Área: INO

[^{68}Ga]Gallium radiolabeled ultrasmall paramagnetic nanoparticles as multimodal diagnostic imaging contrast.

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Highlights

This work evaluated the radiolabeling of ultrasmall paramagnetic nanoparticles (UPN) with [^{68}Ga]Ga^{3+} to produce a novel nanomaterial to be applied as a potential PET/MRI bimodal diagnostic agent.

Abstract

Introduction: Imaging techniques are powerful tools for diagnosing diseases. Computed tomography (CT) and magnetic resonance (MR) are powerful techniques for anatomical images. In contrast, radioisotope imaging, such as positron emission tomography (PET), provides functional information about the cellular metabolism of a patient's tissues. The development of compounds that can be used for CT or MR contrast associated with radiation emitting radioisotopes can drastically improve diagnostics, simultaneously giving morphological and metabolic information. This work evaluated the radiolabeling of ultrasmall paramagnetic nanoparticles (UPN) with [^{68}Ga]Ga^{3+} to produce a novel nanomaterial to be applied as a potential PET/MRI bimodal diagnostic agent.

Material and methods: UPN was produced by a method previously reported by our group(1). [^{68}Ga]$GaCl_3$ was eluted from a ^{68}Ge/^{68}Ga generator, concentrated in a cation exchange resin (Strata® X-C) and reformulated in NaAcO 0.2 M pH 4 solution. The reaction conditions were evaluated in a solution containing 2 mg of UPN and 0.5 to 2 mCi of the radioisotope, under pH 4 and 7, temperature of 21 °C and 100 °C, and time of 10 and 30 min(2). The radiolabeling stability was assessed in citrate buffer, and the interaction with protein was checked by incubation with human serum albumin (HSA) at 37 °C. The results were analyzed using paper chromatography or TLC-SG, measured by autoradiographic image or in a gamma counter.

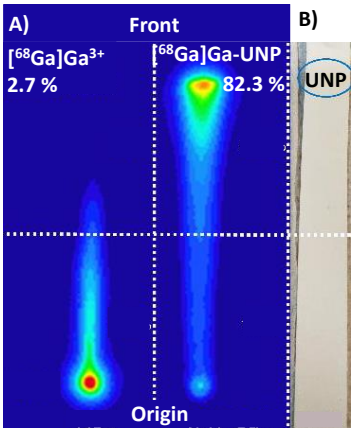

Figure 1. A) Radiochromatograms of the [^{68}Ga]Ga^{3+} and [^{68}Ga]Ga-UNP B) Chromatogram of the UNP

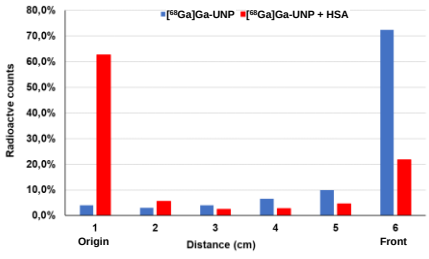

Figure 2. Radiochromatograms of the [^{68}Ga]Ga-UNP and [^{68}Ga]Ga-UNP + HSA

Results: The analysis demonstrated the migration of [^{68}Ga]Ga-UPN to the front of the chromatographic system (Figure 1), and the best radiolabeling condition was achieved at pH 4, 100 °C, and 30 min of incubation, given a radiochemical yield around 85 %. In the presence of HSA, both radioactive and chemical analyses demonstrated an interaction of HSA with UPN, moving the retention profile of the UPN from the front to the origin of the chromatographic systems. In addition, HSA exerts a protective effect against transchelation by citrate (Figura 2).

Conclusion: UPN can be adequately radiolabeled by direct interaction with the [^{68}Ga]Ga^{3+} ion, and the radiolabeled nanoparticles interact with albumin, in a form to be determined yet, promoting a protective effect against citrate transchelation.

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