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(UG) Comparing the Dose to Circulating Lymphocytes in Conventional and State-of-the-Art Radiation Therapy

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Cancer radiotherapy often lowers patients' lymphocyte counts. This radiation induced lymphopenia is significantly correlated with survival for certain treatment sites and cancer types. Despite this, the dose to lymphocytes is not explicitly minimised during clinical treatment planning.

Across patients, a given treatment modality, such as photon or proton therapy (PT), may not consistently provide the minimal blood dose. Which patient parameter, or combination thereof, that causes this variation is not well understood. Should a causative parameter be identified, it would provide a clinical indicator for which treatment provides the minimal blood dose. One such parameter to investigate is the target volume.

In line with current models, the dose to circulating blood was calculated as a surrogate for the dose to circulating lymphocytes. By doing so for twenty liver tumour patients from The Radiotherapy Optimisation Test Set (TROT) it is possible to deduce which, if any, patient parameters are useful indicators for a given treatment modality. For example, as the patient dataset offers a range of target sizes (from 75 to 365 cm³) this parameter can be investigated.

The open-source treatment planning system matRad was used to create treatment plans for both photon therapy and PT. The resulting organ doses were then passed to the haematological dose (HEDOS) framework which calculated the dose to circulating blood. The results were then compared across modalities. Comparison across patient parameters is ongoing.

Initial results using a sample patient showed, for comparable standard deviations, a 23% decrease in the mean dose to circulating blood from PT as compared to photon therapy. Additionally, 2% of the circulating blood received a dose of 2.8Gy or higher in photon therapy versus that of 2.2Gy in PT.

Since RIL is correlated with survival, it is to be expected that reducing the dose to circulating blood will improve patient outcomes. The initial results showed that, as its dose to circulating blood is lower, this may be achieved by using PT.

Ongoing analysis will show if there are any correlations between patient parameters and the modality which provides circulating blood the lower dose. This subsequently reveals if any patient parameters are suitable indicators for a treatment modality.

Keyword-1

Radiotherapy

Keyword-2

Radiation dose to lymphocytes

Keyword-3

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