

## **Analysis of Radiation-Induced Liver Disease (RILD) and Evaluation of Relationship between Therapeutic Activity and Liver Clearance Rate with Tc-99m-Mebrofenin in Yttrium-90 Microspheres Treatment**

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**Abstract :** Aim: Whole liver radiation has the modest benefit in the treatment of unresectable hepatic metastases but the radiation doses must keep in control. Otherwise, RILD complications may arise. In this study, we aimed to calculate amount of maximum permissible activity (MPA) and critical organ absorbed doses with MIRDOSE methodology, to evaluate tumour doses for treatment response and whole liver doses for RILD and to find optimal liver function test additionally. Materials and Methods: This study includes 29 patients who attended our nuclear medicine department suffering from Y-90 microspheres treatment. 10 mCi Tc-99m MAA was applied to the patients for dosimetry via IV. After the injection, whole body SPECT/CT images were taken in one hour. The minimum therapeutic tumour dose is on the point of being 120 Gy, the amount of activities were calculated with MIRDOSE methodology considering volumetric tumour/liver rate. A sub-working group was created with 11 patients randomly and liver clearance rate with Tc-99m-Mebrofenin was calculated according to Ekman formalism. Results: The volumetric tumour/liver rates were found between 33-66% (Maximum Tolerable Dose (MTD) 48-52Gy) for 4 patients, were found less than 33% (MTD 72Gy) for 25 patients. According to these results the average amount of activity, mean liver dose and mean tumour dose were found  $1793.9 \pm 1.46$  MBq,  $32.86 \pm 0.19$  Gy, and  $138.26 \pm 0.40$  Gy. RILD was not observed in any patient. In sub-working group, the relationship between Bilirubin, Albumin, INR (which show presence of liver disease and its degree), liver clearance with Tc-99m-Mebrofenin and calculated activity amounts were found  $r=0.49$ ,  $r=0.27$ ,  $r=0.43$ ,  $r=0.57$ , respectively. Discussions: The minimum tumour dose was found 120 Gy for positive dose-response relation. If volumetric tumour/liver rate was  $> 66\%$ , dose 30 Gy; if volumetric tumour/liver rate 33-66%, dose escalation 48 Gy; if volumetric tumour/liver rate  $< 33\%$ , dose 72 Gy. These dose limitations did not create RILD. Clearance measurement with Mebrofenin was concluded that the best method to determine the liver function. Therefore, liver clearance rate with Tc-99m-Mebrofenin should be considered in calculation of yttrium-90 microspheres dosimetry.

**Keywords :** clearance, dosimetry, liver, RILD

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