Theme: Applied physiology; PET and MR imaging

Fully Automated Synthesis of Copper-61-based Radiopharmaceuticals for Prostate Cancer Detection

Diana Rodrigues[1] *, Alexandra Fonseca[2], Sérgio do Carmo[1,2], José Sereno[1], Célia Gomes[3], Antero Abrunhosa[1,2]
1 CIBIT/ICNAS, University of Coimbra, Portugal
2 ICNAS Pharma, University of Coimbra, Portugal
3 iCBR, Faculty of Medicine, University of Coimbra, Portugal

*presenting author

Abstract:
Background: Considered incurable at advanced stages, prostate cancer (PCa) remains a major health concern. Therefore, new strategies for early diagnosis and effective therapies are urgently needed. Positron emission tomography (PET) has played a significant role in addressing this issue in recent years. Considering the advantageous physical decay properties of copper-61, compared to those of the current PET gold standard gallium-68, we describe a fully automated synthesis process of 61Cu-based radiopharmaceuticals for prostate specific membrane antigen (PSMA) PET imaging.
Methodology: The fully automated purification of copper-61 and subsequent radiolabeling reaction were accomplished by using two disposable cassette kits and two IBA Synthera® Extension modules. The purified radiolabeled compound obtained at the EOS was then subjected to quality control tests to assess its radiochemical purity (iTLC + HPLC), pH and radionuclidic identity. The stability of the radiopharmaceutical was also evaluated over a period of 6 h. The specificity of the radiotracers for PSMA was evaluated in vitro using the LNCaP (PSMA+) and DU145 (PSMA-) prostate cancer cells. PET/MR imaging studies were performed in LNCaP tumor-bearing mice.
Results: The developed automated process was found effective, and the quality of the final products was demonstrated. The radiopharmaceuticals showed excellent stability over time, and the in vitro uptake studies confirmed their specificity for PSMA. In vivo PET imaging showed clear tumor uptake up to 4 h p.i., along with renal clearance, and no significant uptake in non-targeted organs. The simple, cost-effective and reliable method for copper-61 purification and peptide radiolabeling herein presented represents a significant advance in the radiopharmacy field, encouraging the wider use of copper-61 in clinical practice as an alternative to the outdated gallium-68.

Keywords: Prostate cancer, PSMA, Copper-61, PET, Automation, Radiopharmaceutical