

**Purpose:** To investigate the feasibility of volumetric modulated arc therapy, RapidArc (RA), assisted by active breathing control (ABC) for hepatocellular carcinoma (HCC) radiotherapy.

**Methods:** Twelve patients with HCC after TACE underwent 3D-CT scanning assisted by ABC at end inspiration hold (EIH), end expiration hold (EEH), and free breathing (FB). Three treatment plans were designed as 3D-CRT, IMRT, and RA. The volumes of liver, normal liver (the liver volume minus the PTV), GTV, PTV in three breathing status were compared. The conformity index (CI), the dose homogeneity index (HI) of target volume, and the maximum dose, minimum dose, the monitor unit, treatment time, the dose-volume parameters of normal liver, stomach, duodenum were compared.

**Results:** There was no significant difference in the volumes of liver, normal liver, and GTV at three breathing status ( $p > 0.05$ ); but the PTV at FB was larger than that at EEH and EIH ( $p < 0.05$ ). The overall CI and HI for RA was better than IMRT and 3D-CRT at three breathing status ( $p < 0.05$ ). The mean dose, V20, V30, V40 of normal liver were 3D-CRT > RA > IMRT ( $p < 0.05$ ). For the mean normal liver dose, the V10 was FB > EEH > EIH. For the V20, V30 and V40 of normal liver at FB was greater than that of EEH and EIH. The D5cm3 of duodenum was EIH > FB > EEH ( $p < 0.05$ ). The monitor unit for IMRT, RA and 3D-CRT were  $626.33 \pm 113.98$ ,  $550.28 \pm 122.56$  and  $254.06 \pm 18.56$  respectively. The treatment time for IMRT, RA and 3D-CRT were  $540 \pm 45s$ ,  $130 \pm 10s$ ,  $135 \pm 10s$  respectively.

**Conclusions:** RA assisted by ABC for HCC radiotherapy was feasible, with better dose distribution, fewer monitor unit, less treatment time and sparing more OARs.