Investigating low-velocity fluid flow in tumours using convection-MRI

SUPPLEMENTAL MATERIAL

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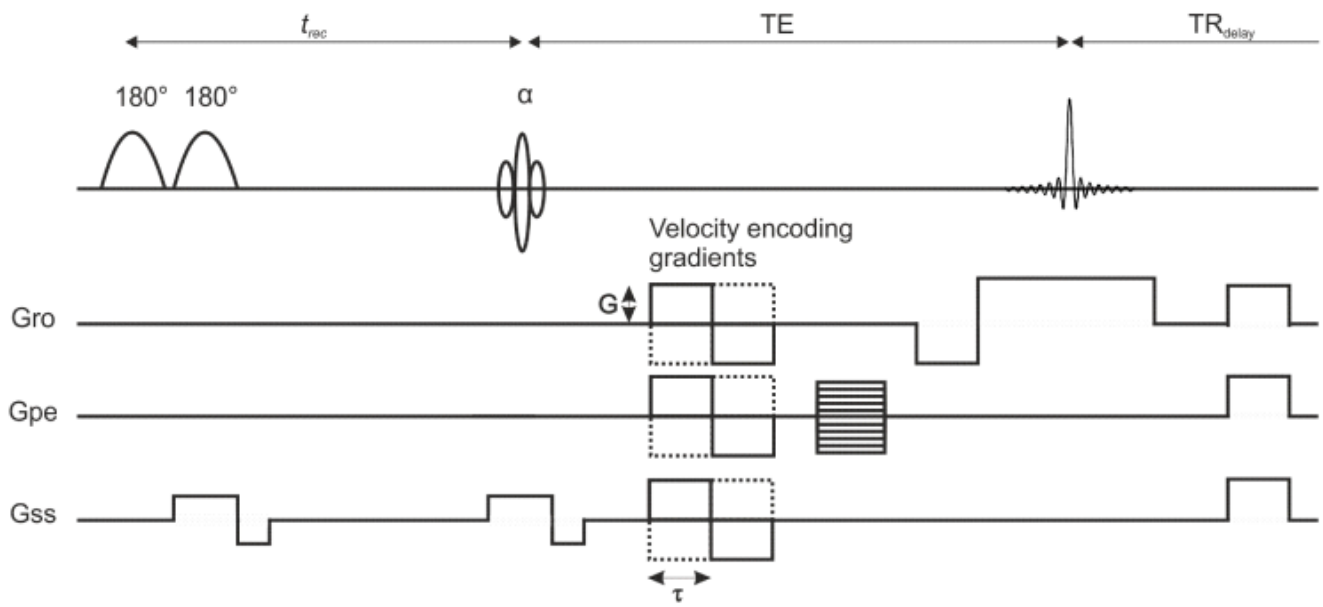
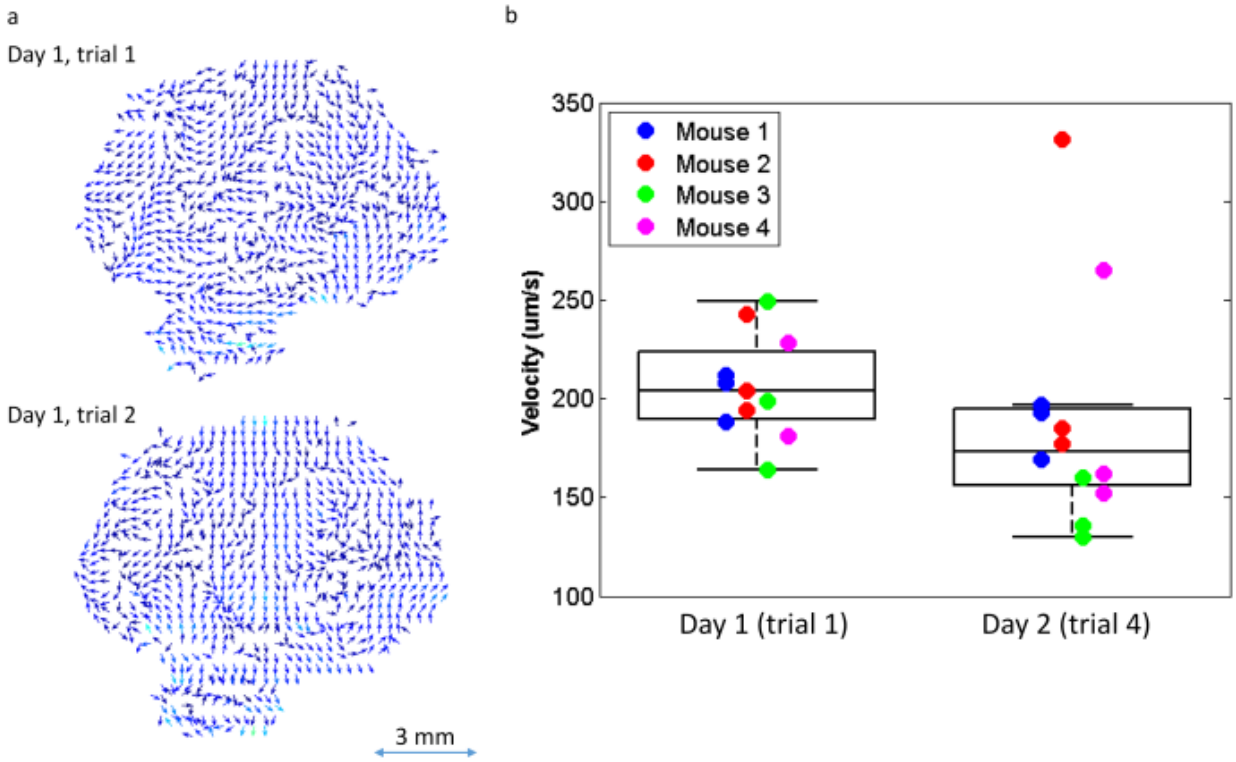
SUPPLEMENTAL FIGURES



