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Case Report

A case report: Ruptured aneurysm with a wide neck treated by flow diverter stent and coil embolization ☆,☆☆

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ABSTRACT

Diagnosis and endovascular treatment for ruptured wide neck aneurysms are challenges in clinics, particularly in developing countries. In the present study, we described a clinical case with a ruptured wide neck aneurysm in Vietnam treated by flow diverter stent and coil embolization. A 77-year-old- female patient had a right droopy eyelid for 2 months. The patient was admitted to hospital on the second day after being presented with a sudden-severe headache. Cerebral computed tomography (CT) and magnetic resonance imaging (MRI) were taken on the second day and fifth day after the onset of the headache. The results showed an aneurysm in the right internal carotid artery but no potential subarachnoid hemorrhage (SAH) was displayed. An uncoagulated blood was found in cerebrospinal fluid indicated by

Abbreviations: FDS, Flow Divert Stent; SAH, Subarachnoid hemorrhage; CSF, Cerebrospinal fluid; CT, Computer tomography; MRI, Magnetic Resonance Imaging.

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a lumbar puncture test. Digital subtraction angiography provided images with one wide-neck right internal carotid aneurysm. The patient was treated by flow diverter stent and coil embolization and the dual antiplatelet therapy with ticagrelor and aspirin at home. After 45 days, the patient did not face with any complication, no neurological symptoms, and the aneurysm was partially thrombosed indicated by MRI images. These results suggested that a lumbar puncture should be analyzed on the patient with brain aneurysm appeared a sudden severe headache and even no potential SAH on brain MRI or CT was found. The combination of flow diverter stent and coil embolization to treat cases with ruptured wide necked aneurysms should be considered in the future.

Introduction

The prevalence of brain intracranial aneurysms was estimated from 2% to 3% in the general population, which might be higher in older patients, females, or patients with family history [1]. Subarachnoid hemorrhage (SAH) was determined as the most devasting consequence of unruptured intracranial aneurysms with the death rate up to 44% [2] and one-third of those who survived after SAH had severe disability [3]. However, the SAH can be misdiagnosed due to its symptoms in asymptomatic or not enough of symptoms of the typical ruptured aneurysm, leading to increased mortality and morbidity [4]. These results indicated the early and correct diagnosis of ruptures of aneurysms, particularly in the case without or mild symptoms of SAH, which play a vital role in treating and reducing the complication of the disease.

Aneurysms with wide necks are defined by neck diameters greater than 4 mm or dome-to-neck ratios less than 2 [5]. Both ruptured and unruptured aneurysms with wide necks are the most difficult to treat by coil embolization due to the risks of distal coil migration or coil impingement on the parent vessel [6], several branches arise from the neck, which might cause branch occlusion during coiling, or higher risk of recanalization [7]. To overcome this concern, flow diversion stent is suggested, which is an established technique to treat intracranial aneurysms not readily amenable to endovascular coil embolization or open microsurgical occlusion with the high rate of complete occlusion and good clinical outcome [8]. Flow diversion stent is based on 2 principal concepts: (1) the placement of stents disrupts blood flow to the aneurysm and (2) the stent provides a frame for which endothelium could grow, and isolating the aneurysm from the parent artery [9]. However, FDS for ruptured aneurysm cases still remained limitations such as using dual antiplatelet therapy before endovascular treatment, leading to increase high risk of recurrent bleeding in ruptured brain aneurysms [8]. In combination of both flow diversion stents and coil embolization, Ghorbani et al. reported that the use of flow diverter stents with coils was a useful method for the treatment of complex wide neck cerebral aneurysms. However, only 3 patients were investigated, and all patients were diagnosed as the unruptured wide neck aneurysms [10].

In the present study, we described a clinical case who presented with a mild headache when admitted to hospital, with a wide neck aneurysm in the right internal carotid artery without a potential SAH in MRI and CT images, and with uncoagulated blood in cerebrospinal fluid. The patient was treated successfully by combined methods of flow diverter stent and coil embolization without any complication.

