Combined Microwave Ablation and Checkpoint Inhibitor Therapy: A Synergistic Strategy for Immuno-Oncology

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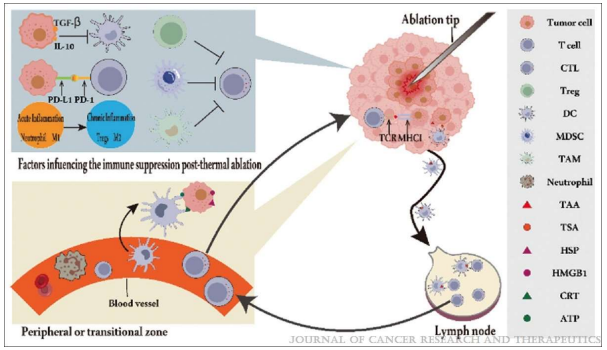
Background

- Microwave ablation (MWA) triggers immunogenic cell death, releasing damage-associated molecular patterns (DAMPs) that activate dendritic cells (DCs) and prime cytotoxic T lymphocytes (CTLs).
- MWA also upregulates MHC I on tumor cells, enhancing the CTL response.
- However, this effect is often counteracted by upregulation of immune checkpoint proteins like PD-L1, suppressing T-cell activity and enabling immune evasion.
- Combining MWA with immune checkpoint inhibitors (ICIs) such as camrelizumab may overcome this immunosuppressive effect, enhancing antitumor immunity



Liu P, Wei Z, Ye X. Immunostimulatory effects of thermal ablation: Challenges and future prospects. J Cancer Res Ther. 2024 Apr 1;20(2):531-539. doi: 10.4103/jcrt.jcrt_2484_23. Epub 2024 Apr 30. PMID: 38687922.

Purpose

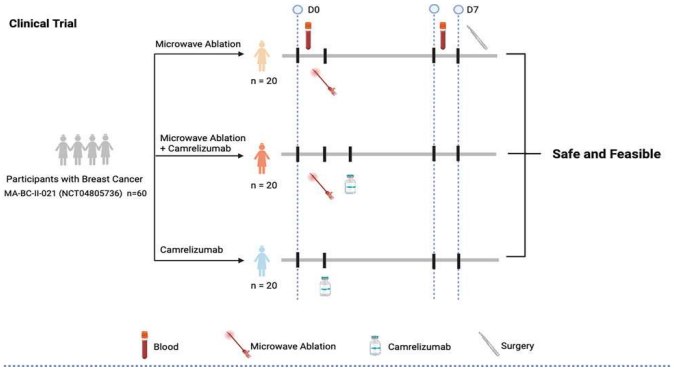
This exhibit reviews mechanistic insights, translational data, and recent clinical studies evaluating the safety and efficacy of combination MWA/ICI therapy in non-small cell lung carcinoma and breast carcinoma.

Materials and Methods

A review of translational and clinical studies on combination MWA/ICI therapy in non-small cell lung carcinoma (NSCLC) and breast carcinoma was conducted, focusing on safety, clinical outcomes, antitumor immune function, and mechanistic insights.

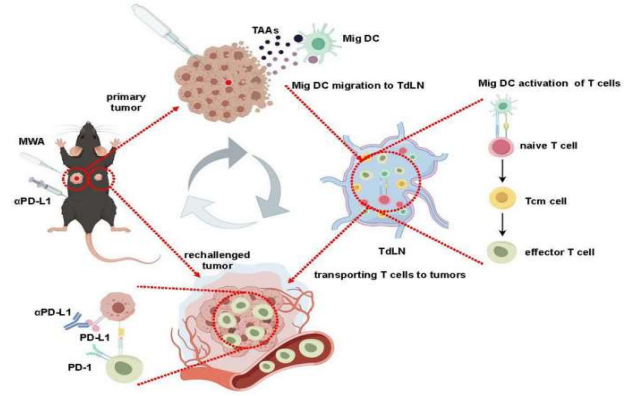
Results

1. Early-stage Breast Cancer (2024 RCT, n=60):
   - MWA/camrelizumab combination therapy was well tolerated.
   - scRNA-seq: ↑ $CD8^+$ T-cell cytotoxicity, ↑ immunologic memory, ↑ MHC-I and IFN signaling.



Pan H, Yu M, Tang X, Mao X, Liu M, Zhang K, Qian C, Wang J, Xie H, Qiu W, Ding Q, Wang S, Zhou W. Preoperative single-dose camrelizumab and/or microwave ablation in women with early-stage breast cancer: A window-of-opportunity trial. Med. 2024 Apr 12;5(4):291-310.e5. doi: 10.1016/j.medj.2024.01.015. Epub 2024 Feb 27. PMID: 38417440.

2. Advanced NSCLC (2025 retrospective, n=62):
   - MWA/ICI combination therapy improved ORR and prolonged PFS vs camrelizumab alone.
   - Mouse rechallenge: MWA alone cleared primary tumors, but only combination therapy prevented recurrence.



Xu F, Sang J, Wang N, Wang M, Huang Y, Ma J, Chen H, Xie Q, Wei Z, Ye X. Microwave ablation combined with immune checkpoint inhibitor enhanced the antitumor immune activation and memory in rechallenged tumor mouse model. Cancer Immunol Immunother. 2025 Mar 25;74(5):161. doi: 10.1007/s00262-025-04003-5. PMID: 40131498; PMCID: PMC11937475.

Conclusions

- Combination MWA/ICI therapy is a promising, minimally invasive strategy that enhances antitumor immunity in breast cancer and NSCLC.
- Early evidence suggests good tolerability and potential to reduce recurrence.
- Large randomized trials are needed to confirm these benefits and optimize treatment protocols.

References

1. Liu P, Wei Z, Ye X. Immunostimulatory effects of thermal ablation: Challenges and future prospects. J Cancer Res Ther. 2024 Apr 1;20(2):531-539. doi: 10.4103/jcrt.jcrt_2484_23. Epub 2024 Apr 30. PMID: 38687922.

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