

Chlorogiannis DD, Sotirchos VS, Georgiades C, Filippiadis D, Arellano RS, Gonen M, Makris GC, Garg T, Sofocleous CT. *The Importance of Optimal Thermal Ablation Margins in Colorectal Liver Metastases: A Systematic Review and Meta-Analysis of 21 Studies*. *Cancers* (Basel). 2023 Dec 12;15(24):5806. doi: 10.3390/cancers15245806. PMID: 38136351; PMCID: PMC10741591.

Section	Key Points
Background	- Thermal ablation is a sufficient alternative to partial hepatectomy for select cases of colorectal cancer (CRC) (ablative margin of >5mm).
Purpose	- To investigate the current evidence supporting the set optimal thermal ablation margin (>5mm) for local treatment of CRC liver metastasis (CLM).
Methods	- Meta-analysis involving 21 studies, 2005 participants, and 2873 ablated CLMs. - 3D software ablation zone assessment techniques were employed in the measurement of the margin. - Measure of ablative effect was measured using risk ratios.
Key Findings	- Tumor ablations with margins <5mm were associated with a 3.6 times higher risk for local tumor progression. (p<0.001) - Using 3D modeling software, the risk ratio of margins <5mm increases to 5.1 times higher risk for LTP (p<0.001). - An ablation margin of >5mm but <10mm posed a 3.64 time higher risk for LTP compared to >10mm margins (p<0.001).
Conclusion	- An ablation margin >5mm is the minimum critical endpoint required. - A minimal margin of >10mm yields optimal tumor control after ablation of CLMs.

Vasiniotis Kamarinos N, Vakiani E, Gonen M, Kemeny NE, Sigel C, Saltz LB, Brown KT, Covey AM, Erinjeri JP, Brody LA, Ziv E, Yarmohammadi H, Kunin H, Barlas A, Petre EN, Kingham PT, D'Angelica MI, Manova-Todorova K, Solomon SB, Sofocleous CT. *Biopsy and Margins Optimize Outcomes after Thermal Ablation of Colorectal Liver Metastases*. *Cancers (Basel)*. 2022 Jan 29;14(3):693. doi: 10.3390/cancers14030693. PMID: 35158963

Section	Key Points
Background	<ul style="list-style-type: none"> - Thermal Ablation is an effective, low-risk treatment for colorectal liver metastases (CLMs), either alone or with surgery. - Local tumor progression (LTP) remains a concern.
Purpose	<ul style="list-style-type: none"> - Evaluate post-ablation biopsy as an independent predictor of LTP.
Methods	<ul style="list-style-type: none"> - Prospective phase II study with 107 patients treated for 182 CLMs (2009-2019). - Ablation Methods: 49% radiofrequency, 51% microwave. - Eligibility: Up to 3 tumors (<5 cm) with controlled extrahepatic disease. - Margin Assessment: 2D manual and 3D software-assisted methods used to evaluate margins. - Imaging Follow-Up: CT scans at 4–8 weeks, then every 2–4 months for 3 years.
Key Findings	<ul style="list-style-type: none"> - Biopsy results and margins are critical for predicting LTP, while tumor size and ablation method are not. - Minimum 5 mm circumferential margin recommended for effective local control. - Post-ablation biopsy value provides objective assessment of tumor viability, correlating with LTP.
Clinical Implications	<ul style="list-style-type: none"> - Routine post-ablation biopsies should be integrated into clinical practice to evaluate treatment effectiveness. - Ongoing studies aim to improve understanding of tissue viability and refine assessment strategies.
Conclusion	<ul style="list-style-type: none"> - Biopsy-proven complete tumor ablation with margins of at least 5 mm achieves optimal local tumor control for CLM, regardless of the ablation modality used.

