

## Reliability of Mismatch Measurement Methods

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**BACKGROUND AND PURPOSE:** We investigated the reliability of two methods of measuring diffusion-perfusion mismatch volume in order to determine whether the reliability of estimating mismatch volume is improved by direct measurement on a single, blended diffusion-perfusion map.

**METHODS:** Image analysis software was used for measurement of ischemic lesion volumes from diffusion weighted MRI (DWI) and mean transit time (MTT) perfusion MRI at acute (< 3 hours from stroke onset and pre-treatment) time points. For each method a semi-automated technique for identification and manual editing of the lesions was used by a single reader, blinded to patient treatment and time point. For the first method the reader separately measured the volume of lesions on the DWI and MTT sequences on two occasions with at least 1 week between reads. For the second method each MTT sequence was registered to the corresponding DWI sequence. The DWI sequence was contrasted to maximize the lesion conspicuity, its intensity values were inverted, and then blended with the registered MTT sequence. The reader measured the mismatch volume as the visual difference between the DWI and MTT lesions directly on the blended images.

**RESULTS:** For both mismatch methods the volume statistics for the two separate reads performed at least one week apart are listed in the Table. The test-retest correlations were 0.963 and 0.99 for the separate volume and the blended difference methods respectively. There was good agreement between the two separate reads for both methods as indicated by the similar mismatch frequency based on the criterion of 20% mismatch. The blended difference method was significantly less variable as indicated by its smaller mean and SD % deviation and larger test-retest correlation compared to the separate volume method.

**CONCLUSIONS:** Mismatch volumes by a single reader can provide highly reliable and consistent results even when separately reading DWI and MTT lesions. However the direct measurement of the mismatch volume using the blended DWI and MTT images proved to be less variable. There is also a potential trend for increased sensitivity in the detection of mismatch with the blended difference method.

**TABLE. Mismatch Volume (cc) Statistics**

Mismatch Volume	Read One Average (N=36)	Read Two Average (N=36)	Spearman Correlation Coefficient	Cases with ≥20% Mismatch (Mismatch Volume / MTT Volume) - Read One	Cases with ≥20% Mismatch (Mismatch Volume / MTT Volume) - Read Two	Cases with ≥20% Mismatch (Mismatch Volume / DWI Volume) - Read One	Cases with ≥20% Mismatch (Mismatch Volume / DWI Volume) - Read Two	Absolute Volume Difference	
								Mean ± Std Dev Median	Mean ± Std Dev Median
<b>Method #1</b>	89.11	85.07	0.963	29	29	28	25	10.73 ± 14.35 4.32	32.02 ± 115.93 9.15
<b>Method #2</b>	86.23	88.82	0.99	31	32	31	29	10.88 ± 12.34 5.61	12.91 ± 9.92 11.85