Case report

A 77-year-old woman who presented with a right droopy eyelid for 2 months (Fig. 1A) and had no significant medical history. The patient had a sudden severe headache and went to the 103 military hospital, Ha noi city, Vietnam on the second day after the headache. The clinical symptoms of the patient when admitted to the hospital showed mild headache, non-vomit, non-nuchal rigidity, negative meningeal syndrome, no sensory disorder, and lower and upper limbs in muscle power Medical Research Council (MRC) grade 5/5. The patients underwent brain magnetic resonance imaging (MRI). The MRI results showed a right internal carotid aneurysm with non SAH and non-intracerebral hemorrhage and brain stem compression due to the presence of aneurysm (Fig. 2).

A 64-slice CT angiography (CTA) was examined on the third day after being admitted to the hospital and the results showed a right internal carotid aneurysm with wide neck size: 15 × 12 mm, non-image of brain hemorrhage with Fisher grade was 0 [11] (Fig. 3).

We could not find the evidence of ruptured aneurysm on MRI or CTA. However, the patient had a symptom of a sudden-severe headache before they came to hospital, suspecting SAH. We decided to perform a lumbar puncture on the third days after the patient admitted to the hospital and found the uncoagulated blood in 3 tubes cerebrospinal fluid (Fig. 4).

Cerebral digital subtraction angiography (DSA) was indicated in this patient in order to treat the acute aneurysm. The patient was used ticagrelor 180 mg, aspirin 300mg before the endovascular therapy. The DSA images revealed a right carotid aneurysm with size of neck was 6.7mm, width 14.3mm, depth 12.3 mm and one narrow segment at the feeding artery (Fig. 5A). In this case, we performed Flow Re-Direction Endoluminal Device Jr 5 × 22 mm (FRED Jr; MicroVention, CA) through the neck combined and additionally put 2 coils: hypersoft 9 × 32 mm and hypersoft 8 × 30 mm (MicroVention Inc., Aliso Viejo, CA) for internal carotid aneurysm. The DSA images after endovascular therapy showed that stents expanded well

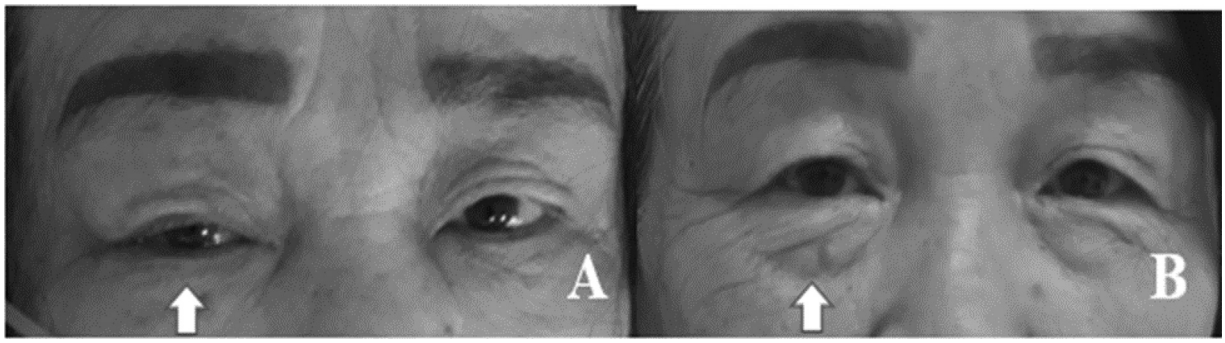

Fig. 1 – A right droopy eyelid before and after treatment. (A) A right droopy eyelid before treatment by the endovascular therapy; (B) a right droopy eyelid disappeared after the endovascular therapy 45 days.

