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Case Report

Balloon-assisted coiling of the proximal lobule of a paraophthalmic aneurysm causing panhypopituitarism: Technical case report

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Abstract

Background: We describe an intra-aneurysmal balloon-assisted technique to limit the coil volume in a large bilobulated paraophthalmic aneurysm. Our intent was to reduce the mass effect and presenting symptoms of diabetes insipidus (DI) with hypopituitarism.

Case Description: A 32-year-old woman presented with symptoms of DI and her work-up demonstrated hypopituitarism and partial bitemporal visual field defects. Cerebral angiography revealed a large paraophthalmic aneurysm with two distinctive lobules, projecting toward the pituitary fossa. The patient declined craniotomy but consented for endovascular treatment. The plan was to limit the embolization to the proximal lobule only. Initially, we used a dual microcatheter technique with a microcatheter in each lobule. A framing coil in the distal lobule did not prevent coil migration from the proximal lobule. Instead, we elected to use a Hyperform balloon in the distal lobule and were able to successfully coil the proximal lobule only. Her 3-year follow-up angiogram revealed a completely occluded aneurysm. The patient experienced resolution of the DI and improvement of her visual fields. However, she remained in hypopituitarism.

Conclusion: Intra-aneurysmal balloon-assisted coiling of proximal aneurysmal lobules might be an alternative for the reduction of mass effect related to the coil mass. Careful follow-up is needed because subtotal occlusion carries a future risk of growth, recanalization and rupture. Unruptured intracranial carotid aneurysms can present with reversible DI and usually permanent pituitary disturbances..

Key Words: Aneurysm, balloon-assisted coiling, diabetes insipidus, hypopituitarism, mass effect

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INTRODUCTION

Controversy exists about the optimal treatment of intracranial aneurysms presenting with symptoms of mass effect. Total and subtotal endovascular occlusion results in improvement of mass effect and neural compression.[4,6,8,12,23,25,29]

It is well known that intrasellar and suprasellar aneurysms

can present with hypopituitarism,[3,7,11,17] while aneurysm rupture and surgical clipping can lead to diabetes insipidus (DI).[15,16,21] However, there are few reports of unruptured carotid aneurysms presenting with DI.[1,5,22]

We report the case of a patient with an unruptured bilobulated aneurysm of the paraophthalmic carotid artery, presenting with DI, hypopituitarism and partial visual field defects. The patient underwent balloon-assisted coiling limited to the proximal aneurysmal lobule in an attempt to reduce mass effect on the adjacent pituitary gland, hypothalamus and optic chiasm. The report includes the technical challenges encountered and a review of the literature for mass effect associated with coiling. We also discuss the hypothalamic and pituitary disturbances seen with intracranial aneurysms.

CASE REPORT

A 32-year-old woman presented with a 3-week history of persistent headaches, increased thirst, polyuria and blurred vision. Computed tomographic angiography (CTA) demonstrated a large suprasellar aneurysm [Figure 1]. Diagnostic angiography revealed a left supraclinoid segment bilobulated aneurysm projecting into the pituitary fossa. Formal visual field examination revealed partial bitemporal visual field defects. Her endocrine work-up confirmed the presence of hypopituitarism and DI. Supplementation was begun according to the endocrine service recommendations. After a careful discussion of all options, the patient declined surgical clipping/reconstruction but consented to endovascular occlusion.

Intervention

Under general anesthesia, the patient was fully heparinized and a 6-French shuttle sheath (Cook, Bloomington, IN, USA) was placed in the cervical segment of the left internal carotid artery. Initially, and in order to prevent coil migration from the proximal lobule, two Prowler Select Plus microcatheters (Cordis Endovascular, Miami Lakes, FL, USA) were navigated into the distal and proximal aneurysmal lobules, respectively. Then, an undeployed GDC (Guglielmi Detachable Coil, Boston Scientific, Natick, MA, USA) was advanced in the distal lobule with the intent of tamponading the coils deployed in the proximal lobule.[2,18,19] Multiple attempts at coiling the proximal lobule only failed, and we employed the reported approach.

A Hyperform balloon (MicroTherapeutics, Inc., Irvine, CA, USA) was positioned inside the distal lobule, and a Prowler Select Plus catheter was navigated in the proximal one. The balloon was inflated to its maximum capacity and brought to the entrance of the distal lobule. Then, a GDC coil was advanced into the proximal lobule but not deployed. A follow-up imaging run demonstrated appropriate coil positioning, sparing the distal lobule [Figure 2]. This coil was deployed and the proximal lobule was successively coiled with a combination of GDC and Hydrocoils (Micro Vention, Inc., Aliso Viejo, CA, USA). Next, the Prowler Select Plus was withdrawn and the distal lobule deflated by deflating and back bleeding the intra-aneurysmal balloon [Figure 3a].

Finally, in order to withdraw the intra-aneurysmal balloon without disturbing the coil mass, a second balloon (Hyperglide, MicroTherapeutics, Inc., Irvine, CA, USA) was advanced and inflated across the aneurysm neck and the intra-aneurysmal balloon was slowly removed [Figure 3b].

