

Echo-guided Local Ablation for Liver Metastasis (Taiwan Academy of Tumor Ablation Guideline)

CME
Credits

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INTRODUCTION

Among all malignant liver tumors, metastatic liver tumors (MLTs) are the most prevalent, accounting for approximately 70% to 90% of cases.^[1] This proportion is even higher in regions where hepatitis B and C viruses are not endemic. The liver's status as the largest solid organ with a rich dual blood supply makes it particularly vulnerable to metastasis. The most common primary tumors leading to liver metastases include colorectal cancer, gastric cancer, pancreatic cancer, breast cancer, and lung cancer.

ROLE OF ABLATION THERAPY

Ablation therapy is a minimally invasive local treatment modality; initially, it has been performed for the treatment of hepatocellular carcinoma (HCC). Over time, its application has expanded to extrahepatic organs such as the kidneys, lungs, and thyroid. The major advantages of ablation include smaller incisions, shorter recovery time, lower procedural risk, reduced injury to organs, and preservation of organ function.^[2]

Recent clinical and research evidence increasingly supports the role of local ablation therapy in the management of liver metastases. Beyond achieving local tumor control and symptom relief, ablation therapy combined with systemic therapy has also demonstrated the potential to improve overall survival, particularly in patients with unresectable colorectal liver metastases (CRLM), where evidence is most abundant and robust.^[3]

ULTRASOUND-GUIDED ABLATION AND ADVANCED TECHNIQUES

Ultrasound (US) is the most commonly used modality for image-guided ablation due to its real-time imaging capability,

absence of ionizing radiation, and lower cost. It can be used through percutaneous or intraoperative methods. However, US has limitations – particularly in visualizing lesions obscured by the lungs, as it cannot effectively penetrate air-filled tissues. For inconspicuous lesions under conventional US, advanced techniques such as fusion imaging and contrast-enhanced US (CEUS) have been introduced.^[4,5]

For subdiaphragmatic tumors that are blocked by the lungs on imaging, artificial ascites or artificial pleural effusion can be used to create an acoustic window. These fluid mediums not only enhance lesion visibility but also act as a protective buffer, reducing the risk of thermal injury to adjacent organs during ablation, especially for tumors located at the periphery of the liver.^[6,7]

PATIENT SELECTION FOR ABLATION THERAPY IN LIVER METASTASES

The standard treatment for liver metastases is systemic therapy, including chemotherapy, targeted therapy, and immunotherapy. However, in cases of oligometastatic liver disease (OLD), locoregional treatment should be considered. Local options include surgical resection, ablation therapy, transarterial embolization therapy, and stereotactic body radiotherapy (SBRT).^[8]

Candidates suitable for ablation therapy generally meet the following criteria:

1. The primary tumor is either cured or well controlled
2. No more than one extrahepatic metastatic organ, which must also be well controlled
3. No more than five liver metastatic lesions.

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Abbreviations

CEUS	Contrast-enhanced ultrasound
CRLM	Colorectal liver metastasis
HCC	Hepatocellular carcinoma
MLT	Metastatic liver tumor
MWA	Microwave ablation
OLD	Oligometastatic liver disease
RFA	Radiofrequency ablation
SBRT	Stereotactic body radiotherapy
TATA	Taiwan academy of tumor ablation
US	Ultrasound

For optimal ablation outcomes, tumor size plays a critical role. Tumors ≤ 3 cm in diameter have the highest chance of complete ablation. For tumors between 3 and 5 cm, the success rate decreases.^[9] Local ablation may also be combined with other locoregional treatments such as surgery, transarterial embolization therapy, or SBRT as part of a multimodal strategy to enhance therapeutic efficacy.

TECHNICAL CONSIDERATIONS AND DEVICE SELECTION

To minimize local recurrence, the ablation zone should encompass the tumor and include a safe margin of at least 0.5 cm, with a preferable margin of more than 1 cm.^[10] Regarding thermal ablation modalities, both radiofrequency ablation (RFA) and microwave ablation (MWA) are widely used. RFA has a longer history of clinical use and a larger volume of supporting literature. However, modern MWA systems offer significant advantages, including higher temperatures, faster ablation times, and a larger active zone of ablation. MWA also demonstrates reduced sensitivity to the heat-sink effect, making it more effective for tumors larger than 3 cm or those located adjacent to blood vessels.^[11,12]

TAIWAN ACADEMY OF TUMOR ABLATION GUIDELINE DEVELOPMENT

The consensus guidelines developed by the Taiwan Academy of Tumor Ablation (TATA) represent evidence-based medical statements. These guidelines are created and reviewed by an expert team including hepatologists, medical oncologists, radiation oncologists, and intervention radiologists through comprehensive medical literature searches, discussions, and voting. The process adheres to evidence-based standards, such as evaluating levels of evidence and grading recommendations based on “The Oxford 2011 Levels of Evidence and 2009 Grades of Recommendation.”^[13] Furthermore, the guidelines are finalized through thorough discussions among all experts and by calculating voting consistency.