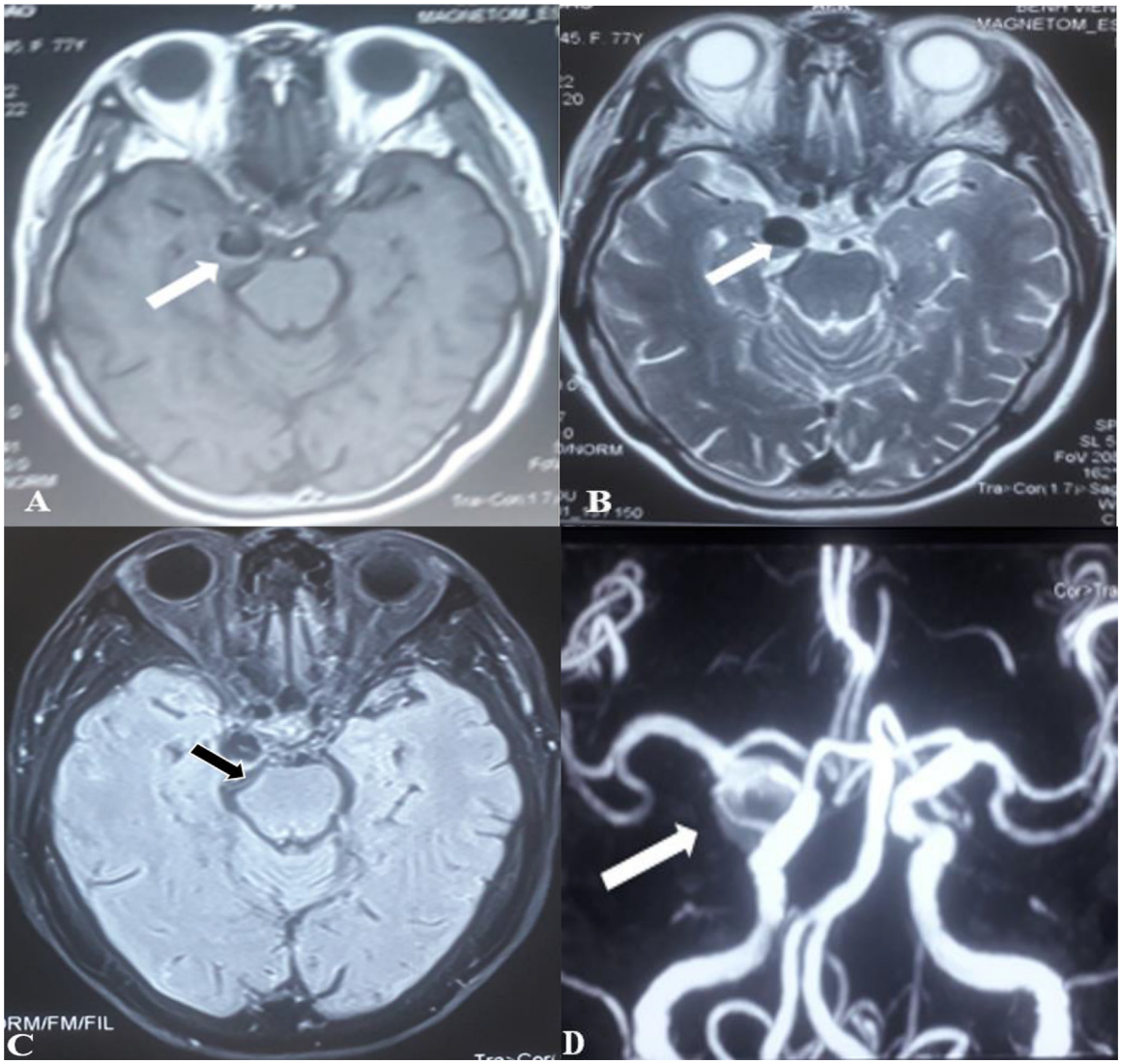

Fig. 2 – Aneurysm on brain MRI. (A, B) Aneurysm on T1-, T2-weighted images; (C) brain stem compression due to the presence of aneurysm on flair-weighted; (D) aneurysm on 3-dimensional (3D) time-of-flight (TOF).

