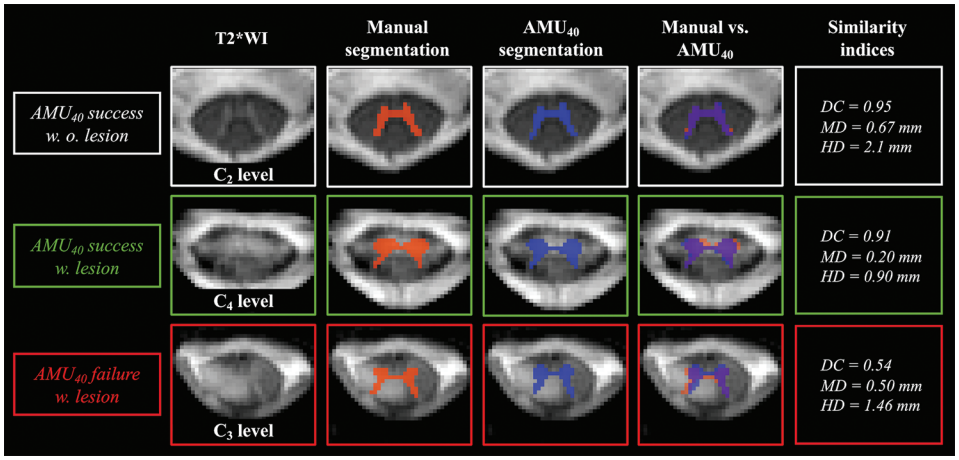

ON-LINE FIGURE. Anatomic T2*WI MR imaging of patients with MS with and without the presence of lesions. From left to right: T2*WI image; manual GM segmentation (*red masks*); AMU_{40}-based automatic GM segmentations (*blue masks*); superimposed manual and AMU_{40}-based segmentations for similarity/difference visualization; similarity indices (Dice coefficient [DC]; maximum median distance on skeletonized segmentations [MD] and Hausdorff distance [HD]) between manual (consensus between the 2 raters) and AMU_{40} segmentations. The upper and middle rows show successful segmentations with (middle) and without (upper) the presence of a lesion. The bottom row shows a failed GM segmentation (defined here as DC $<$0.8) in the presence of a lesion. Note that because the atlas-based segmentation approach relies on image contrast, it is sensitive to signal intensity, contrast, and artifacts. When hyperintensity due to a lesion is present, the nonlinear registration to the template could be compromised, especially when the lesion involves both GM/WM (as illustrated above). Generally speaking, for other pathologies in which the WM/GM contrast is preserved, the template approach behaves perfectly well.

On-line Table 1: Main sequence parameters used in this study

	T2*WI	DTI	ihMT/MT	T2WI
Orientation/readout	2D axial MSMA/multiecho GRE	2D axial MSMA/single-shot SE-EPI	2D axial/HASTE	3D sagittal/TSE
TE (ms)/TR (ms)	27 (TE_{eff}, 5 echoes)/~500[a]	79/~640[a]	52 (ETL 192) /4000[a]	
FOV	135 × 180 mm^2	117 × 128 mm^2	12 × 128 mm^2	256 × 256 mm^2
Voxel size	0.47 × 0.47 × 5 mm^3	0.9 × 0.9 × 10 mm^3	0.9 × 0.9 × 10 mm^3	1 × 1 × 1 mm^3
T_{acq}	~6 min	2× (~7 min)	2× (~8 min)	5 min 53 sec
Parallel acquisition	GRAPPA reconstruction ($R = 2$)	GRAPPA reconstruction ($R = 2$)		
Location (spatial coverage)	C1–C7 (7 slices, 1 per vertebral level)	C2 (5 slices), C5 (5 slices)	C2 (1 slice), C5 (1 slice)	C1–C7
Phase-encoding direction	Anterior–posterior	Right-left	Right-left	Head-feet
Special parameters		30 directions 4 averages $\delta/\Delta = 15.42/34.24$ ms b-values: (0–800) s/mm^2 In-line eddy current distortion correction[50]	ihMT preparation: Frequency offset ($\Delta f = 7$ kHz) 4 Unsaturated images (M_0) 30 Repetitions of 4 saturation schemes including single ($+\Delta f$, Δf) and dual-frequency saturation ($\pm\Delta f$, $\pm\Delta f$) $B_{1RMS} = 5.1$ μT/total saturation energy E_{TR}=13.79 μT^2.second	
Metrics	FA, ADC, $\lambda_{//}$, $\lambda_{\perp}$[b]		$MTR = 1\text{-}MT^{(+\Delta f)}/M_0$ $ihMT = (MT^{(+\Delta f)} + MT^{(-\Delta f)}) - (MT^{(\pm\Delta f)} + MT^{(\pm\Delta f)})$ $ihMTR = ihMT/M^c$	

Note:—SE indicates spin-echo; ETL, echo-train length; GRAPPA, generalized autocalibrating partially parallel acquisitions; GRE, gradient recalled echo; MSMA, Multi-Slices Multi-Angles; B_{1RMS}, root-mean-squarred B1; T_{acq}, acquisition time; δ, duration of the diffusion encoding gradient; Δ, time between the two diffusion gradients; E_{TR}, total saturation energy; M_0, unsaturated image; Δf, frequency offset; TE_{eff}, effective echo time.