Shady W, Petre EN, Do KG, Gonen M, Yarmohammadi H, Brown KT, Kemeny NE, D'Angelica M, Kingham PT, Solomon SB, Sofocleous CT. *Percutaneous Microwave versus Radiofrequency Ablation of Colorectal Liver Metastases: Ablation with Clear Margins (A0) Provides the Best Local Tumor Control*. J Vasc Interv Radiol. 2018 Feb;29(2):268-275.e1. doi: 10.1016/j.jvir.2017.08.021. Epub 2017 Dec 6. PMID: 29203394; PMCID: PMC5803367. <https://pubmed.ncbi.nlm.nih.gov/29203394/>

Section	Key Points
Purpose	<ul style="list-style-type: none"> - Identify and compare predictors of local tumor progression free survival (LTPFS) after RFA and MWA of CLM.
Methods	<ul style="list-style-type: none"> - Retrospective review of 110 CLM patients from 2009-2015. - Margins measured on contrast-enhanced CT 6 weeks post-ablation. - Predictors of LTPFS assessed using a competing risk model adjusted for clustering.
Ablation Procedure	<ul style="list-style-type: none"> - General anesthesia with continuous electrophysiologic monitoring, CT with fluoroscopy ± ultrasonography. - Ablations performed according to the manufacturer's protocol with aim of margin > 5 mm.
Key Findings	<ul style="list-style-type: none"> - No difference in local tumor progression (LTP) rates between RFA and MWA. - Predictors of shorter LTPFS in RFA: margins ≤ 5 mm and peri-vascular tumors. - Predictors of shorter LTPFS in MWA: margins ≤ 5 mm and no history of prior liver resection. - No LTP for tumors ablated with margins over 10 mm.
Conclusion	<ul style="list-style-type: none"> - Sufficient ablation margins remain the most important technical factor for complete tumor ablation. - A0 margins (>10 mm) likely provide complete tumor necrosis. - Regardless of thermal ablation modality, a minimum margin of 5 mm is critical.

Shady W, Petre EN, Gonen M, Erinjeri JP, Brown KT, Covey AM, Alago W, Durack JC, Maybody M, Brody LA, Siegelbaum RH, D'Angelica MI, Jarnagin WR, Solomon SB, Kemeny NE, Sofocleous CT. *Percutaneous Radiofrequency Ablation of Colorectal Cancer Liver Metastases: Factors Affecting Outcomes--A 10-year Experience at a Single Center*. *Radiology*. 2016 Feb;278(2):601-11. doi: 10.1148/radiol.2015142489. Epub 2015 Aug 12. PMID: 26267832; PMCID: PMC4734163 <https://pubmed.ncbi.nlm.nih.gov/26267832/>

Section	Key Points
Purpose	<ul style="list-style-type: none"> - Identify predictors of outcomes after RFA of CLMs. - Evaluate a modified clinical risk score (CRS) for patient stratification and prognosis.
Methods	<ul style="list-style-type: none"> - Retrospective review of 162 patients with 233 CLMs treated with RFA from 2002 to 2012. - Assessed treatment effectiveness with CT 4-8 weeks after RFA. - Calculated OS and LTPFS.
Patient Population	<ul style="list-style-type: none"> - 72% of patients had liver recurrences after hepatectomy. - 28% had unresectable disease or refused hepatectomy.
RFA Procedure	<ul style="list-style-type: none"> - prophylactic antibiotic cefazolin 1 g, general anesthesia, - CT or PET CT used to visualize tumor; US or fluoro guidance for probe positioning - Ablation aimed to create a margin at least 5 mm larger than the tumor. - Immediate post-procedure triple-phase CT started in November 2009.
Key Findings	<ul style="list-style-type: none"> - Tumor size > 3 cm and margin size ≤ 5 mm were independent predictors of shorter LTPFS. - Tumor size > 3 cm and >1 site of EHD predicted shorter OS. - RFA of CLMs in patients with lung-only EHD was linked to better OS than in patients with >1 site of EHD.
Clinical Implications	<ul style="list-style-type: none"> - RFA for CLMs should be considered for patients with controllable lung-only EHD. - RFA should aim to create a margin > 10 mm when feasible.
Study Limitations	<ul style="list-style-type: none"> - Retrospective, single-institution design limits generalizability. - Lack of histopathologic evaluation of tumors.