Basal perforating artery aneurysm within the cavum septi pellucidi

Case report

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The authors describe the case of a 16-year-old boy presenting with clinical onset of subarachnoid hemorrhage. The patient was found to have a small aneurysm arising from the distal portion of a basal perforating branch of the anterior cerebral artery (ACA), lying within a cavum septi pellucidi. Neuroimaging demonstrated a hematoma within the cavum septi pellucidi and the aneurysm was resected via a transcallosal approach guided by an intraoperative portable digital subtraction angiography (DSA) system. The origin of the aneurysm was presumed to be idiopathic. This report is the first to describe an aneurysm of a basal perforating artery arising from the ACA that resulted in an intracaval hematoma. When approaching small vascular lesions during surgery, intraoperative DSA is the method of choice to identify the precise trajectory and distance to the lesions.

KEY WORDS • aneurysm • basal perforating artery • cavum septi pellucidi • digital subtraction angiography

A neurysms arising from small perforating arteries are rare and may be associated with infection, tumor embolus, moyamoya disease, granulomatous angiitis, meningovascular syphilis, or trauma. A hematoma in the cavum septi pellucidi, called a “caval–septal” hematoma, is also rare. We report the case of a 16-year-old boy in whom a spontaneous hematoma developed within the cavum septi pellucidi that was caused by a ruptured aneurysm arising from a distal portion of the basal perforating artery. Successful surgical management was accomplished in this case with the aid of intraoperative portable digital subtraction angiography (DSA). We have reported the usefulness of intraoperative portable DSA in planning strategies to treat intracranial disorders, and this method was helpful in exposing the aneurysm in this case.

Case Report

History. This 16-year-old boy experienced a sudden onset of severe headache associated with vomiting and was transferred to a community hospital emergency room. Computerized tomography (CT) scanning revealed an acute intraventricular hemorrhage with no subarachnoid clot. Cerebral angiography was performed immediately and it demonstrated an aneurysm arising from a basal perforating artery of the anterior cerebral artery (ACA) (Fig. 1). After receiving conservative care for 2 weeks, this patient was referred to our hospital for further diagnostic testing and treatment.

Examination. On admission, the patient was alert and complained of a slight headache with neck stiffness. His medical history was not significant for hypertension, infectious disease, heart disease, head injury, or intravenous drug use. The results of routine laboratory testing showed no abnormalities; specifically, there was no evidence of a hematological disorder or infectious processes. Chest x-ray films, electrocardiography, and echocardiography were also normal. Head CT scans obtained on admission revealed a hematoma within the cavum septi pellucidi with extension to the lateral ventricle. Two weeks later, magnetic resonance (MR) imaging showed a hematoma confined within the cavum septi pellucidi and the resolution of the intraventricular clot (Fig. 2). Cerebral angiography demonstrated an enlargement of the aneurysm in the midline (Fig. 3). On the basis of these findings, the aneurysm was presumed to be in the cavum septi pellucidi.

Operation. One week later, a frontoparietal paramedian craniotomy was performed guided by a portable DSA system. Our portable DSA system (Siremobile 2000; Siemens, Erlangen, Germany) provides real-time subtraction...
images on the monitor; those images are printed out using a videoprinter (UP930; Sony, Tokyo, Japan). After induction of general anesthesia in the patient, the common carotid artery was directly cannulated for angiography, and the patient's head was secured in a carbon headrest that allows imaging in all directions. This headrest allows rapid positioning of the surgical x-ray unit and reduces interruptions during the operation. Parafalcine exposure was attained in the midline, and dissection was continued to the level of the corpus callosum. A 15-mm-long incision was made in the callosum to gain entry into the cavum septi pellucidi. A saccular aneurysm 3 mm in diameter was embedded within the old hematoma in the cavum septi pellucidi. After cauterizing the parent artery, the aneurysm was excised. During these procedures, intraoperative portable DSA was performed several times to obtain a precise trajectory and a distance to the aneurysm (Fig. 4). After excision of the aneurysm, portable DSA confirmed the complete removal of the lesion. On histological examination, the lesion wall was found to have well-defined media and adventitia.

