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Intracranial stents in the management of wide-neck intracranial aneurysms

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Abstract

Intracranial aneurysms are bulges in vessels that are prone to rupture with attendant morbidity and mortality. Early detection and treatment can avoid rupture and its associated consequences. Endovascular treatment of aneurysms with wide neck can be challenging due to potential coil migration or protrusion. The use of intracranial stents and balloons can help overcome some of these management challenges. We present 3 cases of endovascular treatment of wide-neck intracranial aneurysms. The first patient presented with a wide-neck left middle cerebral artery aneurysm that was successfully treated with stent-assisted coiling with complete obliteration of the aneurysmal sac. The second patient presented with a large, cavernous internal carotid artery aneurysm that was successfully treated with a flow diverter stent with complete obliteration of the aneurysm while the third case presented with a wide-neck left posterior communicating artery aneurysm and was also successfully treated with stent-assisted coiling. Even though endovascular treatment of wide-neck intracranial aneurysms is technically challenging, the evolution of new treatment techniques such as the use of stents and stent-assisted coiling make these treatments safe.

Keywords: Intracranial aneurysms, pipeline embolization device, posterior communicating artery, endovascular

INTRODUCTION

An aneurysm is an abnormal focal dilatation/bulge of an artery [1]. Most aneurysms are unruptured and asymptomatic and are often discovered incidentally but rupture of an aneurysm can result in a potentially life-threatening subarachnoid haemorrhage (SAH) [2]. Unruptured aneurysms may also be symptomatic showing cranial nerve palsy when enlarged due to mass effect on the brain. Traditionally, open surgery was the most commonly used method to treat aneurysms by placing a clip across the neck of an aneurysm to eliminate flow from the parent artery into the aneurysm sac [3]. Since the introduction of endovascular treatment of intracranial aneurysms using detachable platinum coils in 1990 by the Italian neurosurgeon Guido Guglielmi, endovascular treatment methods have gained tremendous acceptance as an alternative method for the treatment of intracranial aneurysms [4]. Especially so because endovascular treatment of intracranial aneurysms is associated with lower morbidity and mortality rates compared with traditional microsurgical clipping [5]. Wide-necked intracranial

aneurysms are the most difficult to treat with the endovascular method because of the risk of distal coil migration or coil protrusion into the parent vessel [6,7]. Wide-neck aneurysm is defined as neck diameters > 4 mm or dome-to-neck ratio < 2. Some of the techniques and devices that can be used in the treatment of wide-necked aneurysms include balloon remodeling, use of three-dimensional coils, combined use of stents and coils, and flow diverters. Others include use of intrasaccular flow disruption, simultaneous deposition of more than one coil in an aneurysm, intentional partial aneurysm embolisation and combined extra- and intrasaccular treatment [8]. This study aims to share case series of some of our preliminary experiences in the endovascular treatment of wide-neck intracranial aneurysms, and the options and efficiency of different treatment modalities. This initial case report to the best of our knowledge represents the first case series of intracranial stenting in Ghana and West Africa.

CASE 1

A 71-yr. old male with recurrent history of headaches for 4 yr. was referred to our institution for computed tomography scan with angiography. He had 10-yr. history of well controlled hypertension and Type 2 diabetes. His physical examination (cardiovascular, respiratory, abdominal and

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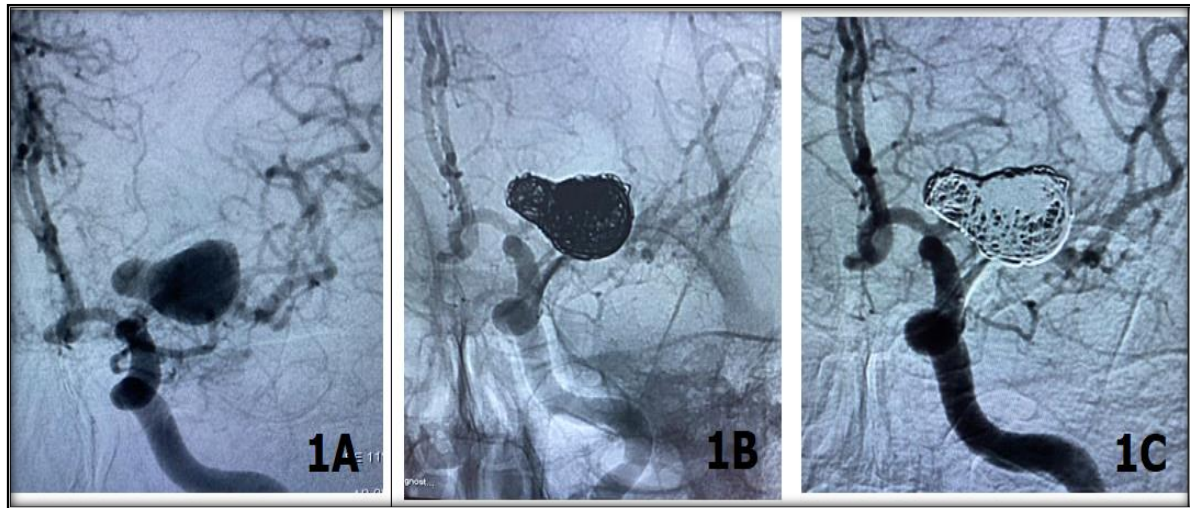


Plate 1: Internal carotid digital subtraction angiogram obtained (x 2 magnification): (1a) before and after coil embolization demonstrating a huge dumbbell shaped middle cerebral artery segment 1 aneurysm: (1b) and (1c) shows complete filling of the aneurysm post stent-assisted coiling.

