

Brachytherapy physics at ESTRO 38

There were a number of very interesting presentations in the brachytherapy track at ESTRO 38. The topic was well represented with a large number of posters, even more e-posters, and a wide range of symposia, debates and proffered papers sessions.

The track opened with a symposium session dedicated to image-guided adaptive brachytherapy (IGABT) for primary vaginal cancer in Europe and North America. The surprising conclusion was that the approach to contouring the planning target volume (PTV) in vaginal cancer is not unified. In some centres the remainder vagina is also part of the PTV, while elsewhere it is an organ at risk (OAR). As vaginal cancer is a rare disease, only a limited number of studies have been published on the topic. Where the vagina has been investigated as an OAR, no correlations were found between vaginal dose and side effects.

The second part of the track was about real-time navigation technologies in brachytherapy. There were exciting presentations about real-time source tracking in high-dose-rate (HDR) pelvic brachytherapy using electromagnetic devices. The type and degree of errors of the source dwells were also evaluated. The next talk featured the *in vivo* dosimetry of brachytherapy with metal–oxide–semiconductor field-effect transistors (MOSFET). The second part of this session was about the challenge of introducing interstitial needles with 3D-printed vaginal templates into the standard procedures for brachytherapy of cervix cancer.

The proffered papers session on cervix brachytherapy started with presentations about the intracavitary and interstitial ring-type versus Fletcher-type applicators, followed by 3D-printed tandem-needle templates. Authors concluded that, generally, dose to the rectum and bladder can be reduced using a ring applicator. However, larger tumours can be irradiated with appropriate dose coverage only with the ovoid shape of the Fletcher-type applicator. The EMBRACE study also came into prominence in this session, with the delineation performance evaluated through MRI images. In spite of the fact that MRI is the gold standard in cervix brachytherapy because of the good soft tissue contrast, the research team found many errors due to conceptual difficulties and variation in case selection.

For me as a medical physicist, the symposium about inverse planning in brachytherapy was the most interesting. The question discussed was whether inverse planning is a one-click solution or not? Several different points of view were explained, but the final conclusion was that it can be a one – or a two to four – click solution, but only in cases where the density of dwell positions is large enough, for example, in breast or prostate brachytherapy. In cervix brachytherapy, inverse optimisation methods can work only in the interstitial aspects of implantations. In intracavitary situations, manual or graphical optimisation is recommended.

Accelerated partial breast irradiation (APBI) was the most popular topic across the brachytherapy track, with three sessions dedicated to it. The first question was about the best brachytherapy technique to deliver APBI. The answer was that a single catheter balloon can be used only in large breasts where the tumour is in the middle of the entire breast tissue. However, clinical evidence exists only for multi-catheter HDR brachytherapy. The second question was about the best technique to deliver APBI, including teletherapy. The answer was that both tele- and brachytherapy have an essential place in APBI, with all methods being clinically feasible. There is no one size fits all technique. The most appropriate technique for delivering APBI is dependent on the individual's anatomy.

In a really diverse session on optimising dose distribution, the audience heard three interesting presentations. They covered:

- a bi-objective optimisation method of dosimetric indices;
- a platina shielding inside the needles, which can reduce the dose to urethra to its tenth in prostate brachytherapy;
- the evaluation of the inter-observer variation in prostate contouring and a robust treatment planning method to mitigate this.

The last proffered papers session was dedicated to prostate HDR brachytherapy. The first study in this session demonstrated acute toxicity of a single fraction of 19 Gy versus two times 14.5 Gy brachytherapy. The next topics were focal salvage brachytherapy, boost brachytherapy and using radiomics in the delineation of dominant intraprostatic lesions (DIL) for dose escalation. Dose to DIL was compared in HDR versus low-dose-rate brachytherapy. The presenters concluded that the HDR technique may dose escalate better when the target DIL is close to critical organs.

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