

## CASE REPORTS

# 18F-fluoroethylcholine PET/MR imaging in salivary adenoid cystic carcinoma

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## Abstract

Adenoid cystic carcinomas (ACCs) are rare tumors arising in the head and neck area and are characterized by a marked tendency for perineural invasion often causing incomplete resection and multiple recurrences. In some cases identifying of recurrences is challenging and in addition to the commonly used magnetic resonance imaging (MRI), a metabolic imaging method such as positron-emission-tomography (PET) could be helpful to differentiate between scar formation, radiation necrosis or vital tumor recurrence. Well established in oncological imaging is PET using 18F-fluorodeoxyglucose (FDG). But the close neighborhood to the brain and its high physiologic uptake may hamper the delineation of the tumor using FDG. 18F-fluoroethylcholine (FEC) is an oncologic tracer with negligible cerebral uptake.

This case report presents in addition to a FDG-PET/computed tomography (CT) for the first time images using FEC for PET/MRI performed with an integrated PET/MR (Biograph mMR®, Siemens Healthcare) in a patient with ACC. The FEC-PET/MRI of the head and neck reveals tumor recurrence with focal intense tracer uptake in the temporal lobe proving infiltration and precise tumor delineation on the contrast-enhanced T1 weighted MRI. Compared to FDG-PET and CT, FEC-PET/MRI might offer an improved metabolic imaging in ACC.

## Keywords

Adenoid cystic carcinoma, FDG-PET, FEC-PET, PET/CT, PET/MRI

## 1 Introduction

Adenoid cystic carcinomas are rare tumors mainly arising from the salivary glands in the head and neck area (10% of all malignant salivary gland tumors). They are slowly growing showing typically a perineural infiltration making any resection difficult and often cause local recurrence. Additional irradiation using high linear energy transfer beams (fast neutrons or carbon ions) improves local control <sup>[1]</sup>.

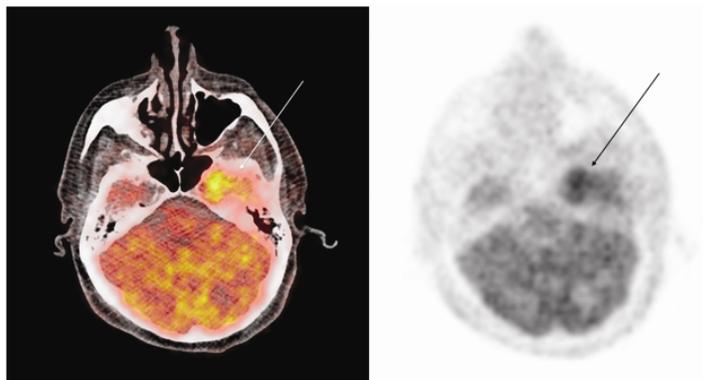
After therapy recurrences are usually identified by MRI, but in some cases differentiation between scar formation, radiation necrosis or vital tumor recurrence is not possible. Thus, metabolic information of PET is needed <sup>[2, 3]</sup>. Combined

PET/CT with 18F-FDG has been shown to be a powerful tool for staging of different tumor entities, isolated described in patients with ACC [4]. The close neighborhood to the brain and its high physiologic uptake may hamper the delineation of the tumor using FDG. 18F-FEC is a tracer with negligible cerebral uptake, but well established in oncological imaging, e.g. in staging of patient with prostate carcinoma.

## 2 Case presentation

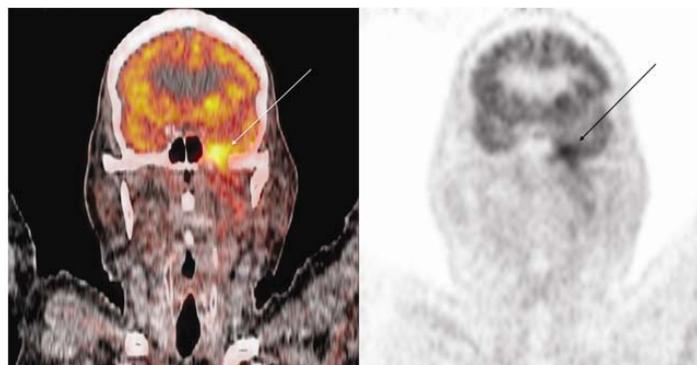
This case report presents for the first time a FEC-PET/MRI performed with an integrated PET/MR (Biograph mMR®, Siemens Healthcare) in a patient with ACC.

