VRIJE UNIVERSITEIT

Volumetric modulated arc therapy for stereotactic body radiotherapy:
Planning considerations, delivery accuracy and efficiency

ACADEMISCH PROEFSCHRIFT

ter verkrijging van de graad Doctor aan
de Vrije Universiteit Amsterdam,
op gezag van de rector magnificus
prof.dr. L.M. Bouter,
in het openbaar te verdedigen
ten overstaan van de promotiecommissie
van de Faculteit der Geneeskunde
op woensdag 19 september 2012 om 11.45 uur
in de aula van de universiteit,
De Boelelaan 1105

door
Chin Loon Ong
geboren te Maleisië
promotoren: prof.dr. S. Senan
           prof.dr. B.J. Slotman
copromotor: dr. W.F.A.R. Verbakel
Biological-based optimization and volumetric modulated arc therapy delivery for stereotactic body radiation therapy. Med Phys. 2012 Jan;39(1):237-45. doi: 10.1118/1.3668059. Authors. Purpose: To describe biological-based optimization and Monte Carlo (MC) dose calculation-based treatment planning for volumetric modulated arc therapy (VMAT) delivery of stereotactic body radiation therapy (SBRT) in lung, liver, and prostate patients. Methods: Optimization strategies and VMAT planning parameters using a biological-based optimization MC planning system were analyzed for 24 SBRT patients. The quality and efficiency of the delivery were assessed according to measured quality assurance (QA) passing rates and delivery times. To date, this goal may be obtained by combining two fundamental technological advances: stereotactic body radiotherapy (SBRT), known as stereotactic body radiosurgery (SRS) when administered in a single fraction (5,6) and intensity modulated radiotherapy with volumetric arc technique known with the acronym of VMAT. Briefly, SBRT couples a high degree of anatomic targeting accuracy and reproducibility with very high doses of precisely delivered radiation, thereby maximizing the cell killing effect on the target(s) while minimizing radiation-related injury in adjacent normal tissues (7). "Few exp A treatment planning and delivery comparison of volumetric modulated arc therapy with or without flattening filter for gliomas, brain metastases, prostate, head/neck and early stage lung cancer. Acta Oncol. 2014; 53: 1005â€“1011. pmid:24937551.Â Volumetric modulated arc therapy for delivery of hypofractionated stereotactic lung radiotherapy: A dosimetric and treatment efficiency analysis. Radiother Oncol. 2010; 95: 153â€“157. pmid:20116115. Volumetric modulated arc therapy planning method for supine craniospinal irradiation. Jianzhou Chen & Chuangzhen Chen & Todd F. Atwood & Iris C. Gibbs & Scott G. Soltys & Carolina Fasola & Lei Xing. Received: 7 March 2012 / Accepted: 23 April 2012 / Published online: 10 May 2012 # Springer-Verlag 2012. Keywords Craniospinal irradiation . Volumetric modulated arc therapy . RapidArc . IMRT.Â cervical uterine, and its advantages in target coverage, treatment-time efficiency, and organs at risk (OAR) sparing have been demonstrated [5â€“10]. CSI, on the other hand, represents a challenging site where treatment is still pre-dominantly done with 3DCRT because of a lack of a sys-tematic procedure for dealing with the disease using VMAT. SBRT is a stereotactic beam therapy for especially accurate radiation of a target of a complicated form, which is located near to radiosensitive structures, ensures shortening of treatment period thanks to the possibility of a high dose delivery with a high accuracy without damaging of healthy tissues. It provides new possibilities for patients with diseases of lungs, pancreas, liver, kidneys, lower pelvis. Nowadays the most modern method of distanced beam therapy is an intensity modulated beam therapy (IMRT). At this kind of radiation the maximum exact adequacy of radiation dose distribution