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THE UNIVERSITY OF EDINBURGH

Multi-PART

MRI Protocols in Experimental Stroke

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The University of Edinburgh

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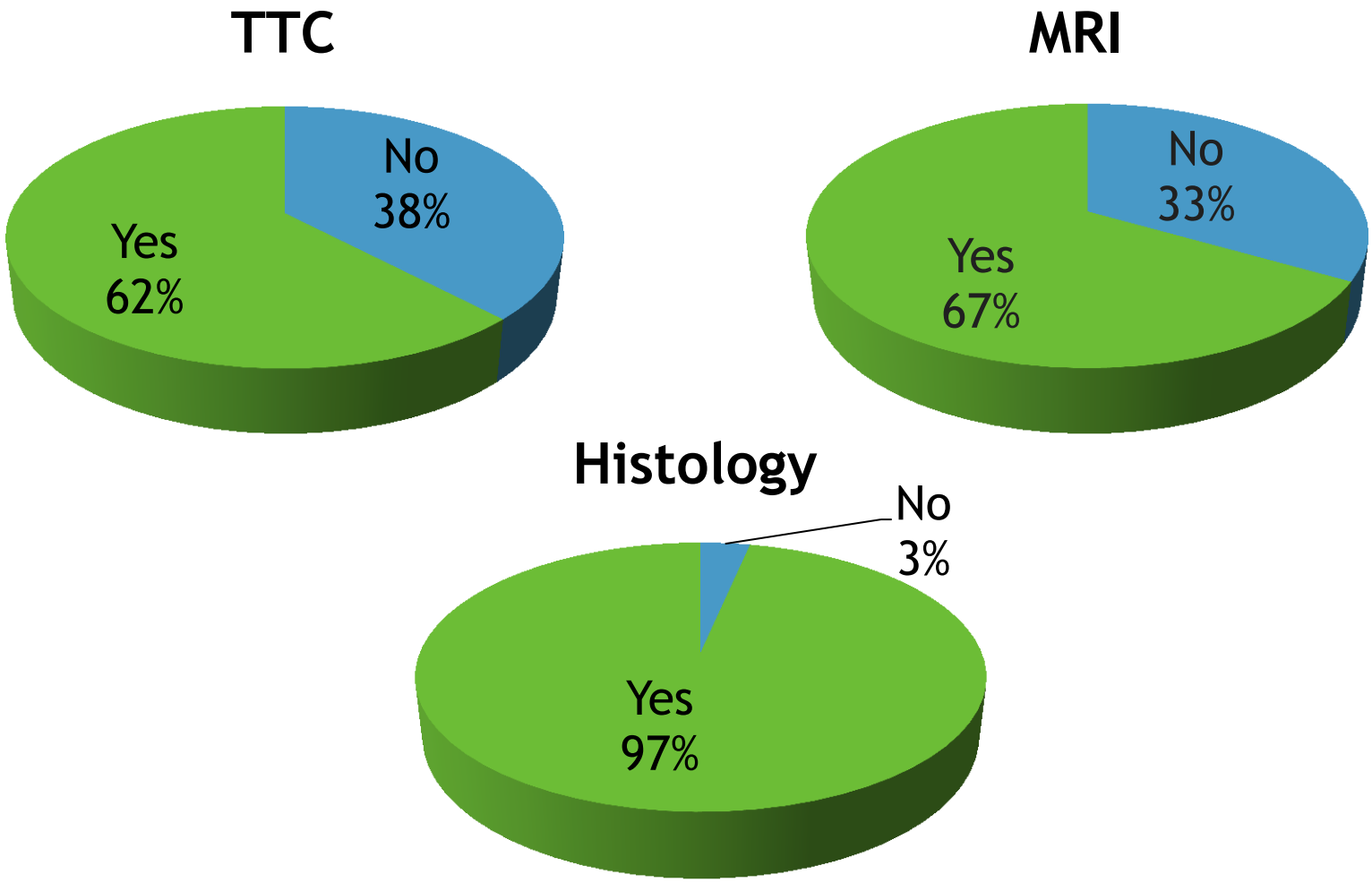
Objective

