Combined PET/MRI

Multimodality insights into acute stroke hemodynamics

Figure [^{15}O]H₂O-PET/MRI in acute stroke

Acute middle cerebral artery occlusion. Diffusion disturbance (A) is surrounded by a perfusion deficit of different extents depending on the modality (B-D). Spontaneous vessel recanalization (E, F) prevents infarct growth as detected on follow-up imaging (G). DWI = diffusion-weighted MRI; FLAIR = fluid-attenuated inversion recovery; MRA = magnetic resonance angiography; pASL = pulsed arterial spin-labeling; PW = perfusion-weighted (T_{max} > 6 seconds).

A 61-year-old man underwent simultaneous PET/MRI 5.5 hours after sudden onset of aphasia (NIH Stroke Scale 4), which revealed a diffusion/perfusion mismatch of different extents as measured with pulsed arterial spin-labeling MRI (59 mL), perfusion-weighted MRI (27 mL), and [^{15}O]H₂O-PET (36 mL) (figure). Due to spontaneous recanalization, the penumbra tissue did not progress towards infarction. This demonstrates that the outcome of critically hypoperfused stroke brain tissue may be favorable even without sufficient collateral flow and without therapeutic intervention.¹ Here, PET/MRI offers the chance to cross-evaluate MRI-based blood flow estimates against simultaneous PET in acute stroke, which may improve the understanding of stroke pathophysiology.²

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