Purpose: Microwave ablation (MW) is a new technology that utilizes microwave energy to heat and kill liver tumors. It offers several theoretical advantages over currently available radiofrequency (RF) devices, which have poor performance near vessels due to the cooling effect of local blood flow. MW ablation offers a larger zone of active heating (1cm radius for MW, 1-2mm for RF) and the ability to use multiple MW probes (up to 8 at one time) to create large overlapping lesions. Also, RF ablation is limited by tissue charring at temperatures greater than 100°C, while MW is not. This study was designed to determine the optimal power and duration of MW application in an *in vivo* porcine model.

Methods: MW lesions were generated in 7 domestic swine using a prototype 13g dipole microwave antenna driven by a 915MHz generator (Vivant Medical). Four lesions were generated at each of 12 possible combinations of power and time (30, 40, and 50W; 5, 10, 15, and 20 minutes), for a total of 48 lesions. Lesion temperature was recorded with a fiber-optic measurement system. Ablation lesions were sectioned at 3 mm intervals and lesion dimensions were measured.

Results: Lesion size increased with power as an independent variable ($p=0.006$, ANOVA). There was a trend for increasing lesion size with increasing time, however this did not reach significance ($p=0.07$). Lesion size was largest at 50W power and 20 minute duration, with a short-axis diameter of 2.2±.7cm, long-axis diameter of 5.7±0.7cm, and volume of 20.8±13.1cm^3. Reflected power (power returned to the generator rather than deposited into the tissue) was 2.5±3.0W at 30W, 5.7±4.9W at 40W, and 13.9±5.9W at 50W ($p<0.001$). Lesion temperature increased with power, but not time ($p=0.04$ and $p=0.5$ respectively) to 134±31°C at 50W.

Conclusions: MW ablation successfully creates coagulation necrosis in hepatic tissue. Lesion size increases with applied power. Although there is a trend towards increased size with increasing duration, this does not reach significance. Ablation temperature is considerably higher than that seen in commercially available RF systems. At high levels of applied power (50W) reflected power begins to rise, causing feedback and heating of the MW system itself. This may be minimized by further refinements in the prototype MW device. As clinical Phase I trials of MW ablation in the treatment of unresectable liver tumors proceed, ablation should be performed at 40W power in order to maximize lesion size while minimizing reflected power.