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A 10mm Posterior Inferior Cerebellar Artery (PICA) Aneurysm Missed on DSA: Case Report

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A 10mm Posterior Inferior Cerebellar Artery (PICA) Aneurysm Missed on DSA: Case Report

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Objective: We present an unusual case in which the gold standard technique of Digital Subtraction Angiography (DSA) failed to reveal a left Posterior Inferior Cerebellar Artery (PICA) aneurysm after previous detection on 64-slice Computed Tomography Angiography.

Clinical Presentation: A 74-year old female presented with symptoms of a subarachnoid hemorrhage. An initial CT was performed which confirmed the diagnosis by depicting extravasation of contrast into the subarachnoid space. Follow-up computed tomography angiography (CTA) was performed to screen for possible presence of aneurysms. A 10mm fusiform-shaped aneurysm was observed in the middle portion of the left PICA. Subsequent DSA failed to reveal the same aneurysm with the standard procedural protocol. We were then only able to locate the aneurysm with selective advancement of the catheter closer to the site of the aneurysm.

Intervention: With the combined information from both studies, endovascular treatment with surgical glue (Onyx HD 500) was performed to embolize the aneurysmal sac. The procedure was completed without any complications and follow-up angiography revealed no contrast enhancement within the previously described aneurysm, suggestive of successful embolization.

Clinical Opinion: Pathophysiological factors such as rapid flow, presence of a thrombus, vessel dissection, or pseudoaneurysm may lead to omission of obvious aneurysms on DSA. In such cases CTA plays a crucial role in detecting these aneurysms due to the increased time of contrast distribution within the arterial system.

INTRODUCTION

Aneurysms can typically arise from a multitude of physiological and anatomical pathologies such as hypertension, trauma, atherosclerosis, hereditary predispositions, and turbulent blood flow at arterial junctions. Despite increasing innovations in diagnostic techniques, non-traumatic subarachnoid hemorrhages, although rare with an incidence of 6-8 per 100,000 individuals, have remained among the most serious causes of death with a mortality rate of 50% and a significant morbidity among the survivors.[1,2] Approximately 2.8% of intracranial aneurysms occur in the Posterior Inferior Cerebellar Artery.[3]

Currently, computed tomography angiography (CTA) is used as a screening technique due to its relatively noninvasive nature and wide availability in the acute setting. Furthermore, it can be performed immediately after the initial CT scan to provide rapid diagnosis and assist in treatment planning.[4] However, the current gold standard among institutions for the detection of intracranial aneurysms is digital subtraction angiography (DSA) because of its significantly higher sensitivity and specificity for diagnostic detection of vascular malformations in comparison to other imaging modalities. The mean size of missed aneurysms by DSA in a study involving 350 patients was 1.94mm (median, 2; range, 0.5-4mm).[5] In the presented case, the patient's aneurysm was nearly five times the magnitude of the average missed aneurysm by DSA. The focus of this paper is to examine the possible causes and/or reasons behind the failure of DSA to detect a 10mm fusiform aneurysm. Existing literature does not document missed aneurysms of such size on DSA, though microaneurysms can be missed and are commonly documented. Our purpose is to propose several possible mechanisms for why an aneurysm of such magnitude might be missed.

