Individualized modelling of prostate cancer therapy

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Project team:

- Prof. Zvia Agur, chair of IMBM
- Dr. Moran Elishmereni, IMBM, responsible for the substantive side of the project
- Alon Nahshoni, IMBM, mathematical and numerical modeling
- Prof. Urszula Foryś, WMIM UW, mathematical and numerical modeling

Within the project – based on clinical data – we developed mathematical model for the growth of prostate cancer in hormone-sensitive stage (HSPC) and its treatment with androgen deprivation therapy (ADT). Tumor size is reflected by measured amount of prostate specific antigen (PSA).

We achieved the following goals:

- proposing and fitting to the data an underlying tumor growth model – we used the data of those patients for whom records of PSA before the start of ADT were available;
- proposing a pharmacokinetic model of the administered drug (leuprolide) and fitting it to the data available from FDA records;
- proposing a testosterone secretion model and fitting it to the available data;
- combining the above models into one model and fitting it to the data from patients treated with continuous ADT;
- mathematical analysis of the model with a constant concentration of the drug in the body;
- proposing a model which includes two resistance mechanism: one influencing the testosterone path and second influencing PSA;
- mathematical analysis of the full model;
- preparation of a manuscript describing the process described above with mathematical analysis of the intermediate stages models and the full model as well.

Preliminary results have been presented during the Israeli-Polish workshop:
https://www.imbm.org/in-the-news/

During COVID-19 pandemic we (with Yuri Kogan) also prepared a review article focusing on individualized immunotherapy of tumors, which was a topic of my previous works with IMBM team:
https://ascpt.onlinelibrary.wiley.com/doi/10.1002/cpt.1942

I have also prepared a manuscript related to mixed effect modeling method in recognition of underlying population dynamics based on the data generated by myself. It is in review now.