Efficiency of FLAIR* at 1.5T, 3T, and 7T for detecting perivenular lesions in multiple sclerosis.

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Objective

To evaluate the efficiency of FLAIR* imaging in detecting the perivenular distribution of lesions at different magnetic field strengths.

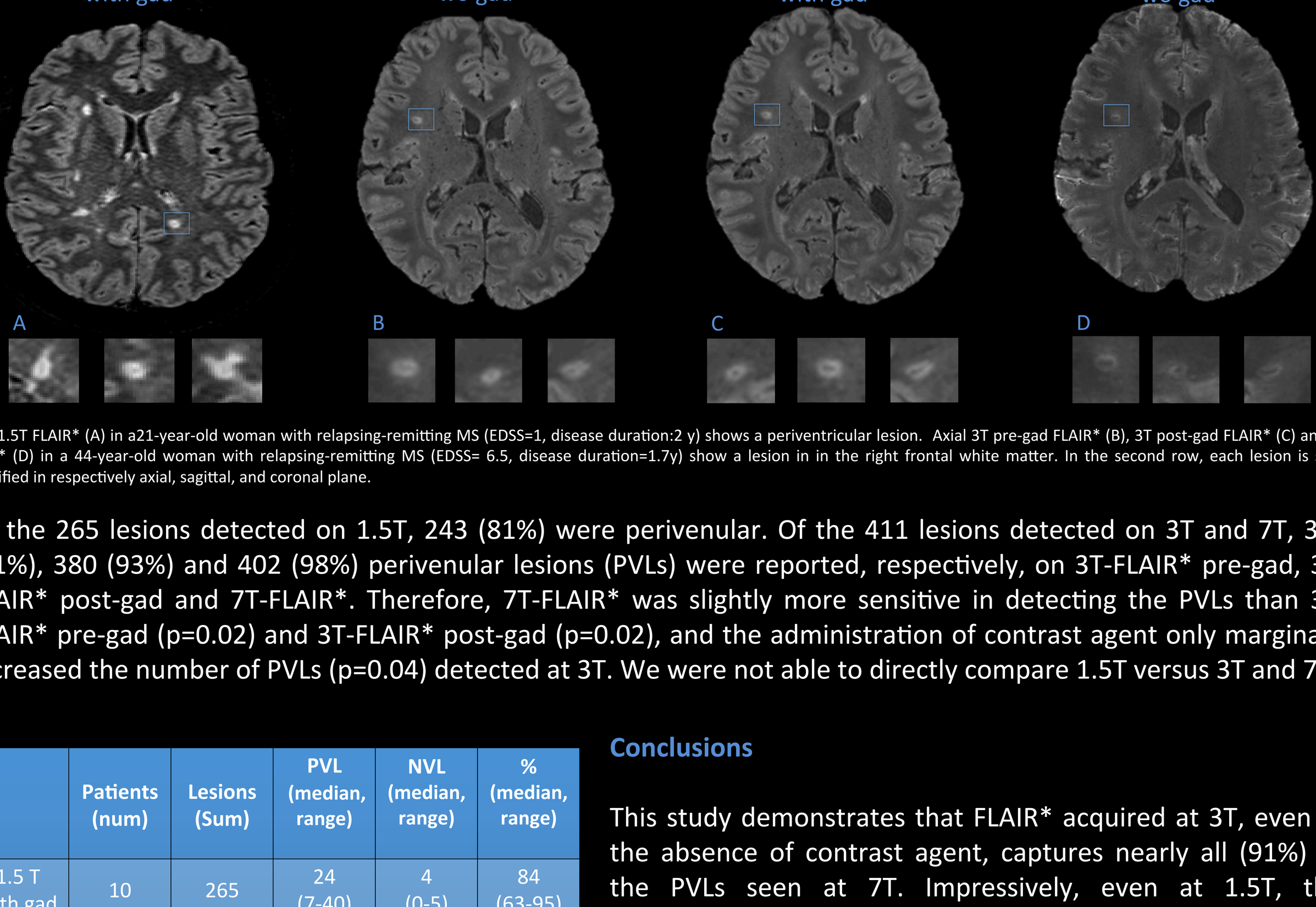
Methods

10 MS patients underwent 1.5T MRI. Moreover, an additional 9 MS patients underwent 3T MRI followed by 7T MRI within 8-13 months. FLAIR* images were obtained as previously described[1]. 3T-FLAIR* was acquired both before and after injection of gadolinium-based contrast agent. A single expert simultaneously evaluated the images, reporting the total number of lesions and classifying the lesions as perivenular if intralesional hypointense signal was noted in at least 2 perpendicular planes and if it was completely surrounded by hyperintense signal in at least 1 plane.

FLAIR*

FLAIR* is a new MRI technique that combines the advantages of T2-FLAIR for detecting MS lesions and of T2* weighting for detecting parenchymal veins. FLAIR* can be used at clinical field strengths (1.5T and 3T) and ultra-high-field strength (7T) to generate high-isotropic-resolution whole-brain images.

Results



Axial 1.5T FLAIR* (A) in a21-year-old woman with relapsing-remitting MS (EDSS=1, disease duration:2 y) shows a periventricular lesion. Axial 3T pre-gad FLAIR* (B), 3T post-gad FLAIR* (C) and a 7T FLAIR* (D) in a 44-year-old woman with relapsing-remitting MS (EDSS= 6.5, disease duration=1.7y) show a lesion in in the right frontal white matter. In the second row, each lesion is shown magnified in respectively axial, sagittal, and coronal plane.

Of the 265 lesions detected on 1.5T, 243 (81%) were perivenular. Of the 411 lesions detected on 3T and 7T, 375 (91%), 380 (93%) and 402 (98%) perivenular lesions (PVLs) were reported, respectively, on 3T-FLAIR* pre-gad, 3T-FLAIR* post-gad and 7T-FLAIR*. Therefore, 7T-FLAIR* was slightly more sensitive in detecting the PVLs than 3T-FLAIR* pre-gad (p=0.02) and 3T-FLAIR* post-gad (p=0.02), and the administration of contrast agent only marginally increased the number of PVLs (p=0.04) detected at 3T. We were not able to directly compare 1.5T versus 3T and 7T.

	Patients (num)	Lesions (Sum)	PVL (median, range)	NVL (median, range)	% (median, range)
1.5 T with gad	10	265	24 (7-40)	4 (0-5)	84 (63-95)
3 T wo gad	9	411	39 (11-86)	4 (0-9)	91 (76-100)
3T with gad			39 (11-87)	3 (0-8)	93 (80-100)
7T wo gad			40 (11-91)	0	100 (94-100)

PVL: perivenular lesion: NVL: not perivenular lesion

Conclusions

This study demonstrates that FLAIR* acquired at 3T, even in the absence of contrast agent, captures nearly all (91%) of the PVLs seen at 7T. Impressively, even at 1.5T, the proportion of PVLs is high (81%). Therefore, this study supports the usefulness of FLAIR* imaging on clinical scanners and paves the way for multicenter trials to assess its diagnostic utility.

[1] Sati P, George IC, Shea CD, Gaitan MI, Reich DS. FLAIR*: A Combined MR Contrast Technique for Visualizing White Matter Lesions and Parenchymal Veins. Radiology. 2012.

DISCLOSURES

LV, BED, PS, DSR have nothing to disclose.

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