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Missed cervicocephalic dissections and the role of digital subtraction angiography and MRA with vessel wall imaging

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Abstract

Non-traumatic arterial dissection exhibits a propensity for the Asian population and predominantly affects the posterior circulation. Regrettably, during the initial fortnight prior to diagnosis, approximately one in thirty cervicocephalic artery dissections (CAD) are misdiagnosed. Overlooked CAD, more prevalent in the younger demographic, can result in severe complications such as ischemic stroke, subarachnoid hemorrhage, and possibly death. Comprehensive investigations are necessary to prevent overlooking such a diagnosis. Digital subtraction angiography (DSA) is universally acknowledged as the most efficacious technique for assessing luminal morphology and hemodynamics, but may miss the vessel wall characteristics, an important component for diagnosing dissection. Magnetic resonance angiography (MRA), conversely, is less invasive and can assess vessel wall properties. A high-resolution MRA with vascular wall imaging can efficiently identify conditions such as intimal flaps, double-lumen signs, intramural hematomas, mural thrombi, and pseudoaneurysms, aiding in the evaluation of suspected CAD. MRA with vascular wall imaging and DSA complement each other in the identification and characterization of cerebral artery dissections, both contributing to treatment. In cases of undefined stroke etiology, particularly among the young demographic, utilizing both tests (when one yields no significant findings) may assist in detecting overlooked instances of CAD. The prompt identification and treatment of CAD are essential, particularly for surgical intervention and to avert recurrence in predisposed patients. Identifying the etiology of a stroke or transient ischemic attack is important for providing precise therapy and preventing recurrence.

Keywords

magnetic resonance angiography, cervicocephalic artery dissections, digital subtraction angiography

Introduction

One of the stroke etiologies with a high possibility of a miss is cervicocephalic artery dissection (CAD). The incidence of traumatic dissection (mostly extracranial) is up to 0.86% and 0.53% for the internal carotid artery and vertebral artery, respectively, while the incidence of traumatic intracranial artery dissection is not well reported [1]. In case of non-traumatic artery dissection, the intracranial artery dissection has a predilection for the Asian population and the posterior circulation [1]. In the initial two weeks before diagnosis, approximately one out of thirty CAD received a misdiagnosis [2].

Presentation of the case and discussion

A 39-year-old woman presented to the emergency room with an acute onset of left-sided neck pain with radiation to the back of the scalp and left upper limb that started after she had a minor neck trauma. She had no neurodeficit, was diagnosed to have cervical radiculopathy, and no imaging was performed. The patient was sent back home with a neuropathic pain-relieving agent after the acute pain was relieved. However, she returned two days later with an acute stroke, bilateral ophthalmoplegia, quadriparesis, and a National Institutes of Health Stroke Scale (NIHSS) score of 24. Vertebral arterial dissection was obvious in CT angiography, along with a basilar thrombus. An emergent endovascular treatment was performed, and the clot was retrieved within half an hour of her acute stroke presentation. However, she had no improvement, and an MRI of the brain revealed a pontine infarct. She has remained in the locked-in state since then (was followed up for nine months after the second admission). The first presentation in our case was most likely the warning sign, and even though a patient has no neurodeficit, vascular imaging is warranted even if we have the slightest doubt of a vascular insult, especially in a young person with recent trauma.

Missed CAD may lead to serious complications like ischemic stroke, subarachnoid hemorrhage (SAH), and potentially death. So, timely diagnosis and treatment are crucial, especially surgical intervention. The reasons behind missing the cases of dissections are as follows:

1. It is often accompanied by nonspecific symptoms of headache, neck pain, dizziness, and tinnitus without localizing signs. In patients with trauma, coexisting injuries, particularly head injuries, may mask the signs of dissection, making it difficult to diagnose.
2. Clinically significant symptoms of the dissection may not surface immediately after the injury but can be prominent a few hours to months later. This delayed onset can lead to a missed diagnosis during initial evaluation. Many a time, patients may have subtle symptoms.
3. Cerebral dissections, while a significant cause of stroke in young people, are not common, and clinicians may not initially consider them as a cause of a patient's symptoms.
4. Finally, while the standard imaging modalities are used to diagnose dissections, the presence of an intimal flap, double lumen, or dissecting aneurysm can be difficult to detect in some cases.