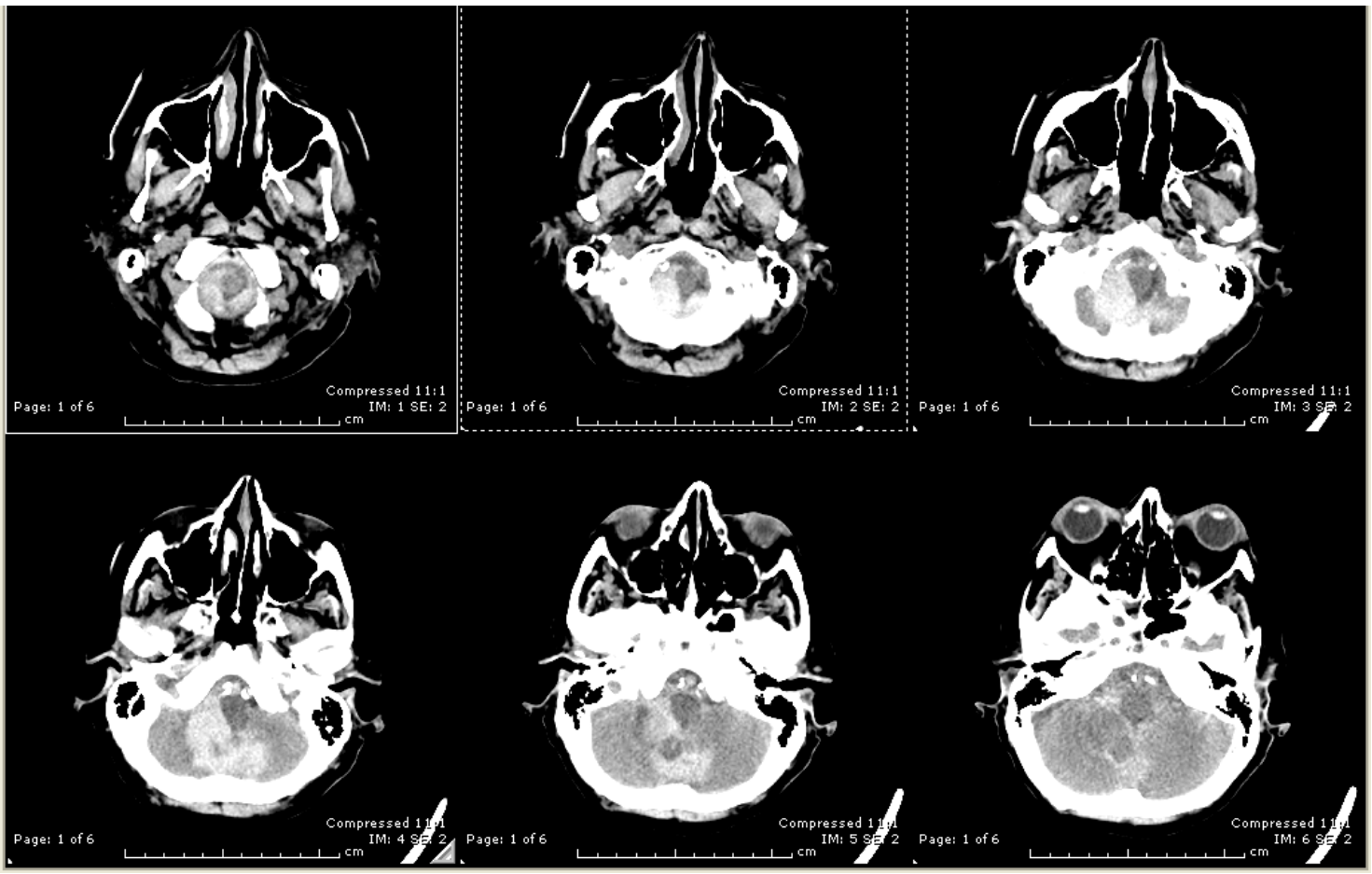

Figure 1. Non-contrast CT Showing Subarachnoid Hemorrhage

CLINICAL PRESENTATION

A 74-year-old right-handed female was transferred from an outside hospital after awakening and complaining of a severe headache before vomiting once and rapidly becoming unconscious. Her past medical history was significant for atrial fibrillation and hypertension. Her social history revealed that she was an ex-smoker. On physical exam her blood pressure was 95/60, pulse 86, and respiratory rate 22. A neurological exam was performed, which revealed absent eye opening with sluggish, 2mm pupils bilaterally. The patient displayed withdrawal to pain of all four extremities. The patient's clinical presentation suggested a pathological localization on the left side.

DISCUSSION

DSA is commonly a reliable means to detect intracranial aneurysms, and it is virtually undocumented to miss aneurysms of the magnitude observed in this case. With such a unique case, there are many questions that remain unanswered. Although there are cases of missed aneurysms reported in a number of studies, these studies did not attempt to analyze the data in a way that acknowledges the discrepancies.[5] The importance of understanding the etiology of missed aneurysms could provide additional information in selecting appropriate diagnostic techniques for particular situations, thus improving patient outcomes.

