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Research article

Absence of convection in solid tumors caused by raised interstitial fluid pressure severely limits success of chemotherapy—a numerical study in cancers

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Supplementary

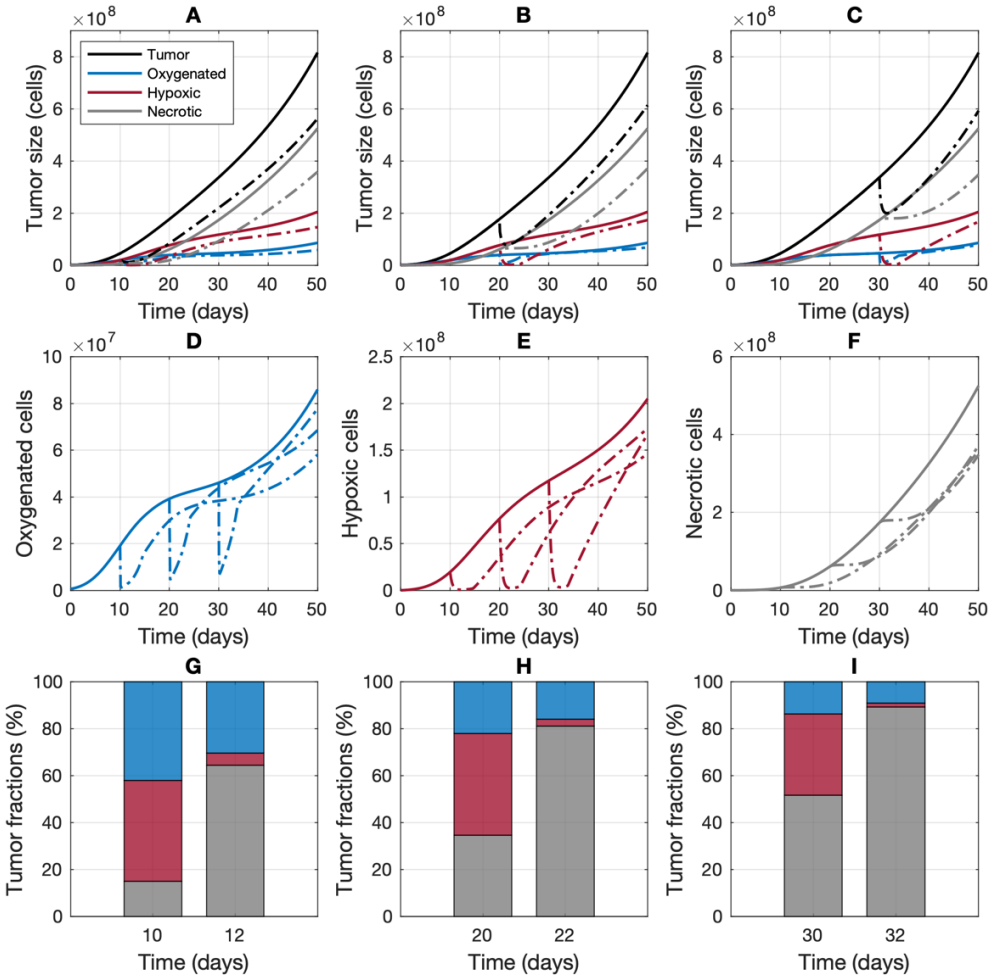

Figure S1. Simulation results of tumor growth under chemotherapy on different days. Simulation was performed with a reoxygenation process that stop after the oxygenated compartment reaches 80% of the cell count before treatment. Panels A–C show the growth curves of an untreated tumor (solid lines) and the treated tumor (dashed lines). Treatment was applied on day 10 (A), day 20 (B), and day 30 (C). Panels D–F show the effects of different treatment times on the oxygenated (D), hypoxic (E), and necrotic layers (F). Panels G–I compare the percentage distribution of the individual tumor fractions before and two days after treatment for tumors treated at day 10 (G), 20 (H), and 30 (I), respectively.

