Cite this article as:

Palmer AL. *BJR* brachytherapy dosimetry special feature. *Br J Radiol* 2014;87:20140506.

BRACHYTHERAPY DOSIMETRY SPECIAL FEATURE: EDITORIAL

BJR brachytherapy dosimetry special feature

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Brachytherapy involves the precise placement of short-range radiation sources directly at the target site. While external beam teletherapy may be the dominant modality in radiotherapy, brachytherapy continues to play an important role in cancer treatment, more than a century after its introduction.¹ Indeed, brachytherapy is often described as the ultimate conformal technique, delivering radiotherapy treatment from within or very close to the tumour. The pace of change in brachytherapy has been rapid, with continual innovation and progress since its introduction. The current era is presenting a face of brachytherapy that is changing faster than ever,² including multimodality well-developed image guidance, new dosimetry standards, advanced treatment planning algorithms and methods, fully optimized treatments, three-dimensional prescription and reporting methods, improved radiobiology understanding, technical applicator improvements and treatment equipment developments. As examples, in high-dose-rate prostate brachytherapy, technological advances in real-time ultrasound image guidance and live patient-specific optimization places the treatment modality at the forefront of innovation in radiotherapy.³ In low-dose-rate brachytherapy for the prostate, recent years have seen an evolution from the traditional two-stage technique to a single session with interactive planning and seed delivery in theatre, hence removing a main source of uncertainty.⁴ In cervical cancer, the past decade has seen a step change from two-dimensional to three-dimensional image-guided brachytherapy, with various uses of fluoroscopy, ultrasound, CT, MRI and positron emission tomography.⁵ Brachytherapy is an exciting field to practice, with much research in progress, particularly understanding and reducing uncertainties,⁶ alongside clinical and technical developments, and clinical trials. Brachytherapy is also a compelling modality, by its nature it is a subject in which physics and clinical aspects are closely linked, physicists and doctors (radiologist, oncologist and urologist) often working very closely together.

This brachytherapy special feature includes a broad range of articles that indicate the variety of developments taking place in the field, with a particular focus on the physics

aspects of brachytherapy. The first article by Thorsten Sander (doi: 10.1259/bjr.20140176) is a review of recent developments in primary standards for the calibration of brachytherapy sources, a critical first step in the accuracy of brachytherapy treatment. Sander provides a unique and detailed overview of reference dosimetry in brachytherapy, including a discussion of reference air kerma rate, air kerma strength and absorbed dose rate to water. Panagiotis Papagiannis et al (doi: 10.1259/bjr.20140163) then provide a comprehensive review of a subsequent step in the treatment chain, considering state-of-the-art algorithms for brachytherapy treatment planning. The deficiencies of traditional brachytherapy dosimetry are well known, and we are now seeing the realization of the promise of advanced algorithms. It is essential that users, and especially those commissioning such planning systems, understand the concept and limitations, which are provided in the article. Next, Chris Lee (doi: 10.1259/bjr.20140146) reviews progress in brachytherapy treatment planning, an area where recent developments are probably most visible. The article provides a review of best-practice brachytherapy planning, in particular considering how imaging developments have been incorporated into planning techniques. Gustavo Kertzscher (doi: 10.1259/bjr.20140206) then tackles the challenging prospect of *in vivo* verification of brachytherapy treatment delivery, reviewing trends and prospects for the future. This timely article considers how real-time *in vivo* dosimetry may detect errors and discusses current capabilities and latest developments. Finally, I have contributed a review of dosimetric audit in brachytherapy (doi: 10.1259/bjr.20140105). Another challenging area, but important to ensure patient safety and aid optimization. My review considers previous audits, those currently in progress and future directions for independent review.

I hope this collection of articles is an interesting update and review for those currently practising brachytherapy, and reminds those outside our "niche area" of the rapid development and future prospects for this specialized treatment modality.

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