Summaries of publications and abstracts involving the Emprint™ ablation system with Thermosphere™ technology.
Medtronic provides the following synopsis of a clinical publication involving the Emprint™ ablation system with Thermosphere™ technology.

**TITLE**
Evaluation of microwave ablation of liver malignancy with enabled constant spatial energy control to achieve a predictable spherical ablation zone.

**FIRST AUTHOR**
Thomas J. Vogl (Institute for Diagnostic and Interventional Radiology, Frankfurt-University Hospital, Frankfurt, Germany)

**JOURNAL**
International Journal of Hyperthermia

**PUB DATE**
August 3, 2017 (online)

**Objective:** To assess the Emprint™ ablation system with Thermosphere™ technology (high-frequency microwave ablation [MWA] with enabled constant spatial energy control) for treatment of liver malignancies.

**Key Findings:**
- When comparing Emprint™ ablation system with Thermosphere™ Technology vs. conventional high-frequency MWA vs. conventional low-frequency MWA,
  - median deviation from ideal sphericity of 1.0 was 0.135 vs. 0.314 vs. 0.344 (p<0.001)
  - absolute minimal ablative margin was 8.1 mm vs. 3.1 mm vs. 2.3 mm (p<0.001)
  - ablation volume was 33 cm³ vs. 51.90 cm³ vs. 18.69 cm³ (p<0.05)
  - ablation time was 8.4min vs. 10.1min vs. 10min (p<0.05)
  - technical success (defined as correct interventional accomplishment in accordance to protocol and complete coverage of index tumor through ablation zone by CT at the end of the ablation) was 100% vs. 100% vs. 100%
  - technical efficacy (defined as complete coverage of the index tumor through the ablation zone in the first contrast-enhanced MRI 24-hour post-ablation and with a maximal thin symmetric rim of peripheral enhancement) was 100% vs. 95% vs. 100%
  - local tumor progression (defined as tumor focus connected to the edge of ablation zone, which was previously considered technically efficient in 24-hour post-ablation MRI) at 1 year was 3.57% (2/56) vs. 5% (1/20) vs. 5% (1/20)
  - no major complications or intra-procedural deaths were reported across the three groups
  - minor complications (low-grade subcapsular bleeding not requiring treatment and minimal subcapsular liver abscess) in 3.57% (2/56) vs. 0% (0/20) vs. 0% (0/20) (p=0.486)
- Primary tumor origin locations (breast, colorectal, hepatocellular) treated with Emprint™ ablation system with Thermosphere™ technology did not influence ablation zone sphericity.

**Conclusion:** The Emprint™ ablation system with Thermosphere™ technology produces more spherical ablation zones compared to conventional MWA. As a result, the Emprint™ ablation system realized two to three times larger minimal ablative margins than conventional MWA with less post-ablative volume than conventional high-frequency MWA.

**Study Design:** A single-center, retrospective cohort study comparing 48 subjects with hepatic tumors (total 56 tumors) treated with Emprint™ ablation system with Thermosphere™ technology to subjects who underwent conventional high-frequency MWA (n=20) or low-frequency MWA (n=20).

Independent Study

**THIS CONCLUDES THE CLINICAL SYNOPSIS OF THIS PUBLICATION**
Microwave ablation of liver malignancies: comparison of effects and early outcomes of percutaneous and intraoperative approaches with different liver conditions: new advances in interventional oncology: state of the art.

Objective: To compare effects of the new-generation microwave ablation (MWA) system (Emprint™ Ablation System with Thermosphere™ Technology) on human liver in vivo versus predictions based on ex vivo animal models.

Key findings:
- There was a linear correlation between ablation times and ablation volumes in vivo.
- No significant differences were observed when comparing in vivo results to ex vivo predictions in all operative procedures (percutaneous or intraoperative) and liver conditions (cirrhosis, non-cirrhosis, or previous chemotherapy treatment).
- Nodule proximity (<5 mm distance) to large vessels (>5mm in diameter) or the liver capsule did not influence linear correlation of ablation time / ablation volume.
- For the 81 malignant liver nodules treated with microwave ablation (MWA) procedures, complete tumor ablation* at 1-month was 93% (28/30) for percutaneous and 100% (51/51) for intraoperative (p=0.175).
- One adverse event (pneumothorax) occurred during MWA probe positioning; the adverse event was resolved by immediate pleural drainage.
- 30-day mortality rate was 0%.