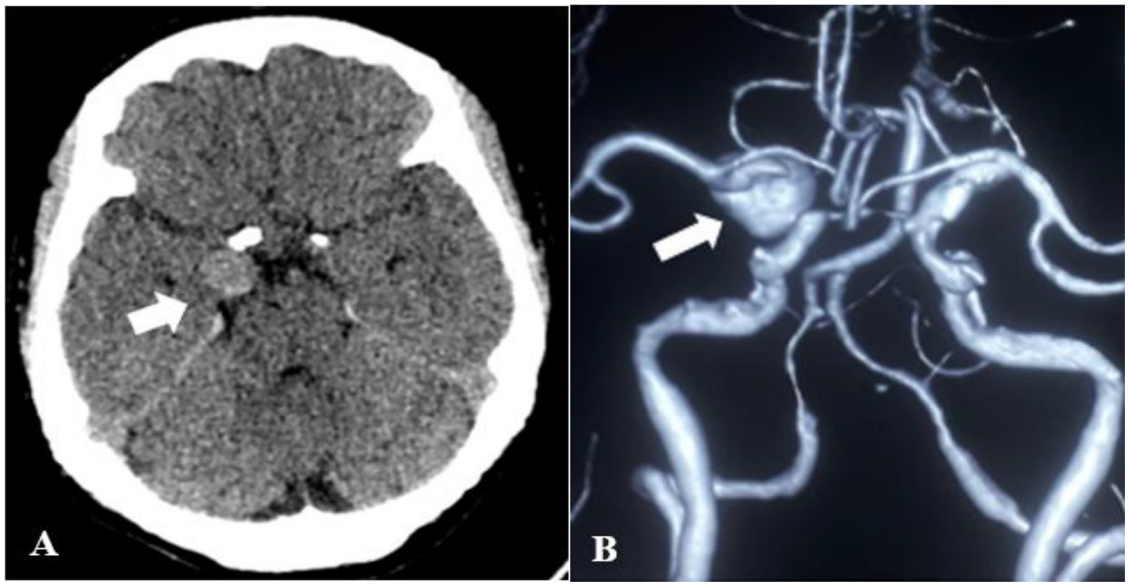

Fig. 3 – The aneurysm on 64-slice computer tomography angiography (CTA). (A) An aneurysm on 64 slice CTA without contrast; (B) an aneurysm in the right internal carotid artery on CTA.

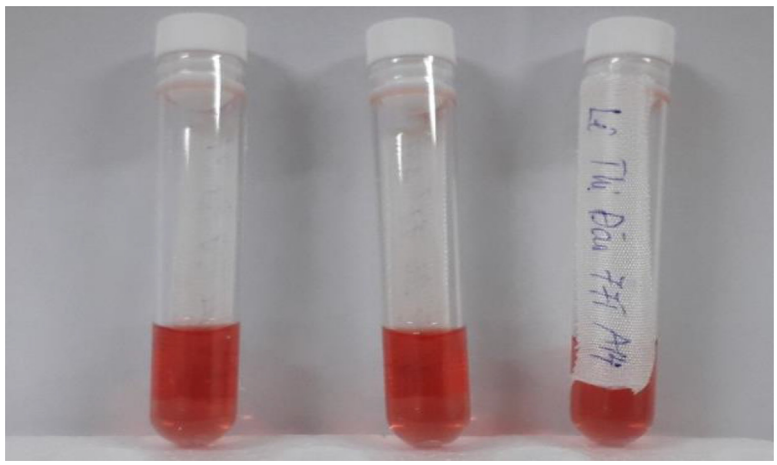

Fig. 4 – Blood in cerebrospinal fluid.

and aneurysmal contrast enhancement still accumulated at the venous phase. The patient's blood pressure was maintained between 120/80 and 140/90mmHg. The patient received lovenox (enoxaparin sodium injection) 40 mg subcutaneously after 6 hours of the intervention, continuously daily maintained by ticagrelor 180 mg and aspirin 81 mg. The patient was discharged from the hospital on the 10th day after the endovascular therapy with the Modified Rankin Scale for Neurologic Disability score [12] of 0.

The patient continued to take ticagrelor 180 mg and aspirin 81 mg per day. Re-examination was performed after 45 days with no right droopy eyelid symptom (Fig. 1B), no neurological symptom indicated by Modified Rankin Scale for Neurologic Disability score [12] was 0, the aneurysm showed partial thrombosis in brain MRI image (Fig. 6A) size of aneurysm was smaller than before, only 10,3 × 10,6mm, Fig. 6B) and relieved compression on brain stem (Fig. 6A).

Discussion

The symptoms of SAH caused by ruptured aneurysm generally indicated by the sudden headache called a thunderclap headache, which reached maximum intensity within 1 hour, vomit, disorders of consciousness, neck stiffness [13,14]. In the present study, the diagnosis of SAH was difficult because of not enough symptoms of ruptured aneurysms. The patient came to hospital with a mild headache, no other symptoms such as nuchal rigidity, vomit, disorder of consciousness. Brain CT and MRI images only showed a right internal aneurysm but no potential ruptured aneurysm was displayed.

