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Liver tumor ablation by electroporation: mathematical modeling for clinical applications

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Electropermeabilization (also called electroporation–EP) is a significant increase in the electrical conductivity and permeability of the cell membrane that occurs when pulses of large amplitude (a few hundred volts per centimeter) are applied to the cells: due to the electric field, the cell membrane is permeabilized. If the pulse duration is sufficiently short (a few milliseconds or a few microseconds, depending on the pulse amplitude), the cell membrane reseals within several tens of minutes: reversible EP, preserves the cell viability and is used in electrochemotherapy to vectorize the drugs until the cell inside. If the pulses are too long, too numerous or if their amplitude is too high, the cell membrane is irreversibly destroyed and the cells are killed. Irreversible EP provides thus a novel non thermal and minimally invasive ablation therapy.
In this talk I will present some recent results of the Inria Team MONC on the mathematical EP modeling combining PDE models and image registration techniques, in order to help interventional radiologists in their practice of percutaneous liver tumor ablation by irreversible electroporation.

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