

Differences in Morphological Factors Associated with Ruptured Aneurysms in Patients with Multiple Cerebral Aneurysms

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Introduction

We evaluated rupture risk of multiple cerebral aneurysms in aspects of various morphological parameters, and determined which parameter can be a reliable predictor as one aneurysm ruptured, and the others did not.

Methods

Between 2007 and 2012, three-dimensional rotational angiographic images of 85 patients harboring multiple aneurysms (85 of ruptured and 104 of unruptured aneurysms) were used to assess the following morphological parameters: the geometry of the aneurysm itself, e.g. maximal size, aspect ratio, bottleneck ratio, height/width ratio, undulation, and daughter sac; the architecture of the aneurysm and surrounding vessels, including, e.g. the aneurysmal angle, vessel angle, inflow angle, parent daughter angle, parent vessels mean diameter, and size ratio type I & II. Univariate analysis was applied to all parameters, and significant parameters were identified in multivariate logistic regression analysis yielding the cut-off point from receiver-operating characteristic (ROC) curve analysis.

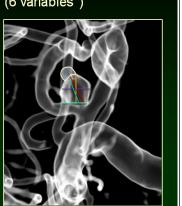
Geometry Of aneurysm itself

Definition of Morphological Parameters

Geometry of Aneurysm (6 variables)

1) Maximal Size

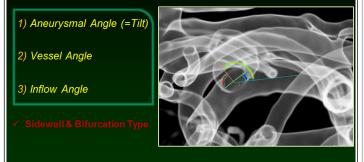
- 2) Aspect Ratio
- 3) Bottle Neck Ratio
- 4) Height / Width Ratio
- 5) undulation
- 6) Daughter Sac

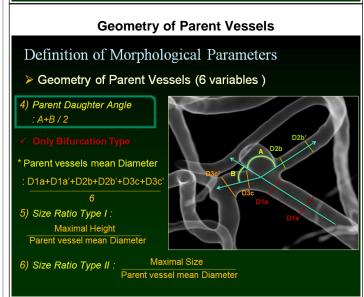


Geometry of Parent Vessels

Definition of Morphological Parameters

Geometry of Parent Vessels (6 variables)





Results

On univariate analysis, ruptured aneurysms were significantly associated with following parameters: maximal size, aspect ratio, bottleneck ratio, height/width ratio, undulation, daughter sac and aneurysmal angle, vessel angle, inflow angle, parent daughter angle, and size ratio type I & II. From multivariate logistic regression, the aspect ratio [odds ratio (OR), 1.214; 95% confidence interval (CI), 1.048–1.405] and daughter sac (OR, 3.124; 95% CI, 1.053-9.265) were significant parameters to rupture status in relation to the geometry of the aneurysm itself. The size ratio type I (OR, 1.135; 95% CI, 1.053–1.223) and parent daughter angle (OR, 1.021; 95% CI, 1.001-1.043) were independent parameters in regards to the architecture of the aneurysm and surrounding vessels. From the ROC curve, the aspect ratio and size ratio type I had cut-off values of 1.3 and 1.8, respectively.

Conclusions

To investigate the risk factor of ruptured aneurysm among multiple cerebral aneurysms is a meaningful process in terms of morphological parameters. The aspect ratio, size ratio type I, daughter sac and parentdaughter angle revealed a significant correlation with ruptured status.

References

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