Killing Cancer with Light: Simulation and Optimisation of Photodynamic Therapy for Glioblastoma

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Background

Glioblastoma (GBM)
- Highly aggressive, treatment resistant brain tumour
- Diagnosed ~0.004% of people
- 14-month median survival rate with standard of care

Maximal tumour resection
Radiation therapy
Chemotherapy

Results / Conclusion

Glioblastoma (GBM)
- > 80% of recurrences occur adjacent to resection edge

Aim - Simulate PDT for GBM trial using a 3D computational brain model and MCRT

Methods

Monte Carlo Radiative Transport (MCRT)
- Numerical method used to predict light distribution in materials with specified optical properties
- Simulation of clinical trial:
  - Treatment time = 9.6 mins
  - Light power = 2 W
  - Simulation run for 5 different drug accumulation concentrations
- Additional simulations:
  - Treatment time = 19.2 mins
  - Light power = 4 W

Results / Conclusion

Effect of Increasing Light Dose on Treatment Outcome

Clinical trial time and power (5µM)
- 2 W, 9.6 min
- 4 W, 9.6 min

Outlook – These results can be used in future clinical trials to improve treatment of GBM with PDT

References