In previous studies, it had been reported that CT scan might omit lesions when a layer thickness is more than 3mm, little bleeding, location of bleeding such as under tentorium cerebelli [15] or the patient's movement during the scan also

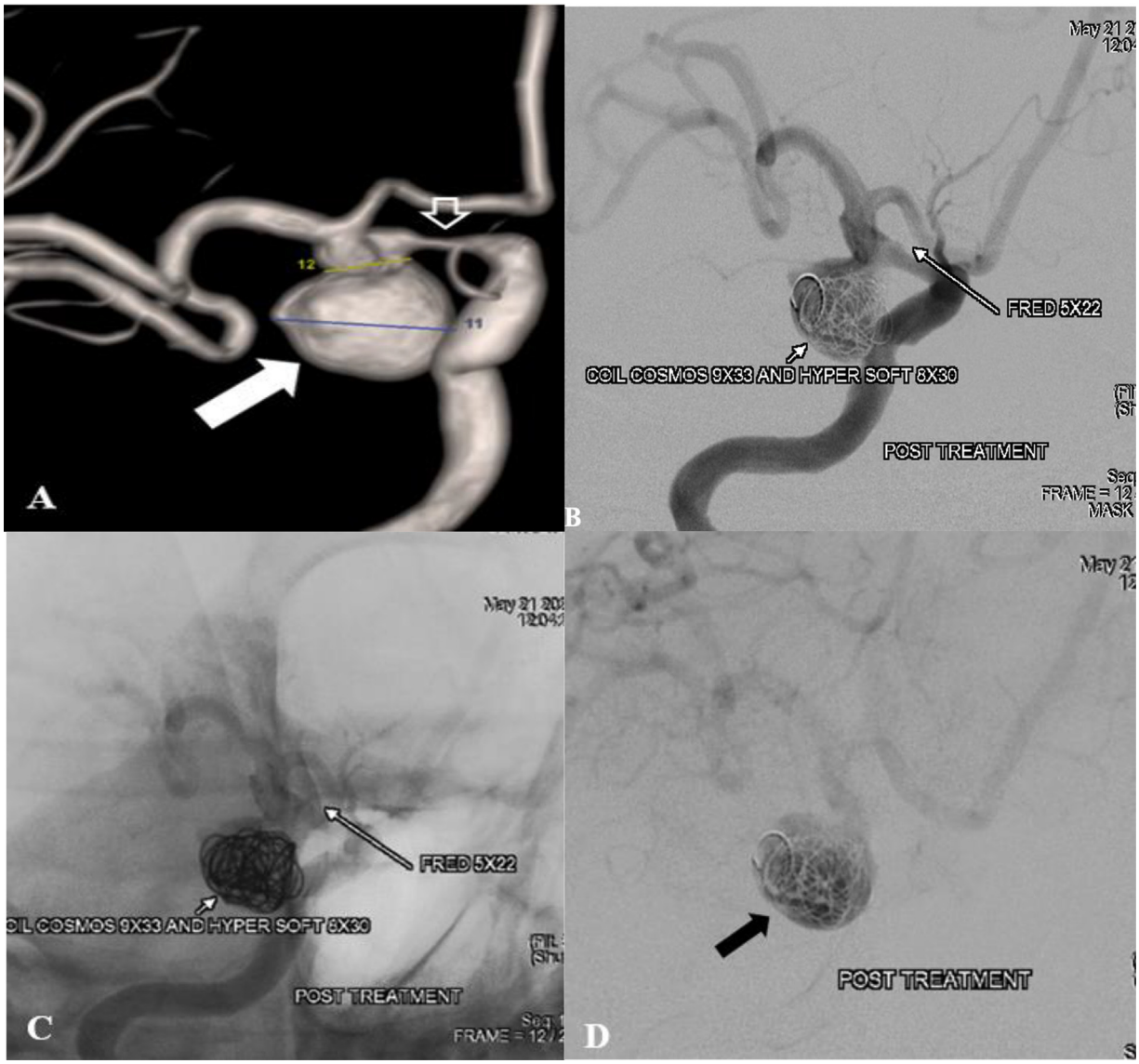

Fig. 5 – (A) Right internal carotid aneurysm with one narrow segment at feeding artery due to spasm. (B, C) Flow Diverter Stent: Flow Re-Direction Endoluminal Device (FRED) 5 x 22 mm, and 2 hypersoft coils: 9 x 33 mm and 8 x 3 0mm. (D) Accumulation of contrast enhancement in the aneurysm after endovascular treatment.

