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A combination of heat induced radiolabeling and click surface modification repurposes feraheme as multifunctional nanoparticles for PET/SPECT imaging agents

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Heat Induced Radiolabeling (HIR) of Feraheme (FH) nanoparticles (NP) is a chelator free, radiocation surface adsorption (RSA) method using heat (120°C) to bond cations to the iron oxide core of FHNP in less than 3 hours. It repurposes the FHNP from its current uses of iron anemia treatment (approved indication) and MR contrast agent (off-label use) to a radiolabeled PET or SPECT agent, allowing experience with a well-established drug to suggest the safety, pharmacokinetics and clinical applications of new, radiolabeled NPs. HIR differs from other RSA methods in its (i) radiocation flexibility by using any of three cations widely employed in clinical imaging (89Zr4+ or 64Cu2+ for PET and 111In3+ for SPECT), (ii) procedural simplicity: bonding radiocations to a NP drug with heat, (iii) leaving the physical and biological properties of the NP drug unchanged, save for the presence of trace amounts of radiocation and, (iv) ability to generate multivalency of surface targeting groups since azide's survival of HIR conditions. When injected, HIR FHNPs can be internalized by circulating monocytes that traffic to normal lymph nodes and abnormal sites of inflammation. In addition, many bioactive molecules called targeting groups (such as folate, cRGD, protamine, etc.) can be attached to the HIR-FHNPs through click chemistry and their bioactivities are well retained for receptor targeting, which grants HIR FHNPs potentials for active targeting drug delivery and cell labeling. The combination of HIR and targeting group attachments provides a multi-radiocation RSA method for multimodal molecular imaging as well as for targeting radiation therapy.

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Dosimetric study of calcium score and coronary computed tomography angiography procedures using a 320-detector row CT

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The work is a dosimetric study of cardiac CT scans. The study involved a significant number of patients who have cardiac CT examinations, where the installation used is a 320 detectors scanner. Dosimetric parameters such as CTDIvol, Dose Length Product, PDL, and effective dose were investigated to compare between the contribution of Volume CT and Dynamic CT phases, and to appear the effect of heart rate and tube potential (kVp). The current work showed that heart rate plays a very important role in the determination of irradiation parameters for the Calcium Score and Coronary-CTA procedures. Also, the contribution of the Dynamic CT phase in the CTDIvol was 80.2% rather than the Volume CT phase was 16.5%. However, the total Dose Length Product and effective dose were very comparable to the Volume CT phase where it contributed with 94%. For modulation by ECG synchronization, the prospective mode demonstrated a great reduction of dose compared to the retrospective mode. This study has clearly confirmed that, it is necessary to establish within the teams of doctors and manipulators to scan a true culture of radiation protection.

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