Conclusion:
- Emprint™ ablation system with Thermosphere™ technology produces controllable and predictable ablation zones on human liver parenchyma in vivo.
- MWA with Thermosphere™ technology is little influenced by different pathophysiologic, hemodynamic, and operative conditions.

Study design: This was a prospective observational study, evaluating 60 subjects with ≥ 1 malignant liver nodules (total = 81 nodules) that underwent liver-directed microwave thermal ablations between October 2014 and October 2016. Of the 81 nodules, MWA approaches were percutaneous for 30 nodules, laparotomy = 32, and laparoscopy = 19; liver conditions were cirrhotic = 31, non-cirrhotic = 21, and chemotherapy-treated = 29. Independent Study (Oxford Level 3)

*Complete ablation (i.e., opposite of local tumor recurrence) as defined by Goldberg et al.¹ and Ahmed et al.² to infer residual unablated tumor undetected at previous follow up due to imaging limitations.


**THIS CONCLUDES THE CLINICAL SYNOPSIS OF THIS PUBLICATION**
Medtronic provides the following synopsis of a clinical publication involving the Emprint™ ablation system with Thermosphere™ technology.

**TITLE**
Local recurrence after laparoscopic microwave thermosphere ablation of malignant liver tumors.

**FIRST AUTHOR**
H. Takahashi (Cleveland Clinic Foundation, Cleveland, Ohio)

**JOURNAL**

**PUB DATE**
February 2017

**Why this is important:** This study evaluated local recurrence* after microwave thermosphere ablation (MTA) of malignant liver tumors. Results from this study showed that local tumor control rate was achieved in subjects with malignant liver tumors after undergoing MTA with the Emprint™ ablation system with Thermosphere™ technology.

**Key findings:**
- 76 subjects with 217 malignant liver tumors were evaluated; tumor type included colorectal (n= 85, 39.2%), neuroendocrine (n=83, 38.2%), hepatocellular (n=12, 5.5%), and others (n=37, 17.1%).
- Local recurrence rates were 12.2% (9/74) per subject and 6.2% (13/207) per lesion at a median follow-up of 11 months.
- Local recurrence rates were 9.4% for colorectal cancer, 13.5% for other tumor types, and 0% for hepatocellular or neuroendocrine cancer.
- There were no cases of procedure-related mortality reported.

**Conclusions:**
- The authors indicate that short-term local recurrence rates after ablation with Thermosphere™ Technology may be favorable in comparison to data reported in the literature for radiofrequency ablation and other microwave technologies.

**Study design:** This was a single-center, prospective cohort study, evaluating 76 subjects with 217 malignant liver tumors that underwent MTA between September 2014 and September 2016.

**Congress:** Society of Surgical Oncology (SSO) 2017

*Local tumor recurrence as defined by Goldberg et al.¹ and Ahmed et al.² to infer residual unablated tumor undetected at previous follow up due to imaging limitations.


**THIS CONCLUDES THE CLINICAL SYNOPSIS OF THIS PUBLICATION**
Medtronic provides the following synopsis of a clinical publication involving the Emprint™ ablation system with Thermosphere™ technology.

**TITLE**
Accuracy evaluation of microwave ablation with the Covidien Emprint system in hepatocellular carcinoma: do expected volumes correlate with in vivo results

**FIRST AUTHOR**
S. Venkat (Radiology, University of Miami, Miami, FL, USA)

**JOURNAL**
Cardiovascular Interventional Radiology

**PUB DATE**
August 2016

**Objective:** To compare accuracy of the Emprint™ ablation system ablation results in hepatocellular carcinoma versus predictions based on the ablation zone chart provided by the manufacturer.

**Key findings:**
- Average volume of pre-ablation lesion was 40.9 cm³; average volume for predicted ablation zone was 42.2 cm³, average volume of actual ablation zone was 44.1 cm³.
- There was no significant difference in volume comparing actual ablation zones to predicted ablation zones. Volume % difference was 35.8% (p=0.717).

**Conclusion:** The Emprint™ ablation system produces predictable and reliable ablations.

**Study design:** This was a retrospective database review at a single-center, evaluating 12 subjects (mean age 67 years) with hepatocellular carcinoma (total lesions = 18) that underwent MWA between June 2014 and September 2015.