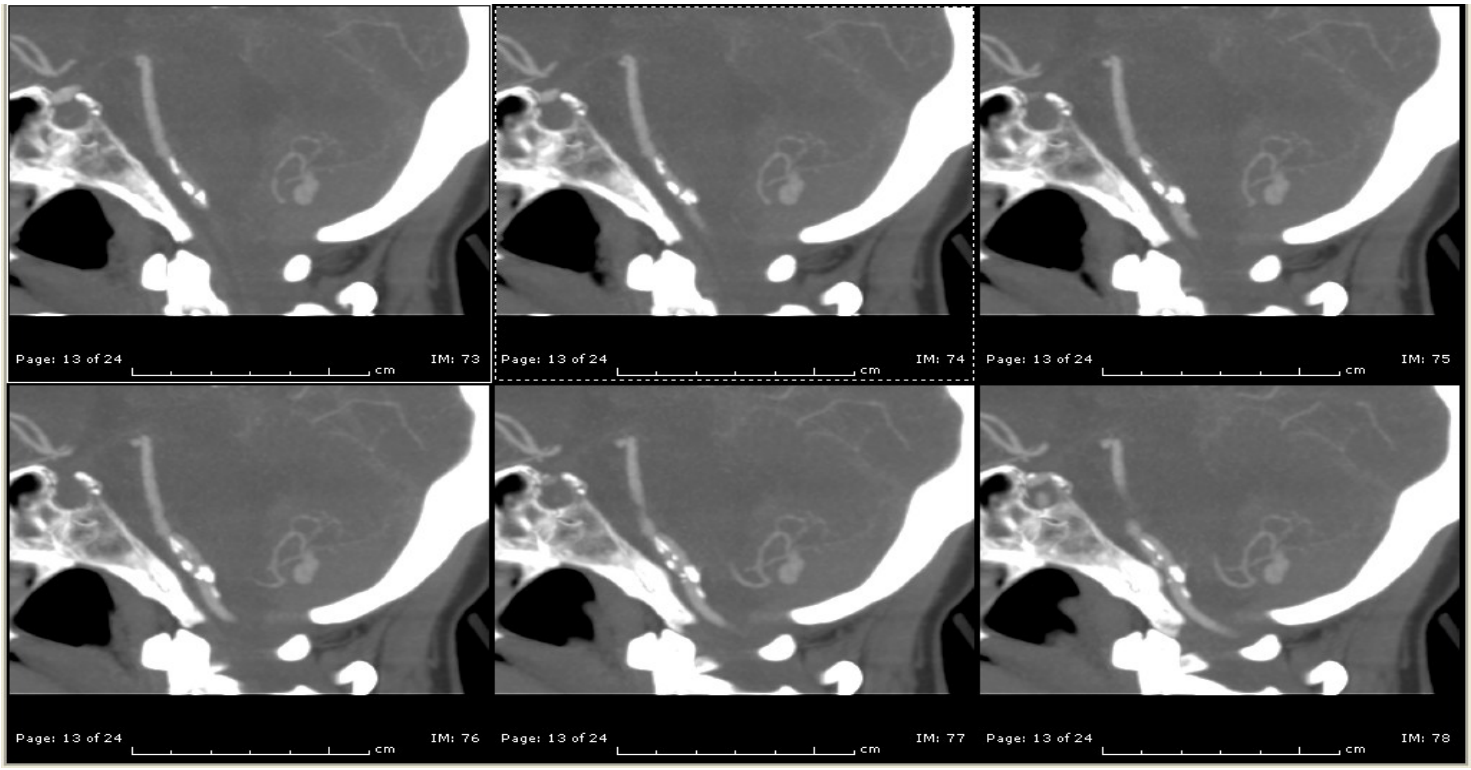

Figure 2. CTA Displaying 10mm Fusiform Aneurysm of the Left Posterior Inferior Cerebellar Artery.

