A giant aneurysm was unexpectedly found on computed tomography angiogram in a 54-year-old female. Cerebral angiogram showed a giant aneurysm at the ventral side of the lower basilar artery trunk. However, it was difficult to demonstrate the precise relationship between the aneurysmal sac and the parent artery because of the incomplete filling of the contrast medium secondary to the preferential flows from a well-balanced development of both vertebral arteries. Three-dimensional (3D) fusion angiography revealed complete filling of the aneurysm as well as the basilar trunk itself beyond the aneurysm, which was dysplastic. Coiling of the aneurysm was safely and completely accomplished based on the fusion images. In this report, we demonstrate a case of giant basilar aneurysm with 3D fusion angiography proving useful in assisting with treatment planning.

**Index terms**
Aneurysm
Angiography
Embolization

**INTRODUCTION**

Conventional angiography is essential to assess intraluminal flow and define aneurysm neck and angio-architecture in treatment planning. However, when giant aneurysms are supplied by more than one parent artery, the precise relationship of the aneurysm to adjacent arterial structures might not be clearly demonstrated even with three-dimensional (3D) rotational angiography, because of the preferential flow to the giant aneurysmal sac (1). We present a case in which each rotational angiogram with 3D reconstruction of both parent arteries was fused with each other to guide the treatment strategy for a giant, partially calcified, lower basilar trunk aneurysm.

**CASE REPORT**

A 54-year-old female was referred to our neurointervention clinic for a giant aneurysm of the basilar top. The aneurysm had been previously detected during an evaluation for a lateral neck mass. The mass was resected and was ultimately proven to be a thoracic duct cyst. The patient reported no past medical history, except for hyperlipidemia. Neurologic examination and primary laboratory investigations were all within the normal limits. Contrast-enhanced computed tomography angiography revealed a 25-mm, partially calcified, intracranial aneurysm in the ventral aspect of the lower basilar trunk (Fig. 1A). Conventional and rotational angiograms obtained using digital biplane angiography with an AXI-OM Artis Zee apparatus (Siemens Medical Solution, Erlangen, Germany) showed the large basilar trunk aneurysm above the level of the anterior inferior cerebellar artery (AICA). However, the angiograms obtained from each vertebral artery showed incomplete filling in both of the aneurysmal sac and the basilar artery above the aneurysm because of the preferential flow from equally developed, balanced vertebral arteries on both sides.
were also uncertainties regarding the aneurysm neck and the angled basilar trunk due to the ventrally-located, giant aneurysm at the basilar artery. Moreover, it was difficult to define the precise relationship of the aneurysmal sac to the origin of the adjacent branches (Fig. 1B), which necessitated further study to develop a treatment plan. The main focus was to define the detailed angio-architecture of the aneurysm and the basilar artery, and to demonstrate the precise relationship of the origin of the AICA to the aneurysm neck. Fusion images were obtained using the VB21C fusion application software of a Syngo X Workplace apparatus (Siemens Medical Solution) to reconstruct the aneurysm and the adjacent segment of the vertebra-basilar system. The full dimension of the aneurysm sac and the basilar artery was demonstrated in 3D fusion images using different color coding according to the orientation of the vertebral artery (Fig. 1C). The origin of the right AICA arose just proximal to the aneurysmal sac on the right side (Fig. 1C). Based on the 3D fusion images, the giant aneurysm was safely treated with coil embolization using the double-catheter technique. Post-procedural angiography revealed dysplastic changes of the distal basilar artery (Fig. 1D), which might not be directly related to the giant aneurysm and were not clearly seen before coiling due to incomplete filling of the contrast agent to the basilar artery distal to the aneurysm. There was no adverse event during the peri-procedural period or after the procedure and a 3D time-of-flight magnetic resonance angiogram obtained 8 months following the procedure showed successful coiling of the basilar aneurysm.

DISCUSSION

A giant intracranial aneurysm is diagnosed when the aneurysmal sac is larger than 2.5 cm in size and represents approximately 5–8% of the intracranial aneurysm (2). A giant aneurysm at the top of the basilar trunk accounts for approximately 15% of all giant intracranial aneurysms and the vertebral artery accounts for approximately 5% of the lesions. Giant aneurysms notoriously remain one of the most difficult to treat intracranial vascular lesions, and can have a dramatic clinical presentation including subarachnoid hemorrhage (25%), intra-aneurysmal thrombosis, subsequent stroke and distant emboli (2–5%) and mass effects that include visual disturbance, cranial nerve dysfunction, seizure, headache and hemiparesis (2). Surgical management of giant aneurysms has been associated with a higher morbidity and mortality (20–30%) than those of smaller lesions (3) and no single technique is effective for treating all giant aneurysms. Current treatment options for these lesions include direct surgical techniques, endovascular techniques and combined approaches (2). Therefore, it is important to determine the precise angio-architecture as a treatment planning for every kind of the treatment modalities, especially for complex vascular lesions, such as giant
Aneurysms.

Attempts to classify giant aneurysms have included morphology and the location (4) and fourth-dimension magnetic resonance imaging to demonstrate the influence of lesion size and morphology on aneurysm hemodynamics (5). Our pre-procedural planning was feasible based on the 3D fusion images that revealed the detailed angio-architecture, especially the aneurysm and its major branch arising from the parent artery. We were able to clarify the origin of the AICA arising from the dorsally displaced, lower basilar trunk secondary to the giant aneurysm, which otherwise was not possible using only 3D rotational cerebral angiography. Additional roles of fusion images based on 3D rotational angiography could be to simultaneously determine the relationship between vascular and osseous structures, especially near the skull base, and to detect calcified tissue near the aneurysmal neck, neither of which is otherwise possible using only 3D rotational cerebral angiography (1, 6). Moreover, increasing attention is being given to the use of computational fluid dynamics to ascertain the association between some specific intra-aneurysmal hemodynamics that can increase the risk of aneurysmal rupture (7).

The 3D rotational angiography fusion technique has some limitations. First, considering the deterministic and random effects of the radiation, it is necessary to reduce the radiation dose in additional 3D rotational angiography scans. Second, an inherent limitation of the volume-rendering technique used in 3D fusion can be that it overestimates the aneurysmal neck size compared with two-dimensional digital subtraction angiography images (8). Last, the additional fusion imaging technique requires more processing time, although it cannot impede the subsequent procedure.

In conclusion, the fusion technique of 3D rotational angiography revealed the complete filling of a giant aneurysm near the confluent junction area of the lower basilar trunk, which was filling from both sides of the vertebral artery. Complete understanding of the angio-architecture of an aneurysm as well as the neck, including the relationship between the origin of the branching artery and the aneurysmal sac, assisted us in performing the neurointerventional procedure accurately and safely.

REFERENCES

기저동맥 거대동맥류 색전술을 위한 3차원 융합영상

이주연 · 서대철

54세 여자에서 뇌기저동맥 하부 복측에 2.5 cm 크기의 거대 뇌동맥류(giant aneurysm)가 확인되었으나, 양측이 비슷한 크기로 발달한 척추동맥에서 얻은 혈관조영상에서는 각 척추동맥에서의 선택적 험류흐름으로 인해 동맥류낭과 원위부 혈관이 완전 충만이 되지 않았다. 3차원 융합혈관조영술을 통해 기저동맥과 동맥류목 및 주위 혈관과의 관계, 동맥류와 원위부 뇌기저동맥과의 관계 등을 확인할 수 있었으며, 코일색전술을 성공적으로 시행하였고 6개월 임상추적검사에서 특기할 이상소견은 발견되지 않았다. 본 증례에서는 치료가 어려운 뇌혈관질환의 하나인 기저동맥의 거대동맥류에서 3차원 융합혈관조영술을 이용하여 정확히 혈관구조를 분석하여 성공적인 코일색전술을 할 수 있었다.

울산대학교 의과대학 서울아산병원 영상의학과