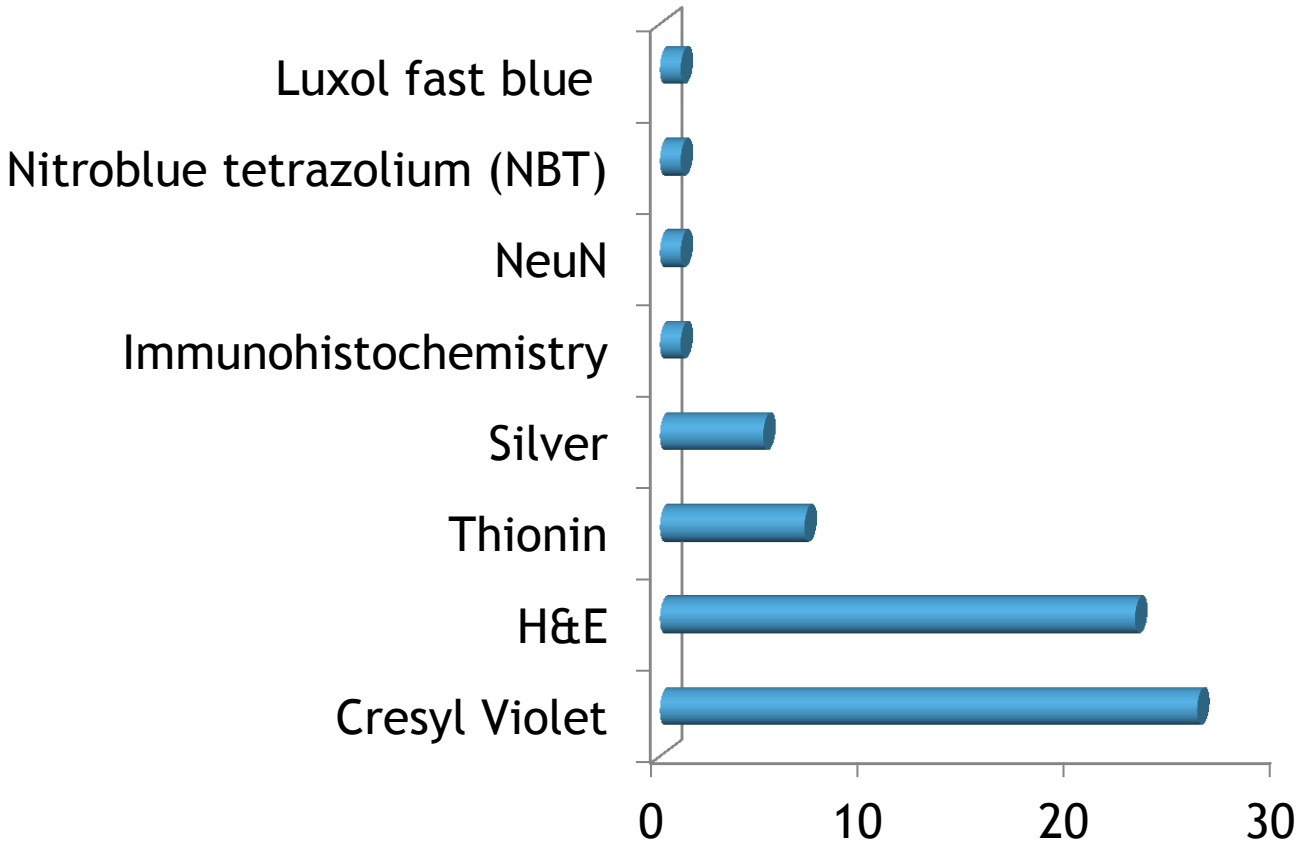
- In Multi-PART magnetic resonance imaging (MRI) data from different scanners will be combined.
- Effective pooling will require standardisation of acquisition protocols and post-processing methods.

We aim to **examine** the variability in the use of MRI in animal models of stroke for measuring the infarct size, and **develop** standardised strategies to facilitate multicentre studies.

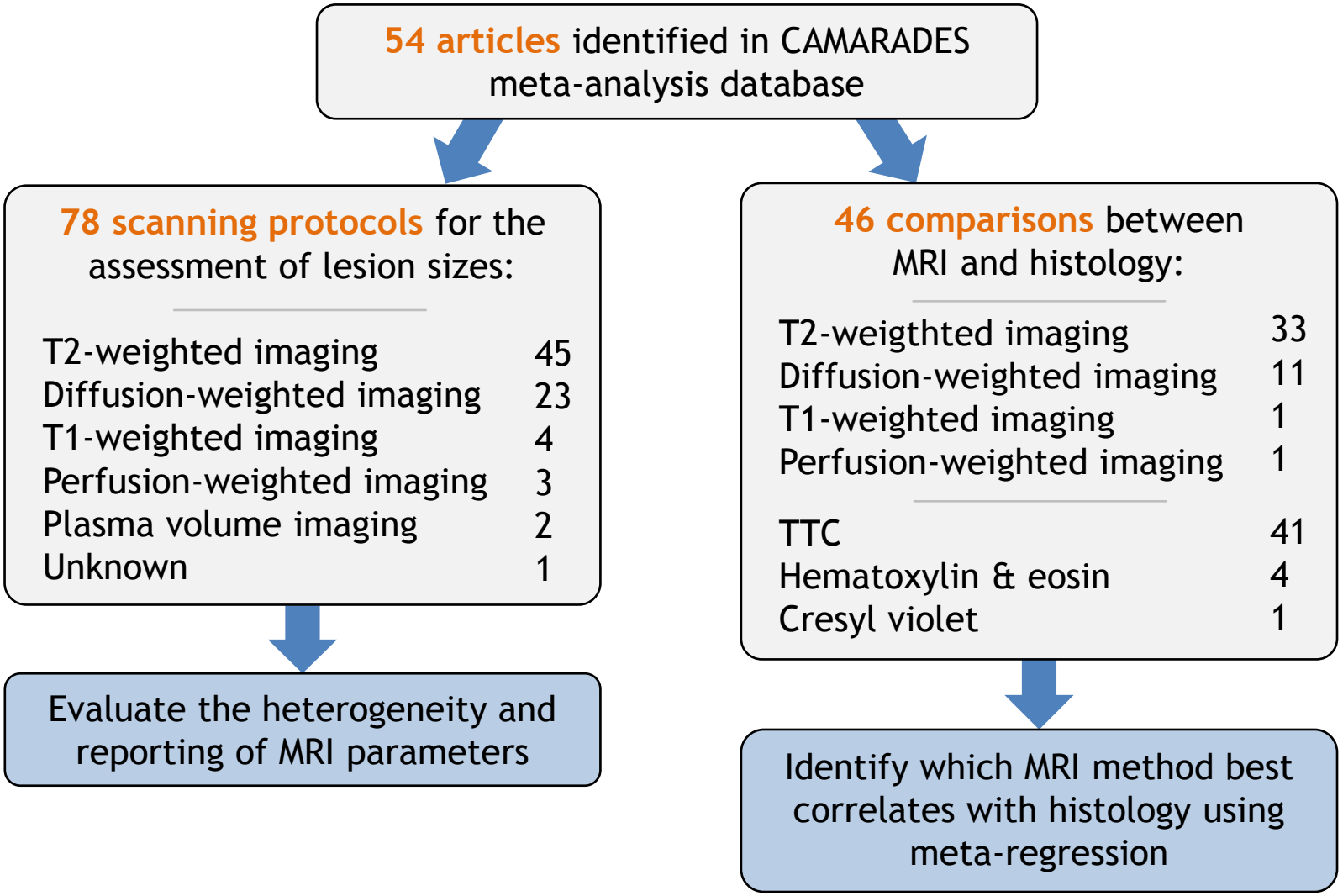
Do you use the following to assess infarct volume?