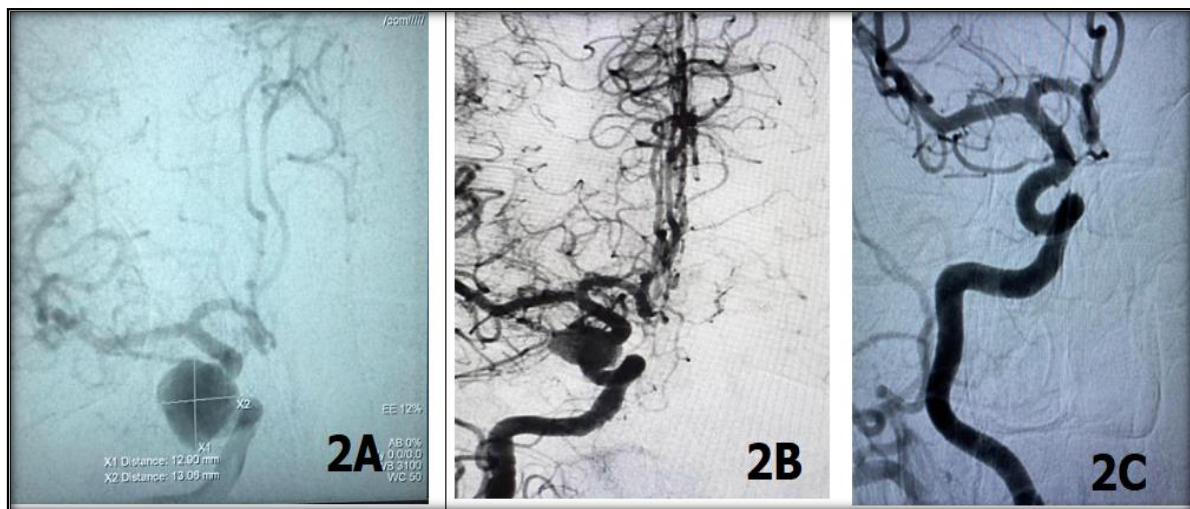


Plate 2: Digital subtraction angiography (x 2 magnification) demonstrating a huge, cavernous aneurysm (2a) and (2b). Slide (2c) shows complete exclusion of the aneurysm at 6 months.

neurological) was unremarkable with no motor or sensory deficit. Liver and kidney function tests were normal. His initial diagnosis by computed tomography angiography was a saccular aneurysm of the left middle cerebral artery. Digital subtraction angiography confirmed wide-neck saccular aneurysm involving the M1 segment of the left middle cerebral artery (Plate 1a). It measured 13.9 x 21.9 mm. Under general anaesthesia and using Seldinger technique, 7F vascular sheath was sited in the right common femoral artery. A 7F envoy guide catheter and a 0.035 inch hydrophilic wire were advanced into the left internal carotid artery under fluoroscopic guidance. A headway 17 microcatheter and 0.14 traxcess wire advanced into the

aneurysm. Another headway microcatheter was used to jail a 3.5 x 2 mm self-expandable braided Leo-Baby stent (Balt, Montmorency, France). Coiling was done till the aneurysm was completely occluded (Plate 1b and 1c). There were no immediate complications and no complications reported by the patient over a 12-wk follow-up period. His initial complaints of recurrent headaches resolved.

CASE 2

A 40-yr. old woman with history of hypertension, presented with 2-mos history of intermittent headaches, dizzy spells, and ptosis. Two weeks prior to visiting the hospital, she experienced sudden onset of severe headache which woke

her up from sleep. On examination, she had ptosis of the right eye and no other cranial nerve palsy was noted. An initial clinical impression of intracranial space occupying lesion was made, likely a cavernous lesion. Follow up digital subtraction cerebral angiography demonstrated a giant 14 x 13 mm saccular right cavernous aneurysm (Plate 2). Under general anaesthesia and using Seldinger technique, 7F vascular sheath was sited in the right common femoral artery. Pipeline embolization device (Intracranial flow diverter stent Medtronic, USA) insertion was done, and the cavernous internal carotid artery aneurysm excluded from the parent artery. Symptoms improved over the course of 6 months with no new symptoms. Follow up digital subtraction cerebral angiography (Plate 2) at 6 months showed complete obliteration of the aneurysm.

