Extended Abstract

Journal of Molecular Cancer

2020
Vol. 3, Iss. 2

Cancer Oncology 2018: Cerebral aneurysms mechanisms

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A brain aneurysm (AN-yoo-riz-um) in a blood vessel within the brain is a bulge or ballooning. It also resembles a berry hanging on a spike. A brain aneurysm may leak or rupture, causing bleeding (hemorrhagic stroke) in the brain. A ruptured brain aneurysm most often occurs in the space between the brain and the thin tissues that cover the brain. A ruptured aneurysm rapidly threatens life and needs immediate medical attention. However, most brain aneurysms do not burst, build health complications or cause symptoms. Such aneurysms are often detected on other conditions during testing. In certain cases , treatment for an unbroken brain aneurysm may be sufficient, and may avoid future rupture.

Purpose: To investigate the mechanisms of cerebral aneurysms and the effect of treatment modalities on the genesis of cerebral aneurysms.

Materials and methods: Seven hundred and twenty four patients with cerebral aneurysms were investigated in the locations of the cerebral aneurysms using the angiographic data. The angiographic data of 140 patients with cerebral aneurysms were processed for computational fluid dynamics (CFD). Different modalities including stent-assisted coiling, coiling alone, stenting alone, single stenting, Y-configuration stenting, and surgical clipping were analyzed for their effects on the mechanisms of CFD.

Results: A total of 1018 cerebral aneurysms were detected in these patients. Seven hundred and seventeen aneurysms involved a branch, accounting for 70.4% of all the aneurysms, with the most populous places being the intracranial internal carotid artery (ICA) segments (23.9%), the anterior cerebral artery (17.9%), the middle cerebral artery (17.8%), and the posterior circulation (9.3%). 301 aneurysms were located on a vascular curve (29.6%), with the most populous site being the ICA (25.4%), the intracranial vertebral artery (2.2%), and the distal cerebral arteries (1.5%). Not a single aneurysm was found on a straight segment of vessel. CFD analysis showed some common features that, on the wall where a cerebral aneurysm was generated, two peak values and one minimal value were demonstrated on the curve of wall shear stress while one peak value was revealed on the total pressure curve. Moreover, cerebral aneurysm occurred on one of the shear stress peak with concomitant high total pressure. Stenting can straighten the arterial bends and change the vascular bifurcation angle, consequently revising the shape of the curves of shear stress and total pressure and the distance between the two peaks of shear stress and thus making the hemodynamic stresses focused more on the divider of vascular bifurcation. Coiling alone or surgical clipping alone cannot alter the arterial shape and the shape of the curves of the shear stress and total pressure, without affecting the hemodynamic stresses for aneurysm initiation.

Conclusion: Cerebral aneurysms are initiated at sites with both high wall shear stress and total pressure, and stenting especially Y-shaped stenting can decrease the hemodynamic stresses for aneurysm initiation while coiling alone or surgical clipping do not. Stenting with Y configuration is a better choice of treatment than coiling or surgical clipping in managing the genesis of cerebral aneurysms.

Note: This work is partly presented at International Conference On Oncology & Radiology in Edinburgh, Scotland during December 03-04, 2018