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Abstract

Technological advances have increased the ability of imaging to provide an accurate preoperative diagnosis of an intracranial mass. We present the case of a patient with metastatic paraganglioma, who presented with headache and depressed conscious state. We had chronic tachycardia and low-grade fevers due to increased catecholamine secretion, which limited his clinical assessment. The combination of novel Positron Emission Tomography tracers and advanced Magnetic Resonance Imaging techniques was able to provide a confident preoperative diagnosis of a pyogenic intracranial abscess, which was not suspected clinically. This allowed appropriate therapy to be instituted until the patient's clinical state improved sufficiently for neurosurgery to be performed.

Keywords: Magnetic Resonance Imaging; Susceptibility-Weighted Imaging; Positron-Emission Tomography; brain abscess; paraganglioma

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Introduction

Advanced MRI sequences and novel PET tracers have improved characterisation of intracranial lesions. We present a case in which the combined MRI and PET appearances provided a confident preoperative diagnosis of an intracranial abscess.

Case Report

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27 A 48 year-old male with metastatic paraganglioma related to a germline SDHB (succinate
28 dehydrogenase subunit B) mutation presented with headache and depressed conscious state.
29 Gallium-68-DOTA-octreotate (GaTate)-PET/CT showed extensive somatostatin receptor-expressing
30 metastases throughout the skeleton, including the calvarium (Figure 1). The patient's hypertensive
31 crisis and clinical status were thus attributed to excess catecholamine secretion. The co-registered
32 CT also showed an area of low density in the right occipital lobe, without GaTate uptake. Given
33 marked hypertension, this was initially attributed to posterior reversible encephalopathy. The
34 patient's neurological state deteriorated, however, prompting an MRI, which showed a peripherally-
35 enhancing mass in the right occipital lobe with central diffusion restriction (Figure 2). A Fluorine-18-
36 fluoroethyl-L-tyrosine (FET)-PET/CT (Figure 1) was performed to clarify whether or not the mass was
37 neoplastic. This demonstrated similar findings to the GaTate study, with tracer uptake in the
38 calvarial metastases, but none in the intracranial mass. The patient was initially considered unfit for
39 neurosurgery and treated conservatively, including with empiric antibiotics. A later MRI showed a
40 minor decrease in the size of the mass, as well as a "dual-rim sign" on Susceptibility-Weighted
41 Imaging (SWI) (Figure 2). After clinical improvement, the patient proceeded to craniotomy,
42 confirming a pyogenic abscess (*Streptococcus anginosus* group).

43

44 **Discussion**

45 Cerebral abscess was not considered initially, as the patient had chronic tachycardia and low-grade
46 fevers due to increased catecholamine secretion. There is a greater reliance on imaging when clinical
47 assessment is confounded by such factors, and our case illustrates the value of a multi-modality
48 approach. In a patient with widespread metastatic disease, a peripherally-enhancing intracranial
49 mass is likely a metastasis. The presence of central diffusion restriction on the initial MRI was
50 suggestive of an abscess rather than a metastasis, but is not entirely specific¹, thus exclusion of
51 differentials with PET added weight to the MRI appearances. GaTate-PET/CT targets masses
52 expressing somatostatin receptors and is widely used for evaluating neuroendocrine tumours. Our
53 experience also suggests utility for paragangliomas², and it has been shown to be more sensitive
54 than metaiodobenzylguanidine (MIBG) imaging, especially in patients with germline SDHB
55 mutations³. The lack of GaTate uptake in the intracranial mass made a paraganglioma metastasis
56 unlikely given high uptake at other known sites of disease. FET is an amino acid tracer with high
57 sensitivity for malignant lesions⁴. Thus, the lack of uptake in the mass effectively excluded other
58 malignant aetiologies, such as metastases from a non-GaTate-avid primary or dedifferentiated
59 disease with loss of somatostatin receptor expression. An important advantage of FET over Fluorine-

60 18-fluoro-deoxyglucose is the low uptake in normal brain parenchyma, which improves lesion
61 characterisation. The diagnosis of an abscess became confident after MRI demonstrated a
62 characteristic “dual-rim sign” on SWI, which has been reported as being specific for pyogenic
63 abscesses^{5,6}.

