

**Purpose:** Volumetric modulated arc therapy (VMAT) has been an evolving technique with improved conformity, normal organ sparing, and the additional freedom of non-coplanar beam design as compared to helical tomotherapy. This study was to compare the dose-volume liver sparing effect between coplanar (C) with and without non-coplanar (NC) design for volumetric modulated arc therapy (VMAT), and to verify the delivery accuracy in patients with liver malignancy treated by the integrated NC-VMAT.

**Methods:** Sixteen patients with intrahepatic malignancies were planned with VMAT using coplanar with and without the additional non-coplanar beams. All the prescribed doses were normalized to the fraction size of 2 Gy. The dose-volume data of liver were calculated by the total liver minus the gross tumor volume. The mean dose, volume fraction receiving more than certain dose x Gy ( $V_x$ ), and effective volume of liver ( $V_{eff}$ ) were compared with paired Student t test. Seven patients treated by the integrated NC-VMAT were verified for dose accuracy using 2-dimensional array method (MapCheck2).

**Results:** With comparable target coverage, NC-VMAT provided significantly better liver sparing effect than C-VMAT in mean dose ( $16.52 \pm 7.8$  Gy vs.  $17.9 \pm 8.9$  Gy,  $p=0.02$ ),  $V_5$  ( $50.3 \pm 15.2\%$  vs.  $53.8 \pm 16.6\%$ ,  $p=0.02$ ),  $V_{10}$  ( $33.1 \pm 10.8\%$  vs.  $35.3 \pm 13.1\%$ ,  $p=0.08$ ),  $V_{20}$  ( $24.6 \pm 10.3\%$  vs.  $26.6 \pm 12.2\%$ ,  $p=0.04$ ),  $V_{30}$  ( $20.1 \pm 10.3\%$  vs.  $22.0 \pm 11.9\%$ ,  $p=0.02$ ), and  $V_{eff}$  ( $9.6 \pm 5.2\%$  vs.  $10.6 \pm 5.9\%$ ,  $p=0.03$ ), respectively. Among the 7 patients treated by NC-VMAT with the average delivery time of  $368 \pm 105$  seconds, All but one patient with the dose accuracy met the 3%/3mm criteria of more than 95%, and all patients completed the treatment with no more than grade 2 liver toxicity.

**Conclusions:** Liver is a sensitive organ to even low-dose irradiation, is located asymmetrically in the abdomen, and has irregular shape. NC-VMAT may be advantageous in liver sparing and feasible for the accurate delivery.