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Case Report

Flow diverter stent as a definitive endovascular strategy to obliterate acute spontaneous rupture of brain aneurysmal subarachnoid hemorrhage in elderly: a case report in Indonesia

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ABSTRACT

Spontaneous rupture of brain aneurysmal subarachnoid hemorrhage (aSAH) is a debilitating disease, half of which occurs in individuals under 50 years old. Challenges in its management arise from the decision-making process regarding the preferred method of definitive aneurysm obliteration, whether through surgical intervention or endovascular approach. This study described the role of flow diverter stent as an effective endovascular approach to obliterate aSAH in the acute phase. A 70-yearold female presented with thunderclap headache, slight right hemiparesis, and pupillary-sparing left oculomotor palsy corresponding with ruptured brain aSAH. Endovascular management of flow diverter stent was preferred and inserted within the third day onset. Double antiplatelet was administered prior to and following the procedure. Three-day follow-up showed resolution of brain aSAH with no neurological sequelae. Flow diverter stent offers several advantages over coiling when treating wide-neck, giant, saccular, or fusiform aneurysm. It is also safer for elderly, especially with multiple comorbids, compared with clipping. However, it has risks of either parent/ distal artery occlusion due to its thrombogenic properties or the potential for rebleeding following dual antiplatelet administration. Effective management and thorough evaluation are essential to maximize the likelihood of favorable outcomes when employing this approach. Flow diverter stent is a promising endovascular management for ruptured brain aSAH, particularly in elderly with many comorbids and wide neck/ giant aneurysm at anterior circulation which is not candidate for coiling or clipping. It is also crucial to monitor, evaluate, and manage risk of rebleeding and thrombosis to ensure long-term success of this management approach.

Keywords: Elderly, Flow diverter stent, Ruptured brain aneurysm, Spontaneous subarachnoid hemorrhage

INTRODUCTION

Spontaneous rupture of brain aSAH is a relatively uncommon yet debilitating condition worldwide. It has been reported to occur at a rate of 6.1 per 100,000 person-years with global prehospital and in hospital mortality rate of 22-26% and 19-20%, respectively.[1] The sudden onset of symptoms, the need for aggressive treatment strategies, and high rates of prehospital and in hospital deaths, especially when treatment is postponed, pose significant challenges to its management.[1]

The heterogeneity of brain aneurysm and patient characteristics provide challenges to the decision of treatment modality approach, which was either conservative management, surgical clipping, or endovascular treatment. Although conservative treatment may be considered for unruptured brain aneurysms with low risk of rupture, surgical or endovascular methods are recommended for the definitive management of aSAH.

Surgical clipping is generally advised for younger patients (<50 years old), wide-neck aneurysm, unfavorable vascular anatomy by endovascular approach, or aneurysm at middle cerebral artery or perforator rich regions. Endovascular treatment was suggested for older patients (>70 years old) especially with significant medical comorbidities, poor surgical candidate, posterior circulation aneurysm, or favorable anatomy by endovascular approach.[1,2] Both surgical and endovascular approach provide favorable outcome for aSAH, hence multidisciplinary approach involving neurosurgeon, neuro-interventionist, and interventional neuroradiologist are recommended for determining the risk and benefit of each treatment options.[1]

The evolution of endovascular techniques from coiling to stent-assisted coiling, flow diversion, or WEB device has significantly expanded the treatment possibilities, particularly for wide-neck aSAH cases.[2,3] Flow diverting stent has broadened the application of endovascular method for addressing giant brain aneurysm or wide-neck aneurysm with a notably high reported success rate.[3,4]

This case report described an elderly with spontaneous subarachnoid hemorrhage due to wide-neck saccular aneurysm at internal carotid artery (ICA) which was successfully treated with flow diverter stent. This is also one of few cases being reported in Indonesia.

A 70-year old female was admitted to the hospital due to a sudden severe headache two hours prior to admission, which was followed with sudden right-sided weakness. She had controlled hypertension and denied diabetes, stroke, extracranial or intracranial tumor, recent brain injury, and antiplatelet or anticoagulant use. Physical examination showed blood pressure of 140/90 mmHg, regular heart rate of 112 beats per minute, no nuchal rigidity, slight anisocoria of 2 /4 mm in diameter with reduced pupillary response at left eye, and slight right hemiparesis with motor power of 4.

An urgent brain CT scan was performed, which showed spontaneous subarachnoid hemorrhage at the left temporoparietal lobe and left insula with modified Fisher score of 3. Further analysis using brain angiography CT scan showed saccular pyramid-like aneurysm at C6 segment of intracranial left ICA with aneurysm diameter of 5 mm and neck length of 5 mm (Figure 1 A). She was therefore diagnosed with spontaneous subarachnoid hemorrhage due to a single left saccular aneurysm.

