Endovascular Management of Ruptured Distal Anterior Cerebral Artery (DACA) Aneurysms: A Retrospective Review Study

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■ OBJECTIVE: **Distal anterior cerebral artery (DACA) aneurysms are rare, and their treatment by either surgical clipping or endovascular treatment poses technical difficulties. Earlier studies have reported higher complication rates in DACA aneurysms compared with other aneurysms in the circle of Willis. Therefore, endovascular management of DACA aneurysms still remains a challenge. The aim of this report is to review clinical presentation, angiographic presentation of DACA aneurysms, complications, and outcome of their endovascular treatment in our institutional experience.**

■ METHODS: **A retrospective review of 186 patients with intracranial aneurysms treated with endovascular management from September 2009 to December 2013 in the Max Superspecialty Hospital, New Delhi, India, 11 patients (5.9%) with 12 DACA aneurysms were studied retrospectively. We report the clinical presentations, cerebral angiographic findings, endovascular treatment, complications, and outcomes. The clinical and angiographic outcomes were assessed using modified Rankin scales and the Raymond scale, respectively.**

■ RESULTS: **Of 11 patients, 54.5% were female and 45.5% were male; the mean age was 48.4 years (range, 33–65 years). All patients had subarachnoid hemorrhage that indicated ruptured DACA aneurysm. All the DACA aneurysms were small. Postcoiling angiograms showed complete occlusion in 9 patients. Two patients had intraprocedural aneurysm rupture but without any clinical sequelae, and 1 patient had thrombus formation, which was thrombolysed at the end of coiling. All patients had good outcomes.**

■ CONCLUSIONS: **Our experience with 11 patients showed that endovascular management of small DACA aneurysms, though associated with higher intraprocedural events, is associated with good outcome.**

INTRODUCTION

The anterior cerebral artery (ACA) arises from the medial aspect of the internal carotid artery (ICA) bifurcation below the anterior perforated substance, as 1 of the 2 terminal branches of the ICA. It courses anteromedially toward the interhemispheric fissure. The usual route that it takes is above the optic chiasm or nerve (1). The ACA is divided into 5 segments (A1–A5).[1,2]

The portion of the ACA complex distal to the anterior communicating artery complex (AcomA) (A2–A5 segments of ACA) is referred to as the distal anterior cerebral artery (DACA). The A2 segment travels in a vertical direction from the AcomA, ending with its bifurcation into the pericallosal and callosomarginal arteries.[2]

Key words
- Coiling
- Distal anterior cerebral artery
- Endovascular management
- Rankin scale
- Raymond score

Abbreviations
ACA: Anterior cerebral artery
AcomA: Anterior communicating artery complex
aSAH: Aneurysmal subarachnoid hemorrhage
DACA: Distal anterior cerebral artery
ICA: Internal carotid artery
SAH: Subarachnoid hemorrhage

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Most authors use the term "pericallosal artery" as being synonymous with the ACA distal to the AcomA.[1] Others prefer to define it as originating at the division of the anterior cerebral artery into the pericallosal and callosomarginal branches, but that is somewhat problematic because approximately 18% of hemispheres do not have a definable callosomarginal branch.[1] The callosomarginal artery arises from the A2 segment at the genu of the corpus callosum.[2] The pericallosal artery travels in the pericallosal cistern, and the callosomarginal artery travels in the cingulate sulcus. Variations of the A2–A4 circulation are common. These developmental variants of the DACA may be associated with an increased propensity for DACA aneurysm formation, particularly at the bifurcation of the pericallosal and callosomarginal arteries. This appears to be especially so in true azygous ACA variants.[1]

Aneurysms of the DACA are rare, and treating them by surgical clipping using an interhemispheric approach presents some difficulties in terms of cingulate adhesions and narrow working space, so surgical morbidity has been reported to be relatively high.[1,3,4] Endovascular treatment is an alternative option in the treatment of intracranial aneurysms, but it also has its fair share of challenges in the treatment of DACA aneurysms.[5-7] An earlier systematic review of 16 studies of DACA aneurysms showed that the complication rates of endovascular treatment in DACA aneurysm are higher compared with other aneurysms in the circle of Willis, with an overall periprocedural complication rate of nearly 7% and a procedure-related morbidity rate of 8%, whereas the intraoperative rupture rate of other circle of Willis aneurysms was 1% and the morbidity rate was 6%.[8]

