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2D conventional and synthetic brain MRI in the assessment of multiple sclerosis

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Background

Synthetic MRI reduces acquisition time and could be an alternative to conventional sequences for the assessment of multiple sclerosis (MS).

Objectives

To perform a qualitative and quantitative comparison of conventional and synthetic MRI sequences to evaluate their value in the assessment of brain demyelinating lesions.

Methods

Twenty-seven RRMS patients (18 women), mean age of 44.0 years, median EDSS of 3.5 were examined in a 1.5T MRI scanner. A 2D QRAPMASTER sequence was added to the brain MRI protocol (proton density [PD] and T2w fast spin-echo, fast T2w FLAIR, and T1w spin-echo sequences). SyMRI software version 8.0.4 used QRAPMASTER images to generate synthetic images with the same TR, TE and TI used for conventional MRI.

Four raters performed a blinded qualitative analysis of the images in a random order to evaluate global image quality (GIQ), global image contrast, presence of flow artifacts in posterior fossa, contrast of lesions to white matter, and level of confidence for supratentorial and infratentorial lesion assessment. Moreover, the number of periventricular, juxtacortical, brainstem, and cerebellum lesions, and the contrast-to-noise ratio (CNR) between regions were evaluated.

Statistical analysis was performed in SPSS v. 25. Crosstabs were used to evaluate the degree of agreement between sequences for qualitative data. Wilcoxon signed rank test was used to evaluate differences for quantitative data.

Results

GIQ showed a predominance of better scores for conventional MRI. All other image quality parameters showed a degree of agreement similar or greater to the predominance of better scores for conventional MRI. There were no significant differences in the degree of agreement between pairs of raters in the assessment of conventional and synthetic MRI except between raters 1 and 2. However, we found a clear predominance of disagreement for all pairs of raters. Synthetic PD, T2w and T2w-FLAIR showed higher CNR than conventional sequences for most of the regions. Two raters found a greater number of brainstem lesions in conventional PD and one in synthetic T2w-FLAIR images. Three raters found a greater number of cerebellum lesions in conventional PD, and two of them in conventional T2w-FLAIR images.

Conclusions

Synthetic MRI obtained lower scores for some qualitative rater-related parameters while quantitative CNR data showed higher values. Synthetic MRI shows potential to be used as an alternative to conventional brain MRI sequences in the assessment of MS.

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