

Radiofrequency Ablation versus Microwave Ablation in HCC and Liver Metastases



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Disclosure

Speaker name:

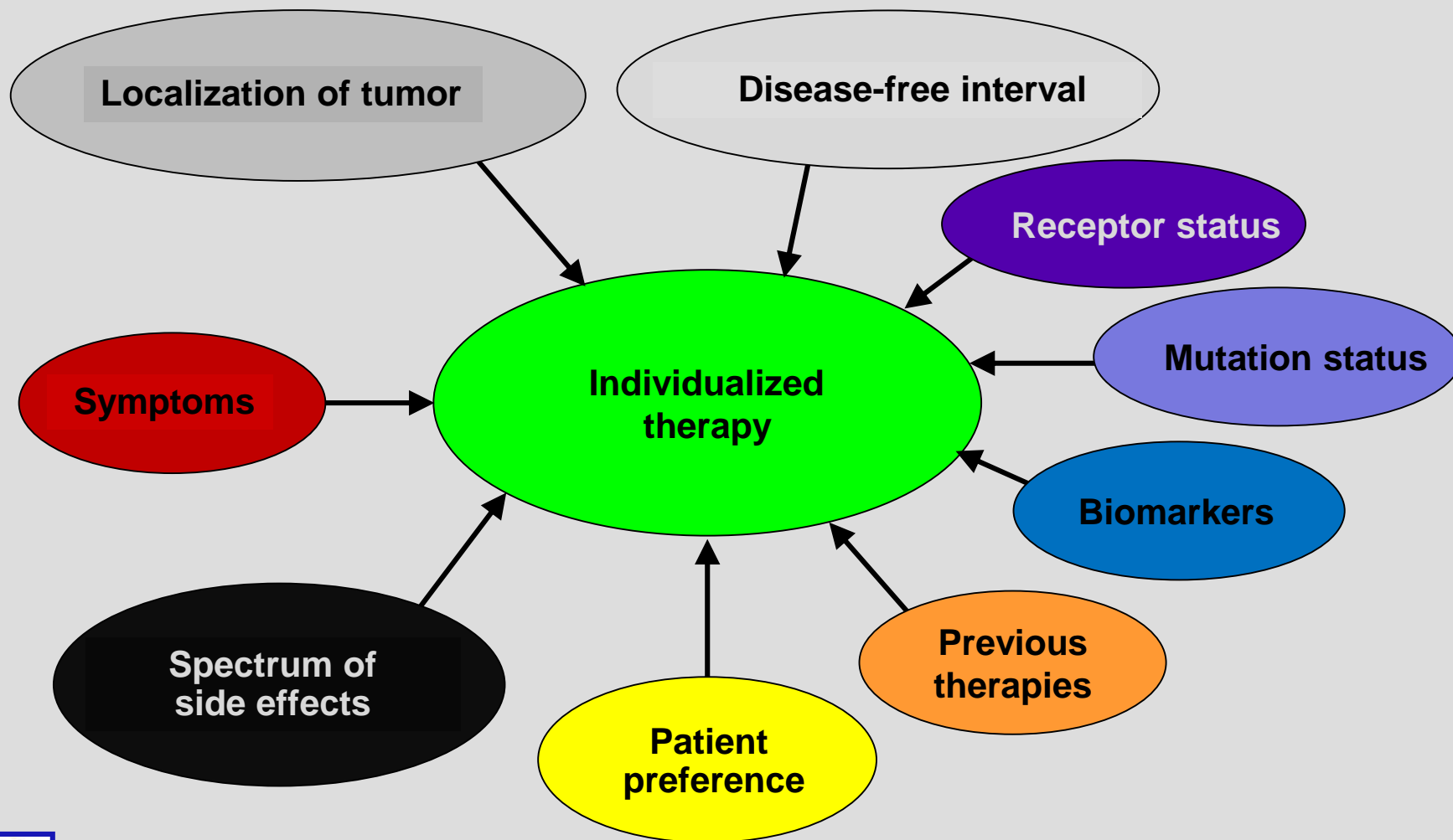
Thomas Vogl

I have the following potential conflicts of interest to report:

- Consulting
- Employment in industry
- Stockholder of a healthcare company
- Owner of a healthcare company
- Other: travel grant

