3D DOUBLE INVERSION RECOVERY SEQUENCE IS SUPERIOR TO CONVENTIONAL MR SEQUENCES IN LESION DETECTION AND INTERRATER RELIABILITY OF MULTIPLE SCLEROSIS LESIONS IN THE ASIAN POPULATION

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Background and Objectives

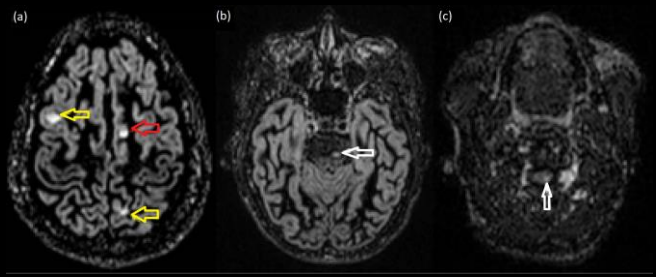
Three-dimensional (3D) double inversion recovery (DIR) sequence has been shown to be highly specific and more sensitive than FLAIR to multiple sclerosis (MS) cortical lesions. In some studies, 3D DIR sequence was also found to improve detection rate of MS lesions in other anatomical regions or anatomical distinction of MS lesions. A previous study suggested that there may be improved lesion conspicuity on DIR compared with conventional T2 and FLAIR sequences in certain locations. However, the use of DIR sequence in the East Asian population, where the prevalence of MS is low , has seldom been studied before. Therefore, we conduct a validation study to compare the detection rate of multiple sclerosis lesions located at difference regions of the brain and interrater agreement between 3D DIR sequence and combination of T2 TSE and FLAIR sequences in the East Asian population.

Methods

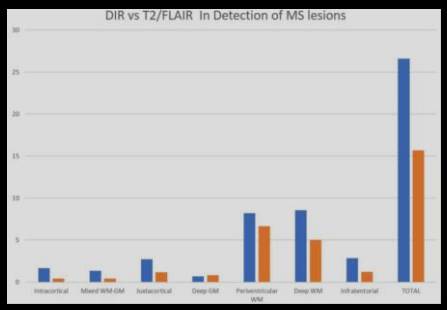
Consecutive patients of East Asian descent known to have multiple sclerosis who underwent MRI (including 3D DIR, T2 TSE and FLAIR sequences) in a single institution between January 1 to December 31, 2017 were retrospectively reviewed. DIR MRI images were reviewed independently by two neuroradiologists. This was repeated for T2/FLAIR after 3 months with the study list in a different random order. Lesions were counted and localized to 7 anatomic regions: intracortical, mixed white matter (WM)-gray matter (GM), juxtacortical, deep WM, deep GM, periventricular WM and infratentorial. The mean lesion counts and interrater agreement between the two imaging techniques were compared using Mann-Whitney U test and intraclass correlation respectively.

Results

18 MRI were performed among 17 patients (mean age: 39.8; M:F = 5:12). More lesions were detected on DIR than T2/FLAIR in total (26.6 vs 15.7) and in almost all individual anatomical regions, except in the deep gray matter. The differences are more pronounced for intracortical lesions (mean 1.7 vs 0.4, p=0.01). There was excellent interrater agreement in lesion detection in the entire brain on DIR (ICC 0.89), while that on T2/FLAIR was fair only (ICC 0.40). The interrater agreement for lesion detection in juxtacortical and periventricular regions on DIR was also excellent (ICC 0.81 and 0.91 respectively), while that on T2/FLAIR was fair to moderate (ICC 0.22 and 0.62 respectively).



Detection of MS lesions at different anatomical regions, including (a) juxtacortical (red arrow) and mixed white matter-gray matter (yellow arrow) (b) infratentorial (white arrow) (c) cervical spinal cord (white arrow), on 3D double inversion recovery sequence.



Number of Multiple Sclerosis lesions detected by DIR and T2/FLAIR sequences.

Discussion

Our study suggested that DIR sequence can depict more lesions in patients with multiple sclerosis and offers better interrater agreement when compared with T2 and FLAIR sequences in ombination. A good interrater agreement allows more consistent quantification of disease burden, which in turn supports treatment response assessment and disease monitoring. This is especially important in MS as it often runs a chronic and protracted course

Conclusion

The more sensitive depiction of MS lesions with the use of DIR sequence is helpful in the diagnosis of MS in the East Asian population where there is a low prevalence of MS. It allows more reliable and consistent assessment of the true disease burden to aid disease monitoring than conventional MR sequences.

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