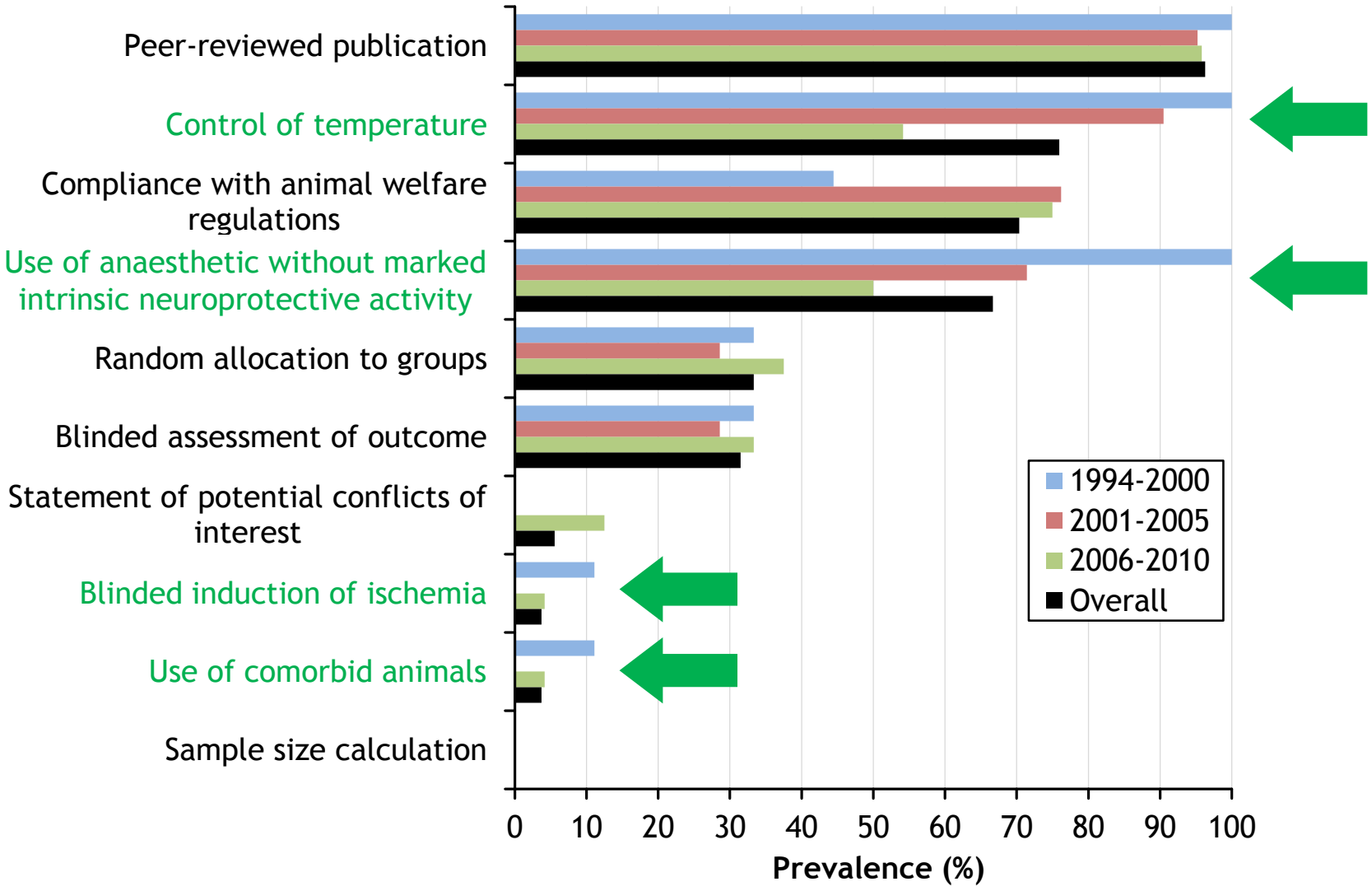
Type of Histology?



