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Clinical Images

A Quarterly Column

Actively Rupturing Intracranial Aneurysm

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INTRODUCTION

We describe the case of a patient with aneurysmal subarachnoid hemorrhage who was transferred to our hospital for treatment. She developed spontaneous rebleeding from her aneurysm that was depicted on her computed tomography (CT) angiogram (CTA) obtained in the emergency department (ED).

HISTORY

A 68-year-old female with a medical history of hypertension was brought to the ED by ambulance after her husband heard a loud noise in the bathroom and found her unresponsive on the floor. The patient was initially taken to an outside hospital where she was found to have a Glasgow Coma Scale of 3. She was intubated and stabilized. CT showed subarachnoid and intraventricular hemorrhage, and she was transferred to Ochsner Medical Center. Upon arrival, the patient was considered Hunt and Hess Grade 5. She had 3 mm reactive pupils bilaterally, and she showed no response to noxious stimuli.

RADIOGRAPHIC APPEARANCE AND TREATMENT

Noncontrast images of the head demonstrated a Fisher Grade 4 subarachnoid hemorrhage with the largest volume of blood along the left side of the suprasellar cistern extending laterally into the temporal lobe and within the left lateral ventricle.

CTA demonstrated a large, left internal carotid artery aneurysm at the origin of the posterior communicating artery projecting posterolaterally. The contrast was actively extravasating from the aneurysm into the adjacent hematoma. Contrast was also streaming posteriorly through the temporal lobe into the temporal horn and atrium of the left lateral ventricle (Figure 1). Subsequent postcontrast CT images showed a mix of preexisting hemorrhage and new contrast-opacified blood, confirming that bleeding was ongoing during the CTA (Figure 2).

After discussion between the neurointerventionalist and neurosurgeon, the patient underwent ventriculostomy followed by emergent angiography and aneurysm coiling at 2 am. Cerebral aneurysm treatment is not commonly performed at night; however, because of the finding of active hemorrhage on CTA, the team decided to proceed with coiling. Angiography demonstrated a $14 \times 10 \times 8$ mm irregular left internal carotid artery aneurysm at the posterior communicating artery origin with a favorable dome-to-neck ratio for coil embolization. No extravasation occurred during angiography, but more mass effect and midline shift were present because of the increased size of the hematoma by that time (Figure 3). The neurointerventionalist (JMM) successfully treated the aneurysm using 7 Penumbra coils without complication (Figure 4). The patient was stable during the intervention, but she expired on the third hospital day because of cerebral edema

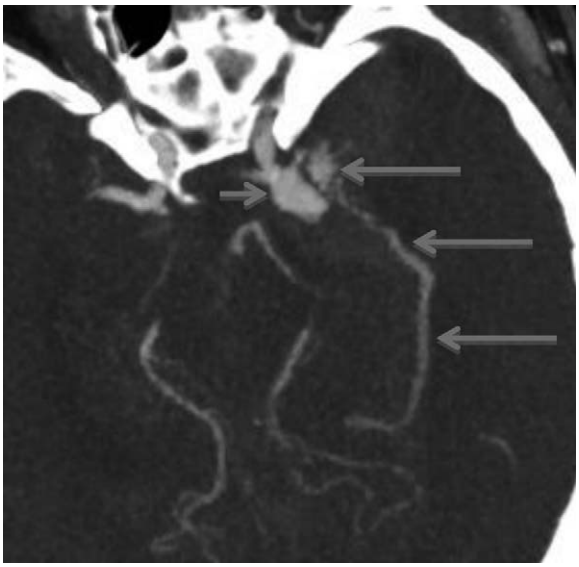

Figure 1. Computed tomography angiogram demonstrates the left internal carotid artery aneurysm (short arrow) with an irregular collection of contrast lateral to its base and linear contrast extending posteriorly into the left lateral ventricle (long arrows).

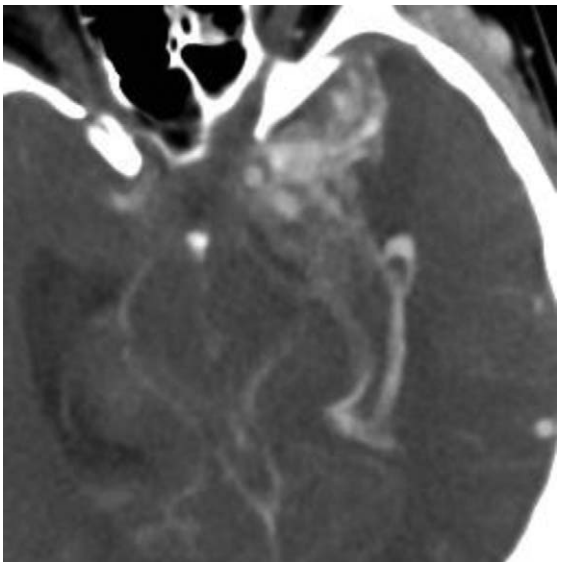

Figure 2. Postcontrast computed tomography (CT) scan immediately after the CT angiogram shows new blood with higher attenuation in the subarachnoid clot around the aneurysm and along the margins of the left lateral ventricle. The higher attenuating blood is caused by active extravasation following contrast injection.

produced by the large volume of intracranial hemorrhage.

