

Is there a Role for Spect with ^{99m}Tc -Tetrofosmin in the Diagnostic Work Up of a Brain Tumor?

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ABSTRACT

Brain MRI is the gold standard for diagnosis of brain tumors. In some cases preoperative MRI cannot predict the grade of malignancy, diagnostic information that could be very helpful to the surgeon. In such cases functional imaging with nuclear medicine techniques may prove quite useful.

We present a case of a 58-year-old man with a brain tumor in the parieto-occipital region. Anatomic brain imaging by magnetic resonance imaging was indicative of a low grade astrocytoma. This was followed by planar imaging and single-photon emission computed tomography (SPECT) with ^{99m}Tc -tetrofosmin which showed increased radiotracer accumulation in the lesion, suggesting a glioblastoma which was histologically confirmed. We think that in the MRI era sometimes a ^{99m}Tc -tetrofosmin brain scan can contribute to diagnostic workup and improve the final management of the patient.

Keywords: brain tumor, SPECT, diagnosis, ^{99m}Tc -tetrofosmin

INTRODUCTION

Functional metabolic imaging by positron emission tomography (PET) and single-photon emission computed tomography (SPECT) of intracranial space-occupying lesions can provide information about the metabolic status of brain tumors and possibly predict the type and grade of malignancy (1,2). PET studies are often cost-prohibitive and not widely available. Therefore, there has been much interest in using

SPECT as a feasible alternative imaging technique. These studies can supplement the neuromorphological workup provided by computed tomography (CT) and magnetic resonance imaging (MRI) (3). The major tumor-seeking radiotracers that have been extensively evaluated are ^{201}Tl (thallium) (4) and ^{99m}Tc (technetium) – sestamibi (5). ^{99m}Tc -tetrofosmin a relatively new radiotracer with similar mechanism of uptake, compared to sestamibi, seems useful in predicting the grade of brain malignancies (6-8).

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We report a case of a patient with parieto-occipital brain tumor in which MRI was indicative of a low grade astrocytoma. On the contrary, planar and SPECT imaging with ^{99m}Tc -tetrofosmin revealed a lesion of high grade malignancy, confirmed by postoperative biopsy. $\square$

CASE REPORT

A 58-years old man was admitted to our hospital complaining of headache, vertigo and hemianopsia lasting for 3 weeks. The emergency CT scan revealed a cystic lesion in the left parieto-occipital region. In the context of pre-operative planning brain MRI was performed. This demonstrated a cystic heterogeneously enhanced lesion (Figure 1A and 1B). The initial

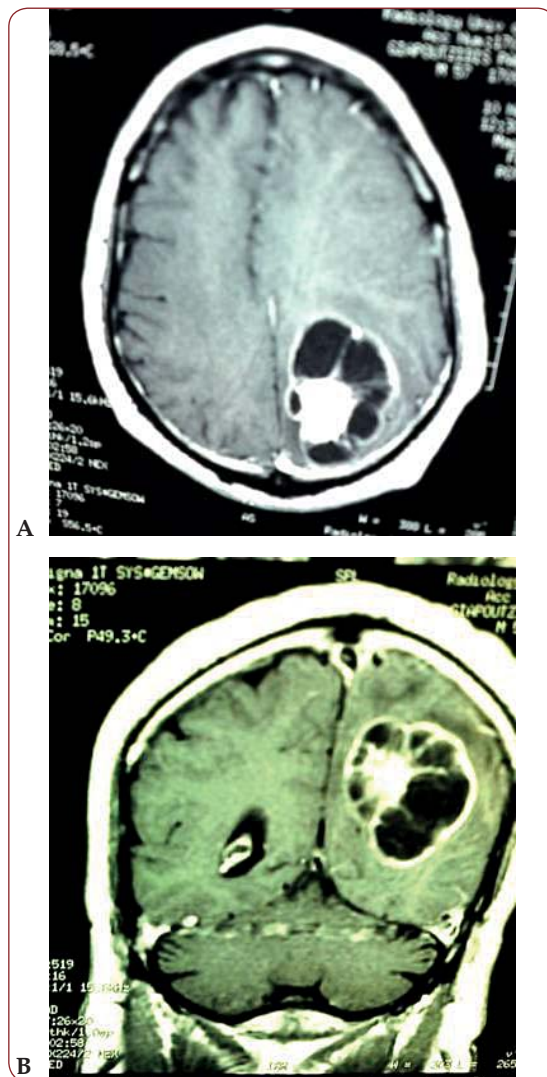


FIGURE 1A, B. Transaxial and a coronal contrast-enhanced MRI of the brain demonstrating the heterogeneously enhancing left parieto-occipital mass.

diagnosis was a low grade astrocytoma. Because of patient's age and the location of the lesion clinicians suspected higher grade malignancy. For further evaluation a ^{99m}Tc -tetrofosmin brain scan was requested.

Planar and SPECT imaging was performed 30 minutes after the intravenous injection of 925 MBq ^{99m}Tc -tetrofosmin. The radiopharmaceutical was prepared using a domestically available powder kit (Myoview, General Electric Healthcare Ltd, Buckinghamshire, UK) that was reconstituted with ^{99m}Tc pertechnetate ($^{99m}\text{TcO}_4^-$) sterile solution in our Nuclear Medicine Department. Imaging was implemented in a single-head gamma-camera (GE Millennium MPS, Milwaukee USA) equipped with a low energy high resolution (LEHR) parallel-hole collimator. The matrix size was set at 128×128 pixels; the photopeak was centered at 140 keV, with a symmetrical 20% window. The tomographic imaging parameters consisted of a 360° -rotation angle, a circular technique and an acquisition time of 30 sec per frame. Raw imaging data were reconstructed using the Butterworth-filtered back-projection algorithm, generating tomographic views of the brain in the 3 planes (transverse, coronal, and sagittal).

