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Case Report

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A Case of Posterior Communicating Artery Aneurysm Accompanied with Infundibular Dilatation Mimicking a Double-Hump Aneurysm

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ABSTRACT

Posterior communicating artery (PComA) aneurysms are common cerebral aneurysms. In cases of PComA aneurysms accompanied by anatomical variations of PComA, such as hypoplasia, hyperplasia, or infundibular dilatation, it is challenging to completely determine the relationship between the parent artery, daughter arteries, and the aneurysmal neck preoperatively. We present a case of a ruptured PComA aneurysm originating from the PComA, accompanied by infundibular dilatation, which was preoperatively diagnosed as a double-hump PComA aneurysm with hypoplastic or absent PComA, based on computed tomography (CT) angiography images. This case emphasized that CT angiography does not always visualize the entire vasculature. A more meticulous dissection of the retrocarotid space should be performed to confirm the relationship between the parent artery, daughter arteries, and aneurysmal neck, especially when digital subtraction angiography is omitted, and clipping is planned for double-hump PComA aneurysms, wherein the PComA is not clearly depicted on preoperative CT angiography.

KEYWORDS: Aneurysm, Computed tomography angiography, Infundibular dilatation, Posterior communicating artery, Subarachnoid hemorrhage

ABBREVIATIONS: CT: Computed tomography, **DSA:** Digital subtraction angiography, **ICA:** Internal carotid artery, **PComA:** Posterior communicating artery, **SAH:** Subarachnoid hemorrhage

INTRODUCTION

Posterior communicating artery (PComA) aneurysms are common cerebral aneurysms (14). To prevent ischemic complications during PComA aneurysm treatment, it is vital to preserve the flow of the PComA and anterior choroidal artery. Among the arteries of the circle of Willis, the PComA has exhibited the most variations (9). In addition, infundibular dilatation of the cerebral arteries was most frequently observed at the origin of the PComA (4). The presence of these PComA variants complicates the diagnosis and management of PComA aneurysms. Therefore, the preoperative evaluation of the relationship between the PComA and the proximal neck of the PComA aneurysm is critical in treating PComA aneurysms without ischemic complications.

Digital subtraction computed tomography (CT) angiography is highly sensitive, specific, and accurate for detecting cerebral aneurysms (7,12). Due to its minimal invasiveness and reduced scan time, it has become the primary diagnostic tool for cerebral aneurysms. It has also been utilized for planning therapy, especially in acute subarachnoid hemorrhage (SAH) patients (7,12). In this endovascular era, digital subtraction angiography (DSA) has frequently been skipped when clipping is planned by the initial CT angiography, especially in patients with ruptured aneurysms. However, DSA remains the gold standard for evaluating cerebrovascular diseases, such as cerebral aneurysms (2).

We report a case of a ruptured PComA aneurysm, originating from PComA, accompanied by infundibular dilatation, which

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was preoperatively diagnosed as a double-hump PComA aneurysm with hypoplastic or absent PComA. This case highlighted that CT angiography did not always depict the entire vasculature. In addition, the retrocarotid space should be dissected meticulously to confirm the relationship between the proximal neck of the PComA aneurysm and PComA, especially when preoperative DSA is skipped and clipping is planned for double-hump PComA aneurysms with CT angiography alone.

CASE REPORT

A 69-year-old man with severe sudden-onset headache was admitted to our department. On admission, he was slightly confused, but he communicated coherently (Glasgow Coma Scale: E4V4M6, Hunt and Hess grade 2, World Federation of Neurological Societies grade 2). CT revealed diffuse SAH (Fisher group 3) (Figure 1A). Reconstructed CT angiography image demonstrated a double-hump aneurysm, measuring approximately 3 mm, in the supraclinoid internal carotid artery (ICA), proximal to the ICA bifurcation (Figure 1B). The origin of the PComA was not identified, even by digitally subtracted axial CT angiographic images (Figure 1C). Despite this, a small hump slightly distal to the aneurysm was likely the origin of the anterior choroidal artery. Therefore, the patient was diagnosed with SAH due to a ruptured double-hump PComA aneurysm with hypoplastic or aplastic PComA (Figure 1B). Neck clipping of the aneurysm was performed through the right pterional approach on day 1. After standard right frontotemporal craniotomy, the sylvian fissure was split, and the ICA, A1, and M1 were exposed. Although the proximal neck of the aneurysm was dissected and exposed, the PComA was not identified (Figure 2A). Meticulous dissection of the retrocarotid space revealed PComA. The part that was initially thought to be the proximal neck of the PComA aneurysm turned out to be the infundibular dilatation of the PComA (Figure 2B). The PComA coursed downward toward the skull base immediately after branching off from the ICA, and then, it coursed posteriorly. The rupture point of the aneurysm was also observed (Figure 2B). Based on these findings, the aneurysm was diagnosed as a PComA aneurysm, accompanied by infundibular dilatation of the PComA origin, rather than a double-hump PComA aneurysm. Neck clipping of the aneurysm was performed while preserving the PComA and it was confirmed by intraoperative indocyanine green videoangiography (Figure 2C and 2D). Postoperative CT angiography revealed PComA aneurysm obliteration and a preserved PComA (Figure 3). The postoperative course was uneventful, and the patient was discharged after 3 weeks without any neurologic deficits.