**Congress:** Cardiovascular and Interventional Radiology Society of Europe (CIRSE)

**Citation:** Cardiovasc Intervent Radiol (2016) 39 (Suppl 3):pp 276, P-358, DOI: 10.1007/s00270-016-1405-3, PMID: 27530358

*Independent Study* (Oxford Level 4)

**THIS CONCLUDES THE CLINICAL SYNOPSIS OF THIS PUBLICATION**
Medtronic provides the following synopsis of a clinical publication involving the Emprint™ ablation system with Thermosphere™ technology.

**TITLE**
Early Safety and Effectiveness of Thermosphere Microwave Ablation (Emprint) in the Percutaneous Treatment of Perivascular Liver Tumors

**FIRST AUTHOR**
J. Park (City of Hope, Duarte, CA, USA)

**JOURNAL**
J Vasc Interv Radiol (2016); 27:e108, Poster 142

**PUB DATE**
June 2016

**Objective:** To evaluate initial results of percutaneous microwave ablation using Thermosphere™ technology in subjects with perivascular liver tumors

**Key findings:**
- Ablation zones ranged from 2.8 - 5.6 cm
- In addition to covering the tumor with margin, ablation zones encompassed adjacent vasculature
- Of the 13 hepatic vessels (hepatic veins = 9, portal veins = 4) impacted by MWA, 12 vessels remained patent and 1 vessel (3.1 mm) was thrombosed post-treatment
- There was complete ablation of tumors and margins at follow-up, with 1 case of local recurrence* in an untreated zone of tissue adjacent to the inferior vena cava
- No significant adverse events were reported. All subjects had stable hepatic biochemical profiles after the procedure

**Conclusions:**
- Emprint™ ablation system with Thermosphere™ technology produces predictable ablation zone shape and sizes, allowing precise treatment planning
- Emprint™ ablation system with Thermosphere™ technology is an option for treatment of challenging perivascular hepatic tumors

**Study design:** This was a retrospective analysis of 8 subjects with perivascular (<5 mm from adjacent vessels) hepatic tumors (total = 9 tumors) that underwent percutaneous image guided MWA with Thermosphere™ technology. Average tumor diameter = 2.2 cm (range 1.3-3.8 cm), vessel size = 5.8 mm (range 3.1-9 mm), and distance of tumor to vessel = 0.8 mm (range 0-4.5mm).

**Congress:** World Conference on Interventional Oncology (WCIO) 2016

Independent Study (Oxford Level 4)

*Local tumor recurrence as defined by Goldberg et al.¹ and Ahmed et al.² to infer residual unablated tumor undetected at previous follow up due to imaging limitations.


**THIS CONCLUDES THE CLINICAL SYNOPSIS OF THIS PUBLICATION**
Medtronic provides the following synopsis of a clinical publication involving the Emprint™ ablation system with Thermosphere™ technology.

**TITLE**
Characterization of a Microwave Ablation Device Characteristics in a Perfused Liver Model

**FIRST AUTHOR**
D.T. Johnson (Radiology, University of Colorado Denver, Centennial, CO, USA)

**JOURNAL**
Journal of Vascular Interventional Radiology

**PUB DATE**
June 2016

**Objective:** To compare ablation characteristics of the Emprint™ ablation system to Cool-Tip™ RF ablation system in a perfused liver bovine model.

**Key findings:**
- There were no significant differences in ablation volume or sphericity for MWA and RFA devices with different blood flow rates (60, 80, 100 mL/min/100 g liver).
- Across study devices, MWA at 100W resulted in the largest ablation volumes; MWA at 45W resulted in the smallest ablation volumes.
- There were significant differences for ablation volume ($p<0.0001$) and sphericity ($p<0.0001$) when comparing the two devices.
- Sphericity of ablation was significantly better with MWA at 45W and 100W compared to RFA ($p<0.0001$).

**Conclusions:**
- The authors conclude that the Emprint™ ablation system produces consistent ablation sizes, which are not affected by blood flow rate.
- Emprint™ ablation system produces consistent ablation sphericity at both low and high powers.
- Sphericity of ablation is significantly better with the Emprint™ ablation system compared to the Cool-Tip™ RF ablation system.

