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PARAMETERS OF IRREVERSIBLE ELECTROPORATION IN ONCOLOGICAL THERAPY – A REVIEW OF CURRENT SOLUTIONS

Keywords: electroporation, ablation, oncology, high-voltage pulses generator

Ablation is the most frequent method of therapeutic tissue destruction, widely used in cancer therapy. The most common are thermal ablation methods, which use high (RF ablation) or low (cryoablation) temperatures to destroy tissue. Exposure to temperature causes tissue necrosis. Thermal methods, due to the low precision of the thermal impact, also damage the healthy tissue surrounding the cancerous tissue. These disadvantages are not present in non-thermal ablation methods. The main method of non-thermal ablation is irreversible electroporation. Electroporation involves acting on cells with short series of high-voltage pulses. This results in the formation of pores in cell membranes (permeabilization). When the pulse energy is lower than the cell-specific critical energy, the pores can naturally close (reversible electroporation). However, if the pulse energy is higher than the critical energy of the cell, then apoptosis, or programmed cell death, occurs (irreversible electroporation).

The purpose of this paper is to determine the range of time and amplitude parameter settings for pulses generated by an electroporator dedicated to experimental research in cancer therapy in animal models and with patients. The goal of the research will be to optimize the parameters of irreversible electroporation depending on the type of cancer tissue. Therefore, the electroporator must make it possible to program electroporation parameters within the widest possible ranges. Moreover, the device must meet all the requirements for medical devices.

The paper contains an analysis of the pulse parameters used in cancer therapy presented in the literature on the subject. On this basis, parameters, such as the shape, phase and amplitude of pulses, the number and frequencies of pulses in a packet, and the number and repetition rate of pulse packets were adopted. The parameters determined in this way will serve as a design requirements for the construction of an electroporator dedicated to research applications in cancer therapy.