

## Single hole cerebral arteriovenous fistula between the anterior choroidal artery and the basal vein of Rosenthal in a child

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### Abstract

**Purpose** The purpose of this study was to show the first reported case of a cerebral arteriovenous fistula (CAVF) from the anterior choroidal artery (AChoA) to the basal vein of Rosenthal in a Child.

**Case report** A 4-month-old male infant with no previous history presented a left thalamic intraparenchymal hemorrhage with secondary intraventricular spread and hydrocephalus. An external ventricular drainage was placed, and a digital subtracted angiography showed a left single hole CAVF. The left AChoA was the single arterial feeder directly connected to the ipsilateral basal vein of Rosenthal. After stabilization and good recovery, he was transferred to our institution for endovascular treatment. He was embolized using the arterial feeder with four Guglielmi detachable coils that produced complete exclusion of the fistula. The patient was discharged 10 days after the procedure without new neurological deficit.

**Conclusions** CAVFs are exceptional, with an incidence between 4.7% and 17% of all brain AVMs in large reported series. They can arise from any artery of the brain with a

great dominance at the supratentorial location. This is the first reported case of a CAVF from the AChoA draining to the basal vein of Rosenthal.

**Keywords** Arteriovenous fistula · Embolization · Children

### Introduction

Single hole cerebral arteriovenous fistulas (CAVFs) are defined as an abrupt brain vascular transition from the arterial feeder(s) to a draining vein, with immediate increase in vessel caliber and absence of a plexiform nidus as seen in the classic pial cerebral arteriovenous malformations (AVM) [1, 2]. CAVFs are unusual and account for approximately 4.7% to 17% of all intracranial AVMs [3, 4]. They present mostly in the early months of life and mainly in the supratentorial compartment [2]. They can arise from any artery of the brain and are usually associated with venous pouches of different sizes. We present, to our knowledge, the first CAVF from the anterior choroidal artery (AChoA) to the basal vein of Rosenthal.

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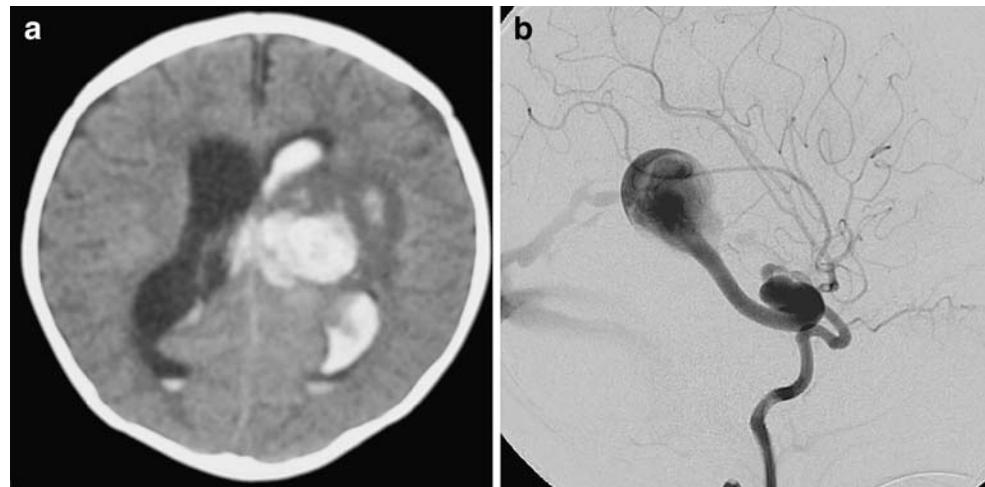
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### Case report

A 4-month-old infant with no previous history was admitted to his local hospital for chicken pox treatment. During hospitalization, he presented with generalized tonic-clonic seizures and decreased conscious status. Brain CT showed a left thalamic intraparenchymal hemorrhage with secondary intraventricular spread and hydrocephalus

**Fig. 1** **a** Non-enhanced head CT scan demonstrating deep left hematoma, with edema and intraventricular bleeding with mild hydrocephalus. **b** Digital subtracted angiography of the left internal carotid artery (lateral view) showing a single hole CAVF fed by the left AChoA connected to the ipsilateral basal vein of Rosenthal with a dilatation in the first portion. A large venous aneurysm is present on the most distal portion of the basal vein, and stenoses are found on the straight sinus



(Fig. 1a). An external ventricular drainage was placed, with good neurological recovery. Some days after, a digital subtracted angiography (DSA) was done showing a left single hole CAVF (Fig. 1b). The left AChoA was the single arterial feeder directly connected to the ipsilateral basal vein of Rosenthal. Stenoses, dilatations, and partial thrombosis were found on the venous drainage. Patient was medically treated, and a ventriculo-peritoneal drainage was placed. Two months later, he was transferred to our institution for treatment. At admission, he presented with a right hemiparesia (M4/5) with no other neurological symptoms.

