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Evaluation of [18F]AlF-NOTA-Folate for PET imaging of rat autoimmune myocarditis

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Background– Myocarditis is an inflammatory disease of the myocardium. Diagnosis of myocarditis is challenging. Positron emission tomography (PET) tracer 2-deoxy-2-[18F]fluoroglucose ([18F]FDG) can be used to detect inflammation, but there is often non-specific physiological uptake in the myocardium. Folate receptor β (FR-β) is highly expressed on activated macrophages at the sites of inflammation in various inflammatory disorders. We hypothesized that FR-β targeted imaging would detect myocardial inflammation.

Purpose– We evaluated positron emission tomography (PET) imaging with [18F]AIF-NOTA-folate for the detection of FR-β expression in autoimmune myocarditis in rats.

Methods– Rats (n=11) were immunized with porcine cardiac myosin and complete Freund’s adjuvant. Control rats (n=3) were injected with Freund’s adjuvant alone. 21 days after immunization [18F]AIF-NOTA-folate was injected followed by cardiac PET, autoradiography and histological analysis.

Results- Focal myocardial inflammatory lesions showing FR-β expression and high density of macrophages were detected in 5 of immunized rats. PET imaging revealed increased [18F]AIF-NOTA-folate uptake that showed excellent co-localization with inflammatory lesions. Mean standardized uptake value in inflamed lesions in autoimmune myocarditis rats was significantly higher than in the non-inflamed myocardium in control rats (SUV 1.59 ± 0.78 vs. 0.24 ± 0.02, respectively; \( P = 0.04 \)) or in immunized rats without inflammation (SUV 0.51 ± 0.41; \( P = 0.005 \)). In tissue sections, [18F]AIF-NOTA-folate binding was completely blocked by pre-incubation with unlabeled folate.

Conclusions– [18F]AIF-NOTA-folate shows specific accumulation in cardiac inflammatory lesions containing FR-β expressing macrophages in a rat model of autoimmune myocarditis. Our result indicates that [18F]AIF-NOTA-folate is a novel potential PET tracer for detection of active myocarditis.
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Abstract:

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Conclusions - $[18F]$AlF NOTA-folate shows specific accumulation in cardiac inflammatory lesions containing FR-ß expressing macrophages in a rat model of autoimmune myocarditis. Our result indicates that $[18F]$AlF NOTA-folate is a novel potential PET tracer for detection of active myocarditis.