CASE 3

A 71-year old woman was referred to our institution on a clinical suspicion of left internal carotid artery stenosis on ultrasound examination. She is a known hypertensive for 4 years on medication. She had no history of stroke or transient ischaemic attack. Physical examination was unremarkable. Muscle power was 5/5 in all limbs. Digital subtraction angiography showed an incidental 4.8 x 3.7 mm saccular aneurysm of the right posterior communicating artery with normal caliber internal carotid artery bilaterally with no stenosis. Under general anaesthesia and using Seldinger technique, 7F vascular sheath was sited in the right common femoral artery and a 7F enjoy guide catheter navigated into the right internal carotid artery. The aneurysm was cannulated with a

headway 17 microcatheter. Another headway 17 microcatheter was used to jail a 3.5 x 1.8 cm Leo-Baby stent (deployed across the neck of the aneurysm) and coiling done with complete obliteration of the aneurysm (Plate 3). Twelve weeks later, follow-up showed complete obliteration of the aneurysm and no new symptom.

DISCUSSION

This study presents treatment of three cases of wide-neck unruptured intracranial aneurysms. One patient was treated with a flow diverter stent and the other 2 were treated with stent-assisted coiling techniques on account of unfavorable necks. Commonly, unruptured aneurysms are asymptomatic and incidentally discovered during diagnostic imaging [2]. They may be symptomatic due to mass effect or when they rupture causing life-threatening subarachnoid haemorrhage [2]. Cranial nerve III, IV and VI palsies may result in strabismus, diplopia and mydriasis [9]. In addition, cranial nerve III palsy may result in ptosis as noted in case 2. Most patients with unruptured aneurysm report history of headache as seen in all our cases. The cause of the headache is unknown given the undefined association between headaches and most aneurysms [10]. However, ruptured aneurysm often presents with sudden onset of severe headache, neck pain, nausea/vomiting, photophobia, loss of consciousness and/or hemiparesis [11,12].

Endovascular treatment for intracranial aneurysms is an accepted treatment option with excellent clinical outcomes and provides sufficient protection against rupture and rebleeding of aneurysms [9]. None of our patients experienced any major intracranial artery treatment complications. All patients were on dual antiplatelet therapy. However, one patient had spontaneous retroperitoneal bleed likely related to the use of dual antiplatelet therapy (DAT) for which DAT was suspended temporarily. This is a common complication by patients on anticoagulation [13]. The treatment success of these cases in the current study represents a small progress in the treatment of wide-neck intracranial aneurysms in Ghana and West Africa. Over a 2-yr. period, we have treated 21 cerebral aneurysms of which 14.3% were wide-neck aneurysms. In a low resource setting such as Ghana, challenges of performing such a novel procedure can be classified as lack of human resource, lack of well-equipped institutions and lack of financing. Currently, in Ghana only Euracare Advanced Diagnostic and Heart Center has the facilities to perform such procedures and with only one interventional radiologist in the country for a population of thirty million accessibility has become a challenge. The high cost of the stents, wires, catheters and other consumables makes it difficult for many patients who truly need this service to afford treatment. Simple coil embolization for wide-necked aneurysms can result in a higher rate of aneurysm recurrence [7]. The recent publications of multi-center randomized trials including the



Plate 3: Digital subtraction angiography images demonstrating wide-neck saccular aneurysm of the posterior communicating artery post stent assisted coiling (x 2 magnification)

International Subarachnoid Aneurysm Trial showing improved safety and clinical outcome of endovascular methods compared with open clipping is encouraging to endovascular neurosurgeons and neuro interventional radiologists [14,15]. Stent-assisted coiling has a high technical success rate. Aydin et al. [16] achieved a technical success of 97.5% among 78 patients who were treated with Leo-Baby stent.

Coiling and flow diversion complications are categorized as complications in the intracranial artery, extracranial artery, related to the placing of the guiding catheter, and those related to the puncture site. Intraprocedural aneurysm ruptures and thromboembolic events are described as the most common intracranial artery complication. Others include, coil migration, stent migration, stent thrombosis and delayed aneurysm rupture [9], however these complications are rare. Kocur et al. [17] reported 2.9% (n = 1/34) periprocedural complication. This was related to prolonged retrieval of migrated coil in the anterior cerebral artery with consequent large infarction. Neurological complication rate of 0% was reported by Santillan et al. [18]. They reviewed 25 patients with 25 anterior communicating artery aneurysms using the Low-profiled Visualized Intraluminal Support Jr stent. Twenty four out of 25 patients were treated successfully without complications with one technical failure.

Conclusions

The endovascular treatment of wide-neck intracranial aneurysms though technically challenging can be done safely in view of the now available treatment techniques, such as the use of stents and stent-assisted coiling, in Ghana.

DECLARATIONS

Ethical considerations

Permission was obtained from Euracare Advanced Diagnostic and Heart Center. Informed consent was sought from the patients before their history was used in this case series.

Consent to publish

All authors agreed to the content of the final paper.

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None

Competing Interests

No potential conflict of interest was reported by the authors.

Author contributions

BDS, BBJ, DA, EB, and BB contributed to the conception, radiological investigation of the cases, drafting of report, and final review of report.

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Availability of data

All relevant data are provided in the manuscript.

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