Supplemental Figure 1. Timing diagram for the convection-MRI sequence, which begins with a pair of inversion preparation pulses; the first is applied globally, the second is slice-selective. Alongside a recovery delay t_{rec}, these pulses aim to null the signal from fluid flowing in blood vessels. This is followed by a readout module featuring a readout pulse with flip angle α, alongside bipolar velocity encoding gradients (amplitude G, duration τ) that can be applied in separate acquisitions along each of the principal gradient directions (G_{ro}¸G_{pe} and G_{ss}). TE is the echo time and TR_{delay} is the recovery time for the magnetisation, following the readout.



Supplemental Figure 2. Repeatability and reproducibility of convection-MRI data in tumor xenograft models. Example streamline maps are shown in (a), taken from repeated acquisitions within a single imaging session. In each imaging session, three sets of data were acquired, and the average velocity measured in each is represented by a symbol in (b) and each color corresponds to a different mouse. This was repeated one day later (trial 4), and no significant difference in the values was found between trials, or between days ($p > 0.05$, Mann-Whitney).

SUPPLEMENTAL RESULTS

Reproducibility and repeatability of convection-MRI measurements

Four nude mice were inoculated with SW1222 colorectal carcinoma cells, as described in the main manuscript. Once the tumors had grown to a diameter of approximately 1 cm, three sets of convection-MRI data were acquired in a single imaging session (day 1, trials 1, 2 and 3). This was repeated 24 hours later (day 2, trial 4).

We assessed repeatability by acquiring multiple repeats within the same session and same animals (trials 1, 2 and 3), and used the repeatability coefficient (RC) for quantification. RC represents the value below which the absolute difference between two repeated test results may be expected to lie within a probability of 95%. In this sense, it is a 'paired' measurement, rather than a comparison of cohort means across trials (which is provided by t-test statistic). The coefficient of variability (CV) reports on the precision of the residuals from an absolute difference calculation from repeated measures; it is therefore complimentary to the RC. Both RC and CV are measurements of variability within individual mice, rather than between cohorts. To enable straightforward statistical analysis, the first trial on each day (trials 1 and 4; days 1 and 2, respectively) was used to measure reproducibility, and trials 2 and 3 (both day 1) were compared for repeatability.

Example EVAC data are shown in **Supplemental Figure 2a**, and average velocities from all measurements are shown in **Supplemental Figure 2b**. There was no significant difference in the mean velocity measured between trials 2 and 3 nor trials 1 and 4 ($p<0.05$, Mann-Whitney U test).

	RC	*CV*	*p*
Trial 2 & 3	36%	19%	0.2
Trial 1 & 4	59%	30%	0.3

Supplemental Table 1: Reproducibility and repeatability statistics for velocity measurements in SW1222 tumors. Coefficient of repeatability (RC), coefficient of variability (CV) and t-test significance are shown.