Radiomic profile of aneurysms is correlated with clinical scales, morphology, and wall enhancement

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1. Introduction

- Radiomic profiling can help in the assessment of intracranial aneurysm (IA) by analysing the spatial relationship of voxels signal intensity (SI) in HR-MRI.
- However, its clinical use requires a better understanding of radiomics features correlation with clinical scales, aneurysm morphology, and aneurysm wall enhancement (AWE).

2. Methods

- Unruptured saccular IAs underwent HR-MRI.
- Segmentations of the IAs were generated using 3D Slicer.
- An in-house code was used to analyse wall enhancement. An IA was classified as "enhancing" if the mean SI on T1Gd after SI normalization to corpus callosum exceeded 1 (3D-CAWE += SI of the aneurysms body/corpus callosum ratio >1).
- Radiomic features (RFs) were extracted from the T1Gd images using Pyradiomics.
- IAs were categorized as high-risk based on the following criteria: ELAPSS ≥17, PHASES ≥5, size ≥7 mm, size ratio (SR) ≥2.3, aspect ratio (AR) ≥1.5, and 3D-CAWE+.

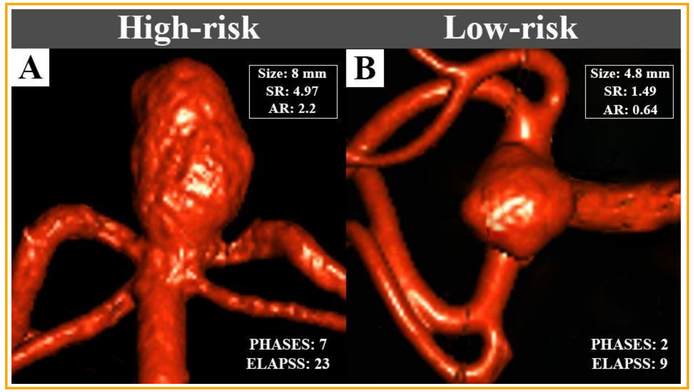


Figure 1. Risk stratification of IA based on morphology

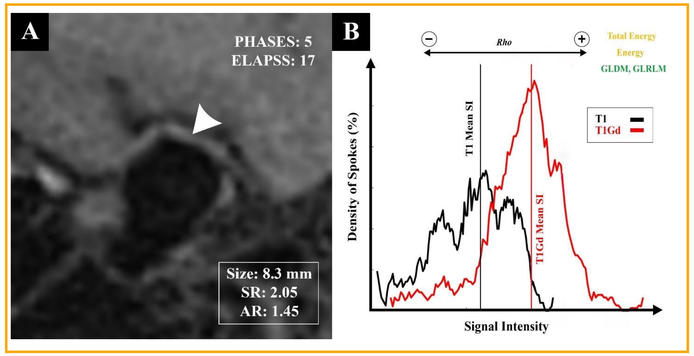


Figure 2. Wall enhancement quantification and radiomics features correlation with increased SI

3. Results

- We analyzed 113 IAs, with 47% (53/113) classified as high-risk by ELAPSS and 50% (57/113) by PHASES. Morphological analysis identified 38% (43/113) of IAs had a size ≥7 mm, 43% (49/113) had a SR ≥2.3, and 37% (42/113) had an AR ≥1.5; 17% (19/113) were 3D-CAWE+.
- Significant differences in RFs quantity were observed between high- and low-risk IAs
- Among these RFs, 36% (20/55) were strongly correlated with ELAPSS ≥17, 30% (22/74) with size ≥7 mm, 14% (10/69) with SR ≥2.3, and 27% (16/60) with 3D-CAWE.
- High-risk IAs were associated with geometric patterns of larger diameters and volumes, reduced sphericity, and greater heterogeneity in voxels intensities, reflecting textural variations within the vessel wall.

4. Conclusion

- **Radiomic profiling** can identify voxel-based differences between high- and low-risk IAs, independent of other risk stratification tools.
- **High risk profiles** were associated with higher ELAPSS scores, larger aneurysm size, SR and AWE.

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