

Comparative study between the use of Maximum Intensity Projections (ITV-MIP) and multiple phases ITV for target outlining of 4DCT in patients with HCC treated by SBRT

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Abstract

Introduction and Objective:

Stereotactic body radiotherapy (SBRT) is a promising technique for the treatment of inoperable HCC. Four-dimensional computed tomography (4DCT) is recently being introduced to radiotherapy process especially SBRT. For target definition, a significant time is needed to delineate 8 CT scans of the respiratory cycle for each patient. The delineation of single MIP scan is used as an alternative. The aim of this study is to compare an internal target volume (ITV) created using MIP (ITV-MIP) to ITV created from the composite volume of 8 gross target volumes (GTVs) delineated on the 8 phases of the 4DCT (ITV-8phases).

Materials and Methods

Ten patients with HCCs treated by SBRT were included, with a prescribed dose 30Gy/5fr/1w.

The delineation of single MIP scan and 8 CT scans of the respiratory cycle was done for each

patient. The 4D treatment plans were performed for each patient using two different planning target volumes (PTVs): PTV1 was generated on the ITV-MIP. PTV2 was generated from the ITV-8phases. The two ITV volumes were compared by calculating the ratio between them. Selection of the treatment plan was done using Homogeneity index (HI) and conformity index (CI).

Results:

In all patients the volume of ITV-8phases was equal or larger than the ITV-MIP. The mean ratio of ITV-8phases/ ITV-MIP was 1.13 ± 0.12 ($p=0.002$). Doses to the normal liver and risk structures are slightly higher using ITV-8phases method, but not statistically significant ($p=0.14$).

Conclusion:

The use of ITV-MIP is acceptable with less time consuming and carries very close accuracy compared to ITV-8phases target outlining, however the uncertainties at the MIP image boundaries should be taken into consideration. The best method of target definition needs to be better evaluated by larger trials recruiting higher numbers of patients.