

Short Communication

Is Single Arc Technique in Volumetric Modulated Arc Therapy Good Enough for Prostate Cancer?

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Abstract

Advancement in treatment delivery techniques in external beam radiation therapy has significantly improved the conformal radiation dose distributions to the tumor while reducing dose to the critical structures. Modern treatment techniques combined with sophisticated treatment planning systems have led to increase in the treatment planning studies in the recent years. In this article, we review the application of the most recent treatment delivery technique in photon based radiation therapy known as volumetric modulated radiation therapy (VMAT). Furthermore, this article is focused on the VMAT planning for the prostate cancer.

INTRODUCTION

Advancement in treatment delivery techniques in external beam radiation therapy (EBRT) has significantly improved the conformal radiation dose distributions to the tumor while reducing dose to the critical structures. Modern treatment techniques combined with sophisticated treatment planning systems have led to increase in the treatment planning studies in the recent years. Volumetric modulated arc therapy (VMAT) is an example of EBRT. This technique can deliver radiation beam with simultaneous adjustment of gantry rotation speed, dose rate, and multi leaf collimators [1]. The radiation beam is delivered typically in the form of one or multiple arcs as the gantry rotates around the isocenter. The main objective of this article is to review the literature on the VMAT planning of the prostate cancer, especially for the one arc technique in the VMAT.

A growing number of treatment planning studies utilizing VMAT planning for the prostate cancer have focused on comparing single arc (SA) and double arc (DA), with two arcs rotating in opposite directions in the DA technique. The current literature suggests that there is no unanimous agreement among different studies in terms of the dosimetric results. For instance, Sze and colleagues [2] compared the SA and DA techniques for fourteen prostate cancer patients. That study reported that DA was better than the SA with the highest minimum PTV dose, lowest hotspot, and the best homogeneity and conformity [2]. Furthermore, the rectal dose was the highest using SA technique compared to the DA technique. Rana and Cheng [3] showed DA could produce more conformal and homogenous plans as well as

reduce dose to the bladder and rectum. In contrast to the findings of these studies [2,3], Guckenberger et al. [4] reported lower rectal dose and decreased spread of low doses for five prostate cancer patients using the SA. However, Wolff and colleagues [5] reported no significant difference in the dosimetric results between the SA and DA when they performed treatment planning study on 10 prostate cancer patients. Similarly, a radiobiological study [6] comparing SA and DA showed comparable tumor control probability (TCP) for the prostate tumor.

A new study by Rana and Cheng [7] showed that partial arc technique could result better dosimetric results of the rectum and bladder for the prostate cancer if the arc in the treatment plan is set up using avoidance sectors in the regions anterior and posterior to the prostate. Sze and colleagues [2] used SA with a full gantry rotation, and this method has resulted higher rectal dose. However, in comparison to the standard SA, the partial-SA technique as shown by Rana and Cheng [7] was superior with lower rectal and bladder doses, but resulted in higher integral dose and femoral head dose.

Despite some disagreement among VMAT planning studies for the prostate cancer, the common agreement was that the SA is more efficient and it requires less number of monitor units compared to the DA. One must note that various factors may influence the treatment planning results. For example, difference in dose calculation algorithms and photon beam energy could provide different dosimetric results [8]. The optimization method also has a great influence in the final dosimetric results. If the treatment planning studies use different planning techniques

and beam parameters, the comparison of dosimetric results of one study with that of another study may not be straight forward.

CONCLUSION

The current literature on the VMAT planning of prostate cancer suggests that the SA technique, especially using the avoidance sectors such as in the partial-SA, could result dosimetric results comparable to that of DA. Treatment efficiency is also better using the SA than using the DA.

REFERENCES

1. Otto K. Volumetric modulated arc therapy: IMRT in a single gantry arc. *Med Phys.* 2008; 35: 310-317.
2. Sze HC, Lee MC, Hung WM, Yau TK, Lee AW. RapidArc radiotherapy planning for prostate cancer: single-arc and double-arc techniques vs. intensity-modulated radiotherapy. *Med Dosim.* 2012; 37: 87-91.
3. Rana SB, Cheng C. Investigating VMAT planning technique to reduce rectal and bladder dose in prostate cancer treatment plans. *Clin Cancer Investig J.* 2013; 2: 212-217.
4. Guckenberger M, Richter A, Krieger T, Wilbert J, Baier K, Flentje M. Is a single arc sufficient in volumetric-modulated arc therapy (VMAT) for complex-shaped target volumes? *Radiother Oncol.* 2009; 93: 259-265.
5. Wolff D, Stieler F, Welzel G, Lorenz F, Abo-Madyan Y, Mai S, et al. Volumetric modulated arc therapy (VMAT) vs. serial tomotherapy, step-and-shoot IMRT and 3D-conformal RT for treatment of prostate cancer. *Radiother Oncol.* 2009; 93: 226-233.
6. Rana S, Cheng C. Radiobiological Impact of Planning Techniques for Prostate Cancer in Terms of Tumor Control Probability and Normal Tissue Complication Probability. *Int J Radiat Oncol Biol Phys.* 2013; 87: S694-S695.
7. Rana S, Cheng C. Feasibility of the partial-single arc technique in RapidArc planning for prostate cancer treatment. *Chin J Cancer.* 2013; 32: 546-552.
8. Pokharel S. Dosimetric impact of mixed-energy volumetric modulated arc therapy plans for high-risk prostate cancer. *Int J Cancer Ther Oncol.* 2013; 1: 01011.

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