64

65 **Conclusion**

66 Combining advanced MRI sequences and novel PET tracers may allow a confident diagnosis of
67 intracranial lesions.

68

69 **Acknowledgments**

70 Nil.

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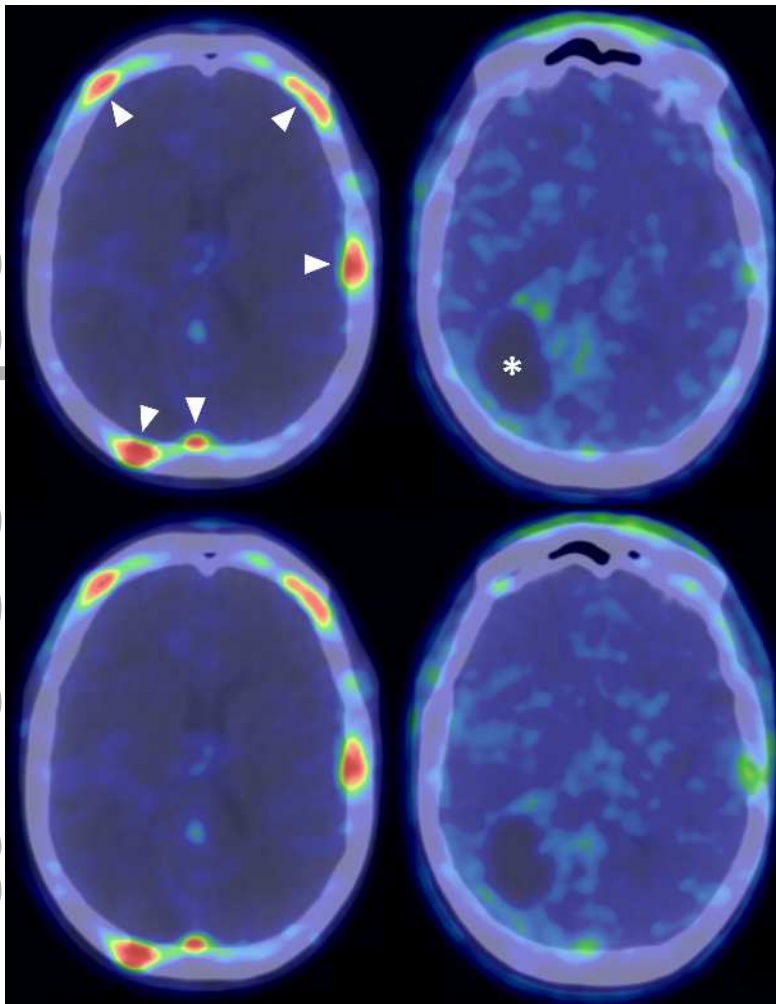
90 **Figure Legends**

91 Figure 1: Fused axial GaTate-PET/CT images (top row) showing multiple areas of GaTate uptake in
92 the calvarium, consistent with paraganglioma metastases (white arrowheads). In contrast, there is
93 no tracer uptake in the right occipital mass (white asterisk). The corresponding FET-PET/CT images
94 (bottom row) demonstrate the same findings.

