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Research/Technical Note

Endovascular Stenting of Vertebral Artery Dissection in Acute Ischemic Stroke

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Abstract: Background: Vertebral artery (VA) dissection causing acute stroke is commonly treated with anticoagulation and rarely requires stenting. While stenting for atherosclerotic stenosis of VA is an established and efficient treatment option, the safety of stenting for VA dissection has not been studied. Case information: We report the technical challenges associated with stenting of a proximal VA dissection in a 74 year-old male with NIHSSS > 20 outside of the time window for thrombolytic therapy presenting with acute basilar artery thrombus and a hypoplastic contralateral VA. Methods: A coronary Drug-Eluting Stent (DES) was implemented in right VA following balloon angioplasty and basilar artery thrombolysis to maintain the patency of the dissected area in proximal VA. Results: The procedure was completed without complication. Postoperative Digital Subtraction Angiography (DSA) confirmed the patency of the vertebrobasilar system. There was no evidence of significant residual stenosis in the right vertebral artery on the follow up Computed Tomography Angiography (CTA) 2 months after the stent placement. Conclusion: Endovascular stenting of proximal VA dissection in the setting of acute ischemic stroke is relatively safe and feasible. It could be particularly considered in patients ineligible for IV thrombolysis with a hypoplastic contralateral VA. Further studies are needed to evaluate the long-term safety and efficacy of stenting for VA dissection.

Keywords: Vertebral Artery, Drug-Eluting Stent, Stroke

1. Introduction

Endovascular therapy has emerged as a primary treatment for patients with large vessel occlusion in the anterior circulation. However, its utility in the posterior circulation is not as well established. Occlusion in posterior circulation is the cause of approximately 12% of acute strokes and is associated with higher mortality rates compared to acute anterior circulation strokes. The patients with posterior circulation stroke are less likely to undergo endovascular treatment. [1] Vertebral Artery (VA) dissection is an uncommon but increasingly recognized etiology of stroke. [2-4] While stenting for atherosclerotic stenosis of VA is an established and efficient treatment option [5-7] and the rate of in-stent stenosis is lower with Drug-Eluting Stents (DESs) compared to Bare Metal Stents (BMSs) [8], the safety of stenting for VA dissection has not been previously presented. [9].

2. Case Presentation

2.1. Patient

A 74 year-old male with a past medical history of atrial fibrillation on aspirin was transferred to our hospital after he was found unresponsive with a head CT demonstrating hyperdensity in basilar artery concerning for acute thrombus. Upon arrival, the patient was intubated and sedated with a NIHSSS >20. His neurological examination under sedation was notable for small reactive pupils. The corneal, gag, cough and vestibulo-ocular reflexes were present. There was no facial asymmetry and the patient was withdrawing in all extremities. CTA showed non-occlusive thrombus in the basilar artery, extending from the mid pons to the basilar terminus (figure 1-A) and occlusion of the right V1 segment with reconstitution at the level of the right C7 (figure 1-B).

Given The patient's moribund clinical status thrombectomy was offered.

2.2. Interventional Procedure

After achieving a right common femoral artery access a 6F destination sheath connected to heparinized saline infusion was advanced to the right subclavian artery. A diagnostic angiogram showed no anterograde flow from the right VA origin. A 5F Envoy with 035 wire was loaded into the system and after multiple attempts Envoy was successfully advanced into the V2 segment. Repeat angiography demonstrated irregularity in proximal V1 segment consistent with dissection (figure 1-C). The patient was loaded with Integrilin. A Boston Scientific Sterling balloon over a Synchro 2 exchange length wire was loaded into the Envoy and inflated at the area of vertebral irregularity (figure 1-D). Following balloon angioplasty, the destination sheath was advanced into the VA and utilizing the Solumbra technique, a Penumbra ACE catheter with a Solitaire device were used to perform a single pass thrombectomy in basilar artery. A subsequent angiogram showed successful revascularization. To maintain the patency of VA origin, a Resolute (R-) Onyx DES, 5.0 mm x 30 mm, was deployed in the area of dissection and the final angiogram confirmed the patency of the vertebrobasilar system (figure 2-A and B).

2.3. Outcome Measure

There were no peri-operative complications. The patient was initially placed on dual antiplatelet therapy (DAPT) with aspirin 325mg and plavix 75mg then transitioned to Aspirin 81 and Apixaban after a month. Post-operative CTA showed the resolution of filling defects in the basilar artery without significant residual stenosis in the right vertebral artery. He was discharged to rehab on post-operative day 10 with a mRS score of 4. A 2-month follow up CTA was unchanged compared to prior study.