The lesion displayed very high ^{99m}Tc -tetrofosmin uptake both in static and in tomographic images (Figure 2A and 2B). A tumor to contralateral normal tissue ratio (T/N) was calculated. This ratio offers rough evidence of tumor aggressiveness. The higher the ratio is, the more hypermetabolic the tissue presents. In static posterior image the T/N ratio was 3, 2 whereas in tomographic (transaxial) image was up to 11, 6. These very high values according to the literature (6,9-12) suggest high grade malignancy. The intraoperative findings were indicative of glioblastoma and were confirmed histopathologically (Figure 3). $\square$

DISCUSSIONS

Among brain tumors astrocytoma grade III and glioblastoma are common and often devastating malignancies (13). Despite advances in detection and new treatment strategies the overall survival of patients with advanced brain tumors has not substantially changed over the past 20 years, with glioblastoma multiforme (GBM) patients rarely living beyond 1 year from diagnosis. The prognosis of patients presenting with primary brain tumors is most

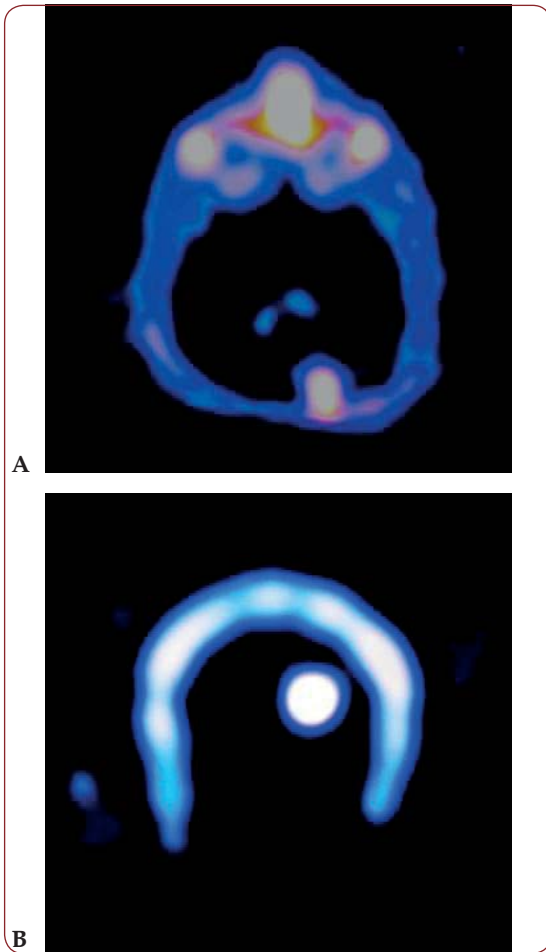


FIGURE 2A, B. Transaxial and a coronal SPECT images of the brain showing marked radiotracer accumulation in the tumor in the same region of MRI finding.

strongly influenced by the histology of the tumor.

The diagnosis of brain tumors is based on an initial assessment of the presenting clinical symptoms and anatomic imaging of the brain with MRI. Pathologic diagnosis remains a key requirement for suspected high grade tumors, although the heterogeneity of aggressive components of gliomas does result in the potential for error in diagnosis following biopsy sampling.

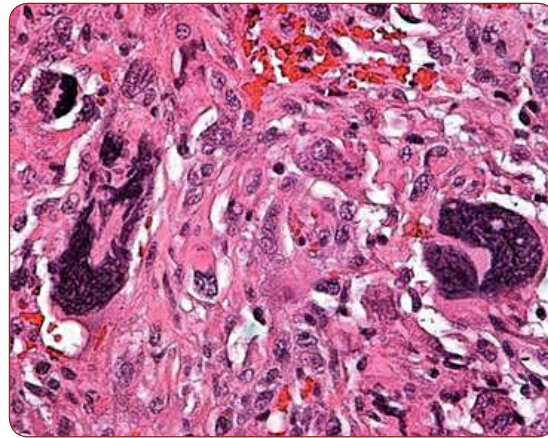


FIGURE 3. Histopathological section.

Both MRI and CT allow exactly to localize brain neoplasia and to define the extension of the tumoral mass to the surrounding normal tissue. Nevertheless, these techniques have some limitations, especially when discrimination between low grade and high grade glioma is required. In such cases, nuclear functional imaging by PET and SPECT can provide a metabolic characterization of the morphological lesions detected by MRI or CT scan. Although PET technology is becoming more and more available, the most institutions are not equipped with PET because of its very high cost. Conventional scintigraphy methods such as SPECT and planar acquisition show good results despite the lower spatial resolution compared to PET. ^{201}Tl l, ^{99m}Tc -sestamibi and ^{99m}Tc -tetrofosmin are the radiopharmaceuticals used for the functional imaging of the tumor brains with gamma camera.

In our case MRI imaging revealed a brain tumor and described it as low grade malignancy. Brain SPECT using ^{99m}Tc -Tetrofosmin showed intense uptake of the radiopharmaceutical, a finding indicative of high grade malignancy which was confirmed by the postoperative histopathological findings.

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