MATERIALS AND METHODS

Patient Demographics and Clinical Presentation

Among 187 patients who had received diagnoses of intracranial aneurysms from September 2009 to December 2013 and were treated using endovascular coil embolization at the Interventional Neurology Department, Max Superspeciality Hospital, 11 patients (5.9%) with DACA aneurysms were studied retrospectively. Time from ictus to admission, symptoms, signs, clinical examination, past medical history, procedure compact discs, and brain imaging findings were collected from medical records. These patients were clinically classified according to Hunt and Hess grades; grades 1 to 3 were considered to be good grades, and grades 4 and 5 were noted as poor grades.[1]

Angiographic Study

Cerebral angiography reports were collected from medical records. Using preoperative intracranial angiography, the characteristics and morphology of DACA aneurysms were evaluated. Ruptured or unruptured DACA aneurysms could be concluded from evidence of subarachnoid hemorrhage (SAH) and its location in computed tomography (CT) and magnetic resonance imaging (MRI) of the brain and from angiographic features pointing to the offending aneurysm, including the following: contrast extravasation, contour of aneurysm, features like irregular morphology with estroflexion (blebs) that might indicate the site of rupture, localization of angiographic signs such as focal spasm, mass effect, or serial change in appearance of the aneurysm on sequential angiograms.[1,2] The greatest diameter of the aneurysm dome was classified as small (<10 mm), large (10–25 mm), and giant (>25 mm), and the neck of the aneurysm was categorized as narrow (≤4 mm) and wide (>4 mm).[9] The shape of aneurysm was classified as saccular or nonsaccular.[9] The location of aneurysm could be seen on the A2 to the A5 segment of the ACA. The number of aneurysms was described as single or multiple (>1).

Endovascular Treatment Protocol

Only patients who underwent coiling procedures done by the senior author, S.H.H., were included in the study. The cerebral digital subtraction angiography (DSA) and endovascular procedures were all done using a single-plane Siemens Axiom Artes Flat Panel machine. Our procedures use Tracker Excel 14 microcatheters (Stryker Neurovascular, Fremont, California, USA), 0.014-inch Transcend microwire (Stryker Neurovascular), Guglielmi detachable coil (GDC-10) (Boston Scientific, Natick, Massachusetts, USA), and/or Target coils (Stryker Neurovascular), Axium coils (ev3, Irvine, California, USA), Hyperform (ev3) for the balloon-assisted techniques, and the stent used was Enterprise (Codman, Miami, Florida, USA). Endovascular treatment was performed with the patient under general anesthesia. Aneurysms were embolized with detachable coils until angiographically complete obliteration was achieved, unless the last coil could not be introduced inside the sac or any intraoperative complications did not allow the procedure to be continued. Balloon or stent-assisted coil embolization could be done depending on the characteristic of the aneurysm.

Antiplatelet-naïve patients who were undergoing stent-assisted coiling, if without contraindication, were given loading doses of aspirin 300 mg plus clopidogrel 600 mg and unfractionated heparin with activated clotting time (ACT) target between 250 and 300 seconds. Hourly monitoring of ACT was done.

Angiography and Clinical Outcome

Endovascular occlusion outcome of aneurysms was immediately classified according to the Raymond classification: (1) complete occlusion, (2) residual neck, and (3) residual aneurysm.[8] Clinical outcome was evaluated at discharge according to the modified Rankin Scale (mRS), which is considered a valuable instrument for assessing the impact of stroke treatment. Good outcome was defined as mRS ≤2.

Angiographic Follow-Up

Follow-up angiograms were performed at least 3 months after coil embolization, unless there were any complaints relevant to intracranial aneurysm before 3 months. Assessments of coiled aneurysms were made according to a modified Raymond classification: 0 = complete occlusion (100%), 1 = minor recanalization at the base of the aneurysm (1%–9% of the original size of the aneurysm), 2a = moderate central recanalization, neck remnant (10%–49%), 2b = moderate excentric recanalization, neck remnant (10%–49%), 3 = major recanalization (>50% of the initial size of the aneurysm).