



Editorial

Microwave thermosphere versus radiofrequency ablation for hepatocellular carcinoma: Are we approaching the time to end the debate?

Man-Deuk Kim

Department of Interventional Radiology, Severance Hospital, Seoul, Korea

Keywords: Microwaves; Radiofrequency ablation; Carcinoma, Hepatocellular

See Article on Page 564

Although microwave ablation (MWA) exhibits high thermal efficiency, conventional MWA systems still have major limitations such as unpredictability of the ablation zone size and the elliptical shape of necrosis. Many studies have compared the efficacy of MWA to radiofrequency ablation (RFA), but most used conventional MWA before 2014. The Emprint™ Ablation System was approved for use by the Food and Drug Administration on April 28, 2014, and it can provide predictable ablation results and outcomes regardless of the target location or tissue type. The unique properties that allow Emprint Ablation to produce reliable large spherical zones of ablation rely on three types of energy control: 1) thermal, 2) field, and 3) wavelength. Few studies have compared Emprint™ Ablation System with Thermosphere™ Technology to RFA.

Recently, Tamai and Okamura¹ evaluated the safety and efficacy of the new next-generation microwave thermosphere ablation (MTA) for small hepatocellular carcinoma (HCC). This retrospective

study of 513 patients determined that MTA was superior to RFA, based on both the local tumor progression rate and the overall survival rate at 3 years.

The main limitation of this study was that the patient recruitment period was different between the MTA and RFA groups. There was also a significant difference in the proportion of perivascular tumors between the two groups. Therefore, the comparison should have been performed after the matching of important characteristics. Interestingly, a similar study that was based on a propensity score-matched analysis found no significant differences in recurrence-free survival and overall survival between the Emprint ablation system and RFA for small HCC.²

Although the relationship between local tumor progression and overall survival remains controversial, this data was from a relatively large patient population and used the Emprint System with Thermosphere Technology. Comprehensive data analyses could reveal novel findings by comparing previous studies. A meta-analysis by Glassberg et al.³ showed that local tumor progression was more significantly reduced by MWA compared to RFA, with similar safety outcomes.

Abbreviations:

HCC, hepatocellular carcinoma; MTA, microwave thermosphere ablation; MWA, microwave ablation; RFA, radiofrequency ablation

Corresponding author: Man-Deuk Kim

Department of Interventional Radiology, Severance Hospital, 50-1 Yonsei-ro, Seodaemun-gu, Seoul 03722, Korea
Tel: +82-2-2228-2355, Fax: +82-2-2227-8337
E-mail: MDKIM@yuhs.ac
<https://orcid.org/0000-0002-3575-5847>

Editor: Edward Lee, Ronald Reagan UCLA Medical Center, CA, USA

Received: Aug. 29, 2021 / **Accepted:** Sep. 3, 2021

For HCC <3 cm in diameter located outside the hilar region, MTA may be recommended over RFA due to its shorter procedure time. The risk of local ablation increases due to the presence of perivascular spaces. The possibility of bile duct injury also increases, especially when the mass is adjacent to the hilar region. Heat-based thermal ablation methods can cause vascular thrombosis, and the portal vein is more susceptible to thrombosis than the hepatic vein after MWA.⁴ Biological differences in thrombogenicity, rather than heat transfer, between the portal vein and hepatic vein may contribute to their different rates of thrombosis.⁵ Since extensive portal vein thrombosis can cause liver failure in patients with poor hepatic reserves, extra care must be taken during heat-based thermal ablation of the hilar region.

In conclusion, MTA has shown promising results for small HCC in a limited number of studies. Therefore, it is at least as safe and effective as RFA in HCC, and is recommended for HCC >2.5–3 cm. A large, randomized controlled study is necessary to validate the efficacy of MTA compared to RFA.

Conflicts of Interest

The author has no conflicts to disclose.

REFERENCES

1. Tamai H, Okamura J. New next-generation microwave thermosphere ablation for small hepatocellular carcinoma. *Clin Mol Hepatol* 2021; 27:564-574.
2. Kuroda H, Nagasawa T, Fujiwara Y, Sato H, Abe T, Kooka Y, et al. Comparing the safety and efficacy of microwave ablation using Thermosphere™ technology versus radiofrequency ablation for hepatocellular carcinoma: a propensity score-matched analysis. *Cancers (Basel)* 2021;13:1295.
3. Glassberg MB, Ghosh S, Clymer JW, Qadeer RA, Ferko NC, Sadeghirad B, et al. Microwave ablation compared with radiofrequency ablation for treatment of hepatocellular carcinoma and liver metastases: a systematic review and meta-analysis. *Onco Targets Ther* 2019;12:6407-6438.
4. Chiang J, Cristescu M, Lee MH, Moreland A, Hinshaw JL, Lee FT, et al. Effects of microwave ablation on arterial and venous vasculature after treatment of hepatocellular carcinoma. *Radiology* 2016;281:617-624.
5. Chiang J, Nickel K, Kimple RJ, Brace CL. Potential mechanisms of vascular thrombosis after microwave ablation in an in vivo liver. *J Vasc Interv Radiol* 2017;28:1053-1058.