

Title:	Comparison of Microwave and Radiofrequency Ablation of Hepatic Tissue in a Porcine in Vivo Model
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Abstract:

Purpose: Microwave thermal ablation has not been widely utilized for tumor ablation outside of Asia. Recently, a new microwave ablation (MW) device has been developed that has several theoretical advantages over radiofrequency ablation (RF) including: a larger zone of active heating (1 cm radius for MW, 1-2 mm for RF), the ability to ablate large or multiple zones of liver using multiple probes (up to 8), and more rapid tissue heating. Also, current RF systems are limited by tissue charring to 100°C, while MW is not. This study was designed as an initial evaluation of the clinical and pathological characteristics of MW vs. RF ablation.

Methods and Materials: Eight domestic pigs (wt=40 kg) were placed under general anesthesia, and the liver exposed through a midline incision. Four pigs received 4 RF lesions each (RITA Medical Model 90, Irvine, CA, deployed to 3cm, 100°C target temperature, 10 minute duration), while 4 pigs received 4 MW lesions each (Vivant Medical Systems, Irvine, CA, 40 Watts power, 10 minute duration). Animals were closed and allowed to recover. Blood was drawn at 2 days and 4 weeks for complete blood count and liver function tests. Animals were sacrificed at 4 weeks and livers removed and perfused with formalin via the portal vein. Tissue was sectioned at 3 mm intervals and lesion dimensions were measured. Specimens were stained and tissue histology was examined.

Results: Mean lesion volumes were $7.0 \times 5.4 \text{ cm}^3$ and $6.4 \pm 7.7 \text{ cm}^3$ for MW and RF, respectively ($p > .05$, student's t-test). White blood cell counts were 12.1 ± 2.2 and 12.6 ± 0.3 at 2 days ($p > .05$, student's t-test) and 14.9 ± 1.8 and 16.2 ± 3.6 at 4 weeks ($p > .05$, student's t-test) respectively. Total bilirubin levels were 0.2 ± 0.0 and 0.1 ± 0.0 at 2 days ($p > .05$, student's t-test) and 0.1 ± 0.0 and 0.3 ± 0.2 at 4 weeks ($p > .05$, student's t-test) respectively. All specimens demonstrated coagulative necrosis on pathology.

Conclusion: No significant differences in laboratory values or histology could be identified in animals undergoing

either RF or microwave ablation. Microwave ablation has several potential advantages when compared to current RF ablation devices, and further investigation of these advantages appears warranted. (F.T.L., A.S.W. has received research support from Vivant Medical.)