- I do not have any potential conflict of interest

Liver Malignancies: Treatment Decision-making is a Complex Task



Liver Malignancies: Check List

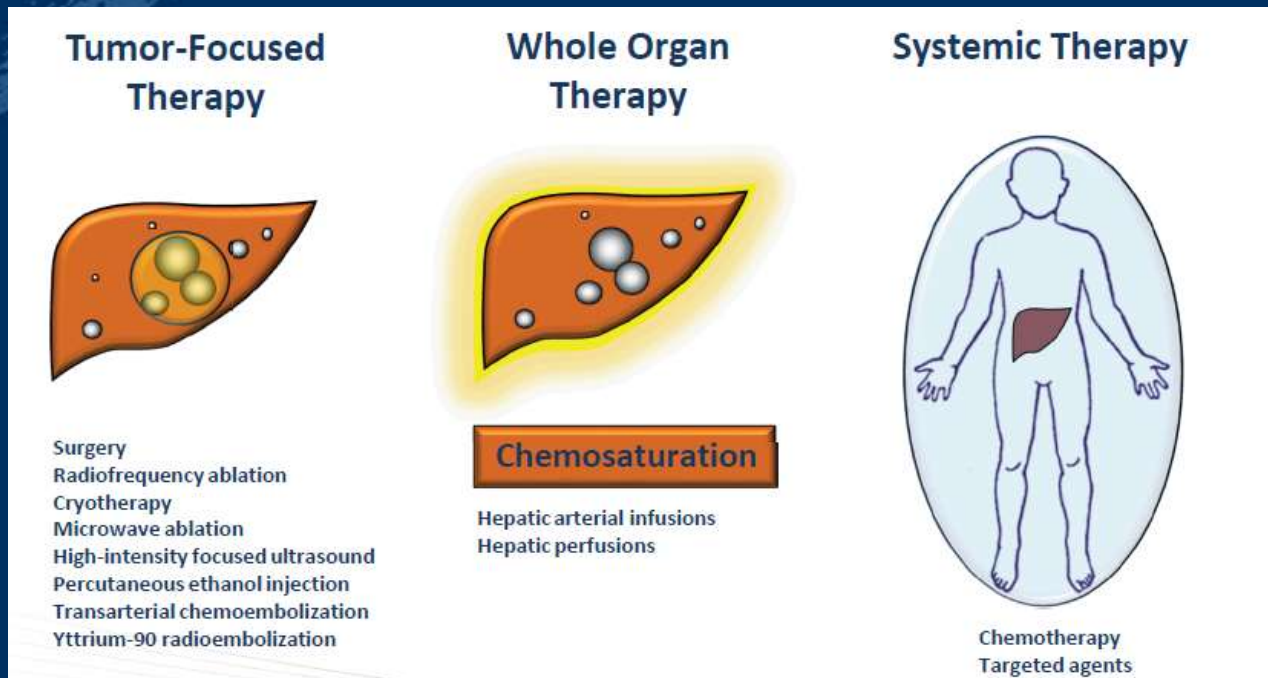
1. Unilobar – bilobar
2. Resectable – unresectable
 - resection combined with contralateral ablation
3. Synchronous – metachronous
4. No extrahepatic manifestation – extrahepatic manifestation
 - peritoneum
 - lymph nodes
 - lung
 - (bone tumors)
5. Symptomatic – asymptomatic



Liver Malignancies: Treatment Options

When resection is not possible, treatment options include:

- tumor-focused or local ablative therapy
- whole organ or regional therapy
- systemic therapy



Liver Malignancies: Arterial Therapies

• Definition:

1. Intraarterial hepatic chemotherapy (IAHC)
Transarterial chemoperfusion (TACP)
2. Transarterial chemoembolization (TACE)
 - conventional TACE
 - TACE with DC beads
3. Radioembolization
4. Isolated liver perfusion



• Indications:

1. Salvage therapy: response when systemic therapy inefficient
2. First line therapy (induction therapy): convert nonsurgical patient to surgical patient



Liver Malignancies: Clinical Classification

Group 1

Primarily resectable metastases



Surgery

or

FOLFOX

Group 2

Potentially resectable metastases



symptomatic
rapid progression

Intensified therapy:

FOLFOX + Cet

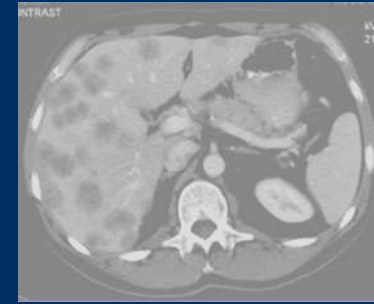
FOLFIRI + Cet

FOLFOXIRI

CT + Bev ? HAI, TACE

Group 3

Liver metastases that are unlikely to become resectable

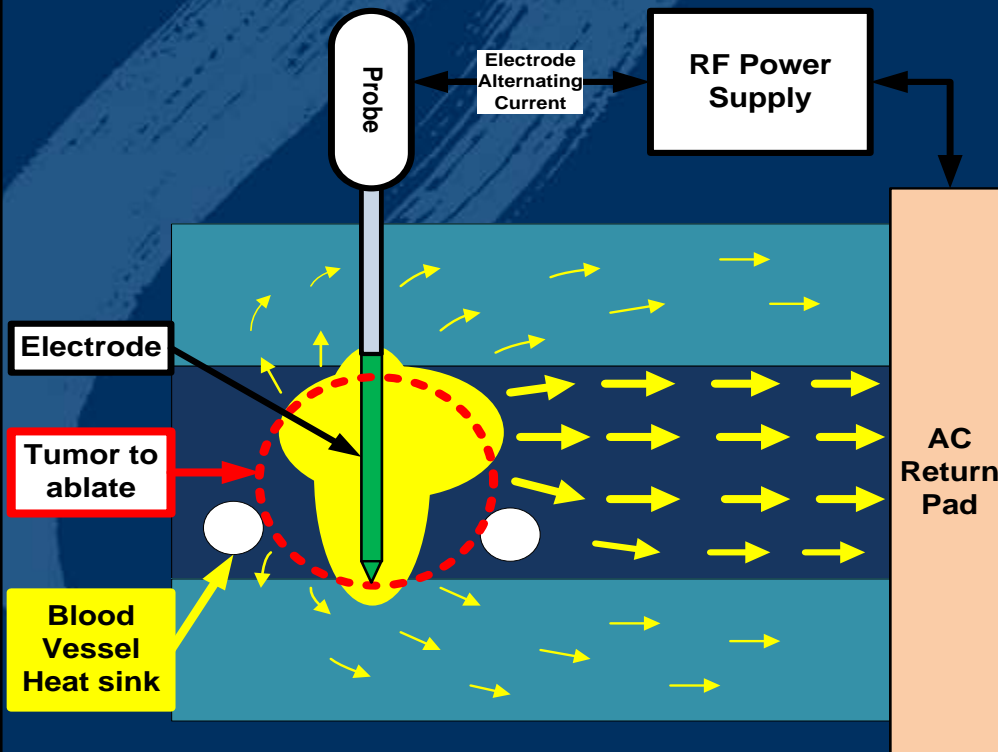


asymptomatic
slow
progression

primary goal:
QoL, survival time ↑
TACE, HAI, SIRT



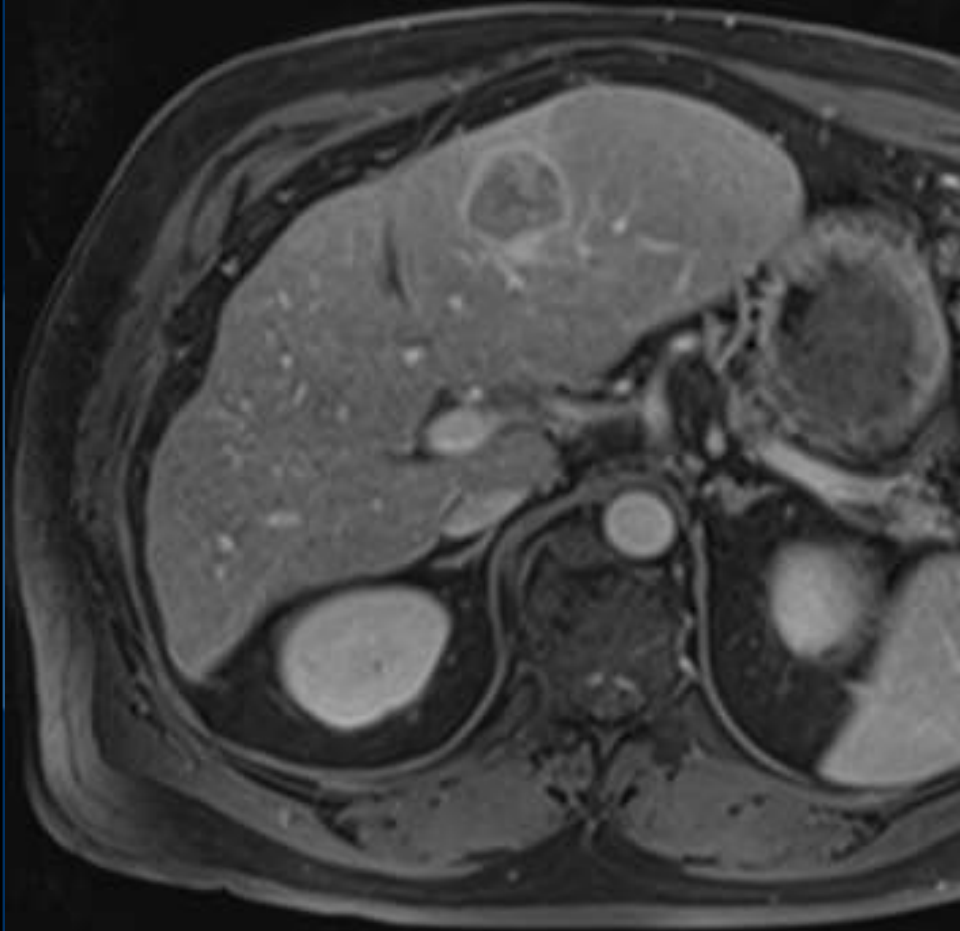
Radiofrequency Ablation



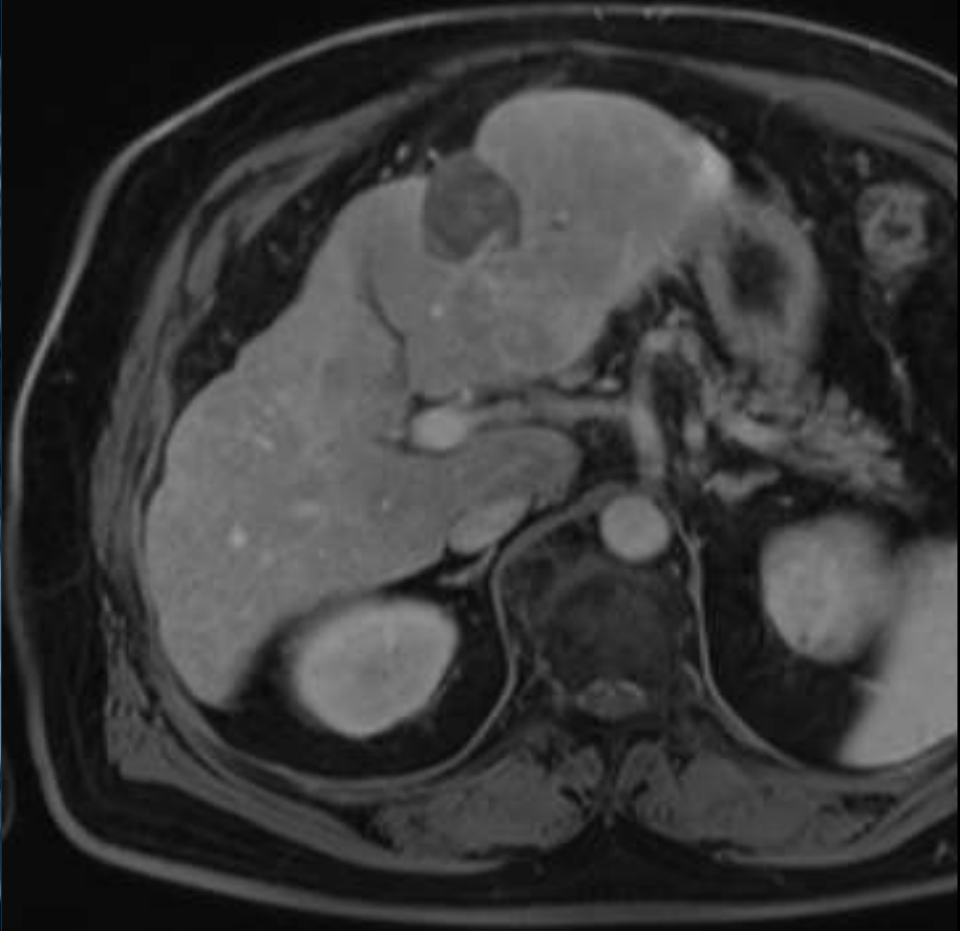
1. RFA is based upon the biophysical interaction of high-frequency alternating current (typically 450–500 kHz) and biological tissue in terms of resistive (frictional) energy loss.
2. Between the active and the reference electrode (or two active electrodes in bipolar systems) an electric field is established which oscillates with RF frequency.
3. Ionic oscillatory agitation induced by this oscillating field results in frictional heat followed by “coagulative” necrosis.



