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The First Proof-of-concept Theranostic Radiopharmaceutical in Thailand

Background/Goal/Objective of the study; Theranostic concept was coined first by John Funkhouser in the last two decades utilizing the combination of a high specific drug that targets diagnostic and therapeutic tools for a specific disease. As a part of personalized medicine, theranostics was practically established in oncology as well as applied to nuclear medicine by labelled gamma emitter diagnostic imaging agent before initiating treatment of labelled beta emitter targeted therapeutic drug. Currently, theranostic applications are used in neuroendocrine tumor (NET) and prostate cancer which have been investigated in many countries around the world, especially in European countries, where thousands of combinations of 68Ga- and 177Lu-labeled PRRT (Peptide Receptor Radionuclide Therapy) together with PSMA (Prostate-Specific Membrane Antigen) doses have been successfully used in clinics. We aim to establish theranostic radiopharmaceuticals in clinically routine use in our facility.

Methodology; Four theranostic radiopharmaceuticals of 68Ga-PSMA, 177Lu-PSMA, 68Ga-HADOTATATE and 177Lu-HADOTATATE were manually labelled under sterile techniques. Briefly, PSMA and HADOTATATE ligands were added with acetate buffer 1.5 ml before mixing to 68Ge/68Ga generator eluted 68GaCl3 4 ml, then heating at 100oC, 15 minutes. After cool down to room temperature, 68Ga-PSMA, 68Ga-HADOTATATE were purified via C-18 column, filtrated through 22 ⊠ membrane filter. In the other hands, PSMA and HADOTATATE ligands were added with ascorbic buffer 1.5 ml before mixing to commercially available non-carrier added Lutetium-177, then heating at 100oC, 15 minutes. After cool down to room temperature, 177Lu-PSMA, 177Lu-HADOTATATE were filtrated through 22 ⊠ membrane filter. All theranostic radiopharmaceuticals were subjected to quality control process before injection to patients. 177Lu-DOTATATE co-infused with amino acid solution for renal protection. Post-treatment SPECT scan time for the patients who were injected with 177Lu-PSMA, 177Lu-HADOTATATE, were 0, 1, 4, 14, 48 hrs, respectively. Absorbed dose in kidneys was determined following the MIRD method.

Results and Discussion; From February 2018 to February 2019, we performed 68Ga-PSMA 35 doses, 68Ga-HADOTATATE 7 doses, 177Lu-PSMA 13 does and 177Lu-HADOTATATE 5 doses. No nephrotoxicity of 177Lu-HADOTATATE and 177Lu-PSMA was found in all cases of our patients according to joint IAEA, EANM and SNMMI protocol guidance.

Conclusion; The first proof-of-concept theranostic in Thailand has been successfully established in King Chulalongkorn Memorial Hospital without nephrotoxicity. In very near future, two new theranostic radiopharmaceuticals, 225Ac-HADOTATATE and 225Ac-PSMA, will be introduced to provide better effective result and enhance our patients'benefit.

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