Basilar Apex Aneurysms in the Setting of Carotid Artery Stenosis: Case Series and Anatomic Study

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Introduction

Intracranial aneurysms (IAs) are life-threatening lesions caused by increased arterial wall shear stress, particularly at bifurcations. There is a known association between carotid artery stenosis (CAS) and anterior circulation IAs, often identified by angiography for CAS work up or treatment. As anterior circulation flow demands change with CAS, one may expect posterior circulation blood flow changes to occur to compensate via the Circle of Willis (COW), adding stress at the basilar apex. We present an anatomic analysis of nine cases of unruptured basilar apex aneurysms (BAA) with concomitant CAS, which, to our knowledge, is the largest series reported.
Methods

Twenty-three patients with BAA aneurysms were retrospectively identified at Loyola University Medical Center from 2011 to 2016. Angiograms underwent independent evaluation by a neuroradiologist, documenting CAS by NASCET criteria, BAA morphology, COW competency, and posterior circulation anatomy relationships.
Aneurysm Measurements

Figure adapted from: Ho AL, et al. PLoS One. 2014 Oct 29;9(10):e110946
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Results

Of the 23 patients, 9 were found to have left or right carotid artery stenosis > 0%. Of these 9 patients, 6 were found to have at least one carotid artery with >50% stenosis.

When compared to patients with no carotid stenosis, patients with any carotid stenosis did not have significant differences regarding the anatomical presence, absence, or hypoplasticity within the COW. Additionally, no differences were found pertaining to angle of the aneurysmal flow angle. Overall, no statistically meaningful difference detected between the two patient sets.

When compared to patients with carotid stenosis <50%, patients with left or right carotid stenosis > 50% did not have significant differences regarding the COW patency or vessel flow angle. However, it was found that, overall, patients with a right or left carotid > 50% recorded lower BA vessel angle values (Median: 61, IQR: 55 – 68) than those with right or left carotid < 50% (Median: 74, IQR: 69 – 80, p = .03).

Aneurysm flow angle direction was found to be opposite the side of great carotid stenosis in in four of six (67%) patients with >50% stenosis, and in six of nine (67%) patients with any carotid stenosis.
## Results

<table>
<thead>
<tr>
<th>BAA-CAS Patient</th>
<th>Hp (mm)</th>
<th>Hmax (mm)</th>
<th>Neck (mm)</th>
<th>NASCET criteria (%)</th>
<th>BA Vessel Angle</th>
<th>Aneurysm Flow Angle (R &lt;180 deg)</th>
<th>Flow Angle Direction</th>
<th>P1 - P1 Angle</th>
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</table>
Discussion

The occurrence of BAA with CAS is higher in our series than what would be expected from the paucity of literature on this topic. As posterior circulation IAs are highly dangerous, it is important to consider complete cerebrovascular assessment of CAS patients. Future studies may further investigate the flow dynamics within the basilar apex in the setting of carotid stenosis to better direct diagnosis and treatment of aneurysms in this region.