IMAGE-BASED DOSIMETRY OF AN IMPLANTED RADIOACTIVE STENT USING INTRAVASCULAR ULTRASOUND

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Angioplasty has become an increasingly popular and effective treatment for heart disease. Unfortunately, restenosis, a cellular and biological reaction to the procedure, has hindered its effectiveness. Two of the most successful methods of inhibiting restenosis are radiation and stents. The combination of these two components, radioactive stents, is not as common as some of the other methods, yet still has potential of slowing restenosis. Investigation into source characteristics and artery wall radiobiology may illuminate some possible solutions to the problems of restenosis.

This work has developed a calculational method to look at in-vivo images of implanted stents and determine the dose to the artery walls in order to test different source characteristics. The images are Intravascular Ultrasound (IVUS) cross-sectional slices of the stent and the artery. From these images, it is possible to determine the implanted stent structure. The pieces of the stent are identified in the images and modeled in a Monte Carlo simulation, using MCNP4c3. The simulation results were combined with the images to give three-dimensional absolute dose contours of the stent. The absolute dose values were verified using radiochromic film and ^{198}Au-plated stents. This work was able to successfully verify the dose results and create a three-dimensional dose map of the implanted stent.