Examining the relationship between aneurysm presence andbifurcation angles in the middle cerebral artery.

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Introduction

It is believed that arterial branching is governed by the principle of total minimum work (1) and prior studies have shown that cerebral vasculature generally adheres to this optimality principle (2). Bifurcation angles of cerebral arteries impact local blood flow and wall shear stress and these hemodynamic characteristics may play a role in aneurysmal development and subsequent rupture (2-3). Thus, further understanding of these quantitative parameters is necessary to assess aneurysmal rupture status (2-4). In this study, bifurcation angles are measured from the M1 segment of the middle cerebral artery and related to the presence of an aneurysm.

Methods

Patient data for 119 individual middle cerebral artery (MCA) aneurysm cases was acquired for retrospective review of CT-angiograms and analysis via 3D reconstruction from a GE Advantage Workstation. Data for 27 patients met inclusion criteria for the study. The 3D scans were evaluated for MCA M1 segment bifurcation angle on the affected side; assessment of the contralateral bifurcation angle served as the control. Middle cerebral arteries with the presence of aneurysm were also assessed on the basis of ruptured versus unruptured MCA bifurcation angles with aneurysms revealed no statistically significant correlation.

Conclusions

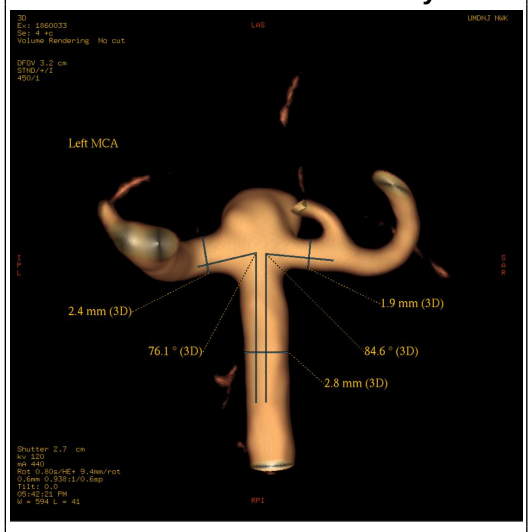
The data suggest that there is a relationship between the bifurcation angle of the MCA and presence of MCA aneurysm. Our results indicate that there is a statistically significant difference between our control and affected populations. Further studies with a larger patient population are needed to determine if this biomorphometric parameter is of clinical use in prognosticating aneurysm development and rupture status.

there was any correlation between these factors.

Results

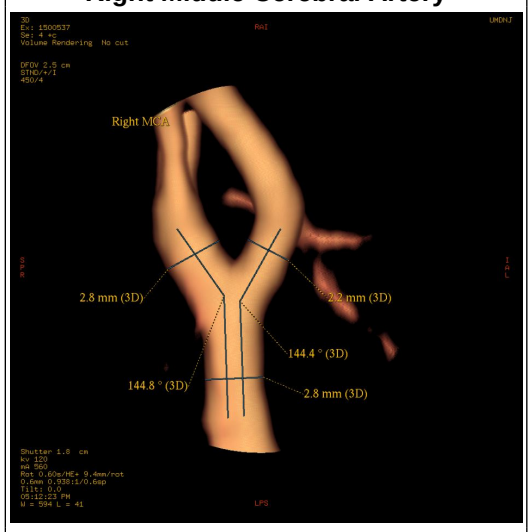
Results were calculated using Microsoft Excel and Matlab. Based on the data there is an average bifurcation angle of 110.13 degrees with a standard deviation of 31.24 degrees in MCA M1 segments that do not have an aneurysm present. There is an average bifurcation angle of 166.61 degrees with a standard deviation of 37.33 degrees at bifurcation points that possess an aneurysm. A Mann-Whitney test was performed on the data in Matlab and a p-value of 1.1662X10^-06 was obtained. Data analysis of ruptured versus unruptured MCA bifurcation angles with aneurysms revealed no statistically significant correlation.

Left Middle Cerebral Artery



Volume rendering of an MCA m1 segment with an aneursym

Right Middle Cerebral Artery



Volume rendering of an MCA m1 segment without an aneursym

Learning Objectives

By the conclusion of the session, participants should be able to:

1) Investigate the relationship between aneurysm presence and bifurcation angles of the M1 segment of middle cerebral artery.

2) Standardize methods for measuring bifurcation angles of neurovasculature.

3) Better understand the effect of bifurcation angles on cerebral blood flow.

References

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