ESTRO Mobility Grant (TTG) Report: A delta radiomics response model for sarcoma patients

Host institute: Department of Radiation Oncology, University of Washington, Seattle, US

Date of Visit: 18 August to 7 September 2019

Aim of the visit

In soft tissue sarcoma (STS) patients who receive neoadjuvant radiotherapy, pathological measures from the resected tumour, such as the percentage of viable cells, do not have the predictive power that is observed in other malignant entities (Schaefer et al., Intl J. Rad. Oncol. Biol. Phys. 2017). Since high-grade STS carries an unfavourable prognosis, selection of non-responding patients for additional therapy may help to personalise therapy regimens. The host institution has a large database of STS patients that includes comprehensive clinical and outcome information. Patients regularly receive post-radiotherapy magnetic resonance imaging (MRI) studies before surgery. During a previous collaboration, pre-therapeutic imaging data of a patient cohort had been completely curated for radiomics analyses. The aim of this visit was the extension of the patient cohort data with existing post-therapeutic MRI scans. This patient cohort would then be used for the development of a delta-radiomics prediction model as a potential novel radiation response parameter. The plan is to externally validate the models on a patient test cohort from the home institution.

Details of the scientific content of the visit

The workflow at the host institution consisted of the following steps:
1) Analyses of the patient database and definition of exclusion criteria to generate a clinically meaningful patient cohort.
2) Analyses of available imaging studies in relation to the specific dates of therapy such as chemotherapy and radiotherapy. Image data export and anonymisation into a research database. MRI sequences to be collected were T1-weighted contrast enhanced fat-saturated and T2-weighted fat-saturated MRI scans.
3) Manual segmentation of the selected STS on pre-therapeutic and post-therapeutic imaging studies.
4) Preliminary radiomic feature extraction.
5) Extension of the availability of the pathological measure “number of viable cells” as a competing response parameter.

Results from the studies undertaken

Several exclusion criteria were defined, including certain sarcoma histologies, treatment regimens, imaging artefacts and availability of image sequences. A large patient cohort with pre- and post-therapeutic imaging studies could be curated. Most patients had both MRI sequences available. Besides post-radiotherapy scans, we were able to extract a larger cohort of post-chemotherapy imaging studies as well. Manual segmentation was performed successfully for all patients on both extracted imaging sequences.
First radiomic analyses have been undertaken for quality assurance purposes. Radiomics-feature analyses and model building will be performed in the coming months. The number of viable cells could be determined for an additional number of patients. For the remaining patients, the parameter is currently being analysed retrospectively by a pathologist.

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View of Mount Rainier from the University campus