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High Frequency Irreversible Electroporation Ablate Tissues with Plate Electrodes Inhibiting Muscle Contraction

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Irreversible electroporation (IRE) with non-thermal has quickly translated into clinical applications for solid tumors ablation. However, muscle contractions and tumors recurrence also come with IRE. Bursts of high frequency bipolar pulses have been reported may solve these problems appropriately, but muscle contractions need further reduction and the ablation effects and uniform electric field distribution in heterogeneous tissues also need experimental validation. We presented rabbit livers ablation experiments with the bursts of bipolar high frequency pulses (which are called H-FIRE) and IRE pulses through Plate Electrodes. Plate electrodes can eliminate non-uniform electric field distribution which come with needle electrodes, and minimize current flow outside of the treatment volume to limit muscle contractions. The results from the animal experiments and simulations showed that H-FIRE can be less susceptible to distortions due to the vessels without muscle contractions, and the parameters of the bursts should be optimized for better ablation effect. Integrating into account the ablation effect and muscle contraction, we consider that the bipolar bursts with the individual pulse durations for 5 μ s and 10 μ s, electric field intensity for 2000 V/cm, can replace the traditional IRE, which have a good ablation effects and less extent of muscle contractions for animals.

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