**Quantitative Analysis of DCE-MRI Parameters $k_{trans}$ and $v_L$ in Intracranial Aneurysms**

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**Purpose** The clinical significance of intracranial aneurysm (IA) wall permeability to contrast agent and the interobserver variability in measuring quantified $k_{trans}$ and $v_L$ metrics have not been explored. The purpose of this study was to determine whether dynamic contrast enhanced (DCE) MRI could quantify IA wall permeability, how it correlated with established metrics of rupture risk, and the reproducibility of measurements between two observers.

**Methods** Twenty-seven IAs in 24 patients were imaged with DCE-MRI, and wall permeability parameters ($k_{trans}$ and $v_L$ using Tofts’ Model (1)) were measured in regions adjacent to the aneurysm wall and healthy normal vessels by two independent reviewers. Interobserver strength of agreement was compared using intraclass correlation, Bland-Altman, and regression analysis. Aneurysms were sorted into ISUIA-determined, size-associated risk bins to assess correlation of $k_{trans}$ with size. A second risk paradigm used size-independent clinical criteria (progression to rupture, symptomatic presentation, dome irregularities) to sort and compare aneurysms. The two-sample t-test was used to compare mean $k_{trans}$ and $v_L$ for each risk paradigm. Adjustments for multiple comparisons utilized Tukey’s studentized range test.

**Results** Interobserver agreement was strong as shown in regression analysis ($R^2=0.93$), bland altman (mean bias = 0.005 min$^{-1}$), and intraclass correlation (0.93). In all IAs (Figure1a), there was a pronounced increase in wall permeability compared to a paired healthy normal vessel ($k_{trans} = 0.1778$ vs. 0.0083 min$^{-1}$, p<0.001; $v_L = 12.7$ vs. 4.84%, p=0.0019). $k_{trans}$ was found to be significantly larger in progressively larger ISUIA-determined, size-based risk categories (Figure 1b-c). Furthermore, $k_{trans}$ was significantly larger in high risk versus low-risk IAs when risk was determined using a size-independent and clinically-based paradigm. Size did not show a statistically significant trend in this clinical risk assessment scheme.

**Discussion/Conclusions**

We found that quantitative permeability modeling of IAs is feasible and observer ROI measurements are repeatable. Increased wall-permeability in intracranial aneurysms correlates with size and clinical rupture risk metrics. DCE-MRI studies on IAs may provide useful clinical information especially for longitudinal study of patients.

**References:** 1) Tofts et al, MRM 1995 2) Tofts et al MRM 1989