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DIFFERENTIAL DIAGNOSIS RELAPSE/RADIATION NECROSIS AFTER M3 BRAINLAB-RADIOSURGERY USING IPLAN STEREOTAXY SOFTWARE

Clinical Case Report By Charles A. Valery

Brain metastases are the most common intracranial tumors, with an incidence of about 150 000 new cases per year in the US[3]. Radiosurgery is increasingly used as the first line treatment of these lesions because it achieves a high local control rate (95%) with relatively little side effects, such as radiation necrosis (5-15%) [2, 7]. Differential diagnosis between tumor relapse and radiation necrosis might be difficult to realize because, in both cases, MRI pattern is characterized by an increased gadolinium contrast-enhancement [5, 11, 14]. Nevertheless, one must aim to make an accurate and precise diagnosis because it might highly influence the treatment strategy. This can range from a 'wait and see' approach with corticosteroids in case of radiation necrosis as opposed to surgery. Or, in case of a tumor relapse, a second radiosurgery might be necessary [1,8,15]. Tyrosine-PET examination might be a non-invasive alternative valuable for this diagnosis because of its high specificity for tumoral tissue [4, 6, 9-10, 12-14, 16-18].

The goal of this protocol is to compare results of a non-invasive strategy, including MRI with multiple modalities and Tyrosine-PET with the "gold standard" histopathology study. This correlation is performed using a stereotactic biopsy realized with the Brainlab iPlan Stereotaxy software.

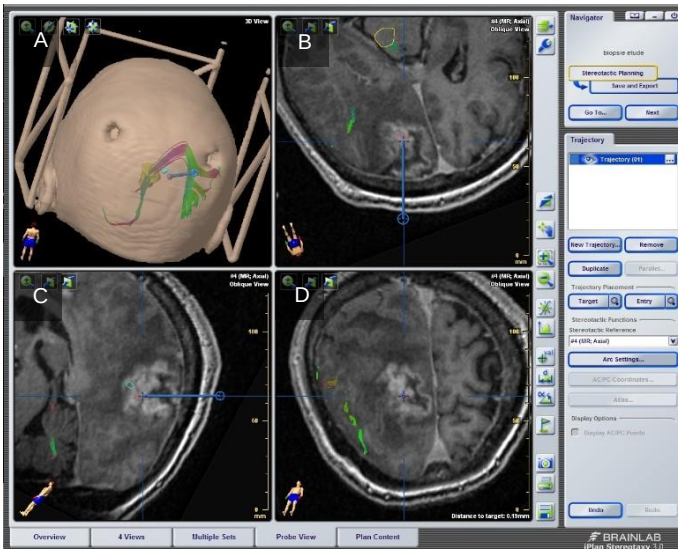

Figure 1
3D reconstruction (A), gadolinium-MRI in axial (B), sagittal (C) and coronal (D) planes. (A): Tractography shows that cortico-spinal tract is displaced anteriorly due to mass effect (B, C, D). Trajectory, figured as a blue line allows visualization of cortical veins.

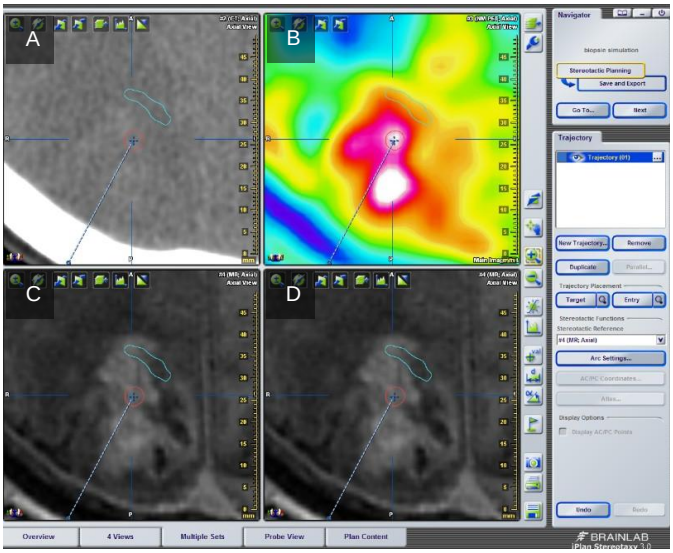

Figure 2
CT-scan (A), Pet-scan (B), and gadolinium-MRI (C, D) axial views.
(B) The main target (delineated in red) which is a hotspot in TYR-PET (SUV 2.9), and the second target (delineated in blue), 9.8 mm above, which has a low SUV value. (C) These samples are also characterized by their gadolinium-status (positive in both cases).

This case is a 74 year old female presenting with breast cancer initially treated in 2008 by radiotherapy and chemotherapy. A cerebral MRI, performed 2 years later because of a diplopia and a hemiparesis revealed a parietal metastasis treated by radiosurgery in November 2010.

At 4 months, local control was achieved, but 16 months later, considering a new motor palsy despite corticosteroids and an increased contrast-enhanced lesion, we enrolled the patient in the protocol.

A 3D-SPGR sequence was performed with Leksell G frame the day of biopsy, then fused with the multimodality MR imaging including blood-oxygen level-dependent (BOLD), diffusion tensor imaging (DTI), MR Spectroscopy and the (18)F-TYR PET/CT studies, which have been acquired the day before. The fusion was performed on pixel-by-pixel basis using iPlan Automatic Image Fusion.

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Two or more regions of interest (ROIs) corresponding to hot or cold spots in (18) F-TYR PET/CT images were plotted as objects, with their values (SUV) defined. We were able to display ROIs in 3D-SPGR sequence and thus correlate their metabolic characteristics with gadolinium enhancement in the multiple sets view.
A stereotactic planning was then performed using 3D, multiple sets and probe view windows. MR angiography as well as DTI and BOLD studies, which are easy to perform, were crucial in order to assess the accurate, safe trajectory of the biopsy.

We plotted 2 ROIs with different metabolic and enhancement characteristics over single trajectory.
Samples of tissue were then taken and analyzed. Results were compared to those assessed by non-invasive modalities.
Correlation of (18) F-TYR PET/CT and 3D-SPGR IR (Inversion Recovery) images allows us to choose the best targets for biopsy and if possible to perform multiple sample acquisition along a unique trajectory, in order to reduce side-effects.

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