There is much debate regarding the potential for CTA to supersede DSA in the near future as the primary diagnostic tool for intracranial aneurysm assessment.[6] From our experience, we believe that CTA and DSA are complementary imaging modalities as they provide different aspects of the same vascular anatomy. While the sole use of DSA will hold greater clinical value in determining flow dynamics, CTA is superior at providing valuable anatomic detail due to its ability to display parent and vessel relationships that occur at the neck of an aneurysm.[7] Furthermore, CTA is superior at defining the morphology of aneurysms, which is very valuable for surgeons in preparing to embolize the pathologic vessels. Regardless of which study is superior, it is notable that an aneurysm of such magnitude was missed on DSA. Though no current literature on the subject exists, we hypothesize several mechanisms that may account for the failure of DSA in detecting intracranial aneurysms.

Dissection: Though notably rare, a dissecting aneurysm could have led to the negative findings on DSA in this particular case. Hypertension is the most common risk factor that predisposes an individual to developing a dissecting aneurysm.[8] Hypertensive patients show degenerative changes and loss of smooth muscle cells in the lamina media that is suggestive of mechanical injury to the vessel's integrity.[9] Given the patient's age and history of hypertension, it would not be uncommon to observe vessel damage and moderate to significant atherosclerosis. If a dissection were to be present in the PICA, this lesion may weaken the integrity of the vessel wall and cause a fusiform aneurysm. Such a lesion may be missed upon DSA if contrast did not have enough time to fill the volume of the dissection. Furthermore, CTA was able to clearly identify this aneurysm due to the slower rate of the study which allowed for more filling time.

Pseudoaneurysm: Another rare occurrence in vessels is the pseudoaneurysm, or false aneurysm. These malformations involve the development of a tiny hole in

