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Solitaire AB Stent Deployment for Treatment of Basilar Apex Aneurysm via the Posterior Communicating Artery

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ABSTRACT

AIM: To report the retrograde technique of horizontal stenting through the PCoA using a Solitaire AB stent.

MATERIAL and METHODS: A self-expandable stent was deployed from one posterior cerebral artery to the opposite, across the neck of a ruptured wide-neck basilar apex aneurysm.

RESULTS: The technique allowed successful aneurysm embolization with coils in a 53-year-old woman.

CONCLUSION: Differently from clipping, where the fetal posterior communicating arteries may represent an obstacle, in endovascular treatment it provides an alternative way to the aneurysm. The Solitaire AB stent is easy to navigate, fully retrievable and repositionable, which enables accurate deployment.

KEYWORDS: Basilar artery, Endovascular procedures, Intracranial aneurysm, Stents, Therapeutic embolization

INTRODUCTION

Microsurgical treatment of basilar artery (BA) aneurysms tends to be challenging due to their deep location and close relationship with eloquent structures (8,9). In addition, the posterior communicating artery (PCoA) sometimes crosses the small surgical corridor and requires ligation to reach the aneurysm (1,5,9). This arterial sacrifice is especially dangerous in patients with the fetal-type PCoA, in whom the posterior cerebral artery (PCA) originates from the internal carotid artery (ICA). Furthermore, in this anatomical variation, occipital infarct leading to hemianopia may occur (1,5). Whereas recent advances in endovascular techniques offer new therapeutic options, here we describe a case of a patient with a ruptured BA aneurysm who was successfully treated by horizontal stenting assisted embolization that was deployed through the PCoA.

ILLUSTRATIVE CASE

Ethics Committee of Cajuru University Hospital has approved this study, and written informed consent was achieved and signed by the patient. All patient identification was removed to preserve anonymity.

Clinical Presentation

A 53-year-old woman presented at the Emergency Room with sudden headache and vomiting. Her neurological exam showed somnolence, nuchal rigidity, the Glasgow Coma Scale of 14, the Hunt–Hess scale 4, and the World Federation of Neurosurgical Societies' grading system II. A computed tomography (CT) scan showed ventricular and subarachnoid hemorrhage and Fisher grade IV (Figure 1). Emergency cerebral angiography showed a saccular aneurysm of the BA tip, measuring 6 mm × 5 mm in diameter (Figure 2A, B). In addition, an angiogram showed tortuosity and kinking in the left vertebral artery (VA), hypoplastic distal segment of the right VA, and right fetal-type PCoA.

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Figure 1: A pre-operative computed tomography scan showing intraventricular and subarachnoid hemorrhage.

Surgical Technique

A 6F guiding catheter (Neuron; Penumbra, Alameda-CA, USA) was positioned into the left VA, but progression attempts were unsuccessful. The guiding catheter was then repositioned within the distal segment of the right ICA. Under direct visualization through roadmapping, a microcatheter (Rebar 18; Medtronic, Minneapolis-MN, USA) was inserted over a microguidewire (Silver Speed 0.014 inch; Medtronic) through the right PCoA and right P1 segment of PCA, and then positioned into the left P1 segment (Figure 2C). Following guidewire removal, a 4 × 20 mm stent (Solitaire AB; Medtronic) was advanced crossing the midline. The stent was released, completely covering the aneurysm neck, and the microcatheter was removed. The aneurysm was then accessed with a smaller microcatheter (Echelon 10; Medtronic), which was positioned through the stent struts. Uncomplicated embolization was performed with five platinum coils (Axium; Medtronic), achieving complete aneurysm occlusion (Figure 2D, E). Systemic anticoagulation with intravenous heparin was started following placement of the first coil, and loading doses of 300 mg aspirin and 600 mg clopidogrel were administered via the nasogastric tube at the end of the procedure.

