Recommendations for treatment with IMRT for prostate and head-neck cancer

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Intensity-modulated radiation therapy (IMRT) is an advanced form of radiotherapy for the treatment of cancer that allows, on one hand, to administer a more homogeneous dose to the patients on the volume to irradiate (which would increase the local control of the disease), and on the other hand, to diminish the toxicity in the organs at risk. This type of treatment is based on imaging techniques, on computer dosimetric programs, and on more precise immobilization accessories. Before delivering IMRT it is necessary to establish a protocol that includes the different phases of the treatment process, that is, the obtaining of anatomical data, beam definition, calculation, dose distribution, and treatment performance and control.

In this article we present the basic standards for the IMRT treatment for prostate and head-neck cancer agreed upon a consensus meeting. The follow-up of the recommendations settled down in this document will help in the establishment of a standardized clinical practice—assuring the quality—and a better evaluation of the results of the clinical intervention.

Key words: intensity modulated radiotherapy, IMRT.


Intensity-modulated radiotherapy (IMRT) is an advanced radiotherapy method designed for cancer treatment that allows, on one side, to administer a more homogeneous dose to the volume aiming to be irradiated which would increase the disease local control, and on the other side, to diminish the toxicity in the organs at risk. This type of treatment is based on imaging techniques, dosimetric computer programmes and very precise immobilization accessories. Before using the IMRT it is necessary to establish a protocol, which includes the different phases of the treatment process, that is to say, obtaining the anatomical data, beams definition, calculation, dose distribution and performance, and treatment control.

In our country, this technique is being gradually implemented since its introduction in the year 2000, and the number of patients treated in this manner is progressively increasing.

The Axencia de Avaliación de Tecnoloxías Sanitarias de Galicia (avalia-t), worked out, during the year 2004, a project on this technique, financed by the Spanish Ministry of Health and Consumer Protection Health Research Fund. The aims of this project are, firstly, to analyse the scientific knowledge available on IMRT in terms of efficiency and confidence, in comparison to the conformal radiotherapy treatments and, secondly, to obtain information on the necessary means (both material and human) to implement the technique. This way an approach to the standardisation of the prostate and head-neck cancer treatment could be made.

**ABBREVIATIONS**

CTV: Clinical Target Volume
GTV: Gross Tumor Volume
Gy: Grey
HDV: Histograms Dose-Volume
ICRU: International Commission on Radiation Units and Measurements
MV: Megavolt
PTV: Planned Target Volume
For the achievement of the first aim, a literature systematic review was performed\(^6\)\(^6\). For the second aim, a questionnaire was elaborated and sent to the Spanish centres that were treating their patients (or about to start treating them) with IMRT\(^6\)\(^6\)\(^6\)\(^6\). Finally a consensus meeting was held with the aim of joining the criteria of the professionals involved in the IMRT development in our country\(^4\). In this publication only the basic standards for the IMRT treatment for prostate and head-neck cancer agreed upon that meeting are presented, with the aim of giving it a major spread. Since these recommendations are valid for the centres that had foreseen the implementation of the intensity modulated radiotherapy, they can extent to the national and the international radiation therapy community. A consideration must be taken about the fact that the consensus document should be reviewed when the clinical practice and new studies provide new data and evidences.

**RECOMMENDATIONS**

**Prostate cancer**

1. The tumoral stages subject to treatment with IMRT are the localized disease: T1 to T3 (the T4 requires an individual assessment), N0 and M0.

2. Metastatic tumours are absolute contraindications for the IMRT.

3. Previous irradiation and obesity are relative contraindications. Hip prosthesis can be a contraindication and requires an individual assessment of each patient.

4. It is recommended to set the patient in decubitus supinus for the image taking and for the treatment thereafter (decubitus supinus will be always the first choice for obese patients).

5. As immobilization device it is advisable to have at least knee cradles and footrest. Although they are not considered immobilization elements, it is recommended to place some type of seed markers which will help to improve reproductivity.

6. The photon energy that can be used ranges from 6 MV to 15-18 MV. Although the dose distribution homogeneity improves with the energy, and given that the total number of monitor units has to be considered, the election of energy would be determined by the IMRT technique. In case of a dynamic technique, with a high number of monitor units given, the use of 6 MV would more convenient, in order to reduce the dose due to neutrons. In the case of static techniques, the choice can be aimed at higher energies.

7. The number of fields to be defined will vary depending on the technique, either dynamic or static. As orienting value, 5 fields for the dynamic techniques and 7 fields for the static techniques can be sufficient.

8. The number of segments will be determined by the number of monitor units per segment, and this, at the same time, is set by the linearity limit of the monitoring system.

9. The anatomical data acquisition is made at least with a computerized tomography and always with the rectum empty of air.

10. For the definition of volumes and margins the following is recommended:
   10.1. CTV same as GTV. Keep with ICRU 62\(^7\).
   10.2. PTV same as CTV plus margins of 10 mm on axis X, 10 mm on axis Y and 6 mm on axis Z.

10.3. Organs at risk:
   - Rectum: PTV plus margin. HDV should always be made with the same delineation of the rectum wall.
   - Intestine: irradiate only lymph nodes.
   - Femoral head: it is recommended to delineate the ischiatric head.
   - Penis bulb: it is necessary to use an infant probe in order to define its contour.

11. The reference dose in the total PTV should be between 76 Gy and 80 Gy of nominal dose, depending on the treated stage. The dose per fraction will range from 1.8 Gy/fraction to 2 Gy/fraction.

12. For the dose limits in the organs at risk the following is recommended:
   - Rectum: 46% of the volume or less should receive 50% of the dose and 50% of the volume or less should receive 70% of the dose. Another way is to establish a limit of 40% in the rectum wall and 88% of the prescribed dose, as it is done at Memorial Sloan Kettering Cancer Center\(^8\)\(^8\).
   - Bladder: 46% of the volume should receive 50% of the dose and 50% of the volume should receive 70% of the dose or, as it is performed at Memorial Sloan Kettering Cancer Center, to establish a limit of 58% in the bladder wall and 98% of the prescribed dose\(^8\)\(^8\).
   - Intestine: maximum dose will be 65 Gy.
   - Femoral heads: maximal dose will be 60 Gy.
   - Penis bulb: maximal dose will be 40 Gy.

15. Dose homogeneity criteria: it is recommended that the heterogeneity does not exceed values between -5% and +7% of the prescribed dose\(^17\)\(^19\).

14. As far as the reference isodose is concerned, it is recommended to use the 95% of the prescribed dose\(^17\)\(^19\).

**Head-neck cancer**

1. The tumoral stages subject to treatment are the localized disease (T1 and T4) and postradiation recurrences.