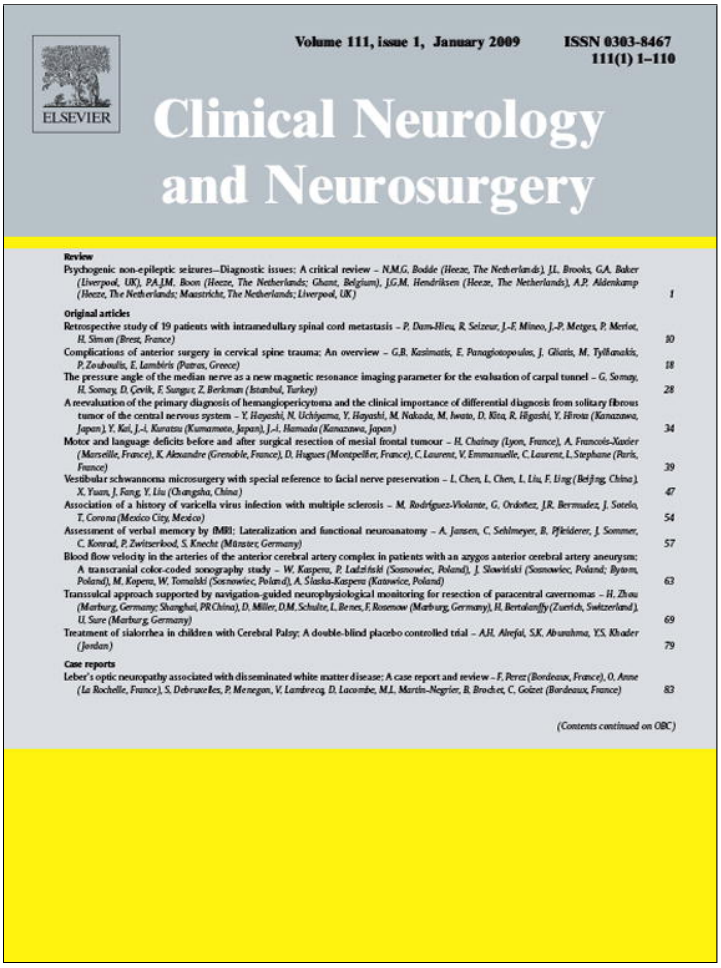

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Case report

Actively bleeding intracranial aneurysm demonstrated by CT angiography

Sohum Desai [a], Jonathan A. Friedman [a,b,*], Joseph Hlavin [b], Frederick Kash [b]

[a] Department of Surgery, Neuroscience and Experimental Therapeutics, Texas A&M Health Science Center, College of Medicine, College Station, TX, United States
[b] The Texas Brain and Spine Institute, Bryan-College Station, TX, United States

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ABSTRACT

CT angiography (CTA) is increasingly being utilized in the initial diagnosis of subarachnoid hemorrhage. While active bleeding from an intracranial aneurysm has been demonstrated on conventional angiography, CT angiogram findings of active aneurysmal hemorrhage are not well described. We present a case of an actively bleeding anterior communicating artery aneurysm demonstrated by CT angiography. The initial CTA demonstrated the extravasation of contrast from the anterior communicating artery. A second CT scan less than 1 h later confirmed the ongoing hemorrhage, with extension of hemorrhage into the subarachnoid cisterns and the ventricular system. Recognition of active aneurismal hemorrhage by CTA may modify plan of treatment and follow-up imaging.

1. Introduction

CT angiography (CTA) is increasingly being utilized in the initial diagnosis of subarachnoid hemorrhage (SAH) [4,5]. As such, subtle nuances and rare findings on CTA are being recognized and described. Active bleeding from an intracranial aneurysm at the time of imaging occurs rarely and has been demonstrated on conventional cerebral angiography. CT angiogram findings of active aneurysmal hemorrhage are not well described. Recognition of active aneurysmal hemorrhage by CTA may modify plan of treatment and following-up imaging. We present a case of an actively bleeding anterior communicating artery aneurysm demonstrated by CT angiography.