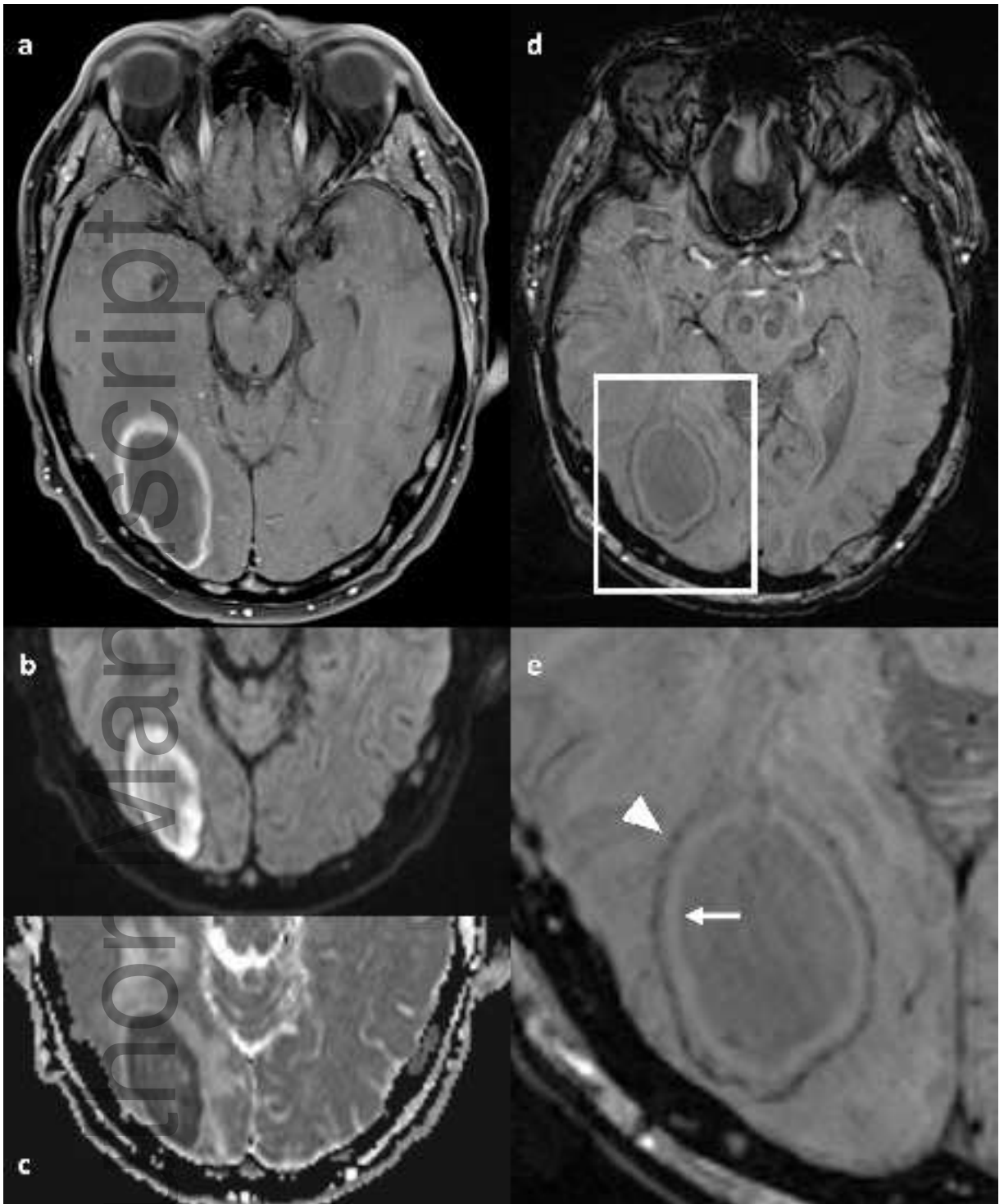
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96 Figure 2: The post-contrast T1-weighted axial image (a) shows a peripherally-enhancing mass in the
97 right occipital lobe. Diffusion-Weighted Imaging (b) demonstrates high signal within the mass, with
98 corresponding low signal on the Apparent Diffusion Coefficient map (c), indicating diffusion
99 restriction. SWI (d) shows a dual-rim sign, better appreciated on the magnified panel (e), with an
100 outer hypointense rim (white arrowhead) and inner hyperintense rim (white arrow) bordering the
101 abscess cavity.

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