Postoperative Course. The patient’s postoperative course was uneventful, and he was discharged 12 days later with no neurological deficits.

Discussion

Intracranial aneurysms in pediatric and adolescent populations are rare, occurring at a frequency of approximately 0.5 to 4.6% in large aneurysm series. Patients younger than 18 years of age account for approximately 1 to 2% of cases of aneurysmal subarachnoid hemorrhage. Therefore, from a clinical perspective, it is important to emphasize that although they are rare, aneurysms do occur in the pediatric and adolescent population.

There have been several reports in which aneurysms arising from small perforating branches of the lenticulostriate, anterior choroidal, thalamostriate, and distal basilar arteries have been described. The basal perforating arteries are small branches that originate from the ACA. The medial group of the basal perforating arteries is composed of four to 10 thin arteries that supply the area of the foramen of Monro, anterior commissure, knee of the corpus callosum, fornix, and septum pellucidum. The aneurysm in this patient arose from one of the medial group vessels. Most cerebral aneurysms occur around the circle of Willis and are congenital or arteriosclerotic in origin when found in that location. Peripherally located aneurysms are rare and normally secondary to infection, tumor embolus, moyamoya disease, granulomatous angiitis, meningoovascular syphilis, or trauma. However, there was no historical or clinical evidence to support any of the aforementioned causes in this case. In addition, three idiopathic aneurysms have been reported within the ventricular system; aneurysms of the choroidal artery in a 27-year-old woman, of the lenticulostriate artery in a 23-year-old woman, and of the thalamostriate artery in a 65-year-old man. On histological examination, these aneurysms were found to have well-defined media and
adventitia, and the same pattern was found in our case. Although hypertension appears to be one of the obvious risk factors for the formation of intracranial aneurysms, none of these patients, including ours, had a known history of hypertension. Therefore, the origin of the aneurysm in our case was presumed to be idiopathic.

Cavum septi pellucidi is usually an incidental finding; failure of septal fusion leads to the formation of a cavum, which is found in 2 to 15% of adult brains. A hematoma in the cavum septi pellucidi, known as caval–septal hematoma, shown on CT scans has been described in cases of ruptured aneurysms arising from the anterior communicating artery. However, Schueler, et al., found that hematomas initially interpreted as lying within the cavum septi pellucidi were in fact located within the interhemispheric fissure. Because a normally formed septum contains no open space unless a cavum septi pellucidi is present, these authors presumed that midline destruction after massive hemorrhage from a ruptured aneurysm resulted in hematomas in this region. Therefore, this common finding almost always represents a hematoma in the anterior interhemispheric fissure, and a hematoma of cavum septi pellucidi is rare. Although a few reports on hypertension- or trauma-induced hematomas in this region have been published, to our knowledge, this is the first to describe a caval–septal hematoma caused by a ruptured aneurysm.

A number of authors have documented the advantages of the transcallosal approach to the ventricular system as opposed to transcortical avenues of entry. However, there has been some incidence of cortical deficit probably caused by the sacrifice or retraction of major parasagittal cortical veins in the region of the interhemispheric entry point. In addition, a major callosal incision could result in disconnection syndrome, including disorders of interhemispheric transfer of information. In this case, we used an intraoperative portable DSA system to guide us in making the most appropriate skin incision and craniotomy, thereby avoiding unnecessary injury to cortical veins and minimizing the length of the callosal incision. Although we expected to encounter difficulty in finding the lesion during surgery because the aneurysm was deep seated and very small, intraoperative DSA was useful in determining a precise trajectory and the distance to the aneurysm. Intraoperative cerebral angiography is recognized as an important method in planning surgical strategies in intracranial disorders, and intraoperative DSA is the method of choice when approaching small vascular lesions to minimize neurological sequelae postsurgery.

Fig. 3. Cerebral angiograms showing an enlargement of the aneurysm located in the midline (arrows).

Fig. 4. Intraoperative portable DSA system study showing the relationship between the retractor and the aneurysm.
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