Endovascular Coiling for a Ruptured Proximal Lenticulostriate Artery Aneurysm

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Aneurysms of the lenticulostriate artery (LSA) are rare lesions that are categorized into either proximal (at the junction of the middle cerebral artery trunk) or distal (within the basal ganglia).[1] These lesions have been reported against the background of a diverse array of pathologies including hypertension,[2] vascular malformations,[3] moyamoya disease, substance abuse, systemic lupus erythematosus, ventricular neurocytoma, and Sneddon's syndrome;[4] however, most cases are idiopathic.[1]

Ruptured aneurysm has a high risk of re-bleeding with a consequent marked decreased risk of patient survival and functional independence,[5] for proximal LSA aneurysm, neurosurgery has been the mainstay of treatment, but its efficacy remains controversial.[1] Development of devices and improved operator experience have rendered endovascular coiling an alternative and acceptable option for such patients.[1,6] In this case report, we illustrated the feasibility of a tailored endovascular coiling for a patient with a subarachnoid hemorrhage due to a left proximal LSA aneurysm.

A 40-year-old right-handed African-descent woman from Tobago, with a history of diabetes mellitus and hypertension, presented initially with loss of consciousness and seizures. The duration of loss of consciousness and seizures were uncertain. The patient subsequently developed a headache upon recovery, remained alert and orientated for 3 days, following which the headaches ceased. No neurological deficits were reported.

The patient went to Port of Spain General Hospital for treatment on April 21, 2015. Brain computer tomography (CT, April 22, 2015) images showed diffuse subarachnoid hemorrhage [Figure 1]. She presented with a Hunt and Hess grade III at the onset. The following CT arteriography (April 22, 2015) revealed a patent circle of Willis without any evident aneurysm, arteriovenous malformation, or other vascular anomaly. Digital subtraction angiography (DSA, April 22, 2015) demonstrated a 2 mm × 3 mm fusiform aneurysm with a visualized 0.2 mm neck located at the proximal segment of the left lateral LSA [Figure 2a]. The risks and benefits of conservative medical treatment, surgical clipping, and noninvasive endovascular coiling were individually discussed with the patient and her family. In light of risk of re-rupture by conservative medical treatment and of postoperative basal ganglia infarction by clipping, endovascular coiling of left LSA aneurysm was chosen.

The operation was implemented on April 29, 2015. Under general anesthesia, a 6 French Neuron Guiding Catheter (Penumbra Inc., San Leandro, California, USA) was placed at the C1 segment of the left common carotid artery via guide catheter, a co-axial assembly of a 0.014-in diameter X-pedion-14 microguidewire (Covidien/ev3, Irvine, CA, USA) and Headway-17 microcatheter (MicroVention Inc., Tustin, CA, USA) were used. While the microcatheter

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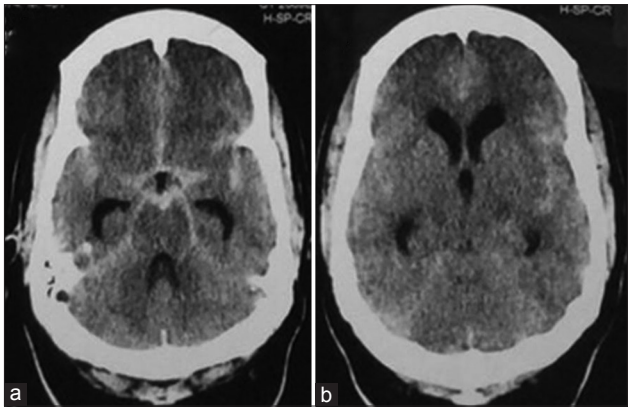

Figure 1: (a) Noncontrasted head computer tomography demonstrating diffuse subarachnoid hemorrhage at slice of cisterna ambiens. (b) At slice of cistern of lateral sulcus, the hemorrhage of the left side is a little more serious than that of the right side.

was positioned at the origin of the lateral LSA, the microguidewire was then withdrawn, a 2 mm × 3 cm Axium™ Helix Platinum Coil (Covidien/ev3, Irvine, CA, USA) was tried but failed into the aneurysm. After removal of the coil, the microcatheter was gently placed between half-way to two-thirds of the way into the aneurysm dome after several attempts with the help of the microguidewire. Then, a new 2 mm × 3 cm Axium Helix Platinum Coil was inserted into the aneurysm. A subsequent angiogram demonstrated partial embolization of aneurysm and good antegrade flow to the lateral LSA [Figure 2b]. A second 2 mm × 1.5 cm Axium Helix Platinum Coil was then placed into the aneurysm which on final check angiograms, demonstrating complete aneurysm obliteration while preserving the LSA [Figure 2c and 2d]. Considering a complete embolization of aneurysm may cause occlusion of the ostium of the lateral LSA, the procedure was decided to be finished at this stage. During the procedure, 4000 U bolus heparin was used followed by 1500 U an hour later. Nimodipine was used perioperatively as a continuous intravenous infusion to reduce the risk of vasospasm. The patient displayed no periprocedural neurological complications. Three days after the intervention, the patient was discharged with no neurological deficit.

