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Título: Radiolabeling EDTA with Gallium-67 for the analyses of renal function

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Introdução: The production of radiopharmaceuticals in Brazil faces challenges related to budget constraints, dependence on imported supplies, and the unequal distribution of Nuclear Medicine services, which are predominantly concentrated in the south and southeast regions. In this context, Gallium-67 (67Ga) emerges as a strategic alternative due to its 3.26 days half-life, which facilitates transportation logistics and provides sufficient time for diagnostic image acquisition. When combined with EDTA, a chelating agent capable of forming stable complexes and promoting rapid biological clearance, this radiopharmaceutical can be applied in renal scintigraphy to assess renal function and urinary tract obstruction, enabling high-quality SPECT imaging, improved diagnostic performance, reduced radiation exposure to patients, and faster renal clearance.

Objetivos: The proposed approach aims to develop a 67Ga-EDTA complex capable of producing high-quality SPECT images for the assessment of glomerular function. The goal is to achieve improved diagnostic performance while ensuring reduced radiation exposure to the patient, shorter image acquisition times, and more rapid renal clearance, resulting in favorable excretion kinetics for clinical application.

Material e Métodos: The synthesis of 67Ga-EDTA consisted of mixing 0.9mg of EDTA (0.05 M, pH 8.0) with gallium chloride (67GaCl3), incubating it at room temperature for 10 minutes and then buffering it to pH~4.5 with the addition of 0.3mL of a sodium acetate/hydrochloric acid buffer system. The definition of this system and the ideal buffer volume was preceded by simulation studies using 0.9M HCl to represent the radioisotope.

Radiochemical purity was evaluated by paper chromatography using Whatman plates and a 0.2M acetate buffer (pH 4.5). After chromatographic separation, were analyzed with an automated gamma counter, allowing discrimination between free 67GaCl3 (segments 1–5), and 67Ga-EDTA (segments 5-10)

The stability of 67Ga-EDTA was assessed by radiochemical purity measurements up to 96h after preparation. Additionally, a fixed EDTA mass (0.9mg) was evaluated with 67Ga activities ranging from 3 to 23.8mCi to determine whether high radiochemical purity could be maintained across different activity levels.

Resultados: Results to date have demonstrated that the synthesis of the 67Ga-EDTA complex using a sodium acetate/hydrochloric acid buffer system was effective in maintaining the pH~4.5. Quality control revealed high radiochemical purity (99.8%), which remained stable for up to 96 hours. Additionally, the EDTA mass used (0.9mg) was found to withstand various activity ranges (from 3mCi to 23.8mCi), maintaining an average purity above 99.4%, thus consolidating the complex as a promising alternative for evaluating renal function through high-quality imaging.

Conclusão: To date, synthesis of the 67Ga-EDTA complex has shown considerable promise; therefore, more experiments will be conducted to evaluate its application in the context of acute kidney injury (AKI), which requires accurate high-quality imaging of renal function. Subsequently, the performance of 67Ga-EDTA will be compared with that of 67Ga-EDTA with established radiopharmaceuticals 99mTc-DTPA and 99mTc-DMSA currently used in renal imaging, to evaluate its diagnostic potential relative to these agents.

Palavras-chave: *Gallium-67; Renal Scintigraphy; Radiopharmaceuticals*

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