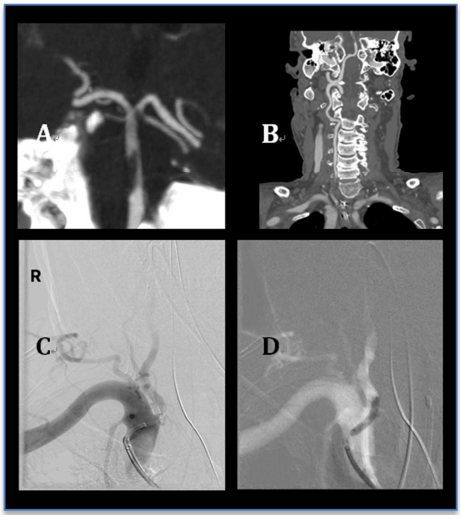

Figure 1. *CTA showing (A) non-occlusive thrombus in the basilar artery and (B) occlusion of the right V1 segment with reconstitution at the level of the right C7 (B). Digital subtraction angiogram showing dissection in proximal V1 segment (C) before and (D) after balloon angioplasty.*

Figure 2. *(A and B) Right V1 segment after stent placement.*

3. Discussion

Endovascular thrombectomy in patients with acute basilar artery occlusion due to VA dissection in the presence of a hypoplastic contralateral VA is technically challenging. In such cases thrombectomy requires passage of the catheter through the dissected VA that is associated with the potential risk of traumatic injury to the vessel wall and extension of the dissection resulting in further narrowing of the arterial lumen. In our case the procedure was technically complicated due to multiple factors. The contralateral VA was hypoplastic not amenable to catheterization for thrombectomy, leaving the dissected VA as the only passage for reaching the thrombus in basilar artery. The dissection was located at the origin of the VA with complete occlusion of the arterial lumen making wire crossing more difficult. Thrombectomy was successfully performed after balloon dilation; however, re-occlusion of the dissected portion of the VA occurred after angioplasty that would result in vertebrobasilar insufficiency without stenting to preserve the patency of the dominant VA.

There are few reports on stenting of a vertebral artery dissection in the setting of an acute stroke. Kawaguchi et al reported a case of successful percutaneous trasluminal angioplasty and stenting for traumatic vertebral artery dissection at the level of C2 vertebrae in a patient presenting with dysarthria due to cerebellar infarction 5 days following the trauma. [10] The procedure was uneventful and the patient made a full recovery. There was no evidence of in-stent stenosis on cerebral angiogram 6 months after stent application.

Fields et al. in a case series of endovascular thrombectomy for acute ischemic stroke due to arterial dissection reported stent placement for VA dissection in one of the patients. [11] The patient presented with a baseline NIHSSS of 17 with a clot and dissection in right VA and basilar artery. The arterial puncture for thrombectomy occurred 5.5 hours after the onset of symptoms without prior administration of IV thrombolysis. Thrombectomy was performed with TICI 3 recanalization after 3 passes. There was no peri-procedural complication and the mRS score at 90 days was 1.

With advancement of stent technology, DESs with a wide variety of anti-proliferative agents have been evolved. DESs are associated with lower rate of in-stent stenosis by

delivering anti-proliferative pharmacological agents and reducing neointimal hyperplasia, a characteristic that may prolong the healing process in dissected vessel. [12] A study by Conrotto et al. describes the safety and the efficacy of DES in spontaneous coronary artery dissection. [13] They reviewed a group of 60 patients treated with DES, 70% with a 2nd generation and 30% with a 1st generation DES, and a group of 48 patients treated with BMS in their multicenter retrospective study. There was no significant difference in complication rate during and one month after the procedure between the two groups. A trend of lower adverse event at long term follow up was observed in the group of patients treated with DES that was not statistically significant. The R-Onyx DES is a balloon-expandable, intraluminal zotarolimus-eluting stent featuring higher visibility with lower contrast load. It is available in multiple diameters from 2.25mm to 5.0mm and is suitable for target lesions less than 35mm in length. [14, 15] Although, the primary indication for R-Onyx is stenting of coronary arteries and there is limited clinical evidence for effectiveness of this stent in other arteries such as VA, in our case minimizing the rate of in-stent restenosis was a major factor influencing decision making for stent selection due to dependency of patient's posterior circulation to the occluded dominant VA. Other factors such as size availability and easy deliverability prompted utilizing the R-Onyx DES.

4. Conclusion

Despite the technical challenges, endovascular stenting of the VA origin dissection in the setting of acute ischemic stroke is feasible with potential benefit for certain group of patients particularly the patients ineligible for IV thrombolysis. Randomized trials are required to further validate the long-term safety and effectiveness of stent placement for dissection of VA. In patients with a hypoplastic contralateral VA who are dependent on the affected VA for posterior circulation utilizing a DES could lower the rate of in-stent restenosis.

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