

Dosimetric Evaluation of Acuros XB for Treatment Plan on Multiphasic Contrast Enhanced CT

Department of Radiation Oncology, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Korea

Sang Hoon Jung, Hyunho Lee, Sung Jin Kim, Jeong Il Yu, and Hee Chul Park

Purpose: Influence of treatment planning with multiphasic contrast enhanced computed tomography (CT) for liver cancer on dose calculation using Acuros XB (Varian Medical Systems, Palo Alto, CA), a grid-based technique to solve the linear Boltzmann transport equation was evaluated._

Materials and Methods: A homogeneous phantom with size of $20.0 \times 20.0 \times 20.0$ cm³ was generated. To evaluate influence of presence of contrast agent on dose calculation, the phantom was filled with various Hounsfield unit (HU) of the phantom from 60 to 100 with steps of 10, corresponding to HU of liver for the non-contrast, arterial phase, portal phase, and delayed phase liver computed tomography (CT). Depth doses for a simple treatment plan various energies (6 MV, 10 MV, 6 MV FFF, and 10 MV FFF), a square field (10.0×10.0 cm²) and source-to-surface distance of 95 cm were calculated using Acuros XB (Ver. 15.6) and compared to those from anisotropic analytical algorithm (AAA)._

Results: The depth doses were compared to those from the phantom filled with 60 HU, which was HU of normal liver on the non-contrast liver CT. Difference of the depth doses for lower energies were increased for higher HU. In dose calculation using AAA, differences of the depth doses were evaluated to be less than 1% for all the depth and energies. In dose calculation using AXB, differences of the depth doses for all the energies and HU were evaluated to be less than 1% up to the penetration depth of 12 cm, and the difference of the depth doses for the phantom filled with 70 HU were less than 1% only.

Conclusions: Although overall difference was evaluated to be acceptable clinically with less than 2%, dose calculation using AXB was influenced by the enhancing HU due to the presence of contrast agent, than dose calculation using AAA. However, as the material composition of the contrast agent could not be modified in the treatment plan using AXB, the treatment planning using the contrast enhanced liver CT should be evaluated carefully.

Keywords: AcurosXB, Contrast-enhanced CT, Treatment Plan