In addition to pharmacological approach, an endovascular neurointervention approach using flow diverter stent was performed during the hot phase (within 3 days) onset of stroke. Double antiplatelet of aspirin 1×80 mg and clopidogrel 1×75 mg were administered at the day of the procedure. A Silk of 4×35 mm was inserted to cover from proximal (C5 segment) to distal (C7 segment) of aneurysm (Figure 1 B). Double antiplatelet was continued thereafter.

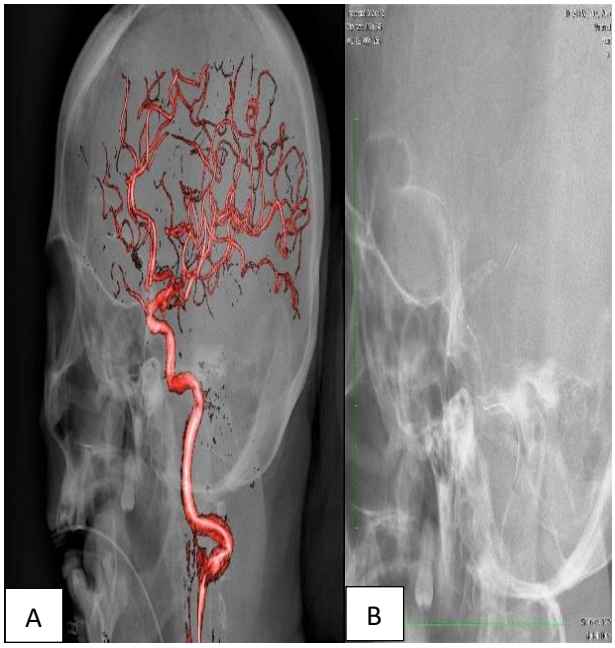

Figure 1 (A and B): 3D reconstruction of spontaneous rupture of brain aSAH at segment C6 of left internal carotid artery. Flow diverting stent was placed from proximal end of C5 to distal end of C7 at left internal carotid artery.

Follow-up three days following the insertion of stent using noncontrast brain CT scan showed reduced bleeding (Figure 3). She was discharged ten days afterwards with no residual neurological deficits.

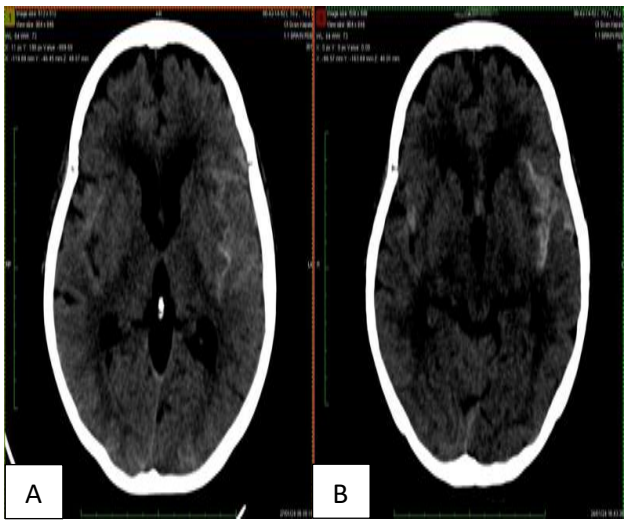

Figure 2 (A and B): Follow up of brain CT scan at 3 days of follow up following the onset of subarachnoid hemorrhage.

DISCUSSION

Spontaneous subarachnoid hemorrhage was less prevalent cause of stroke (5-10%) compared with ischemic and intracerebral hemorrhage, but it carries significant risk for morbidity and mortality.[5] Hunt and

Hess described the survival rate of 70% for the mildest grade of aSAH (grade I), which was asymptomatic or mild headache with slight nuchal rigidity, and 100% for the worst grade of aSAH (grade V).[2] In addition, half of the aSAH cases involve productive-age individuals of less than 55 years old.

Challenges in the treatment of aSAH may arise from the variability of subjects and brain aneurysm characteristics with various risk and benefit of different treatment modalities. This report described successful management of wide-neck saccular aSAH in elderly using flow diverting stent.

