AbstractID: 9885 Title: A Comparison Between the Dosimetric Characteristics of Different Designs of 125I and 103Pd Sources Based on Original TG-43 Recommendations and Review of Some Shortcomings in Present Brachytherapy Source Dosimetry Techniques.

Following the original AAPM TG-43[1] recommendation (1995), dosimetric characteristics (dose rate constant, radial dose function, anisotropy function, and anisotropy factors) of several new designs of ^{125}I and ^{103}Pd brachytherapy sources have been determined and published by various investigators. According to the AAPM recommendations[2], these characterizations were performed using experimental and Monte Carlo simulation techniques. During these investigations, there were three distinct areas which required some clarifications.

1) Because of the differences in the internal structure of the sources, the TG-43 parameters were found to be different from one source type to another. These differences have raised several questions such as "Which source is better?" or "Are the patients receiving the same dose with one source as compared to another source?" To address these questions, dose distributions of a sample prostate cancer patient, implanted with the same number and arrangement of seeds of various designs were evaluated both qualitatively and quantitatively. These evaluations were performed using commercially available treatment-planning systems. The results of different ^{125}I and ^{103}Pd sources were compared with the Nycomed/Amersham Model 6711 ^{125}I and the Theragenics Model 200 ^{103}Pd sources, respectively. Quantitative comparisons of the dose volume histogram and isodose plots were obtained.
2) During the process of the brachytherapy source dosimetry, it has been found that the Monte Carlo simulated anisotropy function was highly sensitive to the thickness and depth of the active layer within the source. This parameter was not always accurately known by the vendors, therefore, some investigators selected the thickness of the active layer to match experimental data. The effect of the active layer thickness on the TG-43 dosimetric parameters of a sample source will be presented in order to justify that the Monte Carlo simulated data by itself is not sufficient for clinical application.
3) Several investigators have argued that the geometric function of the source, $G(r,\theta)$, as defined in the TG-43 report was not applicable for some source designs. For instance, the active length of a source with a long active wire cannot be defined in the same way as a source with active beads at each end. Some investigators proposed a Monte Carlo simulated geometric function, however, no analytical method is available at this time.

With these and other shortcomings in AAPM brachytherapy dosimetry techniques, a review and revision of the TG-43 protocol is warranted to include newer source designs. Dr. Williamson will present an overview of the updated TG-43 protocol[3].

1. Nath, R., Anderson, L.L., Luxton, G., Weaver, K.A., Williamson, J.F., Meigooni, A.S., 1995, Dosimetry of interstitial brachytherapy sources: Recommendations of the AAPM Radiation Therapy Committee Task Group No. 43, Med. Phys. 22 (2), 109-234.

2. Williamson, J.F., Coursey, B.M., DeWerd, L.A., Hanson, W.F., Nath, R., Ibbott, G.S., 1998, Dosimetric Prerequisites for routine clinical use of new low energy photon interstitial brachytherapy sources., Med. Phys. 25 (12), 2269-2278.

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