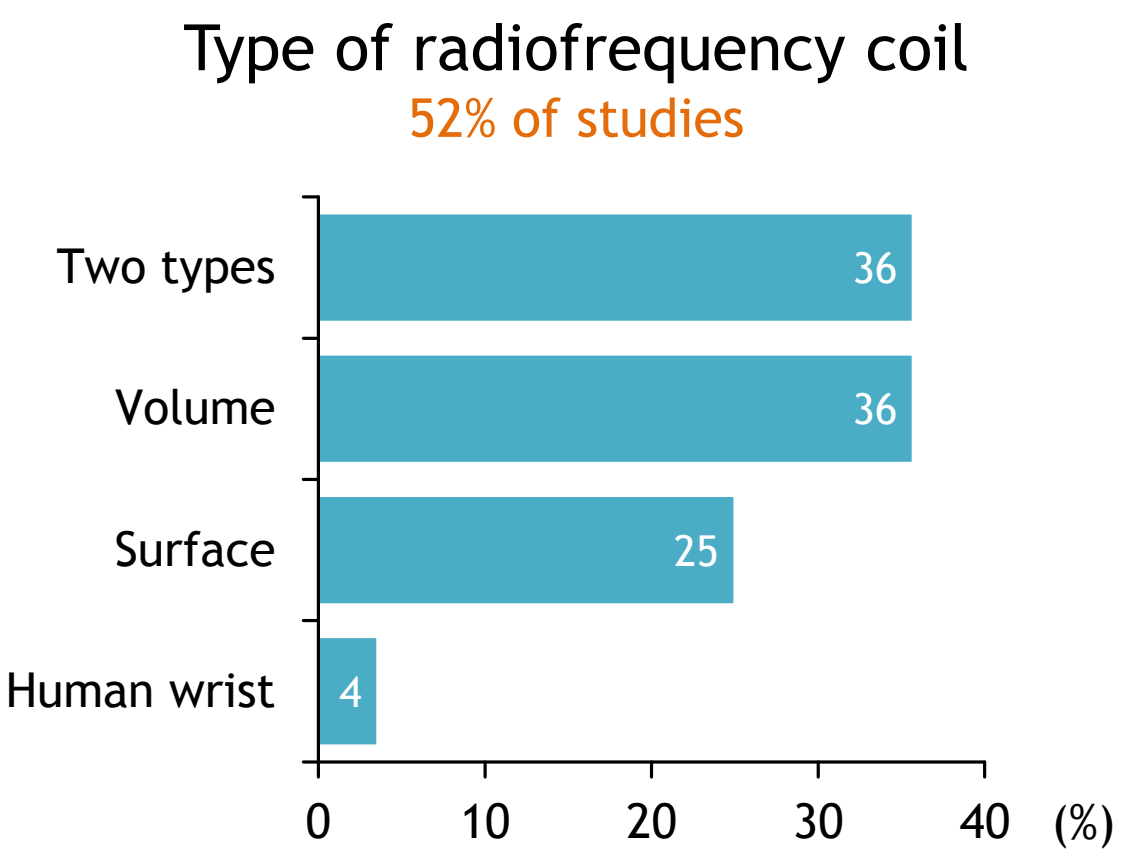
Systematic review of MRI in experimental stroke

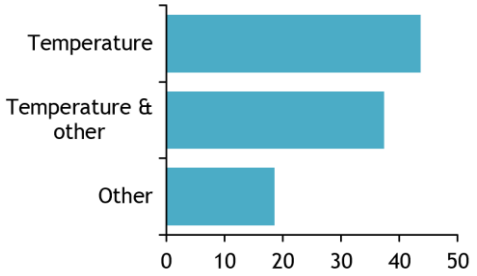


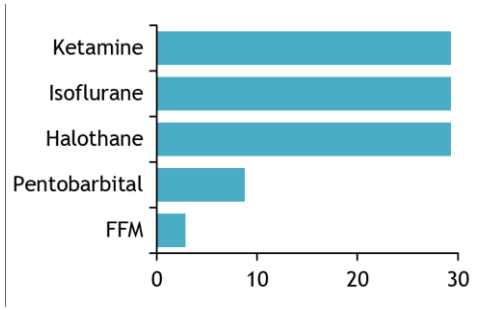
Study quality

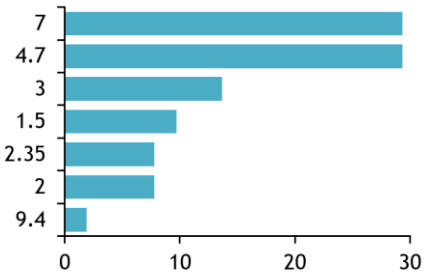


Basic imaging characteristics (1)





