Case Report

Intracranial varix of the transverse-sigmoid dural arteriovenous fistula mimicking a ruptured middle cerebral artery aneurysm: A case report

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ABSTRACT

Background: Hemorrhagic stroke is caused by various vascular abnormalities, such as aneurysms, arteriovenous malformations, and dural arteriovenous fistulas (DAVF). Magnetic resonance angiography (MRA) and three-dimensional computed tomography angiography (3DCTA) are used as efficient initial diagnostic modalities in assessing the etiology of hemorrhagic stroke. We describe the unusual case of a false-positive aneurysm on MRA and 3DCTA.

Case Description: A 65-year-old nonhypertensive woman was brought to our hospital with a sudden onset of headache and left hemiparesis. She also had chemosis in the right eye. CT and magnetic resonance imaging showed an intracerebral hemorrhage in the right temporal lobe. MRA and 3DCTA showed a rounded mass suggestive of an aneurysm arising from the bifurcation of the middle cerebral artery (MCA) and also demonstrated an abnormal tortuous vessel contacting with a rounded mass. Digital subtraction angiography showed a transverse-sigmoid sinus DAVF with a varix in contact with the MCA bifurcation. Hematoma evacuation and venous drainage disconnection through the right frontotemporal craniotomy were performed.

Conclusion: This case is very instructive and clinicians should keep in mind that detailed neurological and radiological examinations are essential in obtaining an accurate diagnosis, especially if the bleeding source is similar in shape and location to common lesions (such as a cerebral aneurysm).

Keywords: Cerebral aneurysm, Dural arteriovenous fistula, Varix

INTRODUCTION

Hemorrhagic stroke, caused by various vascular abnormalities, including aneurysms, arteriovenous malformations, and dural arteriovenous fistulas (DAVF), sometimes requires surgical intervention. Early identification of these lesions is essential for proper treatment and good outcomes.

Digital subtraction angiography (DSA) is the gold standard for diagnosing bleeding sources; however, DSA has the disadvantage of a complication rate reported as about 0.8–2.6%. Recently, instead of DSA, noninvasive imaging modalities, such as magnetic resonance angiography (MRA) and three-dimensional computed tomography angiography (3DCTA), are increasingly used.
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utilized as an efficient initial modality in evaluating the etiology of hemorrhagic stroke. A thorough examination of images from magnetic resonance imaging (MRI), 3DCTA, and DSA provides an accurate diagnosis in most cases; however, correct diagnosis can be difficult if the bleeding source is similar in shape and location to common lesions (such as cerebral aneurysms).

We report a case of intracranial varix of transverse-sigmoid dural arteriovenous fistula mimicking a ruptured cerebral aneurysm. We also present a brief literature review related to this case.

CASE DESCRIPTION

A 65-year-old nonhypertensive woman was brought to our hospital with sudden onset of severe headache. On arrival, she complained of severe headaches and nausea with Glasgow Coma Scale score of 13. Neurological examination exhibited left hemiparesis and conjunctival chemosis of the right eye. Motor power was Grade 3 on the Medical Research Council scale in the left upper and lower extremities. According to her family, the chemosis appeared a few months ago without any trauma. CT and MRI showed an intracerebral hemorrhage (ICH) in the right temporal lobe without subarachnoid hemorrhage and a rounded mass near the right Sylvian fissure [Figures 1 and 2]. MRA also showed another rounded mass, suggestive of an aneurysm, arising from the bifurcation of the middle cerebral artery (MCA) [Figure 2]. A tentative diagnosis of a ruptured MCA aneurysm causing ICH was made. We planned a craniotomy involving hematoma evacuation and aneurysm clipping then performed 3DCTA to obtain more information about the aneurysm, revealing contact with abnormal tortuous vessels [Figure 3]. Initial MRI showed a dilated right superior orbital vein (SOV) retrospectively [Figure 2]. Her long-standing chemosis and these radiological findings pointed away from an aneurysm as the source of bleeding and we performed DSA for further investigation.

DSA demonstrated a transverse-sigmoid junction DAVF fed by branches of the occipital artery. Early retrograde venous drainage flowed into the straight sinus through the inferior petrosal sinus and internal cerebral veins, forming an intracranial varix. DAVF also regurgitated into the SOV and was thought to be the cause of chemosis. No aneurysm was seen on DSA [Figure 4]. The final diagnosis was ICH due to varix but not aneurysmal rupture.

A right frontotemporal craniotomy was performed for hematoma evacuation and venous drainage disconnection of the varix to prevent rebleeding and brain herniation in the acute phase. After a dural incision, the Sylvian fissure was opened entirely. Then, the arterialized vein and varix were detected on the surface of the temporal lobe. After occluding the vein temporarily using a clip, we verified the absence of varix flow and brain swelling using Doppler ultrasound. The hematoma was also successfully evacuated after ligating the vein and varix. Although we planned endovascular embolization of the residual fistula regurgitated into the SOV [Figure 5], her family did not consent to additional treatment because of her poststroke cognitive impairment and dementia, including memory disturbance and unilateral spatial neglect. The postoperative course was uneventful and the left hemiparesis was fully resolved within 3 months.