interfered with the image, limiting the ability to detect bleeding on CT of the brain [4]. Sensitivity of SAH on cerebral CT also decreased over time from the onset [16]. It was also reported that MRI was recommended to perform in the case of suspicion of SAH without lesion on CT [17], particularly T2-weighted MRI image, which had sensitivity of SAH in acute and subacute phase [18]. In the present study, our patient was taken both the brain MRI and CT. The results showed an aneurysm with a wide neck in the right internal artery but it did not reveal SAH in the images. However, brain MRI and CT scan were performed on the second and the fifth day after the sudden and severe headache. We hypothesized that an amount of bleeding blood into subarachnoid space was too little, which was not enough to be detectable on brain MRI and CT image due to no different from artifact of skull base bone. Also, the time taken by CT and MRI was more than 2 days of the illness, the amount of blood was less, which partly contributed to the negative potential SAH on the brain MRI and CT scan. In the current study, the patient was under experience of the sudden-severe headache 2 days before the day of being admitted to the hospital. The symptom led us to decide to perform a lumbar puncture and found the uncoagulated blood in the CSF. Our result was consistent with a previous report by van der Wee et al. in 1995. The author suggested that a lumbar puncture is necessary to find subarachnoid hemorrhage in patients with sudden headache, even normal CT was found [16]. Taken it together, we strongly recommend that a lumbar puncture is required for those with intracranial aneurysms presented any sign of SAH and showed normal CT or MRI.

Identification of ruptured aneurysms plays a vital role in the treatment process. In the present case, the patient had a right internal carotid aneurysm with its neck size, width, and depth were 6.7 mm, 14.3 mm, and 12.3 mm respectively. At the same time, it also had compression into the brain stem

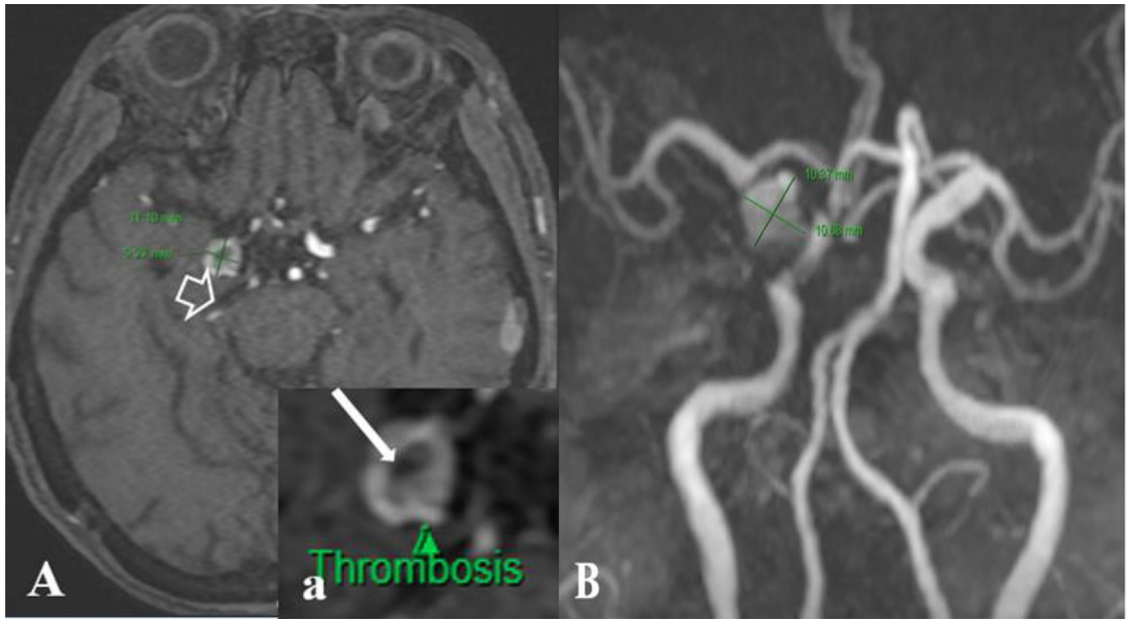

Fig. 6 – Brain MRI images on the 45th day after the endovascular treatment. (A) Phase-contrast MRI measurements showed aneurysm with its size: 11.1 × 9.2 mm and partial thrombosis, (B) a right internal carotid aneurysm.

