**Treatment planning for liver stereotactic body radiation therapy using FFF photon beams**

*Introduction*

Since April 2015, patients are treated in our department with liver stereotactic body radiation therapy on a linear accelerator equipped with flattening filter free (FFF) photon beams. The energy and the use of respiratory gating are adapted for each patient. This study presents the results for the first 14 patients.

*Material and methods.*

Three gold fiducials are implanted inside or in the vicinity of the lesion 7 to 10 days prior plannng imaging. The minimum 4 hour fasting patient undergoes first a 4D CT scan with systematic audio coaching and a thoracic thermoplastic mask (Orfit Industries, Wijnegem, Belgium). An MRI scan in treatment position is acquired and registered to the CT images based on the fiducials. The radiation oncologist outlines the GTV on each of the six respiratory phases. A 6 phases ITV (entire breathing cycle) and a 3 phases ITV (expiratory phases) are then created. The corresponding PTVs are created by adding a 5 mm margin. When the ratio PTV 6 / PTV 3 is higher than 1.5, the treatment is achieved with respiratory gating. The beam used is a conformal dynamic arc of 180 to 200° amplitude, conformed to the PTV. 10 MV FFF beams were preferably used as the dose rate is higher than for 6 MV FFF beams (2400 and 1200 MU/min respectively). For organs at risk, constraints from Timmerman *et al*[1]were used.

*Results*

For the past year, 14 patients have been treated (8 with 3 fractions of 18 Gy, 3 with 5 fractions of 11 Gy et 3 with 5 fractions of 10 Gy), without any restriction on PTV size (from 11 to 273 cm3). The prescription isodose is 80 %. 5 patients were treated in free breathing (PTV 6) and 9 with respiratory gating (PTV 3). Sometimes it has been necessary to treat with respiratory gating in order to fulfill the constraints to the organs at risk. The systematic comparison for the first 10 patients between the two FFF energies showed that the dosimetric objectives were fulfilled similarly for both energy except when the PTV was close to an organ at risk. In this case, better results were obtained with 6MV FFF beam.

*Conclusion*

Despite the fact that the liver is a very mobile organ, it has been possible to treat some patients in free breathing, without compromising the dosimetric objectives, thus allowing a better patient comfort (treatment time 3 times faster). The 10 MV FFF with its 2400 MU/min dose rate was most oftenly used, allowing treatment times lower than 10 min even with respiratory gating and the highest prescribed dose.

REFERENCE

[1] R. D. Timmerman, “An Overview of Hypofractionation and Introduction to This Issue of Seminars in Radiation Oncology,” *Semin. Radiat. Oncol.*, vol. 18, no. 4, pp. 215–222, 2008.