do not provide continuously changing projections of the region of interest as does our rotational technique. The superior diagnostic value of this

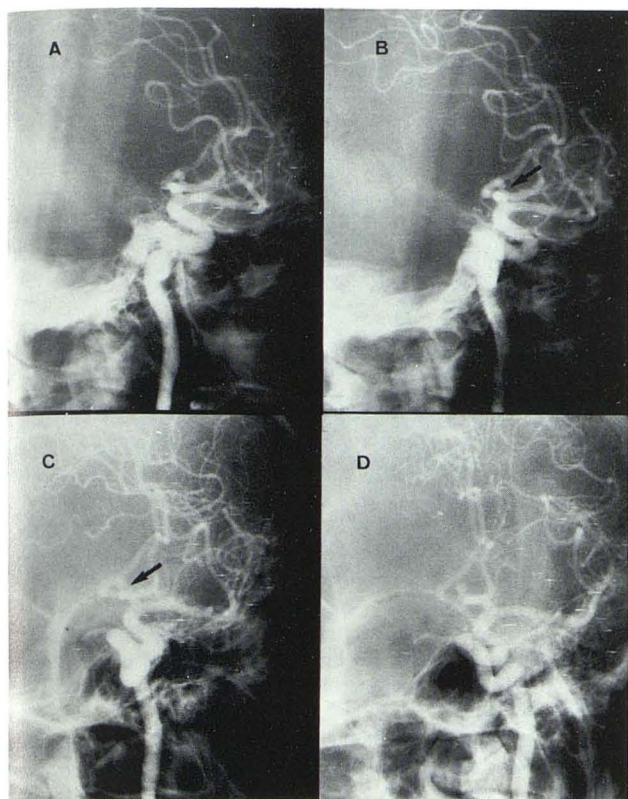


Fig. 4.—Rotation angiography of same patient as in fig. 3. Continuously changing projections from left lateral to right oblique view provide excellent visualization of pedicle and configuration of aneurysm (arrows).

rotation technique for routine cerebral angiography is only limited by a somewhat prolonged injection time and the impossibility of additional subtraction technique for the rotated films. Nevertheless, the advantages of having various oblique views with one injection

procedure are evident, and this technique should be used whenever standard projections provide only restricted information.

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