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Identifying the intra-tumoral heterogeneity of GBM using diffusion tensor image segmentation technique: A look inside application in prediction of overall survival

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Background: GBM is the most common primary malignant brain tumors. Intra-tumoral heterogeneity causes to variable behavior, different clinical symptoms and survival time. Diffusion tensor imaging (DTI) can be used to characterize different regions of tumor, distinguishing solid regions from necrotic and edema regions.

Methods: 11 patients with GBM underwent diffusion tensor imaging and conventional MRI before chemo-radiation therapy. Patients were followed till death date. K-means clustering algorithm applied on (p,q) space to segment different regions of GBM with different isotropic and anisotropic characteristics. The percentage of each region to whole tumor volume was calculated. Correlation between tumor volume, percentage of each region (solid, necrotic and edema) with survival and age were acquired.

Results: Segments with greater isotropic diffusivity represent edema regions, segment with low isotropic and low anisotropic diffusivity represent the solid tumor and segment with high isotropic and low anisotropic diffusivity represent necrotic regions. The correlation's results were as follows: Negative correlation between percentage of solid and edema regions with overall survival (r: 0.527, 0.469 respectively at significant level of 0.05), negative correlation between tumor volumes with ages (r: 0.687, p value: 0.021).

Discussion: Our initial result suggested that applying the k-means algorithm on (p, q) space may potentially provide contrast between edema, anisotropic solid tumor and necrotic region so can be used for prediction of overall survival. The results will be validated in a larger patient population to determine which extracted regions along with another imaging and clinical factor can be adopted as relevant biomarkers for survival time.

Biography

Manijeh Beigi is a PhD student in Medical Physics from Tehran University, Iran and has worked for 6 years as a Radiotherapy Physicist in Jorjani Radiotherapy Center (Imam Hosein Hospital) in Tehran.

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