**SUPPLEMENTAL MATERIAL**

# Magnetic resonance imaging using ferumoxytol improves the visualization of central nervous system vascular malformations

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## Supplemental Methods

*Brain MRI Acquisition Parameters*

Siemens: 1) Axial 2D $T_1$-weighted SE [repetition time (TR), 900 ms; echo time (TE), 10 ms; field of view (FOV), 180 x 240 $mm^2$; acquisition matrix, 192 x 256; number of slices, 44; slice thickness, 2 mm; interslice gap, 0 mm]. 2) Axial 2D $T_2$-weighted turbo spin echo (TSE) (TR, 9000 ms; TE, 93 ms; turbo factor, 9; FOV, 180 x 240 $mm^2$; acquisition matrix, 192 x 256; number of slices, 49; slice thickness, 2 mm; interslice gap, 0 mm). 3) Axial 3D $T_2$*-weighted GRE [TR, 28 ms; TE, 20 ms; flip angle (FA), 15°; FOV, 187.5 x 240 $mm^2$; acquisition matrix, 298 x 448; number of slices, 72; slice thickness, 1.2 mm; interslice gap, 0 mm].

Philips: 1) Axial 2D $T_1$-weighted SE (TR, 900 ms; TE, 9.5 ms; FOV, 240 x 240 $mm^2$; acquisition matrix, 212 x 268; number of slices, 44; slice thickness, 2 mm; interslice gap, 0 mm). 2) Axial 2D $T_2$-weighted TSE (TR, 4500 ms; TE, 93 ms; turbo factor, 14; FOV, 240 x 240 $mm^2$; acquisition matrix, 209 x 268; number of slices, 44; slice thickness, 2 mm; interslice gap, 0 mm). 3) Axial 3D $T_2$*-weighted fast field echo (TR, 31 ms; TE, 41 ms; FA, 15°; FOV, 240 x 240 $mm^2$; acquisition matrix, 284 x 400; number of slices, 72; slice thickness, 1.2 mm; interslice gap, 0 mm).

The slices were positioned parallel to the long axis of the corpus callosum.

*Spine MRI Acquisition Parameters*

Siemens: 1) Sagittal 2D $T_1$-weighted TSE (TR, 700 ms; TE, 10 ms; turbo factor, 5; FOV, 362.5 x 400 $mm^2$; matrix size, 278 x 384; number of slices, 15; slice thickness, 3 mm; interslice gap, 0.3 mm). 2) Sagittal 2D $T_2$-weighted TSE (TR, 3600 ms; TE, 106 ms; turbo factor, 31; FOV, 400 x 400 $mm^2$; matrix size, 307 x 384; number of slices, 15; slice thickness, 3 mm; interslice gap, 0.3 mm). 3) Sagittal 2D $T_2$-weighted GRE (TR, 179 ms; TE, 5.7 ms; FA, 25°; FOV, 400 x 400 $mm^2$; matrix size, 240 x 334; number of slices, 15; slice thickness, 3 mm; interslice gap, 0.3 mm). 4) Axial 2D $T_1$-weighted SE (TR, 900 ms; TE, 10 ms; FOV, 180 x 240 $mm^2$; matrix size, 192 x 256; number of slices, 44; slice thickness, 2 mm; interslice gap, 0 mm). 5) Axial 2D $T_2$-weighted TSE (TR, 9000 ms; TE, 93 ms; turbo factor, 9; FOV, 180 x 240 $mm^2$; matrix size, 192 x 256; number of slices, 49; slice thickness, 2 mm; interslice gap, 0 mm). 6) Axial 3D $T_2$*-weighted GRE (TR, 28 ms; TE, 20 ms; FA, 15°; FOV, 187.5 x 240 $mm^2$; matrix size, 298 x 448; number of slices, 72; slice thickness, 1.2 mm; interslice gap, 0 mm).

The sagittal sequences were acquired as a cervico-thoracic and a thoraco-lumbar part with an overlap of at least three vertebral bodies. The axial images were planned along a line parallel to the intervertebral disc spaces.