Post-procedural angiography demonstrated a stable coil mass and complete occlusion of the aneurysm.

Postoperative course

The patient was discharged 5 days later. Over the following weeks, she had progressive resolution of polyuric episodes. Three years after treatment, her angiogram revealed a stable coil mass and persistent aneurysmal obliteration [Figure 4]. The patient was no longer in DI, but remained in hypopituitarism. Her blurred vision has resolved, and the visual field deficits have improved.

DISCUSSION

Panhypopituitarism and intracranial aneurysms

Intrasellar and suprasellar aneurysms represent an uncommon cause of hypopituitarism, accounting for only

Figure 1: CT angiogram demonstrates a large suprasellar bilobulated aneurysm with a larger distal lobule and a small left middle cerebral bifurcation aneurysm (a, axial; b, coronal; c, sagittal)

Figure 2: Digital subtraction mask with balloon inflated. The tail of the balloon is the wire in the larger distal lobule

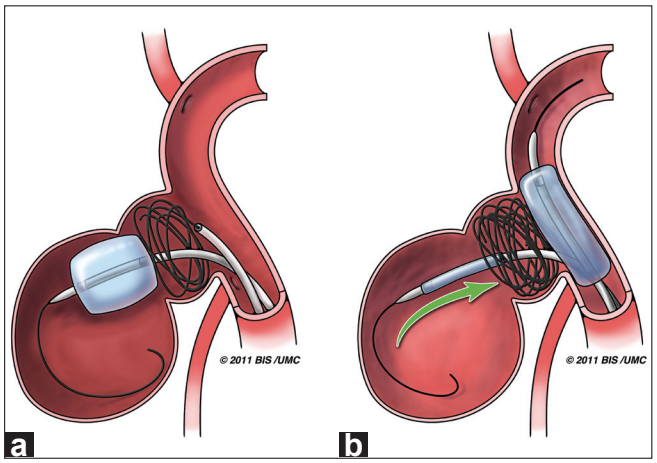

Figure 3: Artist illustration of the intra-aneurysmal balloon-assisted coiling technique. (a) Inflated Hyperform balloon at the entrance of the larger distal aneurysmal lobule, limiting coiling to the proximal lobule. (b) A Hyperglide balloon is inflated across the aneurysm neck as the deflated intra-aneurysmal balloon is slowly removed to prevent coil mass disturbance (Artist: W. Kyle Cunningham, Medical Illustrator at the University of Mississippi Medical Center)

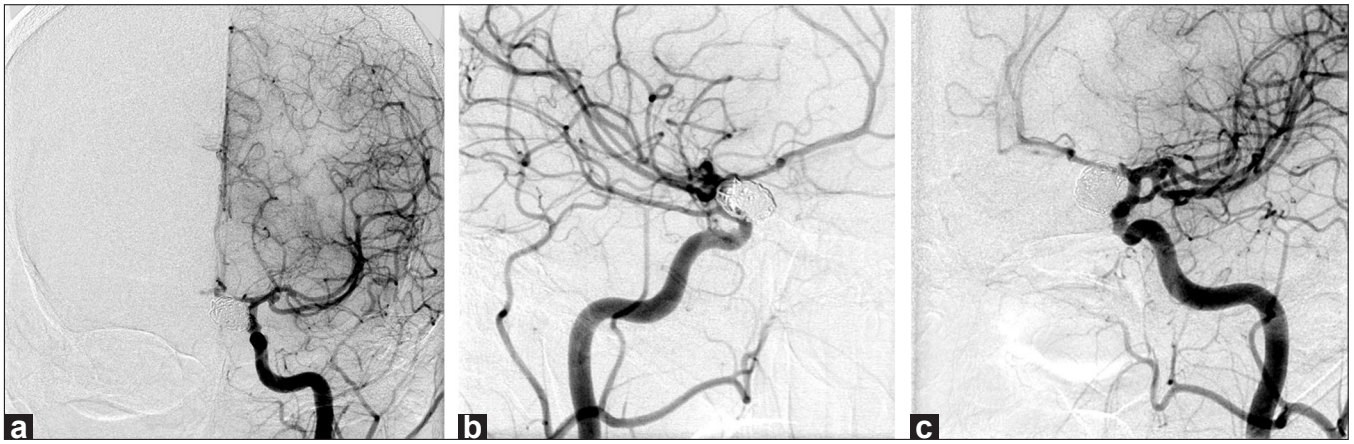

Figure 4: Digital subtraction angiogram 3 years after embolization demonstrates complete occlusion of the proximal lobule and a stable small left middle cerebral bifurcation aneurysm (a, anteroposterior; b, lateral; c, oblique)

0.17% of the cases.[3,7,11,17] Pituitary deficiency may result from compression of the hypothalamus or the pituitary stalk.[7,28] Adrenal, thyroid and gonadal deficiencies along with hyperprolactinemia are the more prevalent abnormalities. DI is very uncommon. Regardless of the therapeutic approach, hypopituitarism is usually permanent, with only a few cases of pituitary function recovery after surgical decompression.[7,10,28]

When DI results from clipping ruptured anterior cerebral or anterior communicating artery aneurysms, it is caused by vasospasm-related ischemia of the anterior portions of the hypothalamus.[15,16,21] We found three cases reported in the literature of unruptured intrasellar and suprasellar aneurysms presenting with DI. In these cases, the proposed mechanism for DI has been direct compression of the hypothalamus, pituitary stalk or posterior pituitary gland.[1,5,22]

In a majority of cases, the DI usually resolves or improves within 3 weeks. DI can be seen in three different patterns: transient with normalization 12–36 hours after onset, prolonged with most returning to normal or near normal at 1 year, and the least frequent triphasic response.[1,5,15,16,21,22] In the case presented, we are unable to conclude whether the resolution of DI was the result of decompression and reduced pulsatility after limited coiling, or merely a reflection of this natural progression.

