THREE DIMENSIONAL GEOMETRICAL FEATURES OF ANTERIOR COMMUNICATING ARTERY ANEURYSMS PREDICTING RISK OF RUPTURE

Tamer Hassan Mohamed, Wael Mahmoud Khedr, Tamer Ibrahim Metwally, Abdallah Mohamed Hassan Ali

Department of Neurosurgery, Faculty of Medicine, Alexandria University

Introduction

Anterior communicating artery "AcoA" aneurysms are considered highly complex due to their intricate vessel geometry and blood flow conditions. This study explores the morphological parameters related to rupture of AcoA aneurysms as observed angiographically.

Aim of the work

This study aims to identify common geometrical characteristics associated with rupture of AcoA aneurysms at the Alexandria main hospital and affiliated hospitals, Alexandria University.

Patients

This study includes a retrospective analysis of 200 cases of ruptured anterior communicating artery aneurysms admitted at the neurosurgery department at Alexandria University hospitals.

Methods

Analysis for 200 patients diagnosed with ruptured AcoA aneurysms was conducted using 3D angiographic studies. AcoA aneurysms were classified according to A1 predominance into dominant and true types. The correlations between rupture of both types of AcoA aneurysms and A1-A2 diameter discrepancy, and A1-A2 angle narrowing were investigated. Additionally, the correlation between maximum aneurysm depth and aneurysm neck was recorded.

Results

A significant correlation between aneurysm depth and the difference in A1 and A2 diameters (p-value = 0.007) was observed in the total cohort of 192 patients was recorded .In left-sided A1 dominant AcoA aneurysms,a significant correlation between A1-A2 discrepancy and aneurysm depth was recorded (p-value=0.015). Narrowing of the A1-A2 angle was significantly correlated with rupture at smaller sizes (p value = 0.041) in both types of AcoA aneurysms. Subgroup analysis showed a significant correlation between a narrow A1-A2 angle and rupture in true AcoA aneurysms (p-value = 0.003), compared to dominant types. Additionaly, a significant correlation between AcoA aneurysm depth and aneurysm neck was recorded in both dominant and true AcoA aneurysms (p value < 0.001)

Table (1) : Descriptive analysis of different morphological parameters measured in 200 AcoA aneurysms.

Morphological Parameter	Mean ± SD.
Right A1 vessel diameter (mm)	1.62 ± 0.38
Left A1 vessel diameter (mm)	1.81 ± 0.47
Average diameter of both A1s (mm)	1.72±0.36
Right A2 vessel diameter (mm)	1.71±0.40
Left A2 vessel diameter (mm)	1.72±0.55
Average diameter of both A2s (mm)	1.72±0.41
Neck (mm)	3.12±1.33
Maximum Aneurysm Depth (mm)	4.43±2.0
A1-A2 Angle (degrees)	95.2±29.5

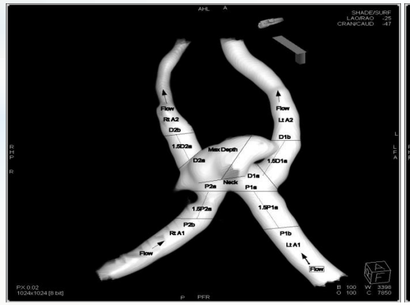

Figure (1) : Illustrates true AcoA aneurysm with two A1 vessels feeding the AcoA complex, the average of both A1 vessels was calculated then the difference between the mean diameters of A1s and A2s was recorded.

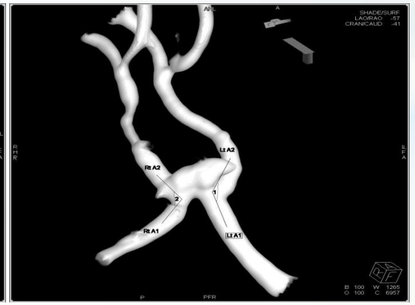

Figure (2) : Representative 3D DSA image of the measured A1-A2 angle in true type AcoA aneurysm. For each case, two angle were identified. The angle recorded is the angle at the side with wider A1 vessel

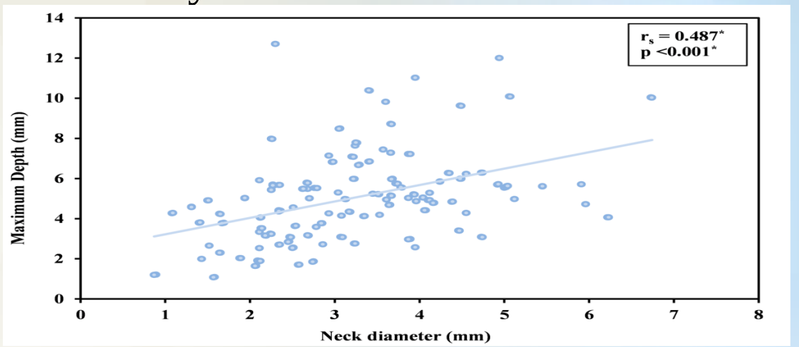

Figure (3) : 2D scatter plot showing the significant statistical correlation between the aneurysmal depth and neck diameter (n=200)

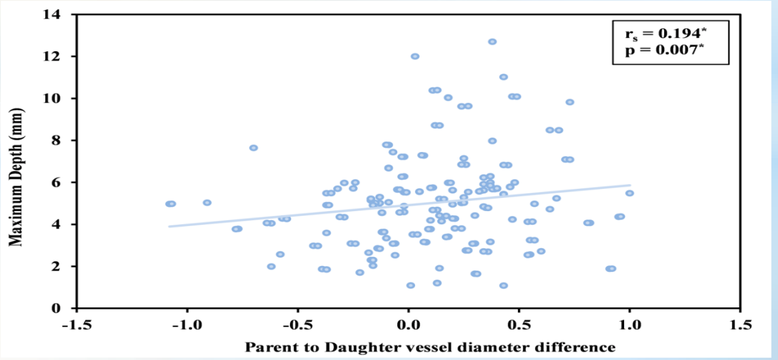

Figure (4) : 2D scatter plot showing the significant statistical correlation between the aneurysmal depth and average diameter difference between parent and daughter (A1 and A2) arteries. The corresponding probability and r2 values are shown. (n=200)

Conclusion

A1-A2 diameter discrepancy is significantly associated with dominant type AcoA aneurysm rupture while A1-A2 angle narrowing is significantly associated with rupture in true type AcoA aneurysms. Using these parameters we can better predict which aneurysms are likely to rupture at smaller sizes, offering potential benefits in clinical practice by supporting earlier intervention.