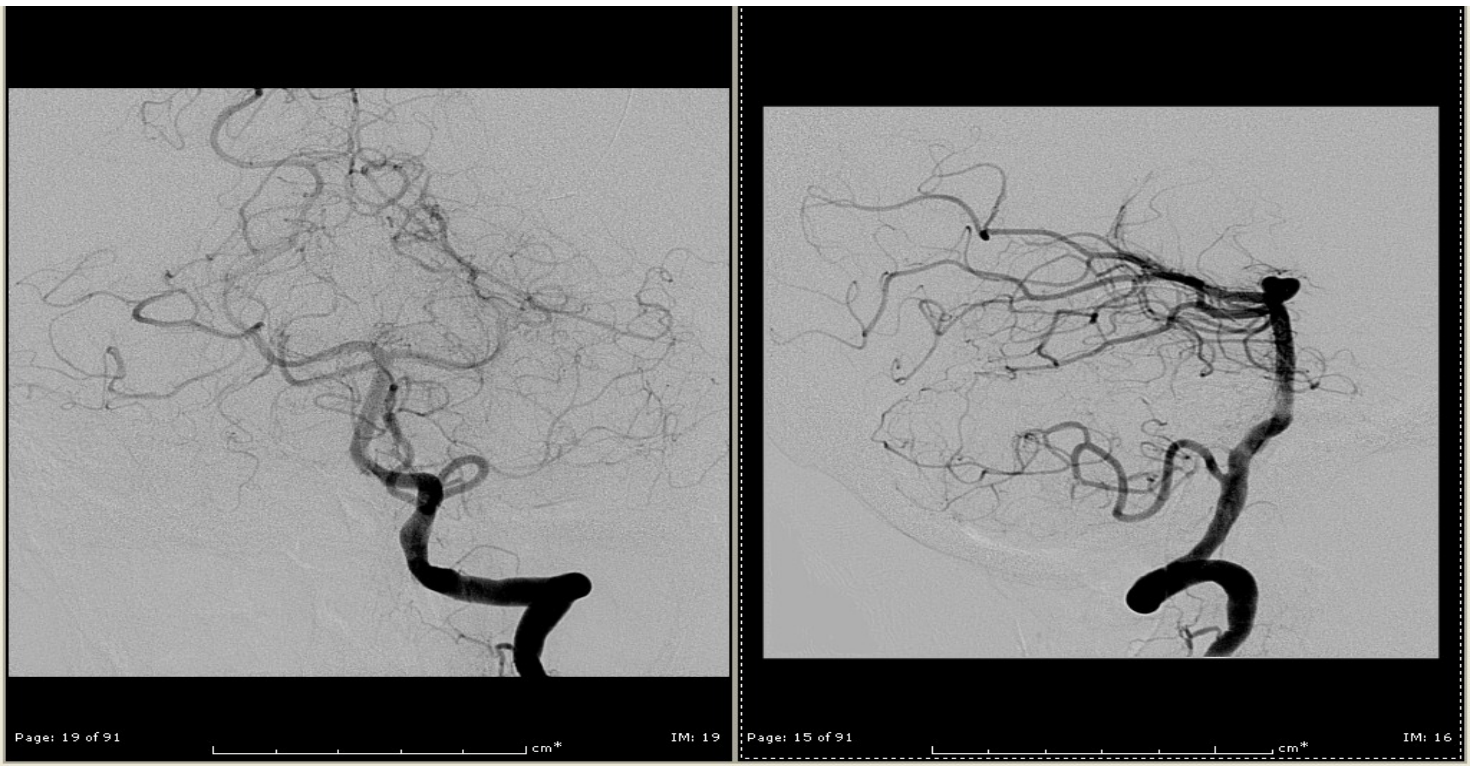

Figure 3. DSA with contrast in the left vertebral depicts no obvious aneurysm in the Posterior Inferior Cerebellar Artery.

the vessel wall, which leads to extravasation of blood outside of the 3-layers of the vessel.[10] The fibrotic reaction, which takes place over time when the blood contacts the extravascular space, maintains communication with the artery and allows for blood to circulate. In a similar fashion to dissections, contrast might not have had enough time to fill the pseudoaneurysm and thus could be a reason for its omission on DSA.

Rapid Flow: In this scenario, a true aneurysm involving all three vessel layers could be missed on DSA due to rapid flow through the arterial system, which would lead to inadequate filling of the aneurysmal sac and therefore negative findings upon DSA.[11] Although the size of our patient's aneurysm makes this scenario unlikely, this nonetheless remains a possible cause for missed aneurysms on DSA.

Thrombosis: Partial intra-aneurysmal thrombosis in the fusiform dilation could potentially be visualized as a patent lumen in DSA.[12] This new "pseudo-lumen" would show on CTA because it is better at visualizing anatomical details of the vessel as opposed to flow.

Other Possibilities: In addition to the previously mentioned hypotheses, there are a few other possible causes that are less frequently observed, yet require consideration when compiling a comprehensive list of possible contributing mechanisms for the failure of DSA to detect an intracranial aneurysm. These other considerations include superimposed normal vasculature overlying the aneurysm, which may lead to a false negative by showing normal vasculature on DSA due to the overlap.[13] CTA, on the other hand, allows for visualization of the vasculature at more obscure angles, which may aid in detecting aneurysms that may have surrounding vasculature, or overlying vessels.[13] Another mechanism would include focal arterial spasms that could obliterate the aneurysmal neck, leading to impeded contrast flow into the aneurysm. With decreased contrast flow into the aneurysm, visualization of the aneurysm would be insufficient.

