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Automated synthesis of therapeutic activities of ^{177}Lu and ^{131}I radio-pharmaceuticals and ^{68}Ga PET agents in a hospital radiopharmacy.

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Objectives

To minimise radiation exposure to radiopharmaceutical chemists preparing ^{177}Lu radiopeptides, ^{131}I radioimmunotherapeutic agents and ^{68}Ga peptide PET diagnostics.

Methods

The Synthera® module (IBA Molecular, Belgium) was adapted to prepare routine fully automated preparations of novel therapeutic and diagnostic radiopharmaceuticals under remote shielded sterile conditions.

Radiochemical yield and purity was measured by instant thin-layer chromatography and high-performance liquid chromatography.

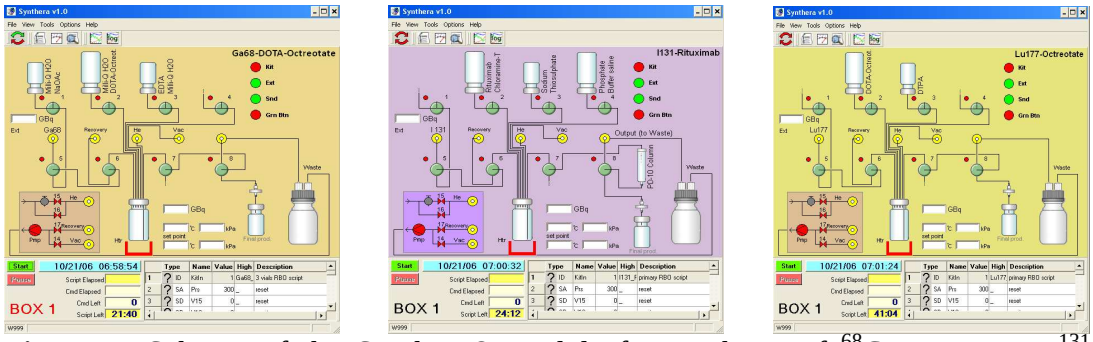

Figure 1. Scheme of the Synthera® module for synthesis of ^{68}Ga-octreotate, ^{131}I-rituximab and ^{177}Lu-octreotate

Results

^{68}Ga-octreotate and ^{177}Lu-octreotate were synthesized, resulting in both a radiochemical yield and radiochemical purity greater than 99 %.

Synthesis of ^{131}I-rituximab resulted in a yield of 60 %, with a radiochemical purity greater than 99 %.

Using 200 MBq $^{68}GaCl_3$ per synthesis, the estimated absorbed body and wrist dose for a manual synthesis was 81 µSv and 11.5 µSv, contrasting with automated synthesis exposure of 7.9 µSv and 1.3 µSv

Using 8000 MBq $^{177}LuCl_3$ per synthesis, the estimated absorbed body and wrist dose for a manual synthesis was 334 µSv and 47.7 µSv, contrasting with automated synthesis exposure of 20 µSv and 2.5 µSv.

Using 6000 MBq ^{131}I per synthesis, the estimated absorbed body and wrist dose for a manual synthesis was 335 µSv and 83.75 µSv, contrasting with automated synthesis exposure of 54.75 µSv and 10.95 µSv.

The reduction in radiation exposure by automated synthesis of radiopharmaceuticals in the Synthera® module was at least five fold.

Conclusion: Automated synthesis of therapeutic ^{177}Lu and ^{131}I radiopharmaceuticals and ^{68}Ga PET agents in the shielded sterile Synthera® module is simple, practical, efficient and virtually eliminates radiation exposure to the radiopharmaceutical chemist.