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42-1 Intensity Modulated Brachytherapy Dosimetry

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Abstract:

Introduction: In 2002, Martin Ebert proposed the theoretical concept of Intensity Modulated Brachytherapy (IMBT), which uses brachytherapy sources that provide anisotropic emissions to achieve intensity modulation. The method for obtaining an anisotropic emission is the introduction of attenuating material (shielding). IMBT has two categories: static and dynamic shielding. In dynamic shielding, the shield is rotated relative to the source or regions of interest during the treatment. Static shielding involves any shielding technique that does not move in relation to the source or regions of interest during treatment (EBERT, 2002 and CALLAGHAN, et al 2019).This literature review highlights the advances, challenges, and current practices of dosimetry in intensity modulated brachytherapy (IMBT).
Methodology: The research developed by Shi et al (2010) used an inverse planning method where the desired dose distribution is specified, the dosimetry algorithm determines the radiation sources required and their placement to achieve this distribution. The new algorithm proved capable of accurately calculating the three-dimensionais doses in the target and surrounding tissues, taking into account the geometry of the brachytherapy applicator.
Kang, et al. (2018) initially used dosimetry through detailed simulations using Monte Carlo simulations. To corroborate the computer simulations, experimental measurements were performed using dosimeters such as ionization chambers and thermoluminescence dosimeters. The tests showed a significant improvement in the accuracy of the dose distribution.
Nath et al. (1995) discussed the recommendations of Task Group 43, in particular with regard to the accuracy and evaluation of the dose distribution. This document emphasizes the importance of detailed computer simulations to model the dose distribution, including methods such as Monte Carlo, and the use of ionization chambers and thermoluminescent dosimeters for experimental dosimetric measurements.
The clinical efficacy of IMBT has been demonstrated in various cancer types, including prostate, gynecological, and head and neck cancers, compared with conventional brachytherapy (Viswanathan et al., 2019).
Conclusion: Intensity-modulated brachytherapy (IMBT), with its new dosimetry algorithm and inverse planning method, represents a significant advance in treatment precision and reduces adverse effects on healthy tissue. Compared to external intensity modulated radiotherapy (IMRT), IMBT offers advantages in dose delivery to the target and preservation of healthy tissue. Continued development of dose calculation models and integration of new imaging technologies are essential to improve its clinical application and therapeutic efficacy.

Keywords:

Dosimetry, Brachytherapy, Intensity Modulated