

Measuring Aqueduct of Sylvius cerebrospinal fluid flow in multiple sclerosis using different software packages

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Background

Aqueduct of Sylvius (AoS) cerebrospinal fluid (CSF) flow dynamics can be quantified using cardiac-gated cine phase contrast (PC) MRI using different software.¹⁻³ CSF flow alterations have been reported in multiple sclerosis (MS) patients using PC-MRI,^{2,3} processed with the MR manufacturer's software² or with in-house software.³

Objective

Our aims were: evaluating AoS CSF flow measures differences in relation to different software; testing CSF flow repeatability; assessing if the software choice influences the differentiation between MS patients and healthy controls (HC).

Methods

Thirty MS patients and 19 HCs underwent cine phase-contrast 3T MRI. The AoS contours were drawn using: Jim-v8.0, Segment-v2.0, and SPIN-v1.1.151211. For each time point, the average flow velocity inside AoS (Vmean), the highest-velocity (Vmax), the AoS cross-sectional area and the flow rate were computed using the three software packages. We tested if there were differences among software and between groups for the following measures: the systolic and diastolic peaks of Vmean, Vmax and flow rate, the average area. Repeated measure ANCOVA (covaried by age and sex) was used, modelling time, method and group. Six subjects were processed twice: the intraclass correlation coefficient was computed for each measure of interest, to test the repeatability.

Results

Vmean diastolic peak differed between SPIN and Jim (P=0.04), but it was not significantly different between groups. Vmax peaks showed the highest repeatability and were not statistically different among software packages. Diastolic Vmax discriminated MS from HC (P=0.036/0.045/0.035 for Jim/Segment/spin). The flow rate peaks were not significantly different among software, but a significantly higher diastolic peak was found in MS vs HC only using Jim (P=0.019). Significantly different AoS cross-sectional area was obtained using Jim compared to the other software (P=0.043)

Conclusions

Vmax peaks were the most repeatable

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measure and differentiated between MS and HC groups regardless of the software package.

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