

ADVANCED RADIOTHERAPY TECHNIQUES

Stylianidou Styliani¹, Memtsa Pinelopi- Theopisti¹, Papadopoulou Aikaterini¹, Chatzigiannaki Anastasia², Tzitzikas Ioannis¹

1. Department of Radiation Oncology, AHEPA Hospital, Medical School of Aristotle University of Thessaloniki, Greece

2. Department of Medical Physics, AHEPA Hospital

BACKGROUND

For many decades it has been known that delivering a high dose to the tumor is critical for local control and for the probability of complications. The basic concept of conformal therapy was elucidated quite early: "Treat the tumour to a high dose while minimizing the dose to normal structures". Nowadays, there are many different combination of technologies used to develop and implement sophisticated conformal therapy.

PURPOSE

Advanced radiotherapy techniques and definitions for conformal and image-guided therapy.

METHODS- MATERIALS

Review of the literature, electronic bases, pubmed and retrospective trials.

RESULTS

Conformal therapy describes radiotherapy treatment that creates high-dose volume that is shaped to conform to the desired target volume while minimizing the dose to critical normal tissues. A number of different treatment planning techniques are routinely used to perform clinical conformal therapy. Three dimensional conformal radiotherapy (3DCRT) was the first conformal therapy technique developed, based on the use of 3D treatment planning and multiple cross-firing, carefully shaped fixed fields. Inverse planning involves creation of the radiotherapy plan using mathematical optimization techniques. The combination of inverse planning and intensity modulated beams is called intensity modulated radiation therapy (IMRT). The combination of IMRT delivery and optimization methods with arc therapy, volumetric modulated arc therapy (VMAT), has become an important method for the delivery of conformal therapy. All of these methods are improved by the use of image guided radiation therapy (IGRT) techniques to accurately position and set up the patient, using intergrated megavoltage or kilovoltage diagnostic imaging, cone beam CT, radiofrequency beacons or radiographic fiducials and other image guidance methods. Active consideration of the patients respiratory motion in planning is described by four dimensional (4D) imaging and planning and active motion management strategies are used during treatment to address the motion issuer.

CONCLUSIONS

The availability of these high quality CBCT or kilovoltage imaging modalities directly on the treatment machine led to the development of IGRT, in which diagnostic imaging is used to correct the patient setup and positioning for treatment every day. IGRT processes have greatly increased the accuracy in the delivery of the radiation therapy that can be routinely achieved. This improved confidence in targeting accuracy has made possible the development of stereotactic body radiation therapy (SBRT), which is now used to give very high doses to well localised targets in the liver, lung and other sites using highly conformal treatment delivery performed with IGRT. The use of the IMRT and the proper handling of patient motion, respiration and other 4D issues have been pursued for many years and are still major threads of current research and development.



REFERENCES

1. Keall PJ., Mageras GS., Balter JM. Et al: The management of respiratory motion in radiation oncology, report of AAPM Task Group 76. Med Phys 33: 3874-3900,2006
2. Gunderson and Tepper. Clinical Radiation Oncology. Intensity-Modulated and Image- Guided Radiation Therapy, 2016,294-297