In fact, a dissecting aneurysm may occur months to years later.

Dissections have a significant risk of recurrence rate (estimated at 0% to 25%), especially in susceptible individuals like patients with collagen vascular diseases or connective tissue disorders [3].

Hence, if we do not find a definite stroke etiology, detailed imaging to rule out intracranial or extracranial dissection should be carried out.

In diagnosing and evaluating arterial dissections, both digital subtraction angiography (DSA) and magnetic resonance angiography (MRA) with vessel wall imaging offer valuable information, but they each have distinct advantages and limitations. DSA is widely recognized as the most effective method for observing luminal morphology and hemodynamics, particularly in medium and small vessels. However, abnormal vessel wall pathology may be missed when the luminal display appears normal (the dissection is limited to the vessel wall), and we cannot rely on changes in luminal lesions to get an accurate idea of the treatment efficacy and the progression of CAD. MRA, on the other hand, is less invasive and can evaluate

vessel wall characteristics. It is much more efficient in detecting internal carotid and vertebral artery dissections. The high-resolution MRA with vessel wall imaging can effectively find issues like intimal flaps, double-lumen signs, intramural hematoma, mural thrombi, and pseudoaneurysms, which help in assessing suspected CAD. However, the MRA presents certain limitations, such as its inability to accurately visualize small vessels, its tendency to misinterpret irregular shapes, and its difficulty in visualizing calcified vessel walls and stent placement, all of which are crucial for diagnosing and managing dissections [4]. We require a 3T MRI machine with absolute technical accuracy to get the best possible images. If the procedure is not carried out properly, MRA is susceptible to motion artifacts, slow-flow artifacts, and free-induction decay artifacts, compromising the diagnostic accuracy [4]. Arterial dissection is responsible for about 5% of SAH cases, not only in the case of intracranial dissections but also when an extracranial dissection expands to the intradural portion. While ruptured aneurysms account for the majority (85%) of SAH cases, dissections, particularly those in the posterior circulation, are a significant, though less common cause. Thus, MRA with vessel wall imaging and DSA are complementary to each other in identifying and characterizing cerebral arterial dissections, and both can contribute to treatment. When we do not find a definite stroke etiology, applying both these tests (when one is non-contributory) may be helpful in identifying the missed cases of CAD. In the same way, using MRA with vessel wall imaging can help find missed dissections as the cause in cases of non-aneurysmal and non-traumatic SAH when DSA does not provide useful information [5].

If we initially miss the dissection, patients may return with catastrophic stroke recurrence. This can either be a prolonged complication from the initial dissection, such as recurrent bleeding, ischemic stroke, aneurysm formation, or fresh new events.

In fact, detecting the etiology of a stroke or transient ischemic attack is important not only for providing accurate management but also for preventing recurrence. This will prevent the unnecessary exposure of patients to inappropriate antithrombotics and their complications, particularly in susceptible individuals who may mistakenly believe that the treatment is effective while the underlying issue remains unaddressed.

Conclusions

The importance of utilizing both DSA and MRA with vessel wall imaging is to improve the detection of CADs. However, we have to acknowledge several limitations and technical challenges associated with these methods. The practical challenges of cost-effectiveness and accessibility may also impact the feasibility of implementing these approaches in real-world clinical settings. Finally, the high rate of missed diagnosis and the risk of recurrence further highlight the need for continued research and improvement in the diagnostic and management approaches for CAD.

Abbreviations

CAD: cervicocephalic artery dissection

DSA: digital subtraction angiography

MRA: magnetic resonance angiography

SAH: subarachnoid hemorrhage

Declarations

Author contributions

DC: Conceptualization, Investigation, Writing—original draft, Writing—review & editing, Validation. The author read and approved the submitted version.

Conflicts of interest

The author declares that there are no conflicts of interest.

Ethical approval

According to the policy of the institution, ethics approval was not required.

Consent to participate

Informed consent to participate in the study was obtained from the patient.

Consent to publication

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Availability of data and materials

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