Technical aspects and mass effect considerations

In a recent report, Fiorella *et al.* described a double balloon technique to coil a large superior cerebellar

artery (SCA) aneurysm. They used an intra-aneurysmal Hyperform balloon to preserve the origin of the SCA at the aneurysm neck. A second balloon (Hyperglide) was used to protect the parent basilar artery and trap the smaller intra-aneurysmal balloon during coiling.[9]

Our patient's bilobulated aneurysm had a smaller proximal lobule. It was reasonable to obliterate the aneurysm and at the same time decrease its mass effect/coil volume by limiting coiling to the proximal lobule. The previously described double catheter technique[2,18,19] with a larger undeployed coil in the distal lobule was employed first and it failed to prevent coil migration into the distal lobule. This led us to use the intra-aneurysmal balloon technique. We do not advocate the use of intra-aneurysmal balloons in ruptured aneurysms and would consider their use only in cases where the distal lobule is larger. In this setting, the proximal lobule can be considered as a "stand alone" aneurysm. In aneurysms with smaller distal lobules, proper occlusion of the proximal lobule only can be done by adequate selection of coils, proper positioning of the microcatheter and manipulation of the catheter–coil system.

We do not recommend having a second deflated balloon within the parent vessel during coil embolization, as it would be a third instrument raising the possibility of thromboembolic events or vascular damage. Nonetheless, it is advised to have a second balloon ready to deploy on the instrument table, in the event of an intraoperative rupture.

Currently available is the Ascent balloon catheter (Micrus endovascular, San Jose, CA, USA), which can also function as a microcatheter/delivery system. If this catheter were available at the time of our reported technique, it would have functioned as the proximal lobule microcatheter and parent vessel balloon. This would have simplified our method to two micro-instruments instead of three, with the added benefit of having a balloon to secure the aneurysmal neck if needed.

Cranial nerve dysfunction, obstructive hydrocephalus, brainstem, and visual pathway compression constitute the more prevalent symptoms of mass effect related to intracranial aneurysms.[8,12,13,20,24,25] Contributing factors for this mass effect include aneurysmal volume, its pulsatile blood flow, and the presence of perianeurysmal edema. It is known that mass effect related to small and large aneurysms improves following total and subtotal coil embolization. Aneurysm size and preoperative duration of mass effect may affect the likelihood of symptoms improving after coil embolization.[4,8,12,13,20,23,24,29]

Having said all this, there seems to be a role for surgical decompression of the coil mass when the mass effect symptoms persist after endovascular coiling.[12,20,24,26,27]

CONCLUSIONS

Balloon-assisted remodeling of the coil mass is a technique available in the treatment of geometrically complex aneurysms. The primary goal of any method of treating intracranial aneurysms is to prevent aneurysm rupture. Considerations of mass effect response are secondary to considerations of the safety, efficacy, and durability of aneurysm obliteration. Whether there is greater reduction of mass effect with a lesser coil mass and distal dome deflation requires further investigation. Careful follow-up is needed because subtotal occlusion carries a future risk of growth, recanalization and rupture.[6,8,12,14,25,27,30]

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Commentary

The authors report a novel and creative strategy to coil only the proximal lobule of an unruptured bilobed aneurysm that was causing symptoms from mass effect, in an effort to spare the added coil mass necessary to coil the aneurysm in its entirety. A hyperform balloon was introduced and inflated in the distal lobule with the microcatheter positioned in the proximal lobule to deliver the coil mass exclusively in the proximal lobule. Once the proximal lobule was adequately coiled, the balloon in the distal lobule was deflated. Prior to removing the deflated balloon across the coil mass, a second balloon was introduced for parent vessel protection and inflated across the aneurysm neck to help buttress it as it is being pulled out so as not to drag the coils out into the parent vessel.

With more favorable anatomy, unassisted coiling of a larger proximal lobule should protect the distal lobule if complete aneurysm exclusion from the circulation is achieved. Balloon inflation in the distal lobule could be dangerous, particularly in the ruptured aneurysm setting. As the authors acknowledge, this is a highly technically demanding strategy that does not have widespread indications but can be kept in our "bag of tricks" for those rare yet extremely challenging cases. This interesting case reminds us that we must continue to become adept and creative at incorporating all adjunctive devices including balloons and stents, alone or in combination, to continue to expand treatment options toward challenging aneurysms. For this, the authors are to be congratulated.

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