Hepatocellular Carcinoma: RF Ablation



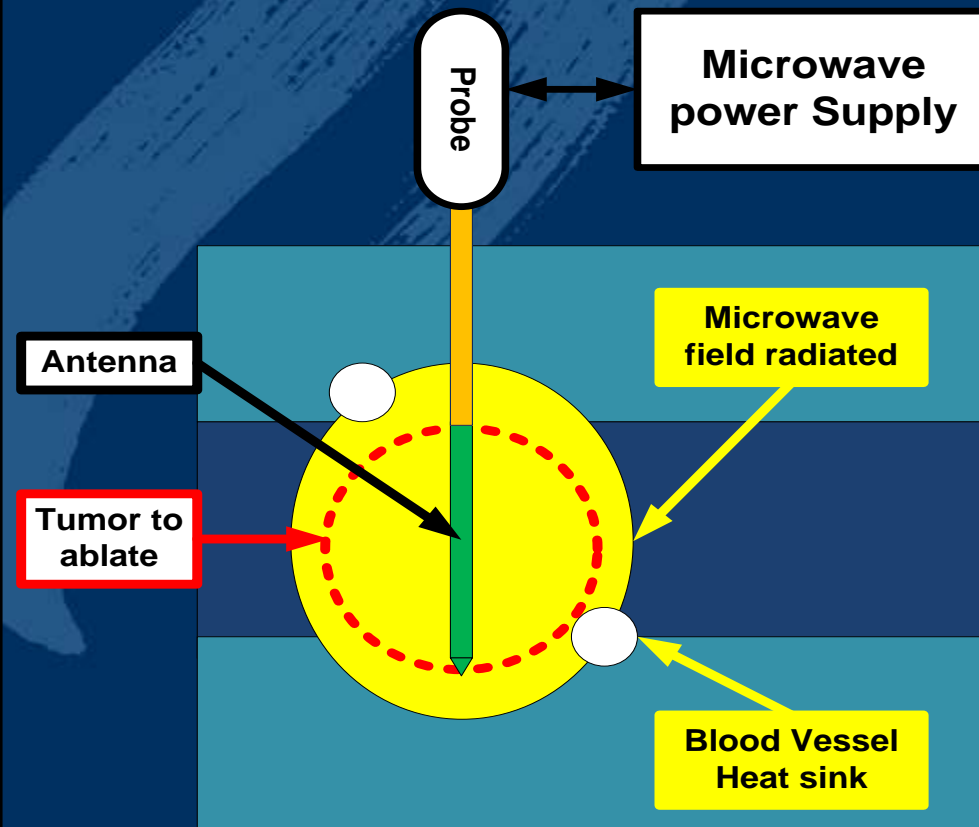
Before RFA



10 mo after RFA



Microwave Ablation

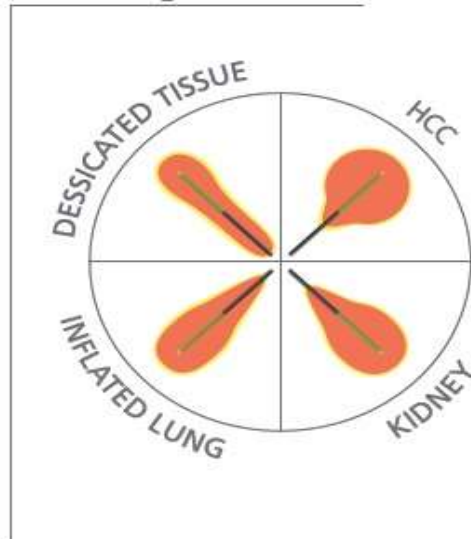


A microwave antenna is placed directly into the tumor. A microwave generator emits an electromagnetic wave (frequency ~ 2450 MHz) through the exposed, noninsulated portion of the antenna. Electromagnetic microwaves agitate water molecules in the surrounding tissue, producing friction and heat, thus inducing cellular death via coagulation necrosis.