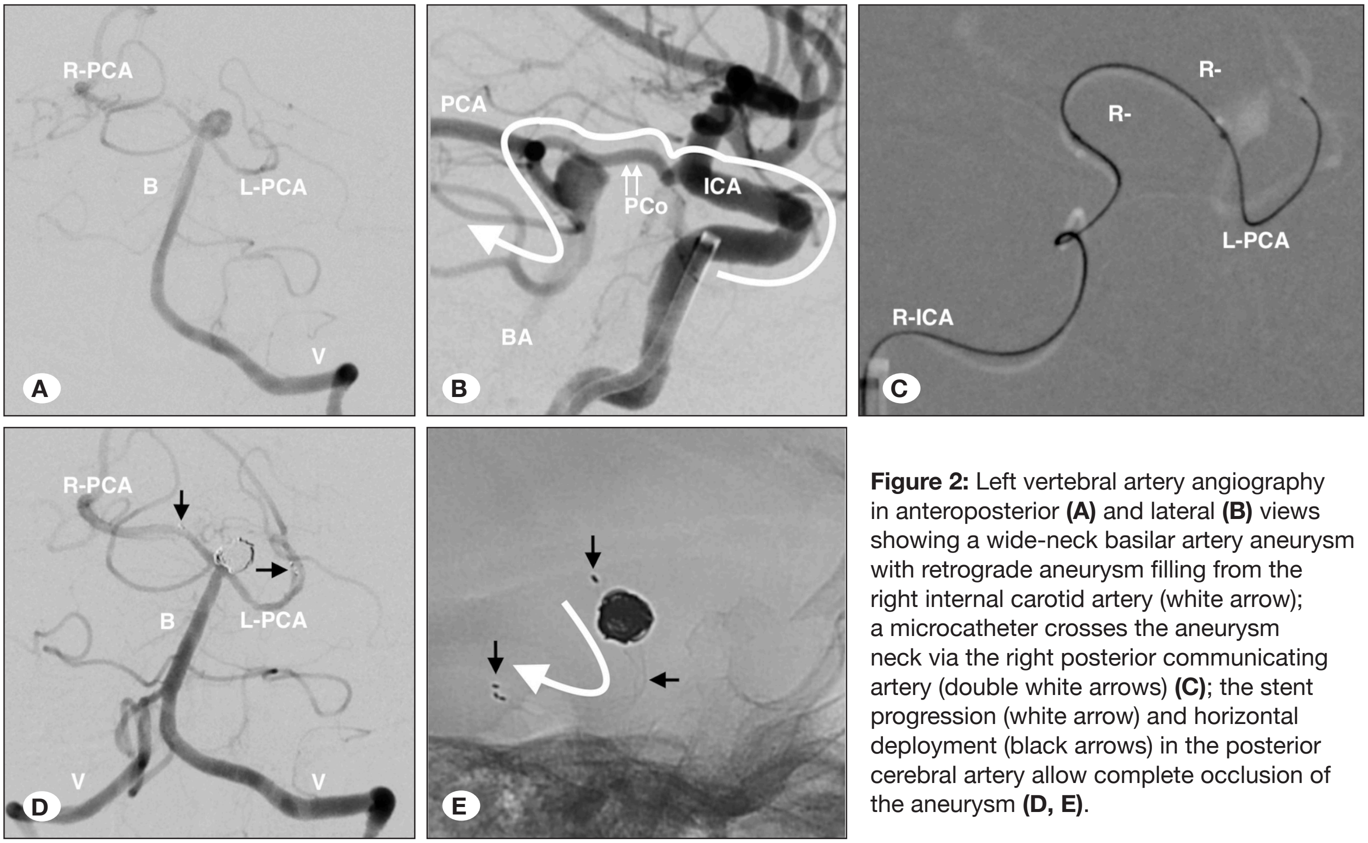

Figure 2: Left vertebral artery angiography in anteroposterior **(A)** and lateral **(B)** views showing a wide-neck basilar artery aneurysm with retrograde aneurysm filling from the right internal carotid artery (white arrow); a microcatheter crosses the aneurysm neck via the right posterior communicating artery (double white arrows) **(C)**; the stent progression (white arrow) and horizontal deployment (black arrows) in the posterior cerebral artery allow complete occlusion of the aneurysm **(D, E)**.

Postoperative Course

Double antiplatelet therapy was maintained, and a postoperative CT scan ruled out any complications. During hospitalization and vasospasm monitoring, transcranial Doppler, biochemistry tests, and echocardiography were performed, all of them were showing normal values. The patient was discharged from hospital 12 days later and was able to resume her normal activities.

DISCUSSION

BA apex aneurysms represent approximately 3% of intracranial aneurysms, and the anatomical condition inflict wall hemodynamic stress, thus contributing to the aneurysm formation (1,5,9). Knowledge of the basic anatomy of the Willis polygon and its variations is necessary to achieve therapeutic success (8,9). The fetal-type PCoA is a common variant where the PCA originates from ICA, which can increase the shear stress in the BA apex (2,4,5).

As microsurgical clipping of ruptured BA apex aneurysms has been associated with high morbidity and mortality, the treatment has progressively migrated toward endovascular therapy (2). However, BA apex aneurysms have frequently a wide-neck and unfavorable geometry for conventional or balloon-assisted coiling, and therefore, adjunctive technologies are required (2,3,7). When the PCAs project superiorly from BA to form an obtuse angle, deploying two stents in a Y configuration may be preferable; otherwise, if both PCAs leave the BA at a perpendicular or acute angle, like in this case, the horizontal stent implantation may provide better approximation to the aneurysm neck (2). In addition, it could cause less flow disturbance and minimize the wall stress, thus protecting the aneurysm neck better (2,4). Although horizontal stent deployment necessitates at least one larger PCoA, this approach also decreases the complexity, and the costs and the risk of thromboembolic complications, being more advantageous than the Y-stent technique (8).

