ROLE OF DIFFUSION TENSOR IMAGING IN DIFFERENTIATION BETWEEN RECURRENT BRAIN TUMORS AND RADIATION NECROSIS

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INTRODUCTION

Gliomas are the most common primary tumors of the central nervous system and represent about one-third of all intracranial tumors in adults with surgical excision followed by radio-chemotherapy being the main line of treatment.

Patients with managed brain tumor often develop new areas of contrast enhancement on routine follow-up imaging which can be the result of treatment necrosis, tumor recurrence, or a combination of the 2 outcomes.

Biopsy is the most reliable method for differentiating treatment necrosis from tumor recurrence.

Among the non-invasive methods that are available for diagnosing intracranial tumors, are single photon emission computed tomography (SPECT), positron emission tomography (PET), proton magnetic resonance spectroscopic imaging (MRS), perfusion and diffusion-weighted MRI including Diffusion Tensor Imaging.

AIM OF THE WORK

To evaluate the role of diffusion tensor imaging (Fractional Anisotropy) in the differentiation between recurrent brain tumors and radiation necrosis.

PATIENTS AND METHODS

Patients:

This prospective study was carried on 20 patients referred to the MRI unit of Radio-diagnosis department Alexandria main university hospital for imaging of the brain, presenting with a history of operated brain tumors followed by radiotherapy with or without chemotherapy and who showed suspicious enhancing lesion at their conventional MRI.

Methods:

MRI examinations were performed with closed1.5 T MRI scanner (Philips machine). Images were obtained on routine images Pre contrast T1W1, T2w2, FLAIR and Post contrast T1 sequences in three planes. Diffusion weighted images, Perfusion Weighted imaging and Diffusion Tensor imaging (Fraction Anisotropy).

RESULTS

1-Thirteen cases showed to be tumor recurrence (65%) , Nine of them showed to be tumor recurrence on top of radiation necrosis (45%), the remaining four cases (20%) were diagnosed as tumor recurrence . On the other hand, seven cases (35%) were considered as radiation necrosis based on the findings of prolonged follow-up MRI at 12 months follow up.

2- In the 20 patients , there were 29 lesions ,13 lesions (44.8%) proved to be tumor recurrence and 16 lesions(55.2%) proved to be radiation necrosis.

3-In all the 13 lesions with tumor recurrence, FA>0.1 (range from 0.11to 0.37).

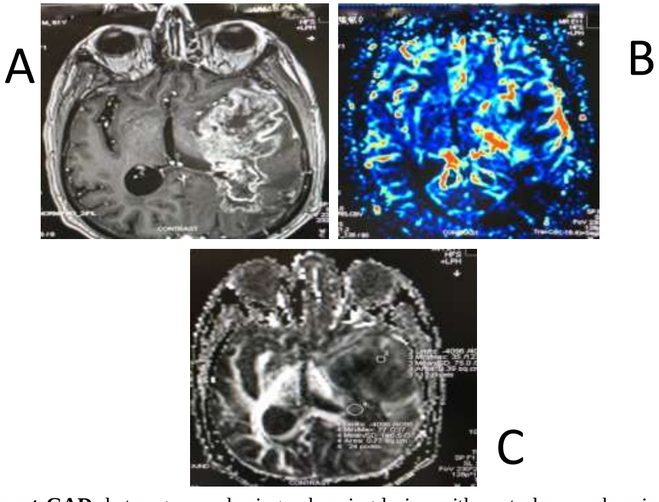
4-In all the 16 lesions with radiation necrosis, FA<0.1 (range from 0.04 to 0.09).

Table 1: Distribution of the studied cases according to final diagnosis

Diagnosis	No. of cases	%
Tumor recurrence on Top of radiation necrosis	9	45%
Radiation Necrosis	7	35%
Tumor Recurrence	4	20%
Total	20	100

Table 2: Descriptive analysis of the studied cases according to fraction anisotropy

Fraction anisotropy	No.	%
<0.1	16	55.2
>0.1	13	44.8
Min. – Max.	0.02 – 0.38	
Mean ± SD.	0.12 ± 0.08	
Median (IQR)	0.09 (0.08 – 0.14)	



A- Axial T1 post-GAD: heterogeneously ring enhancing lesion with central non-enhancing breaking down.

B-CBV color map: most of the lesion is hypo-perfused, yet with small area of hyper-perfusion along the deep aspect of the lesion.

C- FA map: The mean FA at the hypo-perfused area is 0.075suggesting radiation necrosis and 0.14 at the deep hyper-perfused portion of the lesion suggesting tumor recurrence/residual.

CONCLUSIONS

- Diffusion Tensor Imaging (FA) is an essential technique to assess isotropic diffusion of water molecule and hence to discriminate between tumor recurrence and radiation necrosis.
- FA cutoff values of 0.10 could be proposed to differentiate between the two entities; above these cutoff value is highly suggestive of tumor recurrence whereas below these values radiation necrosis/pseudo-progression is the prime diagnosis.