

Purpose: To study the efficiency of a dual-slot antenna with a floating metallic sleeve on the ablation of different ex vivo bovine tissues.

Materials and methods: COMSOL Multiphysics version 4.4 (Stockholm, Sweden), which is based on finite element methods (FEM), was used to design and simulate monopole and dual-slot with sleeve antennas. Power, specific absorption rate (SAR), temperature and necrosis distributions in the selected tissues were determined using these antennas. Monopole and dual-slot with sleeve antennas were designed, simulated, constructed and applied in this study based on a semi-rigid coaxial cable. Ex vivo experiments were performed on liver, lung, muscle and heart of bovine obtained from a public animal slaughterhouse. The microwave energy was delivered using a 2.45 GHz solid-state microwave generator at 40 W for 3, 5 and 10 min. Aspect ratio, ablation length and ablation diameter were also determined on ablated tissues and compared with simulated results. The student's t-test was used to compare the statistically significant difference between the performances of the two antennas.

Results: The dual-slot antenna with sleeve produces localised microwave energy better than the monopole antenna in all ablated tissues using simulation and experimental validation methods. There were significant differences in ablation diameter and aspect ratio between the sleeve antenna and monopole antenna. Additionally, there were no significant differences between the simulation and experimental results.

Conclusions: This study demonstrated that the dual-slot antenna with sleeve produced larger ablation zones and higher sphericity index in ex vivo bovine tissues with minimal backward heating when compared with the monopole antenna.