Under general anesthesia and 4F femoral access, a new DSA of the left internal carotid and vertebral artery showed a significant decrease in the flow of the fistula with increased thrombosis of the distal venous pouch. A unique site of the fistula was confirmed at the AChoA draining directly to basal vein of Rosenthal (Fig. 2a).

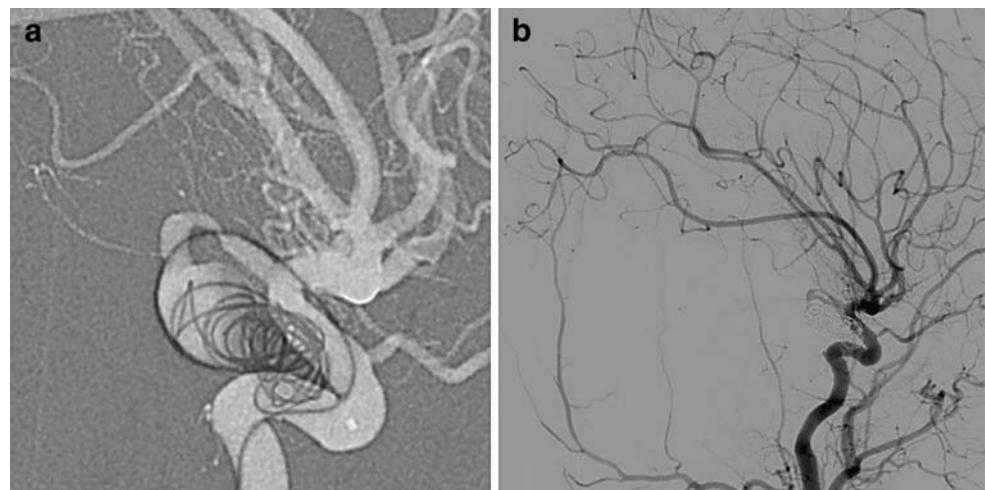
After catheterization with an Echelon 10 microcatheter, the proximal venous pouch was filled with four Guglielmi

detachable coils that produced complete exclusion of the fistula (Fig. 2b). Because complete exclusion of the fistula was achieved and because of concerns of reflux to the AChoA, territory complementary occlusion with glue was not considered. The patient was discharged 10 days after procedure without new neurological deficit.

## Discussion

CAVFs are exceptional, with an incidence between 4.7% and 17% of all brain AVMs in large reported series [3, 4]. Their diagnosis is usually done in the early age with a mean diagnostic age at 2 years old [3, 4]. They can present with surprisingly moderate symptoms compared to huge size of the venous pouches [2]. In newborns and infants, they can manifest with heart failure, enlarged head circumference, seizures, or hemorrhage [2, 5]. In children, they can manifest as hemorrhage (50%), seizure, neurological

**Fig. 2** **a** Digital roadmapping of the left internal carotid artery (lateral view) showing the single hole CAVF fed by the left AChoA with a mild stenosis. Coils are delivered inside the venous pouch at the origin of the basal vein of Rosenthal. **b** Digital subtracted angiography of the left internal carotid artery after treatment (lateral view) demonstrating occlusion of the shunt and absence of opacification of the venous drainage



deficit, headaches, and cardiac insufficiency being rare at this age [3]. They can be associated with hereditary hemorrhagic telangiectasias (26.8% in the series of Bicêtre Hospital) that increased as high as 50% in cases of multiple fistulas [2, 3]. In our case, the child presented with seizures and intraparenchymal and intraventricular hemorrhage. A venous stenosis at the straight sinus might have been the cause of venous hypertension and secondary bleeding as 2 months after the hemorrhage a partial thrombosis of the distal venous pouch and a significant decrease in the flux of the malformation was seen.

Spontaneous closure of these fistulas is infrequent but has been reported [6, 7]. Nevertheless, its unpredictability and low frequency render active treatment necessary as soon as possible after diagnostic because worst neurocognitive prognosis have been shown when the shunts were managed conservatively [8, 9]. Endovascular management has become the treatment of choice for CAVFs. The therapeutic goal is to close the single hole feeder or all the multiple feeders at the entry point to the vein (fistulous point) [2, 4]. Embolization materials have differed from balloon occlusion, coils, and glue (*N*-butyl cyanoacrylate (NBCA)) [5]. Probably, the preferred embolic material still remains to be the NBCA but coils can be used when the feeding artery is too short to prevent dangerous reflux to the normal vasculature. In our case, we decided to use coils because normal AChA branches or the carotid siphon were very close to the fistulous point and reflux with NBCA could have embolized into these normal arteries.

CAVs can arise from any artery of the brain with a great dominance at the supratentorial location (94.2% in the Bicêtre series) [1]. To our knowledge, a CAVF from the AChA to the basal vein of Rosenthal has not been described and this is the first reported case. When the fistulous site is closed and normal vessels are preserved, evolution and clinical response

is good [1, 2]. Our patient had no clinical deterioration and was discharged 10 days after treatment.

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