DISCUSSION

Although DSA is a gold standard for diagnosing the pathophysiology of hemorrhagic stroke, it had been replaced by noninvasive MRI and 3DCTA at the time of initial diagnosis due to its invasiveness. Particularly, in a patient with cerebral aneurysms, 3DCTA and MRA demonstrate high sensitivity and specificity rates that can replace DSA for both detection of this condition and surgical planning.

There are some reports that other bleeding sources, such as DAVF, cavernomas, hemangioblastomas, arachnoid cyst, and gliomas were mistaken for an aneurysmal rupture on initial imaging modalities. In addition, venous structures, such as a venous loop, can also be mistaken for aneurysms. Kim et al. reported a case of a venous loop crossing over the bifurcation of the left MCA mimicking an aneurysm on 3DCTA and performed craniotomy. Kazemi et al. reported a case of an aberrant vein crossing over the ICA bifurcation mimicking an aneurysm on 3DCTA. These reported cases suggest that bleeding sources could lead physicians astray from actual
etioologies, especially if their shapes and locations are similar to other common diseases.

DAVF sometimes has a retrograde cortical venous drainage with varix and this condition is well known for its high risk of hemorrhagic stroke.\(^2\) To the best of our knowledge, only five cases of varices associated with DAVF mimicking cerebral aneurysm have been reported [Table 1], all with variable locations: three were near the anterior communicating artery, one was near the posterior inferior cerebellar artery, and one was near the MCA.\(^{1,3,11,13}\) Initial diagnostic imaging, such as MRA and 3DCTA, suggested an aneurysm in all cases. DSA was effective in most cases to reach the final diagnosis but it was difficult to make a diagnosis even with DSA in one case.\(^1\) Kwon et al. reported that MRA source images may show a flow void cluster corresponding to a DAVF that might be helpful for DAVF identification.\(^{10}\)
It is crucial to keep in mind the possibility of various causes for patients with hemorrhagic stroke and carefully interpret data from multiple modalities, including source images, while neurological examination is required for correct pathophysiological diagnosis.

**CONCLUSION**

This instructive case reminds clinicians to keep in mind that a detailed neurological and radiological examination is essential in obtaining an accurate diagnosis, especially if the bleeding source is similar in shape and location to common lesions (such as a cerebral aneurysm).

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**Declaration of patient consent**

Patient’s consent not required as patients identity is not disclosed or compromised.

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**Conflicts of interest**

There are no conflicts of interest.

**REFERENCES**

1. Chen Z, Tang W, Liu Z, Li F, Feng H, Zhu G. A dural arteriovenous fistula of the anterior cranial fossa angiographically mimicking an anterior ethmoidal artery aneurysm. J Neuroimaging 2010;20:382-5.
2. Cognard C, Gobin YP, Pierot L, Bailly AL, Houdart E, Casasco A, et al. Cerebral dural arteriovenous fistulas: clinical and angiographic correlation with a revised classification of venous drainage. Radiology 1995;194:671-80.
3. Cohen JE, Gomori JM, Spektor S, Shapiro H, Itshayek E. Symptomatic ethmoidal dural arteriovenous fistula with a draining varix mimicking a ruptured anterior communicating artery aneurysm. Isr Med Assoc J 2015;17:520-1.
4. Dawkins AA, Evans AL, Wattam J, Romanowski CA, Connolly DJ, Hodgson TJ, et al. Complications of cerebral angiography: A prospective analysis of 2,924 consecutive procedures. Neuroradiology 2007;49:753-9.
5. Earnest FT, Forbes G, Sandok BA, Piepras DG, Faust RJ, Ilstrup DM, et al. Complications of cerebral angiography: Prospective assessment of risk. AJR Am J Roentgenol 1984;142:247-53.
6. Hostettler IC, Seiffge DJ, Werring DJ. Intracerebral hemorrhage: An update on diagnosis and treatment. Expert Rev Neurother 2019;19:679-94.
7. Ji YC, Li Y, Hu JX, Zhang HB, Yan PX, Zuo HC. Cerebellar varix)

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**Table 1: Cases of varices mimicking cerebral aneurysms.**

| Author and year | Age/sex | Symptom | Type of stroke | Location of varix | Final diagnosis | Initial treatment | Retreatment |
|-----------------|---------|---------|----------------|-------------------|----------------|------------------|------------|
| Machida et al., 1993<sup>[11]</sup> | 48/M | Headache, loss of consciousness | ICH, SAH | Near PICA | TS DAVF | Craniotomy, hematoma removal | TAE |
| Ogawa et al., 1996<sup>[13]</sup> | 57/M | Visual acuity, homonymous hemianopia | ICH | Near AcomA | Ethmoidal DAVF | Craniotomy, fistula disconnection | No |
| Chen et al., 2010<sup>[1]</sup> | 41/M | Headache, vomiting | ICH, IVH | Near AcomA | Ethmoidal DAVF | Craniotomy, fistula disconnection | No |
| Cohen et al., 2015<sup>[2]</sup> | 18/F | Headache, nausea | SAH | Near AcomA | Ethmoidal DAVF | TAE | No |
| Our case | 65/F | Headache, hemiplegia | ICH | Near MCA bifurcation | TS DAVF | Craniotomy, fistula disconnection | No |