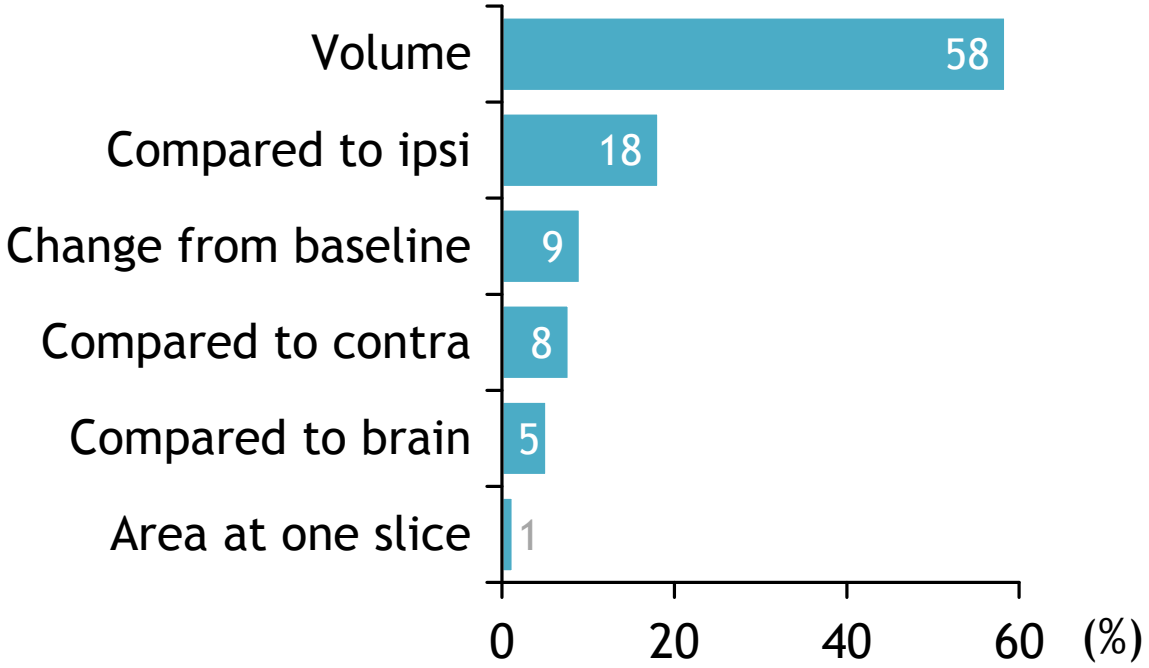


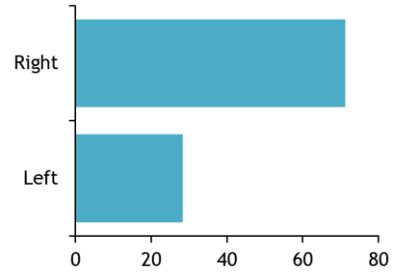


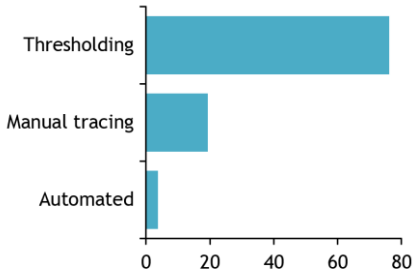
Basic imaging characteristics (2)

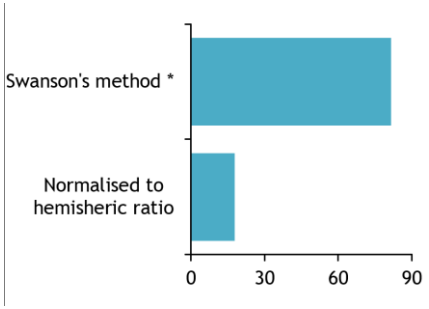
Presentation of lesion size

99% of studies









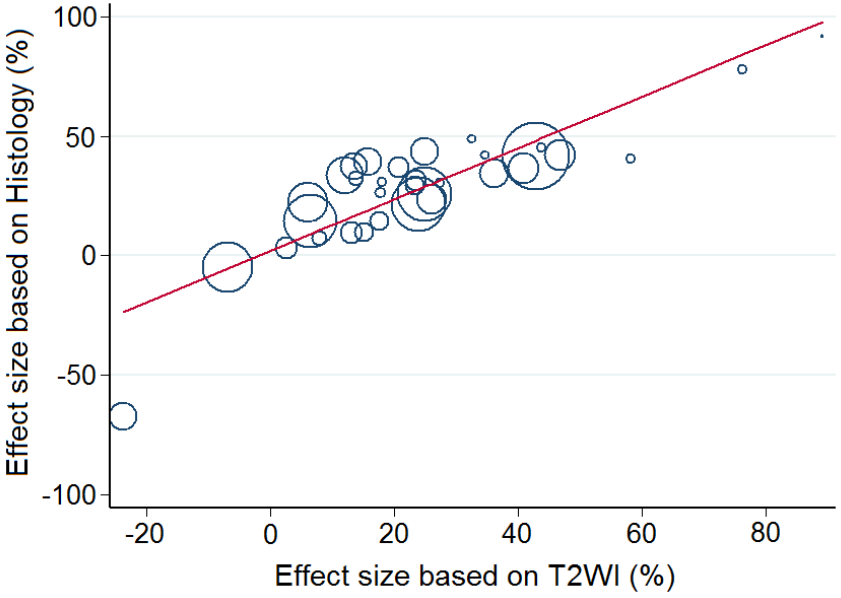
* *J. Cereb. Blood Flow Metab.* 1990;10:290-293

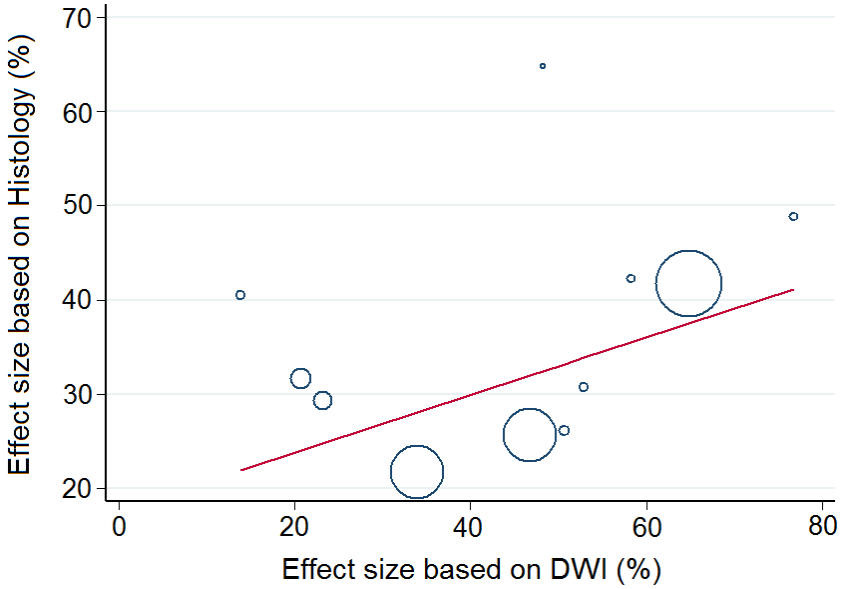
MRI scanning parameters

Parameter	T2-weighted imaging		Diffusion-weighted imaging	
	range	*median*	*range*	*median*
Echo time (ms)	30-120 30-120	60 66	33-100 30	40 30
Repetition time (ms)	1750-8000 1000-3000	3000 2550	1000-4000 1000-1000	3000 1000
Number of slices	6-35 5-25	14 13	4-13 5	8 5
Slice thickness (mm)	0.35-3 0.5-1	1 1	1-2 0.5	1.5 0.5
Field of view (mm×mm)	22×22-120×120 25.6×12.8-20×20	- -	22×22-80×80 22×16	- -
Matrix size (pixels×pixels)	64×64-512×512 128×64-256×256	- -	64×64-256×256 128×64	- -
Number of averages	2-8 8-16	4 12	2-4 N/G	3 N/G

