Successful surgical treatment of giant aneurysm of the basilar artery

Case report

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The authors describe a case of giant aneurysm of the basilar artery successfully treated by bilateral vertebral artery ligation at the sulcus arteriosus of the atlas.

KEY WORDS: giant aneurysm • ligation • occlusion • vertebral artery • basilar artery

Direct approach to giant aneurysms of the vertebral artery has been frustrated by the inclusion of major feeding arteries in the aneurysmal wall. Bilateral cervical vertebral ligation has been shown by Alexander to be feasible in his 12 cases of epilepsy. However, the existence of deep cervical collaterals to the vertebral arteries, and the lack of documented arterial pressure drop in unilateral vertebral ligation has discouraged unilateral cervical vertebral ligation. Direct unilateral intracranial vertebral clipping has been successful when the aneurysm has a dominant feeder and the nondominant side is sufficient to supply the basilar distribution. Basilar aneurysms with bilateral major vertebral supply have proved more difficult to treat. Bilateral vertebral clipping has been reported to have morbid and fatal consequences due to complete aneurysmal thrombosis and the occlusion of the important feeding vessels arising from the artery.

We are reporting a case of giant vertebrobasilar aneurysm and its successful surgical management. Carotid and vertebral collateralization proved sufficient and an extracranial to intracranial bypass was not required.

Case Report

This 5-year-old boy was admitted in a lethargic condition with a history of spontaneous onset of acute headache while conversing with a friend. There was no past history of trauma or infection.

Examination. The patient was lethargic, complained of severe headache, and had a stiff neck. The remainder of the general and neurological examination was normal. Plain x-ray films of the skull and neck were normal. Lumbar puncture revealed grossly bloody cerebrospinal fluid (CSF). He had a CSF hematocrit of 13. Within hours after the hospitalization he suddenly complained of another severe headache, and became unconscious with respiratory arrest, bilaterally dilated pupils, and loss of corneal responses. Resuscitative measures with intubation and
Giant basilar artery aneurysm

artificial respiration were carried out. An emergency twist-drill hole was made for insertion of closed ventricular drainage.

A computerized tomography scan showed hydrocephalus and a large iodine-enhanced globular lesion in the posterior fossa involving the brain stem. Four-vessel cerebral angiography demonstrated a large aneurysm arising at the junction of the basilar and vertebral arteries (Fig. 1). There was angiographic evidence of both vertebral arteries filling the aneurysm (Figs. 2 and 3); the right vertebral artery was the dominant contributor (Fig. 3). The right posterior inferior cerebellar artery (PICA) was not seen but an anterior inferior cerebellar artery (AICA) was visible. The left PICA was present. Both posterior cerebral arteries filled from both vertebral arteries. The carotid circulation demonstrated bilateral filling of the posterior communicating arteries (the left being diminutive) with visualization of the posterior cerebral arteries (Fig. 4).

Over the next 4 days of hospitalization, the patient gradually regained consciousness. By the sixth day after admission he was awake, oriented, and verbally appropriate. The pupils were normally reactive and there was a brisk corneal response bilaterally. On the sixth day he underwent placement of a right ventriculoperitoneal shunt. His recovery from this was uneventful.

Operation. Operation was performed on the ninth day after admission. With the patient in the sitting position, the vertebral arteries at the entrance to the dura were isolated on the sulcus arteriosus of the atlas. The right vertebral artery was then transiently occluded with bayonet forceps. There was no change of vital signs. The right vertebral artery was then ligated with heavy silk suture, and inhalation anesthesia to the patient was stopped. After 15 minutes, during which time the patient’s anesthesia was lightened, continuous monitoring of vital signs, pupillary reactivity, and corneal responses was undertaken. Temporary ligation was then placed across the left vertebral artery. After monitoring vital signs, and pupillary and corneal responses for 7 minutes, the temporary ligature was replaced with a silk ligature. Both vertebral arteries were then doubly ligated.

Postoperative Course. The patient had an uncomplicated postoperative course. He awoke from surgery without neurological deficit and has had no subsequent abnormal neurological signs or symptoms. The patient underwent vertebral and carotid arteriography 7 days postoperatively. Carotid arteriogram revealed retrograde filling of the superior basilar artery segment to the level of the aneurysm with good filling of the right AICA. Flow stopped abruptly at that point, indicating thrombosis of the aneurysm (Fig. 5). Left vertebral angiography (Fig. 6) showed filling of the left PICA via a collateral from the left vertebral artery, the exact nature of which remains obscure. Drake has known four other cases of such collateral filling of the PICA, although the exact mechanism has remained unknown.

Discussion

The ideal goal in treating giant aneurysms of the basilar artery is the obliteration of the
Fig. 2. Preoperative left vertebral injection, lateral projection. A large left posterior inferior cerebellar artery (PICA) is clearly shown arising proximal to the aneurysm. The right anterior inferior cerebellar artery fills from the basilar artery. Note the posterior displacement of the retromedullary portion of the PICA.

Fig. 3. Preoperative angiography, anteroposterior projection, of the left (left) and right (right) vertebral arteries.
Giant basilar artery aneurysm

Fig. 4. Preoperative angiography, lateral views.  *Left:* Left internal carotid injection.  *Right:* Right internal carotid injection.

Aneurysmal dilation while maintaining adequate perfusion to the vital structures. Along with the risk of hemorrhage and occlusion of nutrient vessels, these aneurysms often present with sufficient mass effect to cause related pressure phenomena. This patient developed severe obstructive hydrocephalus due to posterior fossa mass effect and exhibited subarachnoid hemorrhage due to ruptured aneurysm.

We selected sulcus arteriosus vertebral ligation because it afforded direct occlusion of the primary blood supply to the aneurysm while still allowing a secondary supply through the posterior communicating artery to fill the superior basilar segment. Sulcus arteriosus vertebral ligation also provides for high cervical collateral circulation directly to the basilar outflow segments (Fig. 6). In this case the single left PICA is supplied by left

Fig. 5. Postoperative angiography.  *Left:* Right internal carotid injection. There is good reflux of the basilar and right anterior inferior cerebellar artery but no evidence of the aneurysmal sac.  *Right:* Left internal carotid injection. There is reflux filling of the posterior cerebral arteries and joint filling of the basilar artery.
vertebral collateralization, probably via the spinal artery complex (Fig. 6).

Drake\(^4\) states that the safety and efficacy of vertebral artery ligation may depend on the patient’s age, and collateralization through the vertebral and carotid arteries. He has clearly demonstrated in his last series of cases that the presence of posterior communicating arteries of reasonable size is not sufficient evidence that the basilar artery can be occluded safely under general anesthesia, even without alteration of vital signs. Both posterior communicating arteries in our case were small in caliber, and that is why a temporary occlusion of the left vertebral artery at the sulcus arteriosus of the atlas after ligating the right vertebral artery and after discontinuing the anesthetic agents for quite some time under close monitoring of the patient was carried out before permanently ligating the left vertebral artery also.

The possibility of clipping the left vertebral artery distal to the origin of PICA was also considered, but since the origin of the PICA was not demonstrated in the arteriogram and since its origin could be incorporated at the origin of the aneurysm, we were prevented from doing so. The possibility of rupturing the aneurysm during such an attempt as in Drake’s Case 21\(^3\) also existed. In one of his cases, even after the PICA circulation was completely compromised, no neurological deficit secondary to it occurred postoperatively, most likely because the collaterals from the AICA adequately perfused the area supplied by the PICA.

The successful outcome of this case was due to the combination of youth (this being the youngest case recorded), adequate carotid-basilar connection, and vertebrospino-PICA communication.

References

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