INTRACRANIAL ANEURYSM IN A FOUR-WEEK-OLD INFANT

DIAGNOSIS BY ANGIOGRAPHY AND SUCCESSFUL OPERATION

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Padget's\textsuperscript{13} description of the development of the cranial arteries in the human embryo leaves little doubt that congenital aneurysms developing in the very early age group are unresolved vestiges of a primitively normal circulatory system. The alternate hypothesis of aneurysmal formation of Forbus\textsuperscript{7} which ascribes the formation of aneurysms to persistent pressure against the weak point of bifurcation of an artery—where the media may be defective—may be applicable to the older age groups, but even in this category, most authors feel that the former theory applies.\textsuperscript{1,8,12,13}

Because of the probably embryonal origin of aneurysms of the cerebral arteries, it is surprising that a greater number are not manifest during childhood. Occasional papers have reported intracranial aneurysms in children\textsuperscript{8} and most large series of reported intracranial aneurysms usually include isolated instances from the younger age groups.\textsuperscript{3,9} The relative paucity of reported cases of intracranial aneurysms in infants probably stems from the somewhat altered clinical picture that aneurysms cause in infants as compared to adults, and secondly when the suspicion of aneurysm arises, cerebral angiography in patients under 1 month of age poses such a problem that the attempt at diagnosis is discouraged.

Cerebral angiography in infants necessitates exposure and catheterization of the major arteries in the neck. Opening the artery usually requires surgical repair, and, if very small, sometimes ligation. Thus when there are no neurologic lateralizing signs and bilateral carotid and sometimes vertebral arteriography is necessary, this becomes a formidable procedure; and if more than one major artery to the brain is sacrificed as the result of a diagnostic procedure, untoward results may occur.

The purpose of this paper is to report the case of a 4-week-old infant who had an intracranial aneurysm diagnosed by angiography and who has been successfully operated on.

In the past few years there have been numerous workers who have suggested visualization of the entire cerebral arterial tree by "flooding" the circulatory system with dye. This usually is done by retrograde methods, though simultaneous bilateral carotid arteriography has often been done. A method of "total" visualization of the cerebral arterial tree had been reported in the Scandinavian literature a number of years ago\textsuperscript{5} but it was only recently that this method, or modification of it, experienced popularity in this country.

Completely apart from the work done on cerebral angiography in the past years, much work has been done on aortography in infants in attempts to visualize abnormalities of the great vessels and heart.\textsuperscript{2,4,9-11,14,16} In reviewing these papers it was evident that at least a portion of the injected dye went up into the carotid arteries, but no special attention was paid to this portion of the dye except in cases of complication or death when it was felt that inordinate amounts of dye in the cerebral circulation had been the cause of these difficulties.\textsuperscript{2,17}

It was felt that by utilizing and modifying the procedures used for aortography in infants, adequate visualization of the cerebral vasculature could be obtained in those instances when injection of the individual carotid or vertebral arteries was difficult technically because of their small size.

The supraclavicular technique of thoracic aortography as outlined by Eiseman and Rainer\textsuperscript{4} was modified by one of us (E.W.S.). In the method of Eiseman and Rainer the dye is injected in the direction of flow of blood through the aortic arch for the purpose of avoiding regurgitation into the carotid arteries and back into the heart; therefore in an attempt to accomplish the reverse of this situation, the technique was changed from a right to a left supraclavicular approach with insertion of the needle into the arch of the aorta, pointing toward the heart.

The supraclavicular technique with direct injection into the aortic arch seems preferable to the brachial-artery method\textsuperscript{19} since the left carotid artery does not fill unless the entire arch is filled with dye. Percutaneous parasternal aortic punctures are more difficult technically and involve the risk of coronary perfusion.\textsuperscript{1}

The modification of the Eiseman and Rainer technique used on our patient consisted of insert-
The older the patient, and hence the more dense the skull, the greater the kv. requirement to penetrate the skull; this in turn would tend to "burn out" the extracranial portions of the film.

ing the needle above the left clavicle in the mid-clavicular line and directing it to the left and downward. The needle meets the apex of the aortic arch at its broadest point, enters the lumen opposite to the direction of the flow of blood and if advanced will traverse the lumen of the vessel and lie at the base of the ascending aorta. The needle crosses the apex of the left pleura but does not impale the lung. The obturator is kept in the needle to prevent pneumothorax. The patient is placed in a dorsal decubitus position with the head back. The dosage of dye used by most authors is 1 cc. of dye/kg. of weight. Generally about 10 cc. of dye is used in small children and 20 cc. in large children. We used 5 cc. of 50 per cent Hypaque in this patient. To intensify the concentration of dye in the brain, tourniquets were placed on both arms, and the abdominal aorta was compressed high in the abdomen at the time of injection. The patient was anesthetized with rectal anesthesia. The roentgen-ray tube was placed at an angle of 30° (in relation to the plane of the table) and the head was in hyperextension. The resultant roentgenogram was a basilar view of the skull with the superimposed circle of Willis and its entering and exiting arteries. The latter are seen for a distance of 1 to 2 inches from the circle (Fig. 1). This figure is retouched because our inexperience in this technique resulted in films of inferior quality—which though satisfactory for clinical interpretation—do not allow for satisfactory reduplication at the time of publication. Following the identification of the aneurysm, a craniotomy was done and the aneurysm was clipped.

CASE REPORT

L.M., a female, was born on Aug. 23, 1959, the second of two siblings. Delivery was normal. She weighed 5 lbs., 8 oz. The child was well until the morning of Sept. 11, 1959, when she suddenly started to cry. This continued for 1 hour despite attempts to comfort her. At the end of this time the patient had a grand mal convulsion with conjugate deviation of the eyes to the right side. The patient was seen by a pediatrician shortly thereafter and it was noted that she had a tense anterior fontanelle and nuchal rigidity. She was hospitalized in the local hospital on that same day and a lumbar puncture revealed grossly bloody cerebrospinal fluid which did not clear on drainage. Following the lumbar puncture the pupils became dilated and respirations were labored. A transfusion was started and a short time thereafter a ventricular tap was done. The ventricles were of normal size, under increased pressure, and with only slightly bloody cerebrospinal fluid.

The patient was transferred to another hospital on Sept. 18, 1959. Positive neurological findings were nuchal rigidity, slightly dilated pupils, retinal hemorrhages and stupor. Her weight was 6 lbs., 5 oz.

Angiography was done on Sept. 19, 1959. The aneurysm was identified (Fig. 1) and on Sept. 22, 1959 right frontoal craniotomy was carried out. The neck of the aneurysm was clipped (it arose from the middle cerebral artery). The operation was terminated without event.
The postoperative period was without complication. The patient left the hospital on Oct. 3, 1959 in a satisfactory condition; her weight was 7 lbs., 12 oz. Follow-up examinations indicate that she has continued to do well. There is no objective evidence of residual neurological abnormality.

DISCUSSION

To our knowledge, this 4-week-old infant is the youngest patient operated upon for an intracranial aneurysm. Because of the young age of the patient percutaneous carotid arteriography was not possible and thus some alternate method of filling the cerebral arterial tree was sought. By modifying angiographic techniques already developed it was possible to obtain satisfactory visualization of the entire cerebral arterial tree without injury to the patient. Having identified the site and type of pathology it was possible to attack the problem with dispatch.

SUMMARY

A relatively simple and safe method for visualizing the circle of Willis and its immediate entering and exiting arteries, when percutaneous carotid arteriography is difficult technically, is presented. This was used on a 4-week-old infant who had an intracranial aneurysm. The aneurysm was identified and operated upon successfully.

REFERENCES