DISCUSSION

Although DSA is the gold standard for detecting intracranial aneurysms, CT angiography has become an alternative to DSA because of its minimal invasiveness, promptness, convenience, and high diagnostic accuracy, especially in patients with SAH. Since detecting aneurysms close to the skull base or adjacent to a bony structure is difficult with usual CT angiography (7), digital subtraction CT angiography, which provides a bone-free visualization of the intracranial aneurysms and has a higher diagnostic accuracy than the conventional CT angiography, has become the first choice

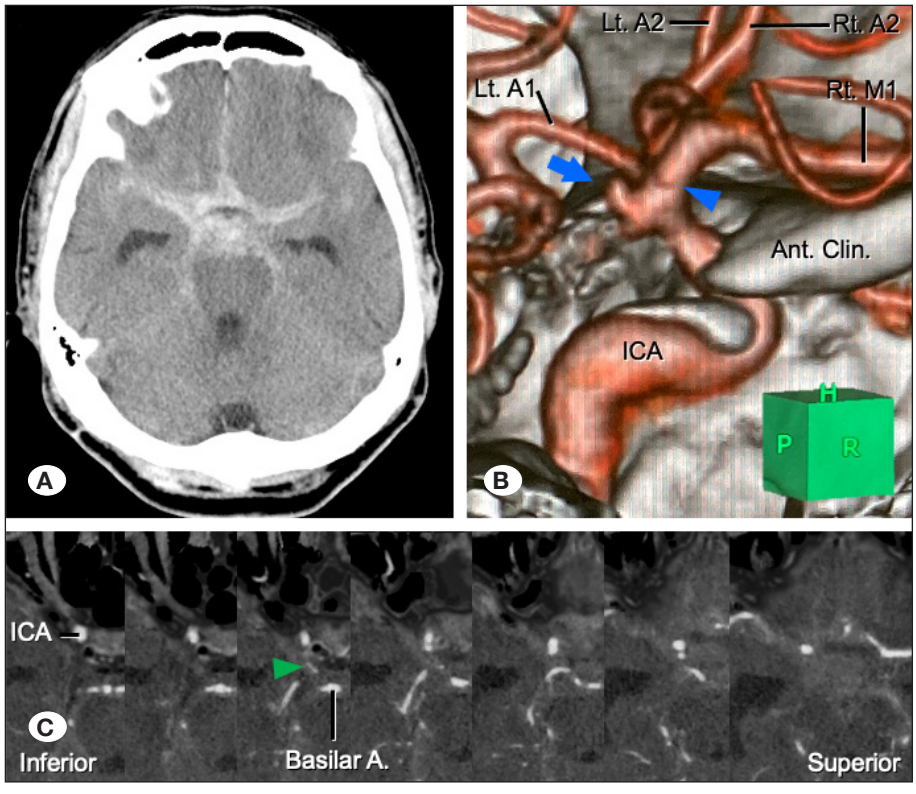

Figure 1: Preoperative neuroradiological examinations. **A)** Axial plane computed tomography (CT) image showing subarachnoid hemorrhage in the basal cistern and bilateral sylvian fissures, and mild hydrocephalus. **B)** Reconstructed CT angiography image shows a double-hump aneurysm originating from the posterior wall of the right ICA (blue arrow). Although the posterior communicating artery (PComA) was not identified, a diagnosis of PComA aneurysm was made because a small ridge that appeared to be the origin of the anterior choroidal artery was identified distally (blue arrowhead). **C)** The origin of the PComA is not clearly depicted on serial axial digital-subtracted CT angiographic images. Only approximately half of the vessels in the distal portion, which appeared to be PComA, were confirmed (green arrowhead). **A:** Artery; **Ant:** Anterior; **Clin:** Clinoid; **ICA:** Internal carotid artery; **Lt:** left; **Rt:** right.

