Purpose: To research the deficiencies of conventional margins in hepatocellular carcinoma radiotherapy comparing to the individual internal gross tumor volume (IGTV) and the individual margins which were obtained by using 4D-CT.

Methods: 12 hepatocellular carcinoma cases were selected, achieved the 4D-CT scan after 3D-CT scan under free breathing (FB). 4D-CT were sort in 10 phases and named CT0, CT10…CT90. GTVs were contoured manually on 3D-CT and 4D-CT (labeled as GTVFB, GTV0, GTV10… GTV90). IGTV1 was obtained from GTVFB using conventional margins (2cm in Z-axial, 1.5cm in X-axial and Y-axial), and GTV0, GTV10… GTV90 were merged into IGTV2, the individual margins in three axial were obtained from GTVFB to IGTV2, and IGTV3 were obtained from GTVFB using the individual margins. The volume of GTVs and IGTVs were compared.

Results: The individual margins of every axial were not symmetrical in particular in Z axial: +X axial (0.67±0.26 cm), -X axial (0.50±0.26 cm), +Y axial (0.65±0.28 cm), -Y axial (0.70±0.29 cm), +Z axial (1.18±0.66 cm), -Z axial (0.70±0.49 cm), and there were two patients’ +Z-axial margins were not sufficient, all conventional margins of others were larger than individual margins. The volume difference among GTVs was not significant (p>0.05); the volume of IGTV3 (125.75 ± 35.95 cm³) was larger than IGTV3 (71.97 ± 28.65 cm³), and IGTV2 was larger than (50.77 ± 14.37 cm³), the volume difference among three IGTVs was significant (χ² = 22.00, p = 0.00). The value of IGTV3/ IGTV3, IGTV3/ IGTV2 and IGTV3/ IGTV1 were 3.61±0.82, 2.41±0.42 and 1.73±0.37.

Conclusions: The symmetrical conventional margins for hepatocellular carcinoma could include partial tumor off-target or too much normal liver tissue accepted irradiation. The individual margins and individual IGTV were very necessary in hepatocellular carcinoma radiotherapy.