Low Energy Permeabilization of Long-lived and Traditional Transient Pores for Improved Tumor Ablation
Technology #17992

Applications

This invention presents a method of ablating a target tissue using an electrical pulse regime that induces cell permeabilization and cell death, as a result of electroporation.

Problem Addressed

Irreversible electroporation is a non-thermal injury ablative modality that is used in the treatment of locally advanced soft tissue tumors. This technique has been successfully performed intraoperatively, laparoscopically and percutaneously. Electroporation techniques utilize intense, yet brief, pulsed electric fields to permeabilize the cell membrane in order to allow for chemical transport across the normally impermeant membrane. Electroporation-based procedures are used clinically to ablate cancer tissue while minimizing collateral damage to the abiotic tissue components. In order to ensure that cells within the target tissue are sufficiently permeabilized, clinicians frequently apply electric field intensities and durations beyond what is required to effectively treat the target tissue. This may result in inadvertent thermal damage due to the excessive electrical current that may pass through and heat the tissue. When temperature of the tissue is increased for a prolonged period of time, protein denaturation and other thermal damage may occur in physiological cells and tissues that may result in further post-operative complications. Therefore, there remains a need in the art of electroporation based methods for the reduction or mitigation of thermal damage that limits conventional electroporation techniques. The current technology addresses this need by presenting a method that induces a high permeability state in cells by using reduced electrical energy required to disrupt the cell membrane.

Technology

This invention describes a method for ablating a target tissue, such as that of a tumor. This low energy, high-intensity permeabilization method can ablate a target tissue by placing electrodes around the tissue and applying an electrical pulse in a manner that results in a change in the cell's osmotic pressure difference. The presence of long lived pores (LLPs) following electroporation causes a change in the cell's osmotic pressure difference. This altered pressure differential results in the eventual expansion of LLP's and induces high permeability state in the outer cell membrane beyond what is survivable for the cell. MRI, ultrasound, or CT scan can be used during treatment to monitor the extent of ablation and to detect any untreated residual tumor. This invention can be combined with adjuvants such as chemotherapeutic drugs to further enhance membrane permeability. Various tumor ablation protocols, such as irreversible electroporation, can also be modified using this method by changing the electrical pulsing protocol to use smaller and fewer pulses, which would result in less tissue heating and less nerve stimulation. This invention represents a new regime of pulse parameters for application that are able to decrease the amount of thermal damage to the target cells by dramatically decreasing the total energy applied during an electroporation-based treatment.
Advantages

- Utilizes less electrical energy
- Mitigates thermal damage to the tissue

Categories For This Invention:

- Life Sciences
- Clinical Applications
- Oncology
- Therapeutics
- Other (Therapeutics)

Intellectual Property:

Low energy permeabilization of long-lived and traditional transient pores for methods for inducing electroporation and tissue ablation
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Methods for inducing electroporation and tissue ablation
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Inventors:

James Weaver
Thiruvallur Gowrishankar
Reuben Son

External Links:

Weaver Group
http://epore.mit.edu/personnel/jcweaver.html