A 71-year-old man suffering from an ACC infiltrating the skull base underwent an 18F-FDG-PET/CT. However, infiltration of the temporal lobe could not be excluded due to only slightly higher FDG uptake in the tumor than in the brain. A FEC-PET/MRI of the head and neck was performed with an integrated PET/MR (Biograph mMR®, Siemens Healthcare) (PET: 8 min/bed position emission, MRI: DIXON based attenuation correction, contrast-enhanced T1 weighted sequence) revealing tumor recurrence with intense tracer uptake on the PET, good tumor to background contrast and enhancement on the contrast-enhanced fat-saturated T1 weighted MRI in the temporal lobe proving infiltration (see Figures 1-3). This examination has been approved by our Institutional Review Board with patient informed consent.



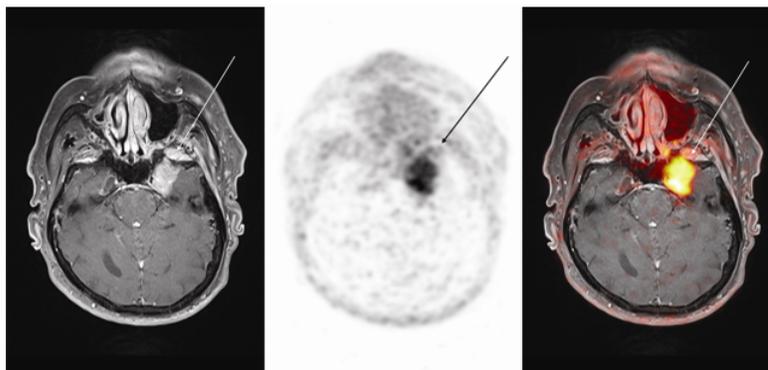
**Figure 1.** Transversal FDG-PET/CT

As shown in Figure 1 the tumor masses only show a slightly higher FDG uptake than in the surrounding brain tissue (fused lowdose FDG-PET/CT on the left, FDG-PET on the right).



**Figure 2.** Coronal FDG-PET/CT

Figure 2 easily demonstrates that precise tumor delineation in contrast to the surrounding brain tissue is not possible on FDG-PET/CT (fused lowdose FDG-PET/CT on the left, FDG-PET on the right).



**Figure 3.** Transversal FEC-PET/MRI

Figure 3 demonstrates that precise tumor delineation easily could be determined on FEC-PET and MRI. A pathological signal-enhancement could be identified in the gadolinium-based contrast-enhanced fat-saturated T1 weighted MRI in the left temporal lobe (MRI on the left). On PET, the tumor lesion showed a corresponding focally increased FEC uptake (FEC-PET in the middle, fused FEC-PET/MRI on the right).

### 3 Discussion

The therapy of ACC is challenging due to its slow tumor growth and expressed tendency for perineural invasion resulting in incomplete resection and frequent local recurrences. Changes in tissues and structures in the tumor surroundings, especially after procedures such as surgery and external beam radiation, is a big challenge for imaging modalities, and they only provide morphological information. In this line, diagnosis of recurrences, especially differentiation between scar formation, radiation effects and vital tumor using CT, US or MRI is limited. In the follow-up of other tumor entities  $^{18}\text{F}$ -FDG-PET is known to be helpful in the differentiation of benign and malignant tumor lesions <sup>[5, 6]</sup>. But especially in patients suffering from a tumor of the head and neck delineation of the tumor masses at the base of the skull could be insufficient due to physiological FDG-uptake in brain and surrounding tissue. Thus, the value of another well-known PET-tracer in oncological imaging namely  $^{18}\text{F}$ -FEC was evaluated. As it could be shown in this patient case FEC-PET seems to be promising in staging of ACC, because it revealed local tumor recurrence with intense tracer uptake and good tumor to background contrast. In times of implementation of integrated PET/MR-systems worldwide, the possibility to investigate these patients in one working step is offered.

Integrated PET/MRI with  $^{18}\text{F}$ -FEC might offer an improved metabolic imaging in ACC compared to  $^{18}\text{F}$ -FDG-PET/CT and enables precise cerebral radiation treatment planning.

### Acknowledgements

None of the authors declare any conflicts of interest. The procedures followed in this study were in accordance with the ethical standards of the local/institutional ethics committee and with the Helsinki Declaration of 1975, as revised in 2000 and 2008.

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