Contribution ID: **21** Type: **Oral**

Imaging the continuous spectrum of therapeutic radionuclides with detectors and pinholes suited for high energy

Monday, May 2, 2016 10:50 AM (20 minutes)

Targeted radionuclide therapy (TRT) is an established cancer treatment modality. It relies on cancer specific agents that are labeled with radionuclides for internal radiotherapy. The biological effect to tissues is generated by the energy absorbed from the radiation (typically beta-emittors) emitted by the radionuclide, TRT can result in substantial sparing of uninvolved tissue and organs and therefore avoid adverse events compared to conventional external beam therapy. Current PET or SPECT systems are suboptimal for imaging isotopes used in radionuclide therapy. SPECT (developed for single gamma photons with mono-energetic low-energy emission) has been used as imaging that has very limited use in the specific domain of radionuclide therapy due to poor quantification. PET can only be used for Y-90, which has a small fraction of positron emission. The main limitations of current SPECT systems for these isotopes are related to the high penetration in the collimator and low detection efficiency of the used detectors. Secondary bremsstrahlung photons, characterised by a continuous energy spectrum, up to the maximum energy of the emitted electron, need a collimator with minimal penetration similar to high-energy pinhole SPECT. To efficiently detect incoming photons, dense high-energy detectors similar to those used in PET should be used.

The conventional 3/8 inch NaI works well at low energies but has only very limited stopping power at 1 MeV. The currrent standard PET scintillator L(Y)SO is not suited for this task due to its high intrinsic activity (which cannot be removed when acquiring in singles mode). BGO is more suited, the main advantage of BGO comes from the high amount of direct photo-electric interactions and resulting smaller amount of Compton interactions arriving in the lower energy window. A disadvantage of BGO is the smaller amount of scintillation light resulting in reduced energy resolution at lower energies (>30% at 100 keV and 15 % at 1 Mev), but given the continuous spectrum this is less important. As the spectrum from a typical therapeutic radionuclide will be mostly composed of low energies, a relatively thin detector can be considered (about 1 cm was selected from simulation study). Based on the expected resolution of these detectors a stationary system can be designed with 1 cm spatial resolution in the cFOV.

Primary author: S. VANDENBERGHE, UGENT (Ugent)

Presenter: S. VANDENBERGHE, UGENT (Ugent)

Session Classification: Theranostics