

Poster presentation

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Validation of segmental visual scar quantification in ischemic and non-ischemic cardiomyopathy: Comparison to signal threshold analysis of delayed enhancement MR images

Nowell Fine*¹, Matthew Brymer², Anna MacDonald³, Maria Drangova² and James White³

Address: ¹London Health Sciences Centre, London, ON, Canada, ²Robarts Research Institute, London, ON, Canada and ³London Health Sciences Centre/Robarts Research Institute/Lawson Health Research Institute, London, ON, Canada

* Corresponding author

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Objective

To determine the correlation between quantification of myocardial scar volume using segmental visual scoring and semi-automated signal threshold techniques.

Background

Visual evaluation of delayed enhancement (DE) MR images using a 5-point, 17-segment model is efficient and more practical than computerized quantitative signal analysis techniques. However, the accuracy of this technique for quantifying scar burden has not been validated.

Methods

161 consecutive patients with abnormal DE findings were included. Blinded visual quantification of segmental (AHA 17-segment model) scar was performed using a 5-point scale, as follows; 0 = none, 1 = 1-25%, 2 = 26-50%, 3 = 51-75%, 4 = 76-100%. Each segment was assumed to represent 1/17th of the LV mass. Computerized, signal threshold-based analysis of total myocardial scar volume was also performed using cut-offs of 2, 3 and 5 SD above mean normal (nulled) myocardial signal. Comparison of visual scar quantification and signal-threshold based quantification was then performed using linear regression. Bland-Altman plots were then performed between visual scar volume and threshold-based scar volume measurements.

Results

Of 161 patients studied, the mean age was 57.5 ± 13.0 years. The mean LV ejection fraction was $46.3 \pm 20.6\%$. Sixty-six (41%) patients had an ischemic DE pattern, 76 (47%) had a non-ischemic DE pattern, and 19 (12%) had a combined pattern. The Pearson correlation coefficients for visual versus threshold-based quantitative analysis at 5, 3, and 2 SD signal intensity thresholds were $r = 0.81$, $r = 0.79$ and $r = 0.63$ ($p < 0.0001$), respectively. Coefficients for patient sub-groups with ischemic and non-ischemic DE were $r = 0.81$, $r = 0.81$, $r = 0.74$ ($p < 0.0001$) and $r = 0.72$, $r = 0.69$, $r = 0.46$ ($p = 0.0001$), respectively. Bland-Altman analysis of the mean difference in total scar volume between visual and threshold-based analysis (5 SD) for all patients, patients with ischemic DE, and patients with non-ischemic DE was $4.3 \pm 7.9\%$, 4.8 ± 7.8 , and $2.6 \pm 7.6\%$, respectively.

Conclusion

Visual quantification of myocardial scar using a 5-point, 17-segment approach correlates well with threshold-based quantitative analysis. In this study the enhanced volume by visual scoring was closely related to both 3 and 5 SD signal-based analysis for both ischemic and non-ischemic patterns of DE.