3D image based concepts in brachytherapy for cervix cancer

Christine Haie-Meder

Brachytherapy Service, Department of Radiotherapy, Institut Gustave-Roussy, Villejuif, France
On behalf of the GYNE GEC ESTRO working group

Brachytherapy (BT) plays a crucial role in the management of invasive cervix cancer from stage I to IV. The rapid dose fall off allows a very high dose to the central pelvis, with a relatively low dose to the organs at risk. Concomitant chemoradiation followed by BT represents the standard of care in patients with tumours larger than 4 cm, i.e. from stage IB2 to stage IVA. For stage IB1, BT represents a treatment option combined with external beam radiation therapy, or as a preoperative BT in combination with colpohysterectomy and lymphadenectomy. Gross Target Volume (GTV) is recognised as one of the most important prognostic factors in terms of local control. A complete coverage of GTV and the related Clinical Target Volume (CTV) is therefore crucial and is expected to be related to a better outcome.

The implementation of treatment planning systems allows an individual adaptation of dose distribution to CTV in high dose-rate or pulsed dose-rate BT but also, to a less extended procedure in low dose-rate BT.

Target volume assessment is still based first on clinical examination with appropriate documentation in three dimensions. If anterio-posterior and lateral dimensions are accessible for clinical evaluation, the cranio-caudal extension of the tumour may be clinically unaccessible, especially when the tumour extends to the endocervix and/or the endometrium. Sectional imaging gives more valid and reliable information on individual tumour extension, configuration and topography. With magnetic resonance imaging (MRI) tumour size and configuration have been proven to be more appropriately assessed compared to clinical examination or CT-scan. Accurate delineation of GTV, definition and delineation of CTV, as well as of critical organs have a direct impact on BT procedure. This is especially so when it is possible to adapt the pear-shape isodose by optimisation allowing dose-volume-histogram (DVH) analysis for a fixed dose and/or a fixed volume. In order to apply these terms to uterovaginal BT, a common language is needed to describe the different volumes of interest.

A gynecological working group within GEC ESTRO was created to support 3D imaging based 3D treatment planning in cervix cancer. The task was to work out a terminology enabling a common language.

Recommendations were proposed based on clinical experience and dosimetric concepts of different institutions. The target definitions took into account differences in BT target definition approaches with clinical traditions based on assessment of disease at diagnosis or extent of disease at time of BT. Two CTV were proposed:

- A '**High Risk**' **CTV** (HR CTV) with a major risk of local recurrence related to residual macroscopic disease. The intent is to deliver a total dose as high as possible to eradicate all residual macroscopic tumour. The approach derived from using point A as a reference point started mainly from tumour extension (GTV) as it presented at time of BT. The total dose is comparable with dose to point A.
- An '**Intermediate Risk**' **CTV** (IR CTV) with a major risk of local recurrence taking initial macroscopic extent of disease into. The intent is to deliver a total radiation dose appropriate to cure significant microscopic disease in cervix cancer, which corresponds to a dose of at least 60 Gy. This approach derived from ICRU 38 recommendations started from GTV at diagnosis for defining CTV at time of BT including safety margins. Total dose prescribed to this CTV is 60 Gy. This dose is not comparable to dose to point A, which is significantly larger.

These recommendations need to be largely spread in order to be validated, with a large potential of improving cervix cancer treatment representing the next step.