Rat
Mouse

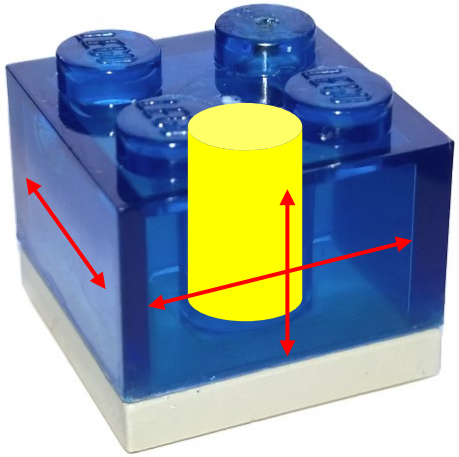
T2-weighted imaging correlates with histology





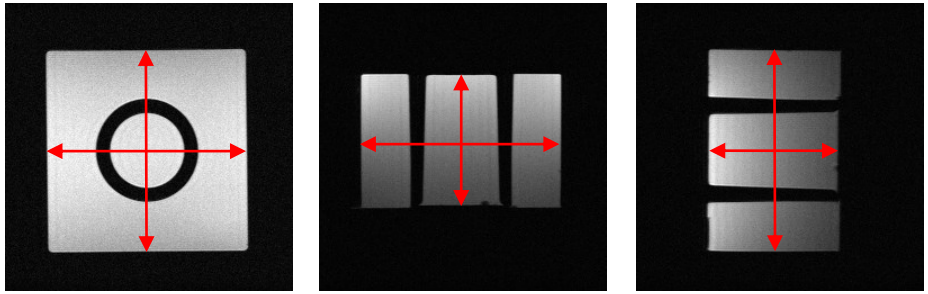
Method	Time post-stroke (h)	Compar.	n	Effect size [95% CI] (%)	Meta-regression		
					Coeff.	$\bar{R}^2$	p
Histology	48 - 336	33	210	25.49 [17.52, 33.46]	1.08	0.699	<0.001
T2WI			410	22.22 [17.90, 26.55]			
Histology	21 - 174	11	105	31.85 [24.02, 39.68]	0.31	0.433	0.136
DWI			147	42.43 [30.88, 53.98]			