This case described a 70-year-old elderly presenting with typical symptoms of thunderclap headache corresponding with ruptured aSAH. Sudden right hemiparesis and partial left oculomotor nerve lesion with pupillary involvement pointed towards aneurysm lesion at left hemisphere, particularly at proximal middle cerebral artery (25%), left posterior communicating artery (25%), left proximal posterior cerebral artery (19%), or left distal ICA (12%) based on PHASES score.[6] The clinical finding in this case was further supported with the discovery of giant aneurysm at left proximal saccular pyramid-like aneurysm at C6 segment of intracranial left ICA using brain angiography CT scan and digital subtraction angiography. Her Hunt and Hess scale was 3, with potential survival rate of 50%.[2]

Aneurysm rebleeding, brain edema, hydrocephalus, and vasospasm have been widely recognized as the complications of aSAH. Therefore, it is recommended to initiate definitive management of brain aneurysm obliteration as early as possible, particularly within 24 hours of onset (2023 American heart association/ American stroke association guideline, class of recommendation I, level of recommendation B).[1] In addition, the national guideline of medical care of stroke in Indonesia recommended that this definitive approach should be performed either before 4 days or after 14 days of onset. This was in conjunction with the possible occurrence of cerebral vasospasm at 4-14 days of onset.7 The definitive approach in this case was performed within 3 days of onset.

In this case, the brain aneurysm was identified as a saccular pyramid-like aneurysm located at the C6 segment of the intracranial left internal carotid artery (ICA), with a dome diameter of 5 mm and a neck length of 5mm. The aneurysm's characteristics, including its more superficial location, wide neck, and an unfavorable dome-to-neck ratio of less than 2, indicated that surgical clipping would be the preferred definitive approach.[2] However, considering the patient's older age and several comorbidities, an endovascular approach was suggested as a potentially better option.[2,7] Challenges arose due to the specific characteristics of the aneurysm for coiling, including narrow neck of <4 mm, anterior circulation, and size of <10 mm.[2]

The advances of endovascular approach has led to several novel methods to treat brain aneurysm other than endovascular coiling, including pipeline embolization device, flow diverter stent, and endosaccular coiling. This advancement has broadened the scope of endovascular approach to include wider neck, saccular, or even fusiform aneurysm.[2,7,8] Pipeline embolization device had disadvantage of the need of double antiplatelet 7-10 days prior to its insertion to prevent thromboembolic event, which result in the increased risk of rebleeding. Flow diverter stent was preferred in this case due to its role in managing wider neck and giant aneurysm, especially at those with high perforating arterial supply such as distal ICA.[2,9]

Flow diverter stent in this case was inserted to cover from proximal (C5 segment) to distal (C7 segment) end of aneurysm using a 4×35 mm silk stent. Silk is a type of flow diverter stent characterised with low porosity leading to velocity reductions of up to 90%. This property was beneficial for directing blood flow within the stent, disrupting blood flow to the aneurysm, and promoting progressive thrombogenesis within the aneurysm sac.[10]

However, using a flow diverter stent presents a dual challenge. On one hand, there was increased risk of thrombosis and potential occlusion of the parent or distal arteries. On the other hand, there was also increased risk of aneurysmal rebleeding following the initiation of dual antiplatelet therapy to prevent thrombosis. A study by Al Matter et al reported that 6 of 45 (13.3%) subjects experienced periprocedural complication including intraprocedural rebleeding, stent thrombosis, and refractory cerebral vasospasm, but flow diverting stent had advantages of preventing wire or catheter manipulation within the aneurysmal sac. Total of subtotal occlusion rate of aneurysm was reported up to 90% at a mean of 9.6 months, with 18% of overall complications including 4% of rebleeding rate and 7% of treatment-related morbidities based on a meta-analysis of 20 studies.4 Therefore, flow diverter stent is typically considered when coiling or clipping are not viable treatment options for the patient, including in this case.[1,4]

This report described the successful insertion of flow diverting stent along with appropriate management of periprocedural and postprocedural treatment for ruptured wide-neck saccular aneurysm. Further reports using similar approaches for addressing challenging aneurysm properties should be undertaken, particularly in elderly with comorbidities, to provide larger coverage of endovascular treatment to encompass a more diverse range of aneurysm characteristics and patient profiles.

CONCLUSION

Ruptured aSAH may not be as common as ischemic stroke or spontaneous intracerebral hemorrhage, but its impact is profound, often leading to severe disability and high mortality rates. When considering how to treat brain

aneurysms, it's crucial to take into account both the characteristics of the aneurysm and the patient. Flow diverting stent may be a prudent approach, particularly for older patients with complex comorbidities, wide-neck or giant aneurysms located in the anterior circulation, and especially for those who are not suitable candidates for clipping or coiling. Furthermore, it's paramount to monitor, evaluate, and manage the risk of both rebleeding and thrombosis appropriately to ensure the long-term success of this management approach.

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