The utility of a gamma-emitting isotope in Intravascular Brachytherapy (IVBT) depends upon the source size and source strength. The size of a source determines its potential for brachytherapy in small vessels where the rate of restenosis is high. The source strength determines the dwell time during brachytherapy, a practical consideration in cath labs. Researchers have explored three photon-emitting isotopes, namely, Ir-192, I-125 and Pd-103, for their utility in IVBT.

The most widely used isotope in clinical trials so far is Ir-192. The first use of IVBT for prevention of restenosis was in the Frankfurt trial initiated in 1990. A high intensity Ir-192 source was employed in treating femoral artery. An excellent patency rate of 82% was observed in a 5-year follow-up of 28 patients. The first use of IVBT in coronary application was by Condado in Venezuela Trial. Subsequently, several trials (PARIS, SCRIPPS, WRIST, GAMMA) have successfully employed Ir-192 for IVBT. Dosimetric studies with low-activity Ir-192 seed as well as HDR source have been performed in evaluating the dose in close proximity of the source. Methods include GaFChromic films, scintillation detectors, and Monte Carlo calculations.

The dosimetric parameters of I-125 and Pd-103 at close distances have been studied in recent past. However, their use in IVBT has not been initiated, due mainly to dosimetric limitations. Their low energy of emission provides a good radiation safety advantage over Ir-192. Other sources such as Yb-169 isotope and miniature x-ray tubes capable of traveling through narrow arterial lumen are being explored.

The clinically relevant dose distribution depends upon the delivery catheter, source centering within lumen, and the seed spacing within the source. Perturbation of dose due to metallic stent and/or calcified plaque becomes secondary for high-energy gamma sources.

This presentation will summarize the dosimetric methods employed in major gamma-based IVBT trials. Comparison of various dose prescriptions will be made. And finally, the utility of image-based planning and dose prescription will be discussed.

List of objectives:

1. to summarize the current status of the gamma-based IVBT systems.
2. to describe the methods employed in obtaining the dosimetry parameters for near-field doses.
3. to compare the doses delivered to patients treated under various prescription methods.

Conflict of Interest statement:

In order to promote the development of new technology in improving the patient care, I have acted as a consultant to Cordis and Best Medical International.