Ophthalmic artery aneurysm classification

Multiple classification systems of ophthalmic artery aneurysms have been proposed, because paraclinoid aneurysms often fail to follow the classic teachings about aneurysmal development, branch vessel origin, or hemodynamic origin.

The natural history of aneurysms involving the paraclinoid region varies based on their anatomic locations and hence the precise localization by neuroimaging study in preoperative period has been one of the most interesting and important problems in clinical neurosurgery.

Aneurysms identified as being completely intradural are at risk for subarachnoid hemorrhage (SAH), and usually require preventive endovascular or surgical treatment. However, aneurysms located completely below the distal dural ring cannot cause SAH, and they have lower morbidity than aneurysms arising from the intradural space.

Preoperative delineation of the distal dural ring and exact localization of the aneurysm in relation to the cavernous sinus structures continue to be critical clinical issues, but catheter angiography or other conventional imaging modalities have failed to localize these aneurysms exactly.

The distal dural ring (DDR) is the anatomic border between the intracavernous and supracavernous internal carotid artery (ICAs), and the DDR is an important landmark to differentiate an intradural paraclinoid aneurysm from an extradural cavernous sinus aneurysm.

On the other hand, cavernous sinus aneurysms have limited or no risk for SAH and are usually followed up in asymptomatic patients.

T2-weighted three-dimensional (3-D) fast spin-echo (FSE) MR imaging allows for an easy examination of the brain using thin sections and a high signal-to-noise ratio (SNR).

These imagings are characterized by a high vascular contrast created by a high signal from surrounding cerebrospinal fluid, a moderate signal from adjacent brain structures, and a signal void of the vessel.

The earliest report on carotid–ophthalmic aneurysms as a distinct entity written in 1968 by Drake et al., offered no classification scheme.

Kothandaram et al proposed the first classification scheme in 1971.

Based on intraoperative observations, they classified carotid–ophthalmic aneurysms into three groups according to their relationship with the optic chiasm: subchiasmal, suprachiasmal, and parachiasmal.

In 1976, Almeida et al. classified their experience with carotid–ophthalmic aneurysms into two groups, again based on the relation between the aneurysm and optic chiasm: latero–optochiasmatic and sub–optochiasmatic.

Also in 1976, Thurel et al. added two other groups: suprachiasmal and global types.

In 1990 Day classified his series of paraclinoid aneurysms into three groups: ophthalmic artery aneurysms, superior hypophyseal–paraclinoid aneurysms, and superior hypophyseal–suprasellar aneurysms.

In 1993 Al–Rodhan and associates classified paraclinoid aneurysms into five groups based on angiographic and intraoperative observations: supraophthalmic, ophthalmic, infraophthalmic/supracavernous, transitional, and cavernous.

They further classified the lesions based on the position of the neck and dome of the aneurysm.

In 1994, Batjer et al classified carotid–ophthalmic aneurysms into three groups: ophthalmic artery, superior hypophyseal artery, and proximal posterior wall of ICA.

In 1997 Fries et al added “partially intracavernous aneurysms” to Batjer's classification.

That year Kumon et al classified paraclinoid aneurysms into five groups: subchiasmatic, lateral chiasmatic, suprachiasmatic, carotid cave, and paraclinoid.

In 1999, De Jesus et al classified carotid–ophthalmic aneurysms into four groups: clinoid, ophthalmic, superior hypophyseal, and posterior paraclinoid.

Barami et al., developed a simple numerical classification system to guide surgical planning. They used angiographic findings to categorize the aneurysms. They followed the nomenclature of the carotid segments by Bouthillier et al (Neurosurgery 1996;38:425-432), C4 being the intracavernous ICA, C5 the clinoidal segment, and C6 the ophthalmic segment of the ICA. The aneurysms were divided into four major types: Types Ia and Ib projected superiorly and arose from the dorsal surface of C6. Type Ia was related to the ophthalmic artery. Type Ib aneurysms were sessile and had no branch relations. Type II aneurysms were related to the ventral wall of the C6 segment without any branch relation. Type IIIa variant arose from medial wall of the C6 segment and was related to the superior hypophyseal artery. Type IIIb arose from the medial wall of the C5 segment below the dural reflection without any branch relation. Large type IV aneurysms arose from the C5 and C6 segments, widening the distal dural ring. Patients' postoperative status and visual and overall outcomes were analyzed. Ultimately, this classification helped them to plan operative approaches and clip selection [1)].

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Based on DSA information, ophthalmic segment aneurysms are classified into 4 groups as reported by Barami et al. Types Ia and Ib originate on the dorsal surface of C6. Type Ia is related to the ophthalmic artery. Type Ib aneurysms are sessile, without any branch points. From a surgical perspective, the type I aneurysms are easiest to treat, with limited correlation with superior hypophysial vessels or other strategically important vessels [2].

The three subtypes are the superiorly pointing aneurysms originating at the ophthalmic artery (i.e., ophthalmic artery [OA] aneurysms), the medially pointing aneurysms originating from the superior hypophyseal trunk, and aneurysms originating from a perforator-free part of the ICA, the so-called atypical or blister ICA aneurysms [3].

see Giant Ophthalmic Artery Aneurysm.

[1], [2]
Barami K, Hernandez VS, Diaz FG, Guthikonda M. Paraclinoid Carotid Aneurysms: Surgical Management, Complications, and Outcome Based on a New Classification Scheme. Skull Base. 2003 Feb;13(1):31-41. PubMed PMID: 15912157; PubMed Central PMCID: PMC1131827.
[3]
Meling T R, Sorteberg A, Bakke S J, Slettebø H, Hernesniemi J, Sorteberg W. Blood blister-like aneurysms of the internal carotid artery trunk causing subarachnoid hemorrhage: treatment and outcome. J Neurosurg. 2008;108(4):662–671