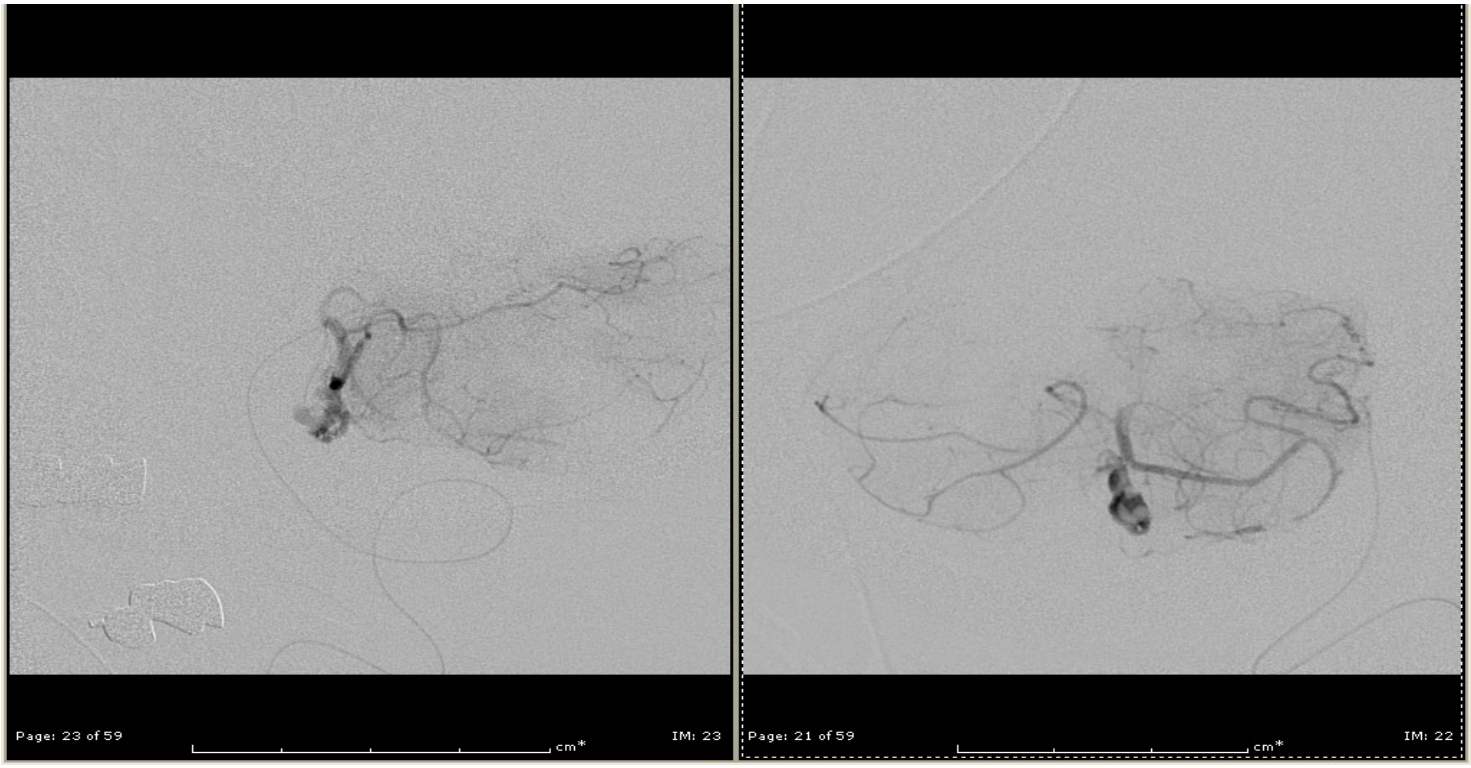

Figure 4. Selective enhancement of the left PICA with catheter enhancement directly into the Posterior Inferior Cerebellar Artery.

Clinical Opinion:

Despite the fact that it is rare to miss an aneurysm of the size mentioned here with the use of DSA, an examination of the possible mechanisms behind the failure of DSA in this particular case can help compile a comprehensive set of factors that may contribute to an understanding of this phenomenon. An extensive literature search revealed a lack of data and discussion surrounding the possible mechanistic causes in the rare cases in which DSA failed to properly identify aneurysms that were detected upon adjunctive imaging modalities. By providing a detailed discussion that highlights a number of limitations associated with the use of DSA, we hope to provide a concise reference source that proposes a number of mechanisms that may explain these findings. We propose that pathophysiological factors such as rapid flow, presence of a thrombus, vessel dissection, focal arterial spasm, superimposed normal vessels, or pseudoaneurysm may lead to omission of obvious aneurysms on DSA. In such cases CTA plays a crucial role in detecting these aneurysms due to the increased time of contrast distribution within the arterial system. Although the adjunctive use of CTA and DSA is a commonly accepted practice, this case report not only provides an important application of the two imaging modalities, but also offers a concise compilation of the possible physiological factors that may affect aneurysm detection on our current gold standard, DSA.

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Figure 5. Post Operative intervention with surgical glue, showing successful embolization of the aneurysm.

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