**Supplementary Information**

**Animal Model**

Permanent middle cerebral artery occlusion (MCAo) was induced using the intraluminal thread model (Longa et al. 1989) where a nylon thread was advanced along the internal carotid artery until it blocked the blood flow from the MCAo. After MRI rats were sacrificed via decapitation in deep isoflurane anaesthesia or injection of saturated KCl.

**MRI data acquisition parameters**

4.7T Varian Inova System

* Single-slice acquisition
* *Trace of Diffusion Tensor (Dav):* spin-echo sequence, with repetition time (TR) = 1500ms and echo time (TE) = 55ms, incorporating 4 bipolar gradients with 4 b-values (0 – 1370 mm-2 s).
* *Fast spin multi-echo T2*:5 echoes with 10ms inter-echo spacing starting at 10ms and TR = 2500ms.
* Field of view (FOV) was 2.56 cm x 2.56 cm covered by 64 x 128 points for Dav and T2.
* For both sequences, Field of view (FOV) was 2.56 cm x 2.56 cm covered by 64 x 128 points.

9.4T Varian Direct Drive System

* 12 slices acquired
* *Dav:* with TE = 36ms, TR = 2000ms, incorporating 3 bipolar gradients with 3 b-values (0, 400, 1040 mm-2 s).
* *Multi-echo T2*: spin-echo sequence, 12 echoes with 10ms inter-echo spacing starting at 10ms, and TR = 2000ms.
* *Fast Low Angle Shot (FLASH) T1:* time from inversion to first FLASH sequence (T10) = 7.58ms, time between inversion pulses (Trelax) = 10s Inversion Time (TI) = 600ms and TR = 5.5ms.
* For all sequences, FOV was 2.56 cm x 2.56 cm covered by 128 x 256 points, with 0.5mm gap and 1mm slice thickness.

**Computation of parameter *f***

The *f* parameter was originally introduced by Knight et al. (2016) and refers to the fraction of voxels with elevated T1 (f1) or elevated T2 (f2) within the ischaemic lesion. The values of *f* used in the present analysis were calculated by McGarry et al. (2016). *f* was calculated as a percentage at each time point post stroke onset for every rat, creating up to 4 data points from each rat. The procedure for this calculation is as follows:

* Ischaemic volumes of interest (VOI) were generated by applying Knight et al.’s (2015) automatic lesion detection procedure to reciprocal ADC maps (1/ADC). According to this approach, a voxel is ischaemic if its value exceeded the median value of the whole brain 1/ADC distribution by one median absolute deviation.
* The number of voxels with elevated qT1 or qT2 within the ischaemic VOI was determined by reflecting the ischaemic VOI onto the homologous region of the contralateral hemisphere to obtain the median qT1 or qT2 of non-ischaemic tissue. Use of the non-ischaemic values were so that each rat served as its own control. A voxel within the ischaemic VOI was considered as having a ‘high’ relaxation time if its median value exceeded the median value of the non-ischaemic VOI by more than one half-width at half maximum.
* To allow for a decrease in relaxation caused by ischaemia or other pathologies voxels with low relaxation times within the ischaemic VOI were also determined. A voxel was considered to have an unusually ‘low’ relaxation time if its median value was below the median value of the non-ischaemic VOI by more than one half-width at half maximum.
* *f* was calculated as a percentage according to the following equation:

refers to the relaxation time (T1 or T2) refers to the number of ‘high’ relaxation time voxels in the ischaemic VOI, is the number of ‘low’ relaxation time voxels in the ischaemic VOI and is the total number of voxels within the ischaemic VOI.

**Computation of VOverlap**

Voverlap is the volume of tissue with both elevated qT1 and qT2 relaxation times within the ischaemic VOI, normalised by the whole-brain volume and represented as a percentage (McGarry et al., 2016). Voverlap values used in the present analysis were calculated by McGarry et al. (2016). Voverlap was as calculated for each rat and time-point as follows:

is the number of voxels within the ischaemic lesion that have both ‘high’ (defined above) qT1 and qT2. is the total number of voxels within the whole rat brain, which was determined by manually creating a VOI around the whole brain on qT2 maps.

**Signal to noise ratio (SNR)**

Signal to noise ratio (SNR) was computed for quantitative relaxation images maps and summed weighted images using the dual acquisition approach described by Firbank et al. (1999). This involves computing a difference image from sequential acquisitions. Here, differences images for all rats were computed by subtracting images acquired in the second hour post MCAo from images acquired in the first hour. SNR was computed using the following equation:

SNRdual =

Where S1 is the mean signal intensity from an ROI (6mm x 6mm) placed in the contralateral hemisphere. SD1-2 is the standard deviation of the signal from the same ROI placed in the same region of the difference image. SNR values given in the results are averaged across rats.

**Statistical Analysis**

Pair-wise comparisons of AUCs were performed according to Delong et al.’s (1988) non-parametric approach, using XLSTAT for Microsoft Excel.

**References for Supplementary Information**

Longa E-Z, Weinstein P-R, Carlson S, Cummins R. Reversible middle cerebral artery occlusion without craniectomy in rats. Stroke 1989; 20(1): 84-91

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