In this case, the aneurysm was classified as the proximal type of LSA aneurysm. The preoperative angiogram showed the aneurysm neck that was incorporated into the origin of the perforating artery. For proximal LSA aneurysm, the optimal treatment remains controversial.[7] Both surgical and endovascular treatment have been described primarily through case reports and small case series representing the experience of individual interventional neurosurgeons or neuroradiologists. Surgical challenges often faced were related to small size, deep location, and complex surrounding vasculature of these aneurysms, making intraoperative localization difficult with added postprocedure risks. Moreover, isolated clipping of the aneurysm neck is seldom possible and generally, sacrifice of the parent vessel is required.[1] Endovascular coiling thus provides a promising alternative approach to treat proximal LSA aneurysms.[1,6]

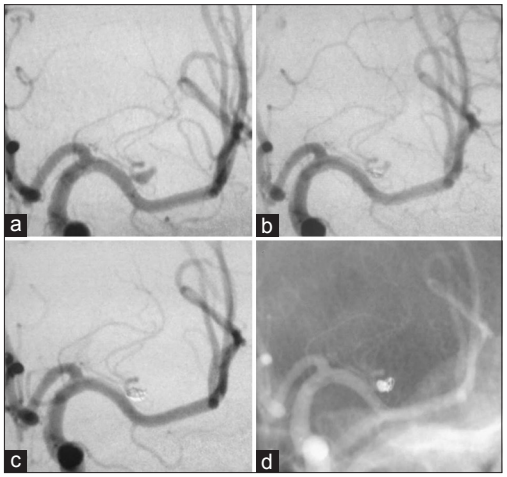

Figure 2: (a) Diagnostic angiogram with a proximal lenticulostriate artery aneurysm, with the perforator artery arising from the base of the aneurysm. (b) The angiogram after the first coiling with partial embolization of aneurysm and good antegrade flow to the lateral lenticulostriate artery. (c and d) The final angiograms after embolization with complete obliteration of the aneurysm and preservation of the lateral lenticulostriate artery.

Based on individual features of this aneurysm, several tailored skills were utilized to reduce and avoid complications of noninvasive coiling. The following strategies resulted in a feasible and safe procedure. First because of sparse and delicate collateral supply to the lateral striatal tissues, sparing of the parent artery is crucial to avoid symptomatic postoperative infarctions. Securing a stable microcatheter tip position followed by a near-complete embolization was chosen to reduce the potential occlusion of the origin of the lateral LSA, with yet allowing some antegrade flow of blood supply to the relevant tissues. The literature mentions a protective technique using a second microcatheter to preserve the parent vessel.[6] However in this case, placing another microcatheter into the distal LSA was not only technically difficult but would have also prolonged the procedure considerably due to the aneurysm's 0.2-mm small caliber, acute-angled origin, and tortuous course shortly after its origin.

Second, great care must be taken in monitoring the position of the microcatheter tip as it enters the aneurysm with subsequent coil placements in embolization stage. Aneurysm perforation due to manipulation of microwave and microcatheter tip or insertion of coils is a potentially serious complication. However, the incidence of aneurysm perforation in this case may be lower than that of a pseudoaneurysm, mycotic aneurysm, or distal aneurysm of LSA[8] because the walls of the latter in general are more fragile and easily prone to perforation.

Third, nimodipine was used in the prevention of the vasospasm. Vasospasm is a common complication that follows embolization of aneurysm located at small sized parent vessels. Nimodipine is a dihydropyridine that blocks calcium influx through the L-type calcium channels, which

is approved by the US Food and Drug Administration for the treatment of vasospasm.[9] The additional risk and difficulty of dealing with vasospasm was thus not encountered in this procedure. It should be mentioned that endovascular embolization of LSA aneurysms with glue was also suggested by several literatures.[8] This option was not chosen for this proximal lesion as it was considered to be attached with a higher risk of glue reflux into the parent artery, leading to increased thromboembolic complications.

In addition, the CT angiography was unable to definitively demonstrate the aneurysm in this case. Recently, CT angiography has emerged as a promising image modality for the detection of underlying structural abnormalities in intracranial hemorrhage. However, even with higher-resolution multidetector CT scanners, the sensitivity for smaller aneurysms <3–4 mm is in the range of 74–92%.[10] The teaching point here is that diagnostic cerebral angiography in patients with high clinical suspicion of aneurysm should still be pursued despite negative CT angiography. In summary, we want to emphasize that the mainstay treatment for patients with ruptured proximal LSA aneurysm is endovascular coiling. It provides satisfactory immediate and short-term outcome. Long-term efficacy of this procedure can be evaluated with a follow-up DSA technique.

Endovascular embolization in patients with ruptured proximal LSA aneurysm is technically feasible. Tailored endovascular techniques based on individual aneurysm features may be well advised to reduce and completely avoid major complications.

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Conflicts of interest

There are no conflicts of interest.

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