2. Case report

A 67-year-old man presented to the emergency room with severe headache and decreased mental status. Non-contrast CT scan of the head revealed diffuse cisternal subarachnoid hemorrhage (Fig. 1). CTA was then obtained (Fig. 2A). The CTA suggested active contrast extravasation from an anterior communicating artery aneurysm. Because the aneurysm had a wide neck, it was felt best suited for surgical repair rather than endovascular coiling. Plans for urgent craniotomy and clipping were made, but the patient's mental status deteriorated associated with hemodynamic instability. Upon transport to the OR, because of the CTA findings and clinical deterioration, a repeat non-contrast CT scan of the head was obtained (Fig. 2B). This scan was taken approximately 47 min after the initial CTA, and revealed massive increase in cisternal SAH, with extension into the lateral, third, and fourth ventricles. Repeat neurologic examination in the OR revealed extensor posturing, loss of pupillary response, corneal and oculocephalic reflexes, and gag. Plans for surgery were aborted, and the patient did not improve. Shortly thereafter, support was withdrawn and the patient expired.

3. Discussion

CT angiography is an increasingly utilized modality in the diagnostic workup of intracranial aneurysms and subarachnoid hemorrhage. In comparison to cerebral angiography, CTA has the advantages of being non-invasive and readily available. Improvements in CT technology and widespread incorporation and availability of these technologies in clinical practice have contributed to the increasing use of CTA. Furthermore, CTA is commonly of sufficient quality and sensitivity to supplant the need for angiography in the majority of cases [4]. Because of the ease of access and short scan time, CTA is particularly useful in the immediate evaluation of the patient with SAH in the emergency department. As such, subtle and uncommon features of CTA which would modify initial treatment paradigms are increasingly being appreciated and described.

In our case, the indistinct appearance of the aneurysm on source images and reconstructions, as well as the differing densities in the immediate region of the aneurysm, led to suspicion

* Corresponding author at: Texas Brain and Spine Institute, Texas A&M Health Science Center, College of Medicine, 3201 University Drive East, Suite 410, Bryan, TX 77802, United States. Tel.: +1 979 776 8896; fax: +1 979 774 0716.
E-mail address: jafriedman@medicine.tamhsc.edu (J.A. Friedman).

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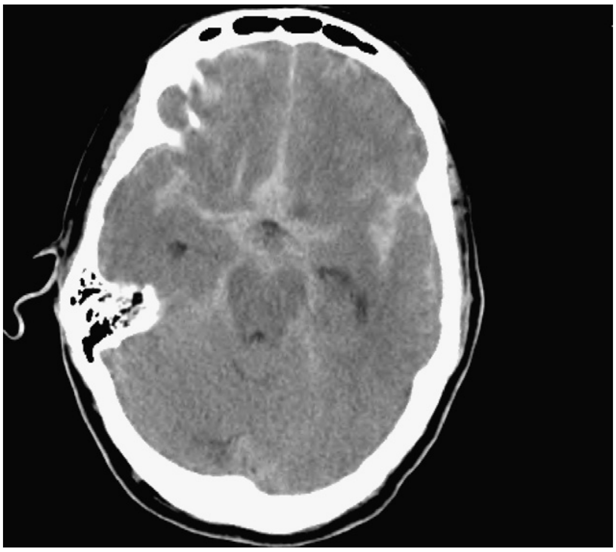

Fig. 1. Initial non-contrast CT taken shortly after the patient presented to the emergency room reveals diffuse cisternal subarachnoid hemorrhage.

of active contrast extravasation. The active contrast extravasation was distinguished from preexisting subarachnoid clot by the higher density of the extravasated contrast. The extravasated contrast was also clearly extravascular, and more dense than the intravascular contrast.

The inability to clearly define the aneurysm anatomy was also an indicator of extravascular contrast. Typically, the higher density of the intravascular contrast allows easy distinction between subarachnoid hemorrhage and the lumen of the aneurysm. This phenomenon was especially noteworthy when trying to perform three-dimensional reconstructions of the aneurysm. The extravasated, extravascular contrast led to inaccurate 3D rendering in ways that created suspicion among the interpreters that active bleeding was occurring (Fig. 3). We suggest that in cases with a similar appearance, active hemorrhage from the aneurysm should be considered. However, other causes of difficulty with 3D reconstruction on CTA include proximity to skull base, close interrelationship of nearby branching arteries and veins, and complex neck anatomy beyond the resolution of CTA.

Fig. 3. 3D reconstruction of the CTA data. The arrowheads depict the anterior communicating aneurysm and the active hemorrhage.

