AbstractID: 8339 Title: Intravascular Brachytherapy Techniques and Dosimetry for Gamma and Beta Radiation Delivery Systems

The primary goal in intravascular brachytherapy (IVB) to treat restenosis is to deliver certain amount of dose to target volumes while minimizing radiation to normal tissues. The target volume is usually in the size of millimeters in depth and can well be treated with either photon emitters or beta emitters. Several types of radiation delivery techniques have been developed for intravascular brachytherapy, including line source system (catheter-based, source train, and stepping source), radionuclide filled balloon, radioactive stent, and surface impregnated radioactive balloon. Currently the most commonly used gamma emitter is ^{192}Ir which emits photons with a relatively high average energy of 370 keV. Low energy photon emitters like ^{103}Pd and ^{125}I are also good choices for the potential use in IVB because of the fact that within 10 mm distance the radial dose functions of all photon emitters are very similar. The beta emitters that have been used and considered in IVB include ^{90}Sr/Y, ^{32}P, and ^{188}Re. In general, in the transverse dimension, the photon emitters are more penetrating than beta emitters and are more suitable for the treatment of target volumes with relatively large diameters. Also, dose distribution is usually less affected by the imperfections in clinical situations (e.g., off-centering, interference of high atomic number materials) for the photon emitters than for the beta emitters. On the other hand, beta emitters can be used to significantly reduce radiation exposure to the adjacent normal tissues in the patients and to personnel. In the longitudinal dimension, beta emitters provide a more uniform dose distributions than photon emitters, i.e., the source penumbra is smaller and is less effected by the source length for beta emitters than for photon emitters. So far, due to the characteristics of material properties, photon emitters are primarily used in line source type delivery systems only while beta emitters have been used in line source type delivery systems, radioactive stents, radionuclide filled balloons, and impregnated radioactive balloons. Techniques for the clinical implementation of these IVB systems will be presented in this course.

Learning Objectives:

1. Describe the characteristics of various photon emitters and beta emitters which are currently in use and in consideration for use in intravascular brachytherapy.
2. Identify and describe various radiation delivery techniques and delivery systems used in intravascular brachytherapy.
3. Describe the clinical procedures used in the IVB using gamma and beta systems already in use.