DISCUSSION

Our case is unusual because this patient's aneurysm was imaged during the time of active

Figure 3. A 3-dimensional angiogram demonstrates the 14 × 10 × 8 mm aneurysm projecting posteriorly and laterally from the left internal carotid artery. The wall appears irregular, but no evidence of active extravasation is present. The middle cerebral artery is elevated because of the hematoma surrounding the aneurysm.

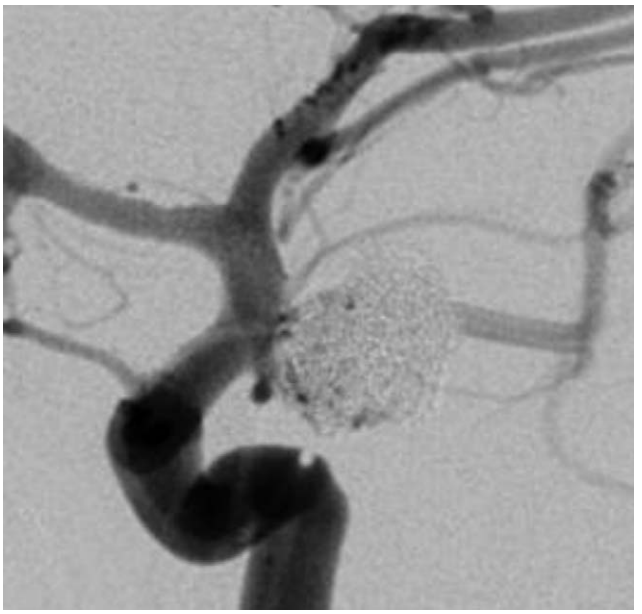

Figure 4. Final follow-up angiogram after successful treatment with 7 Penumbra coils.

hemorrhage. This phenomenon is rarely seen during CT angiography and is associated with poor prognosis, with an estimated mortality of 80%.[1] The active hemorrhage in this patient was consistent with rebleeding in the ED and ultimately led to her death. Standard practice at Ochsner, as at other institutions, involves CTA of the brain immediately after the initial noncontrast CT to help choose the method of treatment and guide the need for general anesthesia prior to conventional angiography.[2]

If a patient survives the initial hemorrhage from a ruptured aneurysm, active bleeding has typically subsided well before the patient reaches the hospital. If a patient has continuous intracranial arterial bleeding for longer time periods, the resulting increased intracranial pressure will likely lead to brain death. An estimated 12%-15% of patients with aneurysm hemorrhage expire before reaching the hospital.[3]

In patients who survive the initial bleed, an estimated 50% of their aneurysms will rerupture within 6 months.[4] Hyperacute rehemorrhage (within 6 hours) is estimated to occur in 49% of patients with rerupture, and the mortality rate for this group is approximately 60%.[5] Factors associated with aneurysm rerupture include longer time to treatment, worse neurological status on admission, initial loss of consciousness, previous sentinel headache, larger aneurysms, and systolic blood pressure >160 mmHg.[2] Rebleeding within the first 48 hours is the most common cause of death in patients with aneurysms who reach the hospital alive.[6] Current evidence suggests early

treatment can reduce the risk of rebleeding.[6] Consequently, ruptured aneurysms should be treated within 48 hours of presentation via either endovascular or surgical techniques if possible.[2]

The treatment of unruptured, asymptomatic aneurysms is controversial. The estimated rate of rupture for aneurysms must be weighed against the likelihood of rupture during the patient's lifetime, knowing that all aneurysms are not the same and each carries an individual risk. Risk factors for aneurysm rupture include size, geometry, location, and patient history of hypertension, smoking, and family medical history.[7] Currently, studies investigating computational flow dynamics using hemodynamic parameters such as wall shear stress (WSS), WSS gradient, inflow jet, impingement zone, and aneurysm inflow-angle are ongoing in an attempt to improve predictive models of aneurysm rupture risk.[8] Such research may eventually help stratify which unruptured aneurysms should be treated.

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