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PET/CT Imaging of Tuberculosis with 68ga-Citrate

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Abstract

Objective: The impact of tuberculosis (TB) on mortality and morbidity is indisputable worldwide and even more so in countries with a high prevalence of Human Immunodeficiency Virus (HIV) co-infection. The development of a non-invasive diagnostic tool that is capable of early and accurate detection, staging and follow-up evaluation of tuberculosis is crucial in minimizing its devastating effects. We evaluated PET/CT imaging with a novel tracer, 68Ga-citrate,in this setting.

Methods: Thirteen patients with tuberculosis were included in this prospective pilot study and were imaged with 68Ga-citrate. A diagnosis of TB was reached with bacteriological or histopathology studies (n=8) or based on a combination of clinical data, biochemistry and imaging (n=5). PET images were acquired at 60 minutes (and 120 minutes where possible) and analyzed qualitatively (relative to the liver) and semi-quantitatively (using SUVmax and change in SUVmax). PET findings were also compared to that of CT.

Results: All 13 patients demonstrated abnormal tracer accumulation in the lungs or extra-pulmonary or both. 68Ga-citrate accumulated in every lung lesion noted on CT in six cases (46%). In seven cases (54%) some of the lung lesions noted on CT were not 68Ga-citrate avid, which is suggestive of non-active tuberculosis lesions. Ten patients (77%) demonstrated extra-pulmonary involvement, which included various lymph node groups, skeletal lesions, pleural-, splenic- and gastro-intestinal tract involvement. More extra-pulmonary lesions were detected on PET compared to CT in eight cases (80%). The results of dual-time point imaging varied significantly amongst study participants.

Conclusion: Pulmonary and extra-pulmonary tuberculosis lesions demonstrate 68Ga-citrate accumulation; with more extra-pulmonary lesions detected on PET compared to CT. 68Ga-citrate PET may also provide a way of distinguishing active from inactive lesions for treatment response evaluation.

Key words: 68Gallium-citrate, PET/CT, tuberculosis
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^{131}I Labeled Zinc Oxide Nanoparticles: Synthesis, Labeling with ^{131}I and in Vitro Uptake Studies on U87-Mg Cells

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Abstract

Objective: A protein to aequorin (the chemiluminescent protein from Aequorea named jellyfish) green fluorescent protein (GFP) has become established as an important tool in drug discovery and biological research (1). It consists of 238 amino acids and its molecular mass is 27-30 kDa. GFP fluorescence occurs without cofactors and this property allows GFP fluorescence to be utilized in nonnative organisms. Genetically engineered cells with GFP expression have provided a valuable tool for automated analysis, and can be adapted for high-throughput systems (2). Inorganic NPs, including metal oxides, are promising materials for applications in medicine, such as cell imaging, biosensing, drug/gene delivery, and cancer therapy. Zinc oxide (ZnO) NPs belonging to a group of metal oxides are characterized by their photocatalytic and photo-oxidizing ability against chemical and biological species. In recent times, ZnO NPs have received much attention for their implications in cancer therapy (4). ZnO nanoparticles have even been shown to specifically target cancer cells and can possibly be developed as an alternative anticancer therapeutic agent. Although several studies have already characterized the toxicology of ZnO nanoparticles in vitro