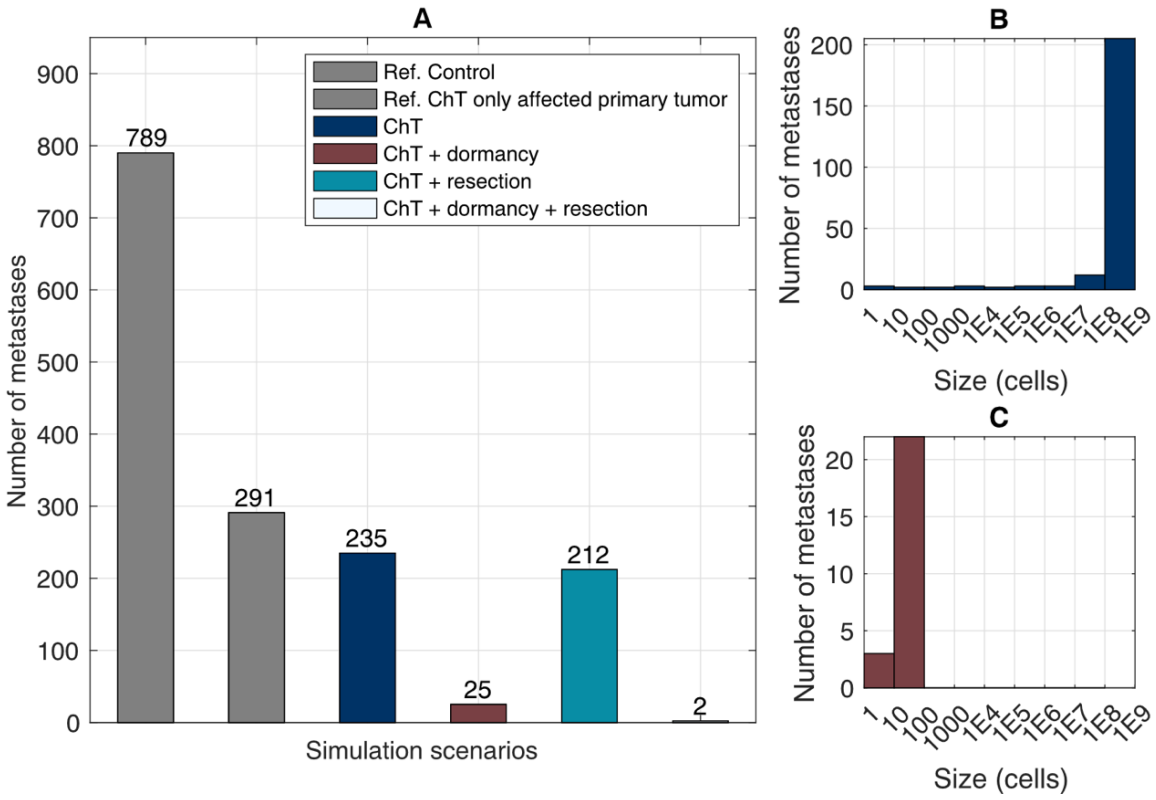

Figure S2. Effect of chemotherapy on number and size distribution of metastases in different scenarios. Simulation was performed with a reduced fractal dimension of 1.58 right after the application of chemotherapy. Panel A shows the number of metastases after different treatment strategies and in varied growth conditions. Panel B shows the size distribution of metastases for chemotherapy when there was no dormancy of the metastases, leading to build-up of interstitial fluid pressure (ChT). Panel C shows the size distribution of metastases for chemotherapy when metastases showed dormancy behavior (ChT + dormancy). The chemotherapy was applied on day 30. The simulation time was set to 50 days. Gray bars represent reference values (Ref.) for an untreated and a tumor treated with chemotherapy to compare treatment effectivity.

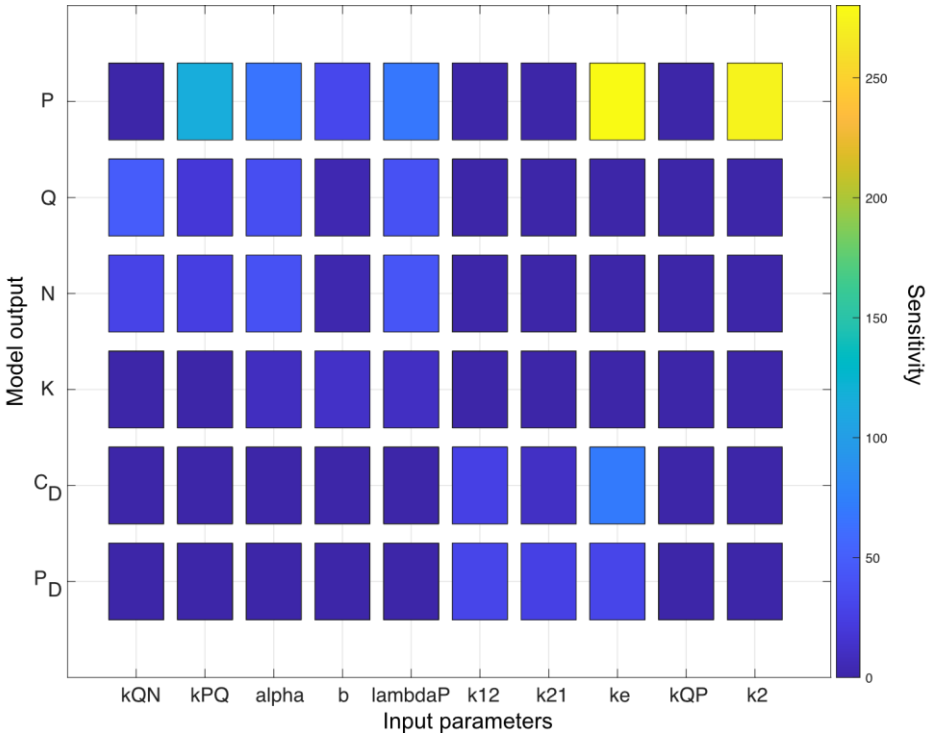

Figure S3. Sensitivity analysis of the combined model. The sensitivity analysis increases the understanding of the relationships between input and output parameters in our model for further investigation. The sensitivity indicates which input parameters influence the output of the model (compartments). The drug clearance *ke* and drug potency *k2* are the most sensitive parameters in this model, which influence the tumor growth, especially the oxygenated fraction *P* since the treatment is only applied in this tissue due to the low penetration depth.