Development of a compartmental model for biokinetics and dosimetry of $^{18}$F-choline in prostate cancer patients

**Background:**
- This work was done in the frame of the FP7 project MADEIRA (Minimizing Activity and Dose with Enhanced Image quality by Radiopharmaceutical Administrations)

**Motivation:**
- Improvement of the PET imaging procedure for $^{18}$F-choline in prostate cancer patients by introducing biokinetic modelling

**Aim:**
- Development of a compartmental model for biokinetics and dosimetry of $^{18}$F-choline in prostate cancer patients based on experimental PET imaging data

PET images of a prostate cancer patient
Development of a compartmental model for biokinetics and dosimetry of $^{18}$F-choline in prostate cancer patients

**Results:**

- Using PET/CT screenings performed with $^{18}$F-choline in 10 prostate cancer patients together with blood and urine analysis for different time points after injection, the temporal concentration course of $^{18}$F-choline has been obtained for different organs, blood and urine.
Development of a compartmental model for biokinetics and dosimetry of $^{18}$F-choline in prostate cancer patients

Results:

- On the basis of this experimental data about the temporal concentration course for $^{18}$F-choline and by using biokinetic modelling and population kinetic approach, a compartmental model was developed describing the individual patients' data for the biokinetic behaviour of $^{18}$F-choline within the body.
- In addition the uncertainty (and the sensitivity) of the model parameters were determined.
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**Conclusion:**

- The biokinetic model developed for the first time for $^{18}$F-choline in prostate cancer patients can enable a better planning of PET screenings (e.g. due to the better prediction of the signal-to-noise ratios in the PET images).
- With the help of the biokinetic model, realistic estimates of the radiation dose received by the patients can be calculated. This helps to better protect the patient due to radiation.

**Committed organ dose coefficients [mGy/MBq]**

<table>
<thead>
<tr>
<th>Target region</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Median</th>
<th>Ref. Patient</th>
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<tbody>
<tr>
<td>Liver</td>
<td>0.036</td>
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<td>0.053</td>
<td>0.062</td>
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<tr>
<td>Kidneys</td>
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<td>0.066</td>
<td>0.067</td>
<td>0.079</td>
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<tr>
<td>Spleen</td>
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<td>0.040</td>
<td>0.027</td>
<td>0.027</td>
<td>0.038</td>
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<tr>
<td>Urinary bladder wall</td>
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<td>0.037</td>
<td>0.022</td>
<td>0.020</td>
<td>0.017</td>
</tr>
<tr>
<td>Other tissues</td>
<td>≤ 0.022</td>
<td>≤ 0.032</td>
<td>-</td>
<td>-</td>
<td>≤ 0.031</td>
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