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Characterize the Effective Half Life for Instant Single Time Point Dosimetry using Machine Learning

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Single time point (STP) dosimetry offers a more convenient approach for clinical practice in radiopharmaceutical therapy (RPT) compared to conventional multiple time point (MTP). Despite numerous advancements, STP methods are limited and challenging by the need for strict and late timing in data acquisition. This study introduces a new concept of instant STP (iSTP), which is achieved by predicting the effective half-life (Teff) using machine learning (ML) based on pre-therapy data.
Methods: Data from 23 patients who underwent pre-therapy [68Ga]Ga-PSMA PET imaging and subsequently [177Lu]Lu-PSMA I&T RPT was analysed. A ML model was developed for Teff predictions for the kidneys (left and right), liver, and spleen. Estimated iSTP values were compared against to MTP method and from Hänscheid values.
Results: The ML-model achieved predicted Teff with mean errors below 9% for the kidney left and right, liver, and spleen. Comparing the predicted Teff with the MTP method, the differences were below 14% for all organs. The iSTP achieved differences less than 26.0 ± 21.0% for both kidneys, 63.7 ± 103.6% for liver, and spleen of 84.2 ± 209.4%. With notable lower differences at 2 h time point.
Conclusion: Given the intrinsic characteristic of effective half-life, our preliminary results prove the concept in prediction and achieving STP shortly and flexibly after RPT. This method could potentially expedite the application of dosimetry in broader contexts, such as outpatient treatment.

Field

Systems and applications

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