Middle cerebral artery aneurysm classification

Although several classifications have been proposed for middle cerebral artery aneurysms, classically they are divided into four groups: proximal, bifurcation, distal, and cortical aneurysms.

While most aneurysms that originate at the MCA bifurcation or trifurcation have a saccular geometry, some MCA aneurysms may exhibit a fusiform morphology and incorporate not only the proximal MCA trunk but also major MCA branches. In contrast to saccular aneurysms, fusiform aneurysms represent a distinct subset of intracranial aneurysms with unique underlying pathological features, hemodynamic forces, anatomical distribution, as well as natural history that governs their treatment.

Anatomical variations of the middle cerebral artery (MCA) are an important clinical issue, due to high prevalence of intracranial aneurysms. Anatomical variations of vessels can lead to higher shear stress, which is thought to be the main factor leading to aneurysm formation and consequently to higher prevalence of aneurysms.

The most common configuration of MCA is bifurcation before the genu with no dominating post-division trunk. Incidence of MCA aneurysms is not correlated with anatomical variations of MCA and the circle of Willis.

Classification

Bilateral Middle Cerebral Artery Aneurysm.

Middle cerebral artery bifurcation aneurysm or Bifurcation-type middle cerebral artery aneurysm.

Unruptured middle cerebral artery aneurysm.

Ruptured middle cerebral artery aneurysm.

Giant middle cerebral artery aneurysm.

Complex middle cerebral artery aneurysm.

Middle cerebral artery M1 segment aneurysm.

Middle cerebral artery M3 segment aneurysm.

Middle cerebral artery M4 segment aneurysm.

see also Distal middle cerebral artery aneurysm.

see also Fusiform middle cerebral artery aneurysm.

Anatomic classification scheme
Classification of middle cerebral artery (MCA) aneurysms is sometimes difficult because the identification of the main MCA bifurcation, the key for accurate classification of MCA aneurysms, is inconsistent and somewhat subjective.

To use the meeting point of the M1 and M2 trunks as an objective, generally accepted, and angiographically evident hallmark for identification of MCA bifurcation and more accurate classification of MCA aneurysms.

Elsharkawy et al. reviewed the computed tomographic angiography data of 1009 consecutive patients with 1309 MCA aneurysms. The M2 trunks were followed proximally until their meeting with the M1 trunk at the main MCA bifurcation. The aneurysms were classified according to their relative location: proximal, at, or distal to the MCA bifurcation. The M1 aneurysms were further subgrouped into M1 early cortical branch aneurysms and M1 lenticulostriate artery aneurysms, extending the classic 3-group classification of MCA aneurysms into a 4-group classification. 3)

Angiographic data from patients with MCA aneurysms between 1995 and 2012 were used to construct 3-dimensional models. Models were then analyzed and compared objectively by assessing the relationship between the aneurysm sac, parent vessel, and branch vessels. Aneurysms were then grouped on the basis of the similarity of their shape patterns in such a way that the in-class similarities were maximized while the total number of categories was minimized. For each category, a proposed clip strategy was developed.

From the analysis of 61 MCA bifurcation aneurysms, 4 shape pattern categories were created that allowed the classification of 56 aneurysms (91.8%). The number of aneurysms allotted to each shape cluster was 10 (16.4%) in category 1, 24 (39.3%) in category 2, 7 (11.5%) in category 3, and 15 (24.6%) in category 4.

Through the use of anatomic visual cues, MCA bifurcation aneurysms can be grouped into a small number of shape patterns with an associated clip solution. Implementing these principles within current neurosurgery training paradigms can provide a tool that allows more efficient transition from novice to cerebrovascular expert 4).

