

Theoretical Aspects of Dosimetry for Intravascular Brachtherapy

The first question that will be considered is: Now that IVB is moving out of clinical trials and into routine use, why should you care about theoretical dose calculations? The answer: They can give you three-dimensional maps of the dose for a wide variety of situations and those maps can help guide important decisions. For example, they can give you insight into what may happen in real, messy, clinical situations such as: arteries that are far from round, sources not centered in the lumen, or the lumen not centered in the artery, and arteries with calcified plaque. They can tell you how much margin may be needed to cover the target once the target dose has been chosen and the uncertainties in target location and source positioning have been estimated. They can help you make sense of the results of clinical trials. For example, you may see how poor results could have resulted from poor target coverage. You can compare two trials even when the prescriptions are written quite differently. Finally, these are very new devices and there is still plenty of room to perfect them. If you want to try out a new radioisotope or a new device, simulating it with a computer first can tell you what may be worth the time and expense to “cut and try” in the real world. The second question to be answered then is: How are these dose maps calculated and what are the strengths and weaknesses of each technique? The answer: All the modern techniques start from Monte Carlo simulations. In some cases, only a piece of the problem is simulated, then the complete dose map is obtained by convolution or superposition. Or the complete problem, with fully realistic geometries and materials, can be simulated from the beginning. As in other dose calculations problems, tradeoffs must be made between speed and accuracy. All these questions will be considered in detail and examples will be given of how theoretical dose calculations have been done and how they have been used in solving practical problems.

Educational Objectives

1. The attendee will become familiar with the clinical problems to which theoretical dosimetry for intravascular brachytherapy can be applied.
2. The attendee will learn the basic principles of theoretical dosimetry in intravascular brachytherapy.
3. The attendee will become aware of the capabilities and limitations of the dose calculation techniques that have been used.