Focused microwave phased array thermotherapy for ablation of early-stage breast cancer: results of thermal dose escalation.

BACKGROUND: Tumor ablation as a means of treating breast cancer is being investigated. Microwave energy is promising because it can preferentially heat high-water-content breast carcinomas, compared to adipose and glandular tissues.

METHODS: This is a prospective, multicenter, nonrandomized dose-escalation study of microwave treatment. Thermal dose was measured as (1) thermal equivalent minutes (cumulative equivalent minutes; CEM) of treatment relative to a temperature of 43 degrees C and (2) peak tumor temperature. Microwaves were guided by an antenna-temperature sensor placed percutaneously into the tumor. Outcomes measured were pathologic response (tumor necrosis) side effects. RESULTS: Twenty-five patients (mean age, 57 years) were enrolled. The mean tumor diameter was 1.8 cm. Tumoricidal temperatures (>43 degrees C) were reached in 23 patients (92%). Tumor size was unchanged after thermotherapy (P = not significant). Pathologic necrosis was achieved in 17 (68%) patients. Complete necrosis of the invasive component was achieved in two patients. One hundred forty CEM is predictive of a 50% tumor response, and 210 CEM is predictive of a 100% tumor response (P = .003). Univariate linear regression predicts that peak tumor temperatures of 47.4 degrees C and 49.7 degrees C cause a 50%
tumor response and a 100% tumor response, respectively. CONCLUSIONS: Thermotherapy causes tumor necrosis and can be performed safely with minimal morbidity. The degree of tumor necrosis is a function of the thermal dose. Future studies will evaluate the impact of high doses of thermotherapy on margin status and complete tumor ablation.