

## **Evaluation of the Dosimetric Parameters of the Interstitial HDR Liver Brachytherapy at USM**

**Keerthaanaa Yogabalan<sup>1</sup>, Mohd Zahri Abdul Aziz<sup>2</sup>, Gokula Kumar Appalanaido<sup>2</sup>, Jayapramila Jayamani<sup>1</sup>**

1Medical Radiation Programme, School of Health Sciences, Health Campus, Universiti Sains Malaysia, 16150, Kubang Kerian, Kelantan, Malaysia

2Oncological and Radiological Sciences Cluster, Advanced Medical and Dental Institute (AMD), Universiti Sains Malaysia, 13200, Kepala Batas, Pulau Pinang, Malaysia

\* Corresponding author: [jayapramila@usm.my](mailto:jayapramila@usm.my) / [ykeerthaanaa@student.usm.my](mailto:ykeerthaanaa@student.usm.my)

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### **Abstract**

There are numerous treatment options available to treat hepatocellular carcinoma (HCC). Up to now, stereotactic body radiotherapy (SBRT) has been considered the best option to cure the HCC, however SBRT does not adequately spare the nearby organ at risk (OAR) [1]. A high dose rate interstitial brachytherapy (HDR IBT) technique for HCC is considered as an alternative to the SBRT due to accurate and precise dose delivery to the target and well spared adjacent OAR [2]. The main objective of this retrospective study was to evaluate the dosimetry tolerance for the tumour and OAR for HDRIBT technique for HCC technique using the iridium-192 (Ir-192) source.

A computed tomography (CT) image-guided for 41 patients with 71 treatment cases in USM were used to analyse the dose distribution in tumour (HCC) and the OAR (diaphragm). The computed dosimetry data from the Oncentra treatment planning system (v.4.3) was used to analyse the relationship between the dosimetric variables, of the prescribed dose (15 Gy – 25 Gy) and fractionation used for the HDRIBT for HCC by statistical analysis.

In this study, 95% of the gross tumour volume (GTV) of HCC adequately achieved the prescribed dose in both single and multiple fractionations. The GTV dose decreased as the GTV volume increased for all the prescribed doses. Apart from that, the prescribed doses, 20 Gy and 25 Gy, exhibited a higher diaphragm dose in single fractionation treatment compared to 15 Gy dose. Meanwhile, the multiple fractionations treatment also exhibited a remarkably high diaphragm dose compared to the single fractionation treatment.

The minimum GTV dose recommended was based on a comparison with the RTOG 0438, liver SBRT protocol. These recommended values were applicable in both single and multiple fractionations. In addition, it is also applicable in a prescribed dose of 15y – 25 Gy. In short, the minimum recommended GTV doses were the  $V_{99\%} \geq 90\%$  of the prescribed dose,  $V_{95\%} \geq 95\%$  of the prescribed dose  $V_{90\%} \geq 100\%$  of the prescribed dose, respectively. Meanwhile, the diaphragm tolerance dose in this study was compared with RTOG 0438 protocol of ribs tolerance dose, within 54 Gy. Therefore, the diaphragm tolerance dose recommended for diaphragm volume of 0.2cm<sup>3</sup>, 0.5cm<sup>3</sup> and 2.0cm<sup>3</sup> (15 Gy prescribed dose) < 10 Gy, (20 Gy prescribed dose) < 15 Gy and (25 Gy prescribed dose) < 20 Gy in single fractionation respectively for all prescribed dose, whereas for the

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multiple fractionations < 54 Gy, regardless of the GTV volume. In conclusion, HDRIBT technique for HCC is the most promising technique by maximizing the dose to the GTV and reducing dose to the diaphragm by both single and multiple fractionations.

### Keywords

Diaphragm dose, GTV dose, Hepatocellular carcinoma (HCC), HDR liver IBT for HCC

### References

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