Contribution ID: **211** Type: **Poster Presentation**

Experimental Study on Variations of Rabbit Tissue Impedance during Irreversible Electroporation Ablation

Thursday 7 July 2016 14:10 (20 minutes)

Irreversible electroporation (IRE) is a new method for tissue ablation. An exposure of a cell to a sufficiently high external electric field results in irreversible electroporation. The electrical conductivity of the cells will change during the irreversible electroporation, and the impedance of the tissue will also change. This paper uses various tissues of New Zealand white rabbits for study, which are applied high intensity microsecond pulses. We measure and analyze the change rules of the tissue impedance. The experimental results show that all the biological tissues impedance in the irreversible electroporation will decrease. And with the increase of pulses number, the impedance will decrease to a stable value. Electroporation occurs on the cells which are applied high intensity pulsed electric field and the electrical conductivity increases. Then the conductivity reaches a maximum when irreversible electroporation takes place. When the applied pulsed electric field disappears, the impedance of biological tissues becomes larger again, and some pores return spontaneously to their pre-breakdown state. Through the study of the tissue impedance change rule, we can estimate that whether the irreversible electroporation occurs in the biological tissues. The result can help judge whether the tissues are ablated effectively.

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Session Classification: Poster 2-A

Track Classification: Biological, Medical, and Environmental Applications of Power Modulators