Purpose: the study aimed to observe and analyze the variations of liver cancer GTV between 4D-CT and 3D-CT associated with active breathing control device (ABC).

Methods: 13 cases with primary liver cancer were selected and underwent CT simulation and localization. Each case underwent 4D-CT scanning first, with ABC device working on to monitor and analyze the breath wave. Afterwards, 3D-CT scanning were underwent, respectively when patient breathing freely, at the end of inspiration and expiration. GTVs were contoured, according the same criterion by one radiologist and one radiation oncologist jointly, respectively on 6 CT series: CT0 series (4D-CT end-exhale), CT50 series (4D-CT end-inhale), 4D-CT MIP series, 3D-CT free breathing CT series, 3D-CT end-exhale series, and 3D-CT end-inhale series, which were named GTV4D-0, GTV4D-50, GTVMIP, GTVFB, GTVEE, GTVEI. Afterwards, GTV4D-M were obtained by merging GTV4D-0 and GTV4D-50, meanwhile GTV3D-M were obtained by merging GTVEE and GTVEI. The volume of all GTVs were measured and analyzed using SPSS software. Paired Wilcoxson test was applied.

Results: there was no significant difference between GTVEI and GTVEE (P=0.325), as well as GTVEI and GTV4D-0 (P=0.125), GTVEE and GTV4D-50 (P=0.325), GTV4D-0 and GTV4D-50 (P=0.125), GTV4D-M and GTV3D-M (P=0.125), GTVMIP and GTV3D-M (P=0.325). GTVFB was smaller than GTV3D-M and GTV4D-M significantly (P=0.015 and P=0.016), and than GTVMIP without significant differenc (P=0.125). Notably, GTV4D-M differed from GTVMIP (P=0.016).

Conclusions: the margins from GTV to PTV should be noticed, when undergo CT simulation with patients breathing freely, due to the differences between GTVFB and GTV4D-M and GTV3D-M. To merge GTVEE and GTVEI could be an alternative to using 4D-CT for simulation.