indicated by the MRI images and cranial nerves displayed by the patient's symptom of a right droopy eyelid. In previous studies, wide neck aneurysms with large size were performed by only coil embolization, leading to high-risk recanalization [19], high packing density coil associated with the mass effect-related symptoms in brain tissue, cranial nerves [20] or parent vessel around [21]. To overcome this concern, Wang et al. reported that FDS was suitable to treat aneurysm with wide neck to limit risk of recanalization and mass effects [20]. However, time for thrombosis in the aneurysm after putting FDS was longer as compared with coil techniques. In addition, before performing endovascular treatment by FDS, dual antiplatelet therapy should be used to prevent intraluminal stent thrombosis and stroke [22,23], which might increase risk of rebleeding in the case with ruptured aneurysm [22]. Therefore, in order to reduce the risk of recurrent bleeding for the ruptured aneurysm, the shorter the time for the use of DAPT before intervention should be considered. In the present study, we used ticagrelor 90 mg × 2 tablets and aspirin 300 mg 3 hours before the intervention. In addition, in order to make the process of thrombosis in aneurysm faster, supplemental coils after performing FDS was suggested. It was explained by the used of FDS to create new and safe lumens for parent arteries and scaffold to hold the coils [10,24]. In contrast, if the aneurysm was added many coils, it would cause a mass effect to compress the brain tissue around the aneurysm. In the current study, the patient who showed a right droopy eyelid and brain stem compression due to the presence of aneurysm indicated by MRI and CT image. Therefore, we decided to put only 2 supplemental coils after FDS. Taken it together, the number of supplemental coils should be carefully calculated before combination between FDS and coil embolization to promote aneurysm thrombosis.

In the present study, the patient did not face with any complication and continued to use antiplatelet therapy at home, and was re-evaluated on the 45 days after the discharged day from the hospital. The patient showed good clinical recovery and no droopy right eyelid, the wide neck aneurysm was partially thrombosed and no compression on the brain stem illustrated by the MRI images. These results might indicate that the combination of FDS and coil embolization might be a useful method for treatment of ruptured wide neck aneurysms with a small amount of bleeding. However, longer follow-up should be conducted to assess the efficiency of the combination of FDS and coil embolization in treatment of ruptured wide neck aneurysms.

Limitation

Our present study should put in some limitations. There was only one patient in the present study. The time for patient follow-up is not long enough to evaluate the effectiveness of the combination of FDS and coil embolization methods for treatment of ruptured wide neck aneurysms.

Conclusion

This study showed the patient with brain intracranial aneurysm with a wide neck had a symptom of a sudden-severe headache. Brain CT and MRI images only showed a right internal aneurysm but no potential ruptured aneurysm. However, uncoagulated blood was found in CSF by a lumbar puncture. These results provided additionally evidence that a lumbar puncture should be considered for patients who with brain aneurysm and was suspicion of SAH, even if normal CT and MRI were observed. In addition, the combination of flow-diverter stent and coil embolization is considered to treat ruptured wide neck cerebral aneurysms.

Patient consent

Written informed consent was obtained from the patient for publication of the case details and accompanying images.

Availability of data and materials

Not applicable.

Authors' contributions

Do Duc Thuan discovered patients' unique clinical characteristics designed the study, drafted, and revised the manuscript. Pham Ngoc Thao, Nguyen Thanh Xuan collected, drafted, revised a manuscript. Do Duc Thuan, Nguyen Thi Nguyet, Le Duy Chi, Dao Van Nhat, Dinh Viet Hung, Nguyen Khanh found the correct diagnosis. Nguyen Thanh Xuan and Pham Ngoc Thao equally contributed as corresponding authors. All authors have read and approved the final submitted manuscript.

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