Glioblastoma Multiforme imaged with FDG and Fluorocholine
Clinical Summary

62-year-old lady with biopsy-proven glioblastoma multiforme (GBM) located at the left thalamus.

She had completed partial brain conventional external radiotherapy with concurrent chemotherapy 14 months earlier and was on adjuvant chemotherapy when she developed clinical deterioration.

MRI of the brain showed minimal morphologic change in the tumour.
18F-FCH (top row) and 18F-FDG (bottom row) PET/CT studies show increased uptake of both tracers by the tumour at the left thalamus. Normal brain tissue demonstrates minimal uptake of FCH as compared to FDG which shows intense accumulation in normal grey matter.
The area of increased $^{18}$F-FCH uptake (top row) corresponds well with the contrast-enhancing tumour (arrow) seen on MRI.
Clinical progression

No salvage therapy was initiated, and over the subsequent few weeks, the left thalamic tumor mass increased in size on serial MRI scans.
During treatment or follow up of patients with primary brain tumours, a diagnostic challenge lies in differentiating between radiation induced necrosis (RIN) and tumor recurrence.

Radiation-induced necrosis is a well-known late complication which can occur within months to years of completion of radiation therapy. Both RIN and tumour recurrence frequently occur in the same area in the vicinity of the original tumor. They also share similar clinical and radiological features on MRI or CT.

PET has been used to try to differentiate between metabolically active tumor recurrence and less metabolically active RIN. The use of FDG PET in brain imaging in patients with primary brain tumours has its limitations. Part of this is due to the avid uptake of FDG by normal cortex, basal ganglia, thalamus and other deep grey matter.
Teaching point (2)

FCH may offer a potential advantage in imaging of brain tumors particularly in gliomas.

Pharmacokinetics studies conducted in human subjects have shown minimal FCH tracer uptake by normal brain parenchyma[1].

This case shows clearly the lack of uptake of FCH by the normal grey matter in stark contrast to FDG. There is intense FCH uptake by the high-grade GBM tumour, which is consistent with the hypothesis of increased choline utilisation in high-grade tumours secondary to high cell turnover.

Reference: