Synthesis Design and Nuclear Medicine Applications For Radio-metal, Beta and Gamma Emission, Chelated Complexes

ABSTRACT

Nuclear medicine covers a wide variety of radionuclides to meet demands of disease. In the current study, first we have looked at the application of mono-amine mono-amide ligands for Re(V), $^{99m}$Tc(V), and $^{186}$Re(V) with respect to bombesin for receptor targeting in the pancreas. While procedures for synthesizing $^{99m}$Tc complexes is similar to other reported procedures, rhenium complexes were synthesized using [ReO(citrate)$_2$]$^-$ as the starting material, simplifying purification and isolation. Further studies for the 222-MAMA-BBN complex set included biodistribution studies, which determined that the $^{99m}$Tc-BBN complex binds to GRP receptors in the pancreas, ~3% ID/g. The 323-MAMA complex and derivatives were investigated to determine if the 222- or the 323-MAMA backbone provide: an easier preparation, a better framework for chelating given metals, and better transport as a targeting receptor. It is found that, in comparative studies, the 222-MAMA derivatizes are more preferred in chelation. However, in either case, once the metal is chelated, there is no conversion of products upon the addition of a more preferred ligand system.

Another avenue of target therapy being pursued is the study of $^{105}$Rh. We are specifically looking at the study of chelation with tetrathioether complexes, to rhodium(III) to translate to the radiotracers. Three product isomers are formed in the reaction of rhodium, using SnCl$_2$, with 222-S$_4$-diAcOH. The carboxylate arm can either be free dangling, one bound to the metal, or both (removing bound chlorides respectively); all of these isomers can be easily separated using HPLC. These three species will be avoided when translated to the ligand bombesin analog. Future research in this area will be done with the $^{105}$Rh radiotracer for biological applications.