THERANOSTIC PET IMAGING FOR THE MANAGEMENT OF CNS TUMORS

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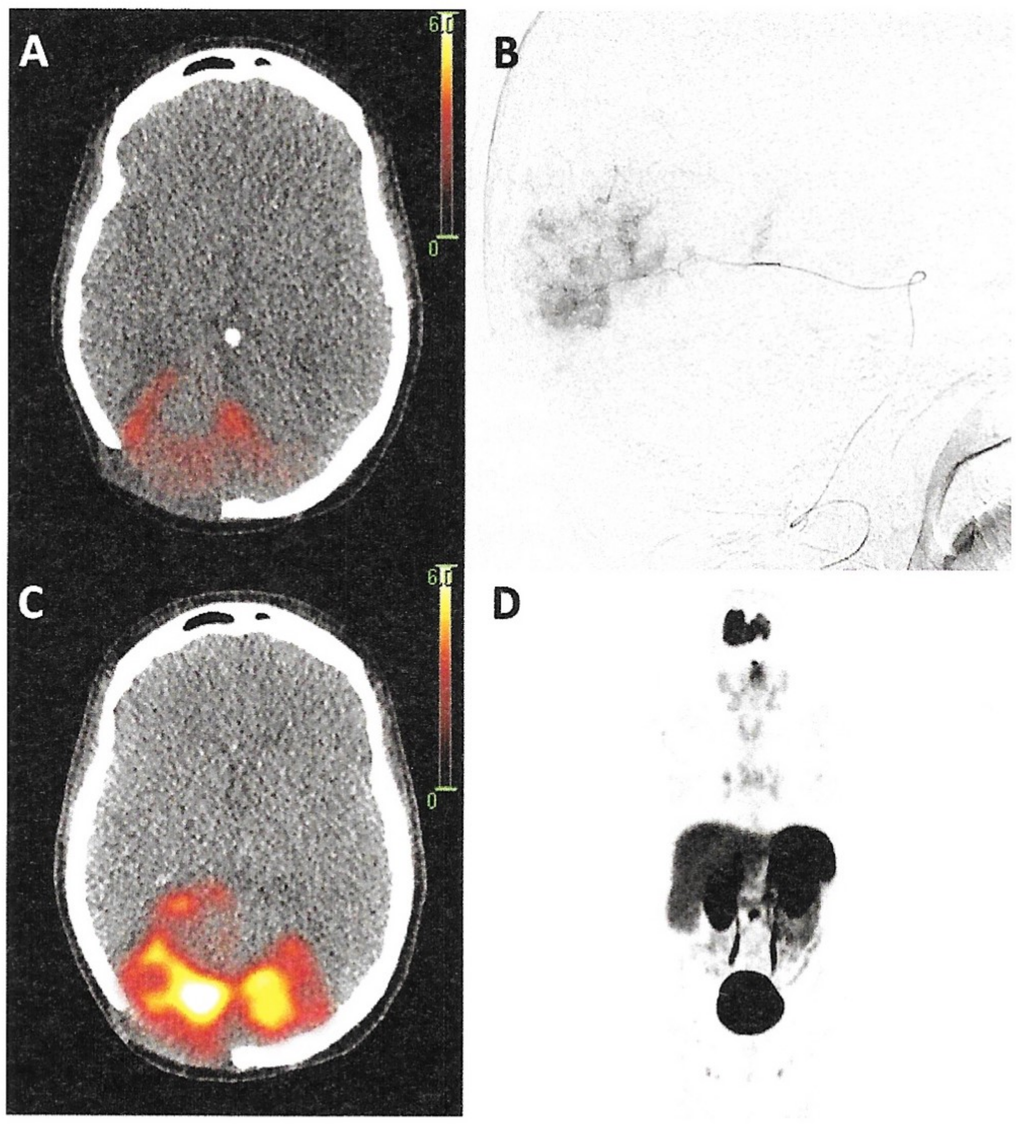
This project is a collaboration between the Departments of Radiology & Nuclear Medicine, Neurology, Neurosurgery and Pathology as well as Amsterdam UMC and the Princess Máxima Center for Pediatric Oncology.

This research line is focused on improving the safety and efficacy of treatment strategies for Central Nervous System (CNS) tumors under the guidance of Positron Emission Tomography (PET) and simultaneous Magnetic Resonance Imaging (MRI).

PET-MRI combines structural tumor characterization with non-invasive quantification of target expression and target binding, which can be used to study the potential of drugs to pass the blood-brain barrier (BBB) and accumulate in the brain, or to determine sites potentially at risk for toxicity. To this end PET can be used for the selection of the most effective drugs and their most optimal dosage and administration route, and for the selection of patients most likely to benefit from treatment. The ability of PET to study treatment efficacy and toxicity *in vivo* holds great promise for improving personalized patient care, and is also attractive for pharma companies as it will increase the success rates in drug development, shorten the time to market, reduce the number of patients needed in clinical trials, and therefore will reduce health-care system costs.

In 2017, we were the first to perform a so-called 'drug imaging study' in children with diffuse midline glioma (*J Nucl Med. 2017;58(5):711-6*). Results showed marked variability in the delivery of bevacizumab to the tumour and considerable toxicity in areas outside the CNS upon systemic intravenous administration. In the coming years, PET-MRI will be used to explore whether intra-arterial administration of drugs, combined with strategies to temporarily open the BBB, will improve drug delivery to CNS tumours whilst reducing systemic toxicity. A next step will be to explore the potential benefit of labeling targeted drugs with radionuclides to additionally induce localized radiation therapy.



Patient with hemangiopericytoma. Upon intra-venous application of [68Ga]DOTATATE, uptake in tumour did not exceed uptake in liver (Krenning-score 2, figure A). Upon intra-arterial injection in the feeding arteries of the tumour (B), uptake in tumour exceeded uptake in liver (Krenning-score 3, C/D), showing targeted peptide receptor radionuclide therapy (PRRT), such as with [177Lu]DOTATATE, can be considered as a serious therapeutic option.