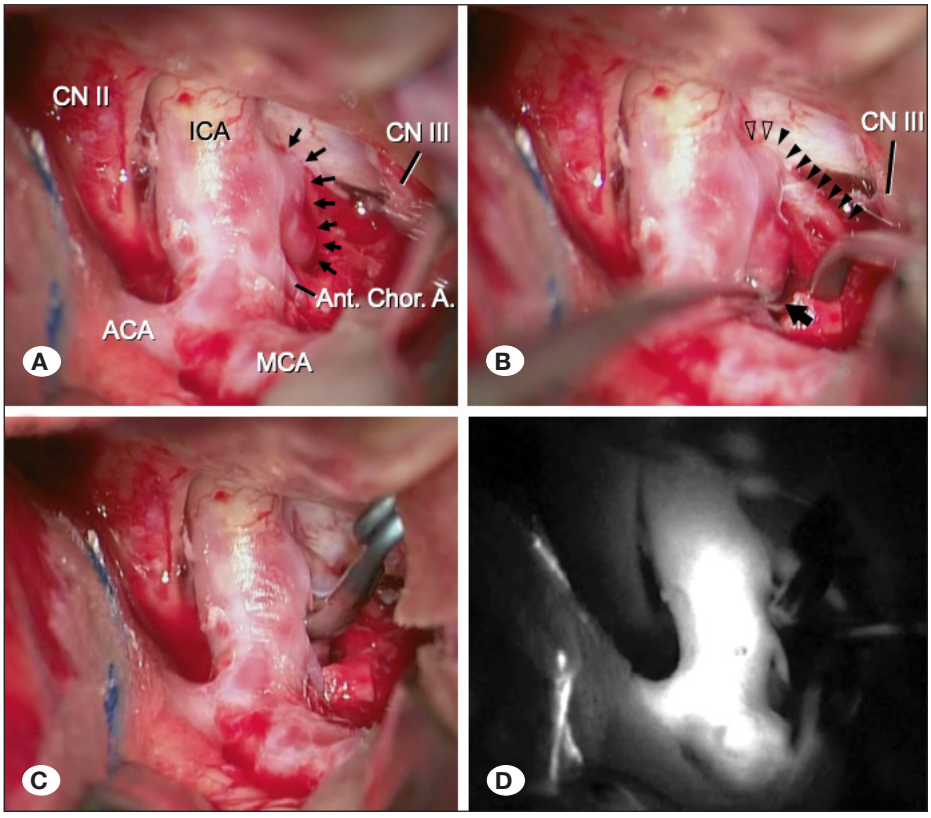

Figure 2: Intraoperative photos
A) After splitting the right sylvian fissure, a double-hump posterior communicating artery (PComA) aneurysm (black arrows) was visible. **B)** Meticulous dissection of the subarachnoid hemorrhage in the retrocarotid space exposes the PComA (open and closed black arrowheads). Its origin is accompanied by infundibular dilatation (open black arrowheads). We initially thought that the proximal neck of the aneurysm was an infundibular dilatation of the PComA. The rupture point of the aneurysm is also shown (black arrow).
C) The aneurysm is clipped with a curved clip while preserving the PComA.
D) Intraoperative indocyanine green video angiography shows complete obliteration of the aneurysm and preservation of the PComA and anterior choroidal artery flows. **A:** Artery; **Ant:** Anterior; **chor:** Choroidal; **CN:** Cranial nerve; **ICA:** Internal carotid artery; **MCA:** Middle cerebral artery.