[a] Acquisition synchronization with electrocardiography to minimize CSF pulsatility–induced motion.

[b] Computed inline using Neuro3D software (Siemens).

[c] Calculated using Matlab R2014a (MathWorks).

On-line Table 2: Results of reliability assessment of the template AMU_{40} to perform automatic spinal GM and WM segmentations on the anatomic T2*WI of both HC and patients with MS[a]

	HC (n = 19)	MS (n = 19)								
		Rater 1 vs AMU_{40}			Rater 2 vs AMU_{40}			Rater 1 vs Rater 2		
	Raters vs AMU_{40}	Total	Without Lesion	With Lesion	Total	Without Lesion	With Lesion	Total	Without Lesion	With Lesion
GM										
DC (n.u)	0.85 ± 0.05 (0.66–0.93)	0.76 ± 0.13 (0.15–0.95)	0.80 ± 0.09 (0.58–0.95)	0.74 ± 0.14 (0.15–0.94)	0.74 ± 0.10 (0.45–0.91)	0.78 ± 0.09 (0.50–0.91)	0.72 ± 0.11 (0.45–0.87)	0.78 ± 0.10 (0.47–0.92)	0.80 ± 0.01 (0.65–0.92)	0.77 ± 0.10 (0.47–0.89)
HD (mm)	0.85 ± 0.37 (0.36–2.90)	1.03 ± 0.42 (0.40–2.19)	1.07 ± 0.45 (0.50–2.1)	1.02 ± 0.41 (0.40–2.19)	1.05 ± 0.32 (0.50–2.10)	1.00 ± 0.38 (0.50–2.10)	1.07 ± 0.29 (0.50 – 1.61)	0.90 ± 0.33 (0.41–2.08)	0.94 ± 0.33 (0.41–1.86)	0.89 ± 0.33 (0.41–2.08)
MD (mm)	0.24 ± 0.12 (0.14–1.27)	0.29 ± 0.15 (0.14–1.17)	0.29 ± 0.12 (0.14–0.67)	0.29 ± 0.17 (0.14–1.17)	0.29 ± 0.10 (0.20–0.57)	0.24 ± 0.07 (0.20–0.41)	0.31 ± 0.11 (0.20–0.57)	0.25 ± 0.08 (0.14–0.57)	0.24 ± 0.08 (0.14–0.50)	0.25 ± 0.08 (0.20–0.57)
WM										
DC (n.u)	0.92 ± 0.02 (0.81–0.96)	0.90 ± 0.05 (0.70–0.96)	0.90 ± 0.04 (0.78–0.96)	0.89 ± 0.05 (0.70–0.95)	0.89 ± 0.04 (0.76–0.94)	0.90 ± 0.03 (0.85–0.94)	0.89 ± 0.04 (0.76–0.94)	0.91 ± 0.03 (0.80–0.95)	0.91 ± 0.02 (0.87–0.95)	0.91 ± 0.03 (0.80–0.95)
HD (mm)	1.20 ± 0.34 (0.50–3.10)	1.32 ± 0.38 (0.40–2.30)	1.31 ± 0.41 (0.40–2.30)	1.33 ± 0.36 (0.50–2.25)	1.31 ± 0.37 (0.63–2.15)	1.20 ± 0.40 (0.63–2.15)	1.37 ± 0.35 (0.73–2.10)	1.26 ± 0.34 (0.50–2.02)	1.24 ± 0.38 (0.71–2.02)	1.27 ± 0.33 (0.50–1.91)
MD (mm)	0.23 ± 0.08 (0.20–1.00)	0.26 ± 0.09 (0.20–0.70)	0.25 ± 0.07 (0.20–0.50)	0.26 ± 0.09 (0.20–0.70)	0.28 ± 0.07 (0.20–0.50)	0.29 ± 0.08 (0.20–0.50)	0.28 ± 0.07 (0.20–0.50)	0.23 ± 0.04 (0.20–0.40)	0.22 ± 0.03 (0.20–0.30)	0.23 ± 0.05 (0.20–0.40)

Note:—MD indicates median distance; HD, Hausdorff distance; DC, dice coefficient; n.u., no unit.

[a] DC range, 0–1 with 1 indicating perfect similarity; skeletonized MD, with lower MD indicating higher similarity; and HD, with lower HD indicating higher similarity. Mean ± SD (minimum-maximum) values over all cervical levels are reported. Rater 1 is a neurologist; rater 2, a spinal cord MR imaging physicist. Columns labeled "Total" report values from all data, columns "With Lesion" and "Without Lesion" report values from slices with and without T2*-WI-visible lesions, respectively. The similarity indices between the manual segmentations, particularly for WM, suggest a good agreement between the 2 independent operators. Similarity between each independent operator and automatic segmentation was in the same range as the agreement between both operators. Results were obtained in MS for the C2–C3 levels only for comparison with Prados et al,[35] and pooling WM/GM with/without lesions led to a mean DC and HD of 0.84 ± 0.06 and 1.16 ± 0.38 mm, respectively, in line with Padros et al[35] (DC: 0.80 ± 0.07; HD: 1.46 ± 0.36 mm). Results obtained in HC were similar to those of Taso et al.[29]