CONSENSUS GUIDELINE OF “TAIWAN ACADEMY OF TUMOR ABLATION (TATA)” (UNDER REVISION BY THE JOURNAL OF “LIVER CANCER”):

- General concept for MLTs
 - Statement 1: MLTs are considered a systemic disease,

and the feasibility of locoregional treatment should be evaluated in addition to systemic therapies; ablation therapy is one of the locoregional treatment methods for MLTs

- Statement 2: For patients whose primary tumor is controlled or cured and who have up to one well-controlled extrahepatic metastatic organ, locoregional treatment can help control MLTs
- Ablation for MLTs
 - Statement 3: Ablation therapy is an effective treatment for OLDs, defined as having 1–5 MLTs. It is more effective in treating tumors ≤ 3 cm and is primarily intended as an adjunctive treatment for unresectable CRLM with tumors in the size range of 3–5 cm
 - Statement 4: The ablation margin exceeding 1 cm is the most critical factor of long-term local tumor control
 - Statement 5: Artificial ascites, artificial pleural effusion, or pneumoperitoneum techniques improve ablation safety for tumors near critical structures or organs
 - Combined treatment with ablation
 - Statement 6: Combination of thermal ablation with SBRT shows promise in managing larger or challenging location of liver metastases
 - Statement 7: Combining thermal ablation with transarterial therapies enhances local control in larger or multifocal liver metastases
 - Statement 8: Combining surgical resection and ablation provides a comprehensive strategy for patients with both resectable and unresectable liver metastases
 - Effectiveness of ablation
 - Statement 9: Ablation therapy is an alternative to surgical resection for achieving local tumor control and symptom relief in MLTs
 - Statement 10: Thermal ablation shows promising results as a salvage therapy for unresectable and recurrent liver metastases after surgical resection
 - Statement 11: Ablation therapy is a curative treatment for small-size (≤ 3 cm) CRLM with less complications, shorter operative time and length of stay, noninferior disease-free and overall survival compared to hepatic resection
 - Comparison between radiofrequency ablation and microwave ablation
 - Statement 12: The optimal use of RFA and MWA depends on tumor size, location, vascularity, and patient-specific factors
 - Statement 13: MWA has better local tumor control for MLTs near vascular structures or >3 cm than single-electrode RFA
 - Survival benefit of ablation in metastatic liver disease
 - Statement 14: Combination therapies integrating ablation with systemic treatments improve overall survival in patients with unresectable CRLM
 - The role of imaging
 - Statement 15: The accurate diagnosis and

characterization of MLTs before local ablation procedures are crucial for successful treatment and better outcomes. The choice of imaging modality depends on factors such as tumor characteristics, patient-specific conditions, and availability of technology

- Statement 16: Image-guided ablation, using computed tomography, magnetic resonance image (MRI), or US with/without the assistance of fusion imaging or CEUS, is essential for accurate targeting of MLTs and optimizing treatment outcomes
 - Statement 17: Patients undergoing local ablation for MLTs should be regularly monitored with contrast-enhanced imaging to assess local recurrence or new metastatic lesions
8. Ablation and systemic therapy
- Statement 18: Ablation-induced tumor necrosis may enhance systemic immune responses, potentially improving the efficacy of immunotherapy
 - Statement 19: Ablation has benefit for patients with residual liver tumors after systemic therapy
 - Statement 20: The timing of integrating ablation with systemic chemotherapy should be tailored to individual patients, considering their specific factors including host factors, tumor characteristics, mechanism of drugs, and immune status
9. Perspective of ablation treatment
- Statement 21: Future advancements in ablation focus on enhancing precision through artificial intelligence (AI), robotics, and advanced imaging
 - Statement 22: Personalized treatment planning incorporating AI and three-dimensional modeling enhances the outcomes of thermal ablation.

CONCLUSION

Metastatic cancer is a systemic disease, and local treatments for MLTs can achieve local tumor control and symptom relief.^[14] Increasing evidence suggests that combined local and systemic treatments may also extend overall survival, particularly in cases of unresectable CRLM.^[8] Ablation therapy is one of the many local treatment options for MLTs. In addition to its earlier use in the treatment of HCC, an increasing number of MLTs originated from colon, breast, gastric, pancreatic cancers, or neuroendocrine tumors are now being treated with ablation therapy clinically.^[15-17] Local ablation therapy plays an increasingly important role in the multidisciplinary management of MLTs, particularly in OLD. Advancements in US-guided techniques and device technology such as AI or robotics, multielectrode switch-controlled ablation, and high energy power continue to expand the scope and safety of ablation therapy.^[18,19] With careful patient selection and appropriate technique, ablation offers a promising option for improving outcomes in patients with liver metastases.

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Conflicts of interest

There are no conflicts of interest.

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