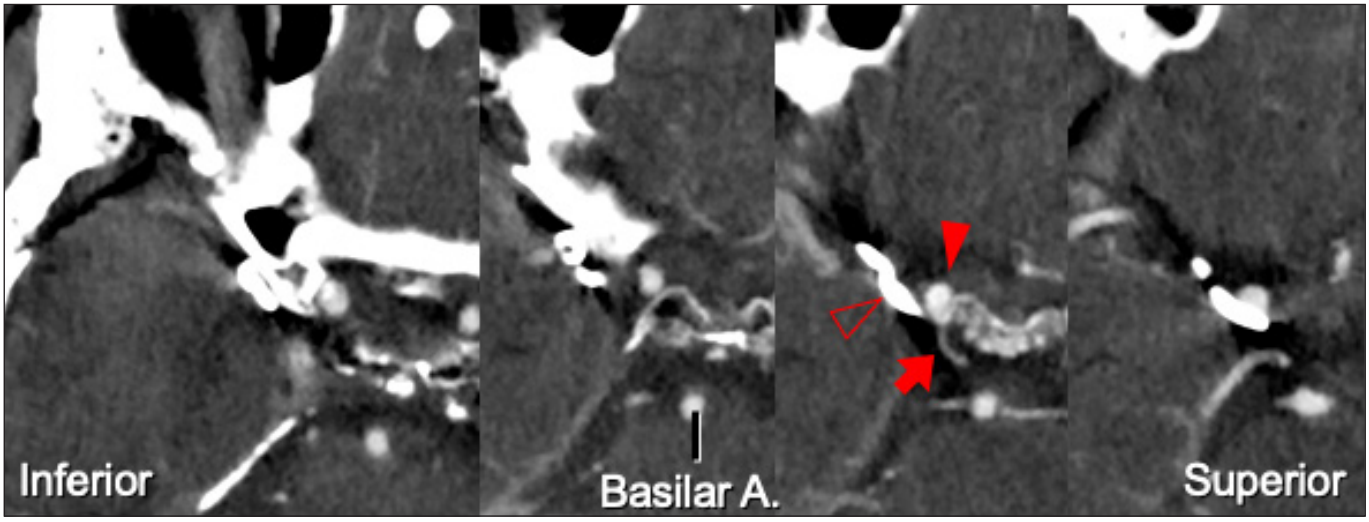

Figure 3: Postoperative serial computed tomography (CT) angiographical images. Complete obliteration of the posterior communicating artery (PComA) aneurysm while preserving the PComA is confirmed (**red arrow:** PComA, **open red arrowhead:** clip, **close red arrowhead:** internal carotid artery). **A:** Artery.

for detecting ruptured intracranial aneurysms and planning therapeutic interventions (3,7). In our institute, along with most other institutions, digital subtraction CT angiography is preferred for detecting intracranial aneurysms and planning therapeutic interventions for SAH patients. In the present case, the origin of the PComA was not depicted on digital subtraction CT angiography. Therefore, the initial diagnosis was a ruptured double-hump PComA aneurysm with PComA hypoplasia/aplasia, which was not uncommon (9). Intraoperatively, it turned out to be a PComA aneurysm, accompanied by infundibular dilatation of the PComA origin. Without meticulous dissection of the retrocarotid space, the PComA might have been compromised. This case highlighted that although CT angiography was a viable alternative to

conventional angiography, it did not always depict the entire vasculature. Postoperatively, the entire course of the PComA was identified on subtraction CT angiography. This was likely caused by the elevated intracranial pressure, the timing of the scan after contrast injection, or both. Due to its invasive nature, conventional angiography is not routinely performed for SAH patients. Preoperative DSA could have depicted the relationship between the PComA origin and the proximal neck of the PComA aneurysm.

To avoid ischemic complications during PComA aneurysm treatment, the PComA should be preserved. Approximately 6 to 8 perforators originate from the PComA and supply the hypothalamus, ventral thalamus, anterior third of the optic tract, posterior limb of the internal capsule, and subthalamic nucleus (5,11,15). Therefore, occlusion of the PComA can result in hazardous complications, such as hemiparesis, memory disturbance, and loss of consciousness (1,14). The largest branch is defined as the premammillary artery, which is also referred to as the anterior thalamoperforating or tuberothalamic artery (1,14). Some authors considered that hypoplastic PComA could be sacrificed without ischemic complications (8,10). Others have reported that the number of perforating branches from PComA remained constant regardless of its diameter (5,11,14). Since the Allcock test is an inadequate indicator of collateral flow after sacrificing the PComA, preserving the PComA is ideal (1). If PComA needs to be sacrificed, indocyanine green videoangiography helps avoid ischemic complications (6). As shown in this study, infundibular dilatation of the PComA, which is most frequently observed among arteries comprising the circle of Willis (13), made it difficult to understand the relationship between the proximal neck of the PComA aneurysm and PComA. To avoid postoperative ischemic complications after PComA aneurysm clipping, a complete comprehension of the relationship between PComA and the proximal neck of the PComA aneurysm before clipping is warranted.

Some young and less experienced neurosurgeons dissected only around the aneurysm neck and clipped due to apprehensions of intraoperative rupture. This can lead to severe complications. Accurately determining the relationship between the parent and daughter arteries and aneurysms prevents complications. In the endovascular era, preoperative DSA has frequently been skipped when clipping was planned by initial CT angiography, especially in patients with ruptured aneurysms. Knowing the limitations of preoperative imaging modalities and performing the appropriate dissection to expose the parent and daughter arteries as well as the aneurysm (including neck, dome, and rupture point) are essential for aneurysm surgery.

CONCLUSION

The PComA aneurysms, accompanied by anatomical PComA variants, make it difficult to completely comprehend the relationship between the parent artery, daughter arteries, and aneurysms. A meticulous dissection of the retrocarotid space should be performed to confirm the relationship between the proximal neck of the PComA aneurysm and PComA, especially when clipping was planned for the double-hump PComA aneurysms with CT angiography.

AUTHORSHIP CONTRIBUTION

Study conception and design: SM

Data collection: SM, SY

Analysis and interpretation of results: SM, SY

Draft manuscript preparation: SM

Critical revision of the article: KM

All authors (SM, SY, KM) reviewed the results and approved the final version of the manuscript.

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