Assessment of MRI using a structural phantom



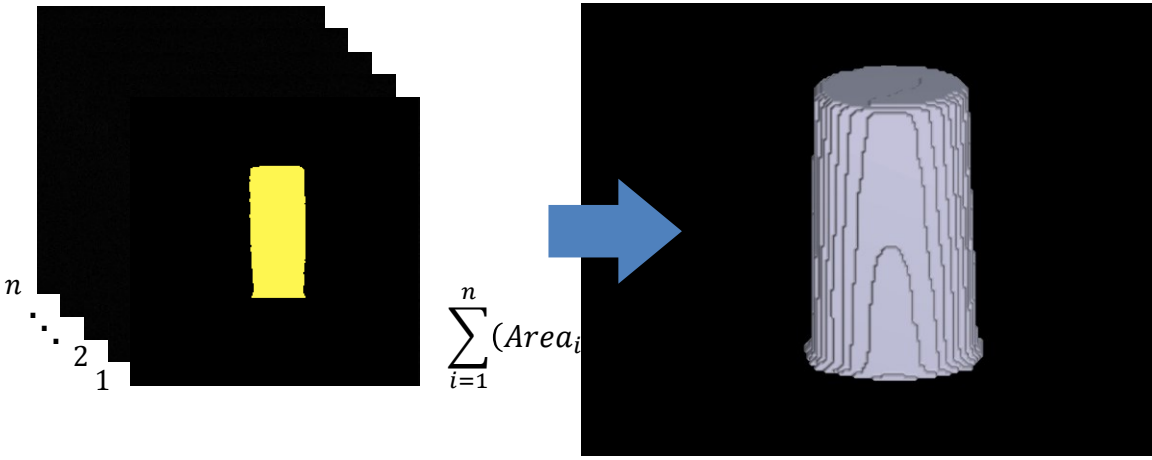
Internal dimensions

Assessment of scaling in 3 directions



Cylindrical volume

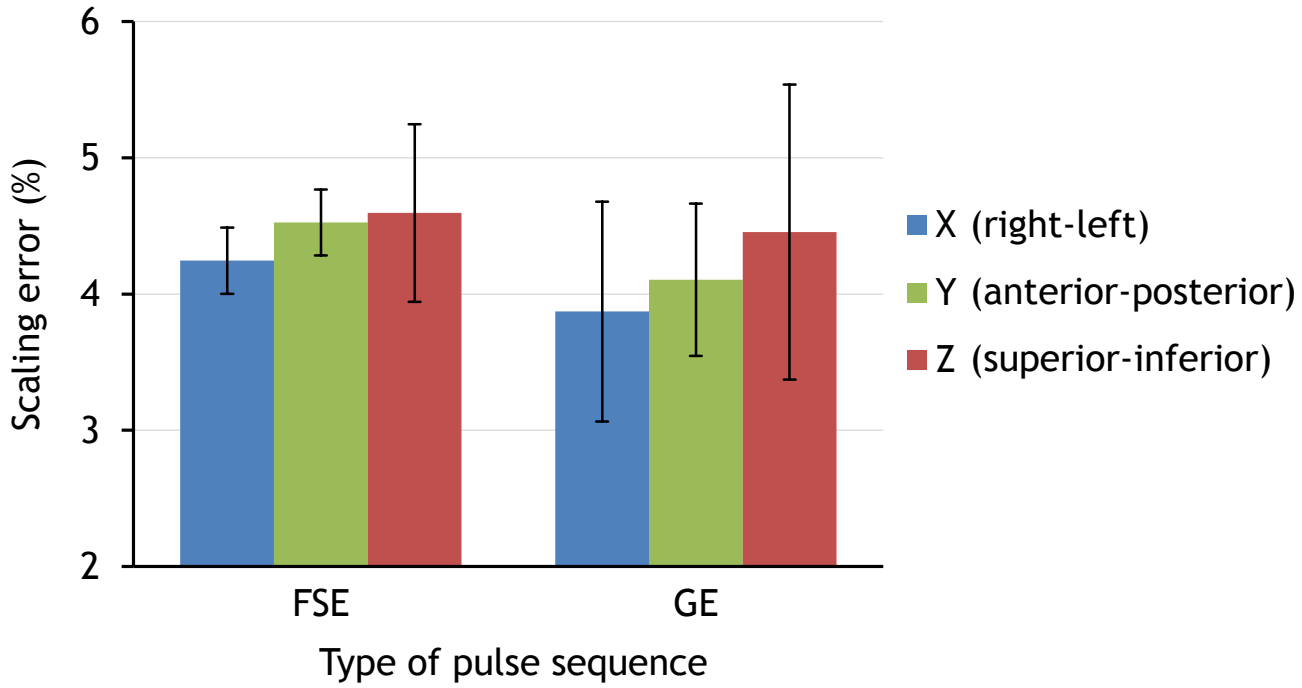
Assessment of acquisition parameters



Differences between pulse sequences

7T Agilent preclinical scanner, 120mm bore gradient coil, 72mm (ID) volume transmit & 2 channel mouse phased array surface receive coil

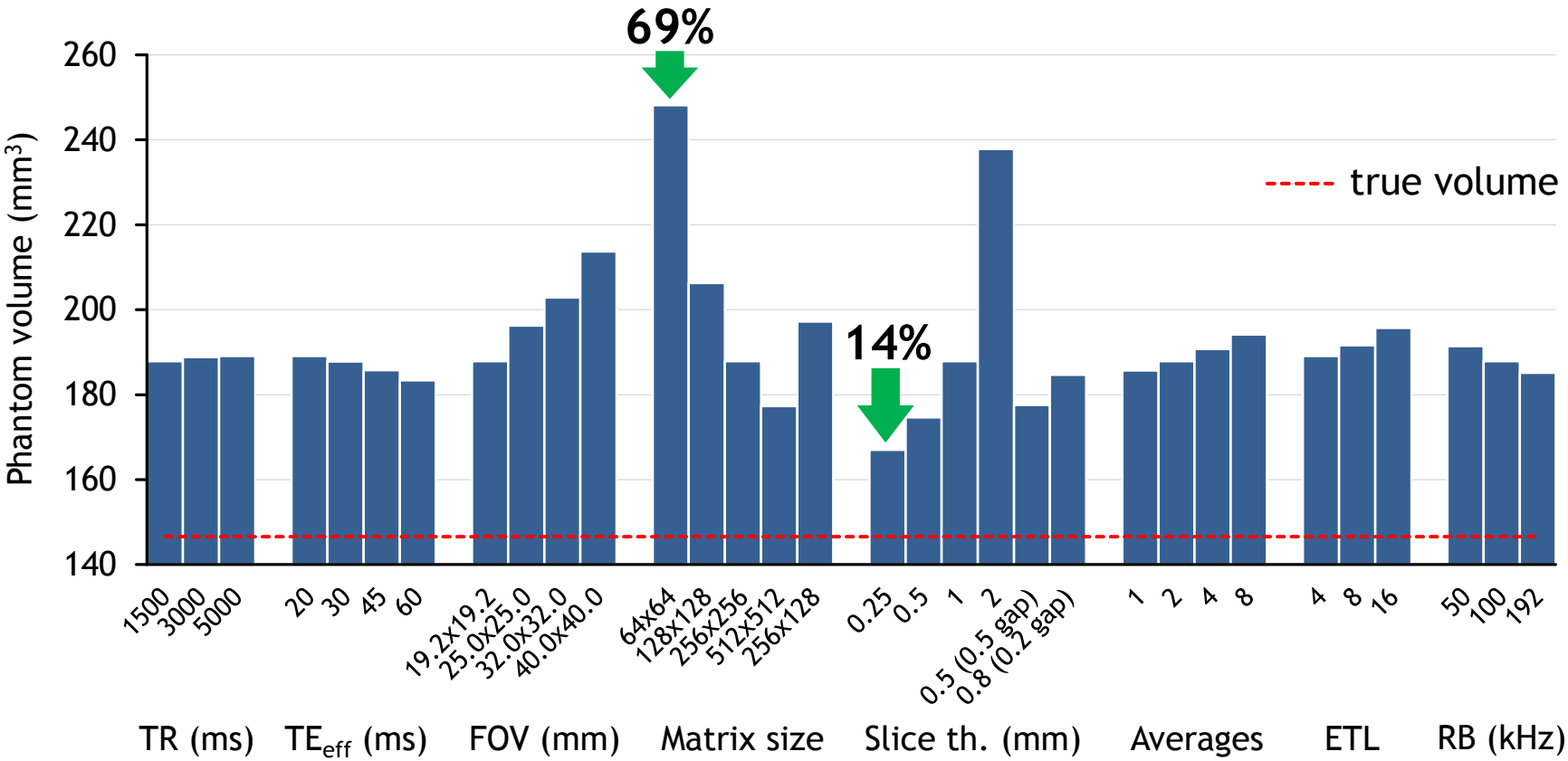
Fast spin echo (FSE) vs. **Gradient echo (GE)**
(19.2×19.2mm FOV, 256×256 matrix, 1mm slice thickness, 2 averages)



