**Original Paper**

# Thermal distribution in ablation of squamous cell carcinoma skin tumors using irreversible electroporation

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## Abstract

**Background and Objective:** Irreversible electroporation is a new treatment modality for skin tumors ablation. In order to successful treatment, all of tumoral tissues must be exposed to intense electric field. In addition, the heat that produced during the surgery has adverse effect on recovery procedure. This study was done to evaluate the thermal distribution in ablation of squamous cell carcinoma skin tumors using irreversible electroporation.

**Materials and Methods:** In this study numerical modeling by finite element was used for determination of electrical and thermal distribution in healthy and tumoral tissues. Three-Dimensional Model was done using MR imaging of patient with squamous cell carcinoma in FEMLAB v3.5a software. Electric field distribution determined using Laplace equation and distribution of thermal damage calculated using bioheat equation and Arrhenius equation. This calculation was done for different geometry parameters of needle and plate electrodes.

**Results:** Thermal damage of first-degree burn was not observed in any cases. However in high voltage, volume with temperature above 43˚C reach to 10% of tumoral tissue and 3% of healthy tissue. The study show that the voltage applied to the electrodes and the distance between the electrodes can have the greatest impact on the thermal and electrical distributions. Although needle electrode showed better electric coverage in tumoral area.

**Conclusion:** This study showed that it can be possible to select optimized electric and geometric parameter to select electrode for complete tumor ablation, control of thermal damage in tumoral and healthy tissues.

**Keywords:** Irreversible electroporation, Tumor ablation, Thermal damage, Cancer skin, Numerical modeling

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