Horizontal deployment of a stent in the BA apex was first described in the treatment of unruptured aneurysm by Cross et al. (2) and subsequently used for a ruptured aneurysm by Fitzpatrick et al. (4); both groups of authors used the NeuroForm stents (Boston Scientific, Natick-MA, USA). Including those cases, a total of 28 patients with BA apex aneurysms were treated with this technique, also using the Enterprise (Codman & Shurtleff, Raynham-MA, USA) and Wingspan (Boston Scientific) stents (2,4,8). However, to the best of the authors' knowledge, this is the first report of the use of a Solitaire AB stent with this technique. The Solitaire AB stent has large, closed cells in a slotted design, with electrolytic detachment that enables full retrieving and precise deployment, an advantage for difficult locations. In comparison, new generation low-profile stent models, such as stent LVIS Jr. (MicroVention, Aliso Viejo-CA, USA) or NeuroForm Atlas (Stryker, Kalamazoo-MI, USA) have lower profile requiring smaller microcatheters, which may favor the cases of narrow PCoA (6,9,10). All these intracranial self-expanding nitinol stents have specific design, and none seems to be superior to others in all aspects (7). As a result, the stent choice should be individualized, and clinical, anatomical, and technical features should be considered (7). Although these options may be safe, some stents are not available in our practice, and most of them also require access via the BA. In our case, this therapeutic option was chosen due to the difficult access by posterior circulation, as well as the need for precise device deployment considering the tortuosity of the ICA–PCoA route. A single horizontal T-stent implantation via the retrograde approach was sufficient to achieve aneurysmal occlusion, and it permitted good technical and clinical results (4).

Different from microsurgery, where the fetal-type PCoA may pose an obstacle, in the endovascular approach, this artery sometimes offers a safe way to access the BA. Thus, this approach makes an attractive option to keep in the surgeon's armamentarium.

MAIN POINTS

- Ruptured wide-neck BA apex aneurysms have high morbidity and mortality associated with microsurgical clipping.
- The BA apex aneurysms geometry usually requires stent deployment.
- When the PCA leaves the BA at a perpendicular or acute angle, horizontal stent implantation is preferable, and the PCoA route may be considered.
- The Solitaire AB stent presents good navigability and is fully retrievable, being a feasible and safe option to use with this technique.

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AUTHOR CONTRIBUTIONS

Z.D.J., G.L.K., and G.S.A.: conception of the work and acquisition of the data. L.A.M.G., T.V.W.F.O., and A.N.F.: analysis and interpretation of the data. Z.D.J., and G.S.A.: drafting of the work; L.A.M.G., G.L.K., T.V.W.F.O., and A.N.F.: critically revising the work for intellectual content. Z.D.J., G.S.A., L.A.M.G., G.L.K., T.V.W.F.O., and A.N.F.: final approval of the version to be published. Z.D.J., G.S.A., L.A.M.G., G.L.K., T.V.W.F.O., and A.N.F.: accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

REFERENCES

1. Ahn SH, Kim BJ, Kim YJ, Kang DW, Kwon SU, Kim JS: Patterns and outcomes of the top of the basilar artery syndrome: The role of the posterior communicating artery. Cerebrovasc Dis 46:108-117, 2018

2. Cross DT 3rd, Moran CJ, Derdeyn CP, Mazumdar A, Rivet D, Chicoine M: Neuroform stent deployment for treatment of a basilar tip aneurysm via a posterior communicating artery route. AJNR Am J Neuroradiol 26:2578-2581, 2005
3. Demartini Z Jr, Galdino J, Koppe GL, Bignelli AT, Francisco AN, Gatto LA: Endovascular treatment of cerebral aneurysm after renal transplantation in polycystic kidney disease. Interv Neuroradiol 24:284-287, 2018
4. Fitzpatrick D, Chen M, Meyers PM: Horizontal Neuroform stent deployment for a ruptured basilar terminus aneurysm via the posterior communicating artery. J Vasc Interv Radiol 17:1687-1691, 2006
5. Gunnal SA, Farooqui MS, Wabale RN: Anatomical variability of the posterior communicating artery. Asian J Neurosurg 13: 363-369, 2018
6. Jankowitz BT, Hanel R, Jadhav AP, Loy DN, Frei D, Siddiqui AH, Puri AS, Khaldi A, Turk AS, Malek AM, Sauvageau E, Hetts SW, Zaidat OO: Neuroform Atlas Stent System for the treatment of intracranial aneurysm: Primary results of the Atlas Humanitarian Device Exemption cohort. J Neurointerv Surg 11(8):801-806, 2019
7. Krischek O, Miloslavski E, Fischer S, Shrivastava S, Henkes H: A comparison of functional and physical properties of self-expanding intracranial stents [Neuroform3, Wingspan, Solitaire, Leo+, Enterprise]. Minim Invasive Neurosurg 54:21-28, 2011
8. Lesley WS, Lyon K: Basilar tip aneurysm Wingspan stent-assisted coil embosurgery via P1 to P1 approach: Proc (Bayl Univ Med Cent) 33:87-89, 2019
9. Pride GL Jr, Welch B, Novakovic R, Rickert K, White J, Dutton-Johnson K, Samson D, Purdy P: Retrograde crossing stent placement strategies at the basilar apex for the treatment of wide necked aneurysms: Reconstructive and deconstructive opportunities. J Neurointerv Surg 1:132-135, 2009
10. Sato H, Haraguchi K: Comparison of stent-assisted coiling for unruptured internal carotid artery aneurysms between LVIS or LVIS Jr. and enterprise VRD: A retrospective and single-center analysis. Turk Neurosurg 31(3):379-384, 2021