NON-INVASIVE HYPERTHERMIC NECROSIS OF CANCER CELLS USING A NANOSECOND PULSED ELECTRIC FIELD

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Invasive ablation of cancer cells using radiofrequency-heating techniques has been demonstrated clinically, but the current methodology still has many flaws, including inconsistent tumor ablation, and significant healthy cell death\(^1\). Research has been done to develop a method that is both non-invasive and more selective for the cancer cells using metallic nanoparticles and constant electric field exposure\(^2,3\). The mechanism by which cell necrosis is achieved in these studies is the heating of functionalized metallic nanoparticles, which are attached to the cancer cells via antibody conjugation. Our approach to studying this phenomenon is to use similarly functionalized metallic nanoparticles that are specific for the T47D breast cancer cell line, but expose these nanoparticle-cell conjugates to a nanosecond pulsed electric field. The percentage of cells killed from hyperthermia can then be assessed using hemacytometer cell staining and counting techniques.

Studies thus far show that 60ns electric field pulses of 20kV do not harm the T47D cells alone, but when these cells are conjugated to metallic nanoparticles and then exposed, cell death occurs. As the number of pulses increases from 1 – 16, cell death occurs in a semi-linear trend beginning from below 10% and increasing to greater than 80%. Future studies are to include varying the pulse duration (300ns is an available option), the voltage (1-20kV range), and the material of the metallic nanoparticle (Fe, Au, etc). Should these studies continue to yield effective cell necrosis compared to studies performed using a constant electric field, with significantly less exposure time, we will conclude then, that pulsed electric field ablation is superior to constant electric field ablation.