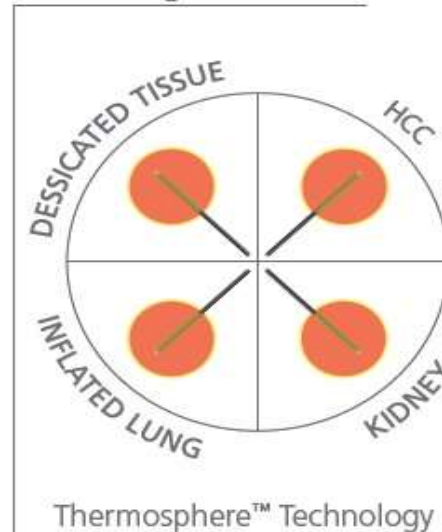
MWA with Thermosphere Technology™

**Maintaining spherical ablations
across changing tissue conditions** with
wavelength-controlled field-based energy

**Without
Wavelength Control**



**With
Wavelength Control**



2. Brannan J et al (2014), Thermal Ablation: Understanding the Breakthrough to Predictably Spherical Ablations with the Thermosphere™ Technology. US140714.

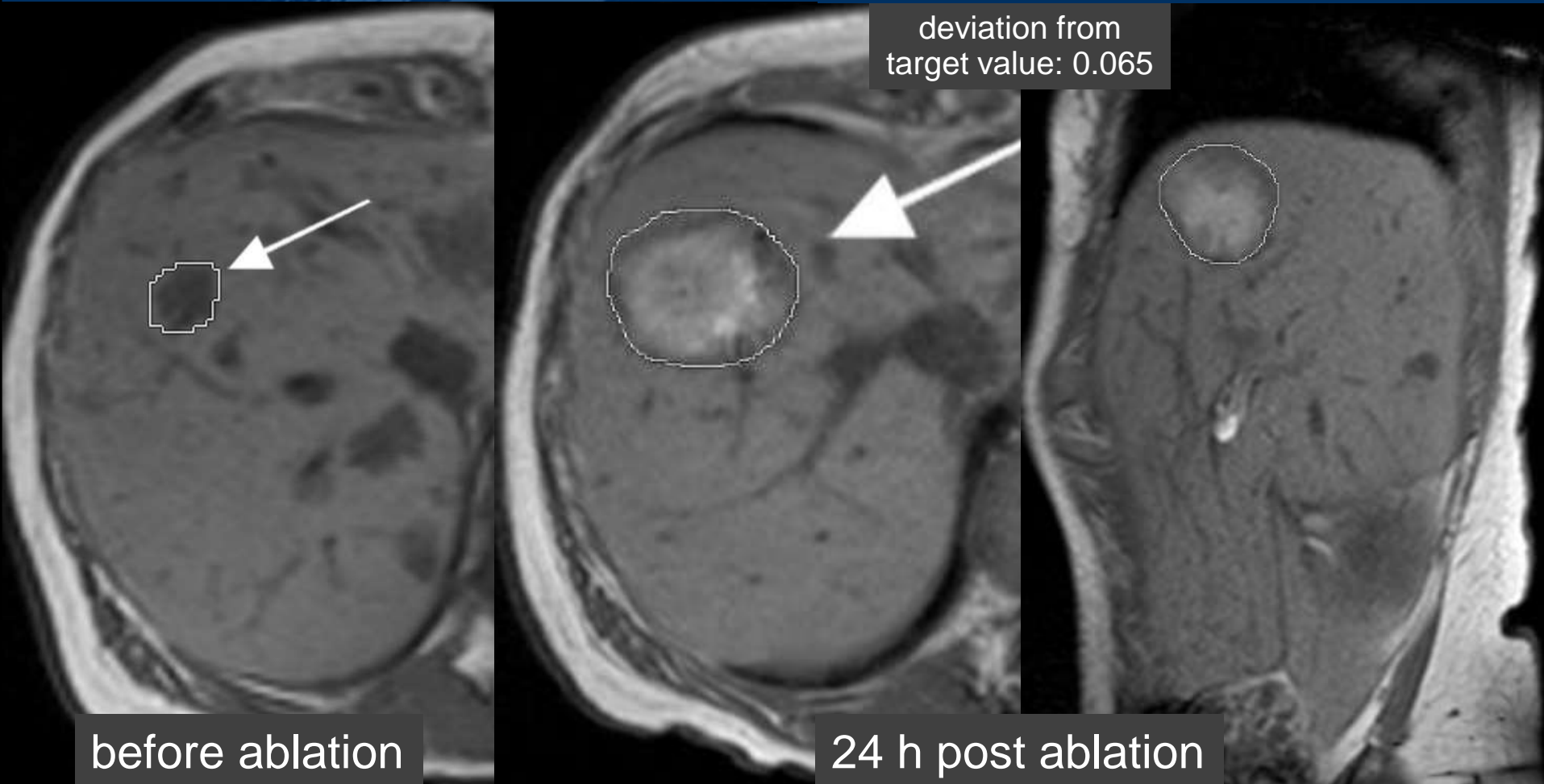


Microwave Ablation: Thermosphere™ Technology



69-year-old patient with a liver metastasis from breast cancer
Institute of Diagnostic and Interventional Radiology, Goethe University, Frankfurt/Main

Microwave Ablation: Thermosphere™ Technology



before ablation

24 h post ablation



69-year-old patient with a liver metastasis from breast cancer
Institute of Diagnostic and Interventional Radiology, Goethe University, Frankfurt/Main

Results: MWA ECSEC versus LF and HF

- Median deviation from ideal sphericity (1.0):

▶ group 1 (ECSEC):	0.135	
▶ group 2 (LF):	0.344	
▶ group 3 (HF):	0.314	p<0.001

- Absolute minimal ablative margin:

▶ group 1 (ECSEC):	8.1 mm	
▶ group 2 (LF):	2.3 mm	
▶ group 3 (HF):	3.1 mm	p<0.001



Results: MWA ECSEC versus LF and HF

- One-year mortality rate:

- ▶ group 1 (ECSEC): 16.1%
- ▶ group 2 (LF): 15%
- ▶ group 3 (HF): 10%

- Local tumor progression:

- ▶ group 1 (ECSEC): 3.57% (2/56 lesions)
- ▶ group 2 (LF): 5% (1/20 lesions)
- ▶ group 3 (HF): 5% (1/20 lesions)



MIRA trial Results: MWA versus RFA

- Treatment of 36 HCC lesions:
 - mean diameter: 2.4 cm (range: 0.9-5 cm)
 - ▶ group 1 – MW ablation: 2.5 cm
 - ▶ group 2 – RF ablation: 2.2 cm

- Mean volume 24 h after ablation: 47.3 cm³
 - ▶ group 1 – MW ablation: 62.0 cm³
 - ▶ group 2 – RF ablation: 32.7 cm³



MIRA trial Results: MWA versus RFA

- Complete ablation: 36/36 lesions (100%)
 - ▶ group 1 – MW ablation: 18/18 HCC lesions (100,0%)
 - ▶ group 2 – RF ablation: 18/18 HCC lesions (100.0%)

- Local Recurrence rate within 1 year: 1/36 pat. (2.9%)
 - ▶ group 1 – MW ablation: 1/18 patients
 - ▶ group 2 – RF ablation: 0/18 patients



MIRA trial Results: MWA versus RFA

- Rate for new malignant formations in another location than the ablated lesion: 19.4% (7/36)
 - ▶ group 1 – MW ablation: 0/18 patients
 - ▶ group 2 – RF ablation: 7/18 patients
 - Mortality rate for this trial: → 0%
 - No major complications
-
- Other therapies:
 - ▶ 16.7% (6/36) patients underwent thermal ablation before participating in this trial
 - ▶ 19.4% (7/36) patients received again thermal ablation in other segments of the liver while being part of this trial



Conclusion

- First data of the MIRA trial showed no significant differences in mortality or complication rates between RFA and MWA.
- Thermal treatment with MWA generates greater ablation volumes.
- The 1-year follow-up of the MWA group showed a similar rate of local recurrences versus RFA.



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Magnetresonanztomographie

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