Impact of scanning parameters on volume measurements

Fast spin echo (TR/TE_{eff}=1500/20ms, 19.2×19.2mm FOV, 256×256 matrix, 1mm slice thickness, ETL=4, 2 averages)

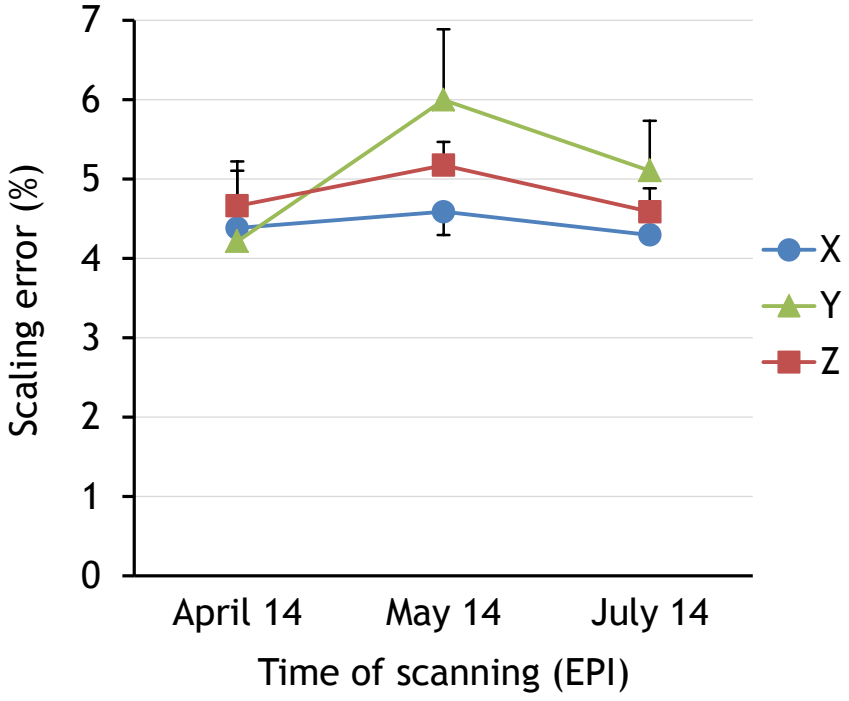
...then changed one parameter at a time

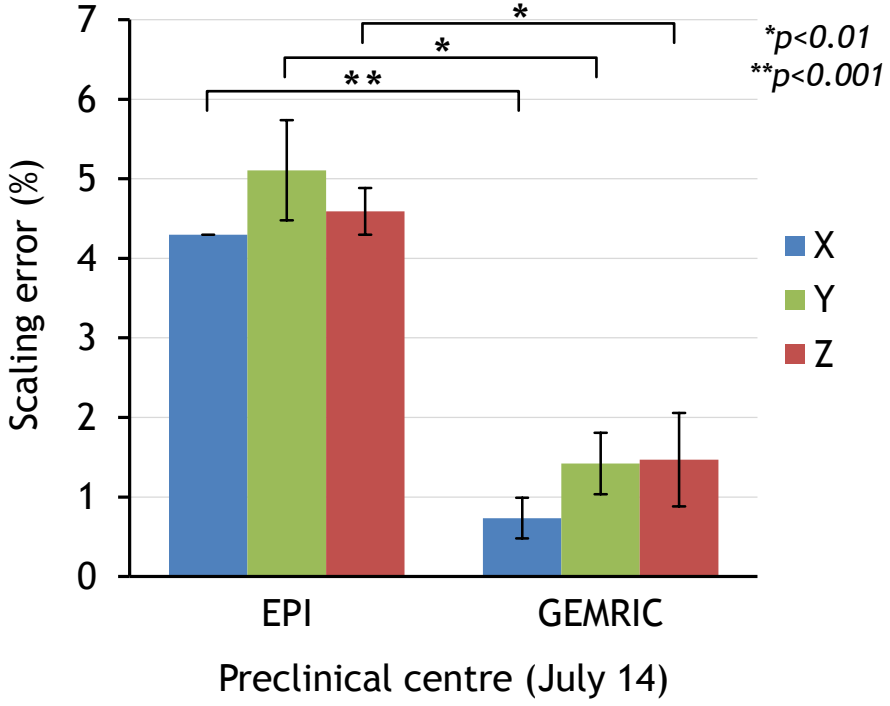


Within- and between-scanner variability

Edinburgh Preclinical Imaging (EPI)
7T Agilent scanner

Glasgow Experimental MRI Centre (GEMRIC)
7T Bruker scanner





Future plans…

Assessment of MRI acquisition protocols using the phantom

- Other pulse sequences
- Other coils
- Other scanners

Assessment of post-processing methods for calculating the infarct size from animal data

- Evaluate performance based on ground truth (manual, histology?)
- Estimate between-method variation

Survey under construction…