AcomA: Anterior communicating artery, DAVF: Dural arteriovenous fistula, F: Female, M: Male, ICH: Intracerebral hemorrhage, IVH: Intraventricular hemorrhage, PICA: Posterior inferior cerebellar artery, SAH: Subarachnoid hemorrhage, TAE: Transarterial embolization, TS: Transverse-sigmoid sinus

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**Figure 5:** Postoperative digital subtraction angiography showing the residual fistula regurgitated into the right superior orbital vein, (a) anteroposterior view and (b) lateral view.
hemangioblastoma mimicking an aneurysm: A case report and literature review. Oncol Lett 2016;12:2622-4.
8. Kazemi NJ, Dennien B, Dan NG. Mistaken identity: A case of false positive on CT angiography. J Clin Neurosci 2002;9:464-6.
9. Kim JH, Cheong JH, Bak KH, Kim CH, Kim JM. Venous loop mimicking middle cerebral artery bifurcation aneurysm on computed tomographic angiography--case report. Surg Neurol 2006;66:524-6.
10. Kwon BJ, Han MH, Kang HS, Chang KH. MR imaging findings of intracranial dural arteriovenous fistulas: relations with venous drainage patterns. AJNR Am J Neuroradiol 2005;26:2500-7.
11. Machida T, Hayashi N, Sasaki Y, Aoki S, Shirouzu I, Sasaki Y, et al. Posterior cranial fossa dural arteriovenous malformation with a varix mimicking a thrombosed aneurysm: Case report. Neuroradiology 1993;35:210-1.
12. McDonald JS, Kallmes DF, Lanzino G, Cloft HJ. Use of CT Angiography and digital subtraction angiography in patients with ruptured cerebral aneurysm: Evaluation of a large multihospital data base. Am J Neuroradiol 2013;34:1774-7.
13. Ogawa T, Okudera T, Miyauchi T, Inugami A, Uemura K, Yasui N. Anterior cranial fossa dural arteriovenous fistula with a varix mimicking an anterior communicating artery aneurysm. Neuroradiology 1996;38:252-3.
14. Ohkuma H, Tsurutani H, Suzuki S. Incidence and significance of early aneurysmal rebleeding before neurosurgical or neurological management. Stroke 2001;32:1176-80.
15. Patel NP, Robinson TM, Lesley WS, Garrett D, Shan Y, Huang JH. Retromedullary hemangioblastoma mimicking a posterior inferior cerebellar artery aneurysm: Case report and literature review. World Neurosurg 2019;122:165-70.
16. Singla N, Aggarwal A, Vyas S, Sanghvi A, Salunke P, Garg R. Glioblastoma multiforme with hemorrhage mimicking an aneurysm: Lessons learnt. Ann Neurosci 2016;23:263-5.
17. Tempel ZJ, Johnson SA, Richard PS, Friedlander RM, Rothfus WE, Hamilton RL. Parasellar arachnoid cyst presenting with a nonpupil sparing third nerve palsy mimicking a posterior communicating artery aneurysm in an adult. Surg Neurol Int 2013;4:87.
18. Uneda A, Yabuno S, Kanda T, Suzuki K, Hirashita K, Yunoki M, et al. Cavernous angioma presenting with subarachnoid hemorrhage which was diffusely distributed in the basal cisterns and mimicked intracranial aneurysm rupture. Surg Neurol Int 2017;8:202.
19. van Asch CJ, Velthuis BK, Greving JP, van Laar PJ, Rinkel GJ, Algra A, et al. External validation of the secondary intracerebral hemorrhage score in The Netherlands. Stroke 2013;44:2904-6.
20. van Asch CJ, Velthuis BK, Rinkel GJ, Algra A, de Kort GA, Witkamp TD, et al. Diagnostic yield and accuracy of CT angiography, MR angiography, and digital subtraction angiography for detection of macrovascular causes of intracerebral haemorrhage: Prospective, multicentre cohort study. BMJ 2015;351:h5762.
21. Wolfe SQ, Manzano G, Langer DJ, Morcos JJ. Cavernous malformation of the oculomotor nerve mimicking a partially thrombosed posterior communicating artery aneurysm: Report of two cases. Neurosurgery 2011;69:E470-4.
22. Yamada S, Takagi Y, Nozaki K, Kikuta K, Hashimoto N. Risk factors for subsequent hemorrhage in patients with cerebral arteriovenous malformations. J Neurosurg 2007;107:965-72.