Demonstration of an actively hemorrhaging aneurysm on imaging is rare [2,3,6–11]. Several case reports of active rupture during conventional angiography have also been described [1,12]. In one report suggesting active aneurysmal bleeding on CTA, the findings are based on an area of attenuation in the subarachnoid space in the area of suspicion being of higher attenuation than the known attenuation of blood given that the patient had not received contrast material previously for any other studies [3]. However, there was no definitive clinical deterioration and rehemorrhage was not seen in follow-up imaging. In our case, the active bleeding was proven by the significant clinical deterioration and extension of hemorrhage

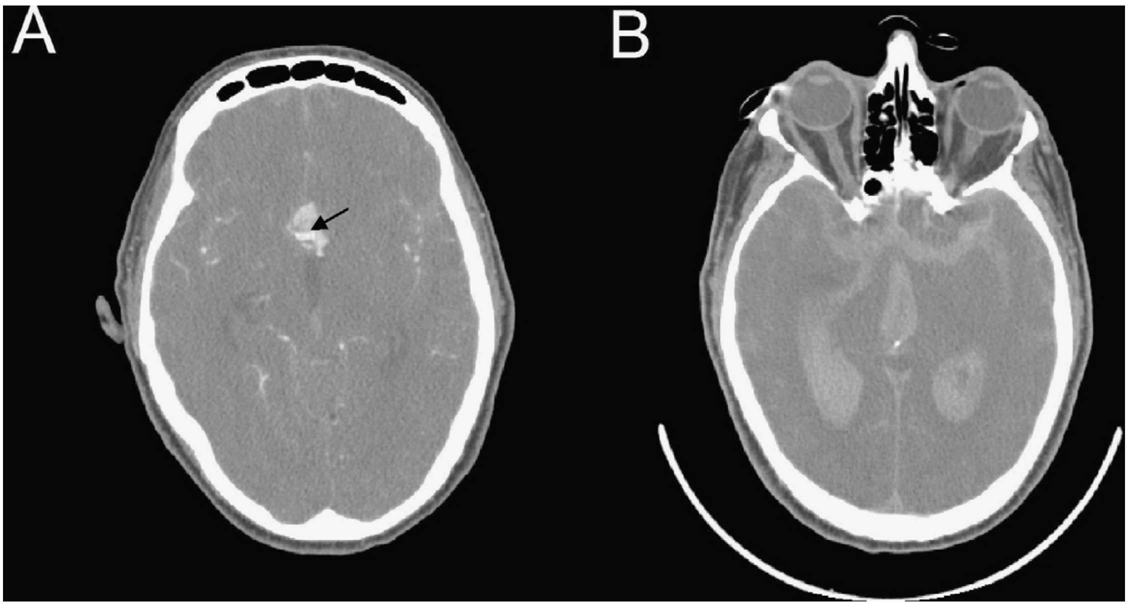

Fig. 2. (A) Axial CTA illustrates anterior communicating artery aneurysm with actively extravasating blood, indicated by the arrow. Note the lateral and third ventricles are free of blood at the time this study was performed. (B) A second non-contrast CT performed 47 min after the initial CTA shows that the lateral and third ventricles are filled with acute blood.

on CT scan less than 1 h later. In other reports, the imaging appearance of active extravasation on CTA is quite variable. The imaging findings of active extravasation have been defined as corkscrew like [10], ribbon like [2,4,11], dumbbell-shaped [2], areas of nebulous enhancement [3], or as an irregular bleb associated with an intracerebral hematoma [9]. The appearance of the contrast extravasation from the aneurysm in our case was seemingly unique. Furthermore, the active bleeding was proven by the significant clinical deterioration and extension of hemorrhage on CT scan less than 1 h later, a feature absent in other cases [3,9]. Given the increasing utilization of CTA in the early diagnosis of ruptured cerebral aneurysms, robust reporting of varying imaging patterns of active bleeding is needed to increase the potential for recognition of this event.

The potential implications of demonstrating active aneurysmal bleeding on imaging include expediting definitive control of the aneurysm, clinical and radiographic reexamination, and intensive monitoring of hemodynamics and clinical status. In practice, it is unlikely that the information can be interpreted and responded to in a clinically meaningful time frame, since the damage from the ongoing hemorrhage likely occurs over a matter of minutes. Nevertheless, the recognition may have important implications. In our case, the recognition led to rescanning on the way to surgery, which demonstrated the extensive rehemorrhage. Ultimately, this finding in combination with the severe clinical decline, led to a conservative treatment course and the patient expired soon thereafter. Additionally, the cause of the clinical decline was clearly defined. Had the active hemorrhage not been recognized and the follow-up scan not performed, the clinical decline and radiographic worsening would have been discovered postoperatively, and the cause would have been less clear.

4. Conclusion

This case demonstrates the appearance on CTA of active bleeding from a ruptured intracranial aneurysm. Recognition of this finding on CTA may modify treatment plans, timing and decision-making.

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