**Study design:** This was an in vitro study using a bovine liver model perfused with autologous blood via the portal vein at 3 flow rates. Ablation characteristics with Emprint™ ablation system were assessed at 45W and 100W with ablation time of 10 minutes (compared to RFA time of 12 minutes).

**Congress:** World Conference on Interventional Oncology (WCIO) 2016

**Citation:** J Vasc Interv Radiol (2016); 27:e62, Paper 44, doi: 10.1016/j.jvir.2016.04.006

**Abstract link:** Click [HERE](#) for Abstract Book (copyright clearance will be required for re-use of published abstracts or abstract book)

Independent Study (Oxford Level 5)

**THIS CONCLUDES THE CLINICAL SYNOPSIS OF THIS PUBLICATION**
Medtronic provides the following synopsis of a clinical publication involving the Emprint™ ablation system with Themosphere™ technology.

**TITLE**
"Laparoscopic Microwave Thermosphere Ablation of Malignant Liver Tumors: An Analysis of 53 Cases"

**AUTHOR**
Nisar Zaidi, Cleveland Clinic, Cleveland, Ohio, USA

**JOURNAL**
Journal of Surgical Oncology

**PUB DATE**
Dec 2015

**KEY FINDINGS:**

- 53 patients with an average of 3 liver tumors each (range 1-12) measuring a mean 1.5 cm (range 0.2–4.5 cm) were ablated (47 laparoscopic, 6 open with combined liver resection).
- The indications for MWA in the 47 laparoscopic patients were unresectable disease in 18 (inadequate liver remnant in 10 and underlying cirrhosis with portal hypertension in 8) and patient decision in 29 patients after the pros and cons of resection versus ablation were discussed.
- Mean ablation time per patient was 19.6±2.7 min (range 2.5-65 min). The lesions were evenly distributed across all liver segments with locations of peripheral 52.3%, central 33.6%, and not specified 14.1% and with blood vessel proximity of near 41.6% and away 58.9%.
- Ablation was for primary HCC tumors in 9 (17.0%) patients and metastatic tumors in 44 (83.0%) patients, 20 of which were for colorectal metastases.
- Single ablation in 70% of lesions and overlapping sequential ablations in 30% required for complete coverage of the ablation zone. A single probe was used in all patients.
- **Single ablations (n=104 lesions):** Longitudinal diameter: 3.1cm±0.09; Transverse diameter A (longest transverse diameter): 3.3cm±0.10; Transverse diameter B (transverse diameter perpendicular to A): 3.1cm±0.11 with Roundness index A (A/longitudinal): 1.1±0.02; Roundness index B (B/longitudinal): 1.0±0.02; and Roundness index transverse (B/A): 0.94±0.02.
- **Multiple ablations (n=45 lesions):** Longitudinal diameter: 3.7cm±0.16; Transverse diameter A: 4.2cm±0.22; Transverse diameter B: 3.9cm±0.22 with Roundness index A: 1.1±0.03; Roundness index B: 1.1±0.05; and Roundness index transverse: 0.95±0.03*.
- Patients who underwent laparoscopic MWA were discharged home the next day.
- At postoperative CT scans there was complete tumor ablation coverage of all, but 1 lesion out of 149. This was the first patient in the series and this failure was ascribed to inexperience at the beginning of the study.
- At a median follow up of 4.5 months (range 0.5-12 months), one lesion (0.7%) developed local tumor recurrence** at 3 months. Seven patients (13%) developed new liver lesions and 6 patients (11%) new extra-hepatic metastases.

**STUDY DESIGN:**
Prospective, single-center, single-arm study of 53 patients with 149 malignant liver tumors treated with the Emprint™ ablation system with Themosphere™ technology between September 2014 and October 2015.
Imaging studies included triphasic liver CT scans obtained within a month before and 1-4 weeks after the MWA procedure with follow-up scans performed at 90 day intervals. All ablations were done at 100W (2.5 min for 3cm ablation, 10 min for 4cm, 15 min for 5cm) based on manufacturer’s reference standards. The ablation zones were assessed for complete tumor response and spherical geometry (n=1.0). Based on real-time ultrasound feedback, repeat ablations were performed if necessary. (Level 4) Independent Study

*Medtronic currently does not provide guidelines around multiple overlapping ablations for the Emprint™ ablation system. This technique is based on the experience, results, and recommendations of the author and may not reflect those of Medtronic.

**Local tumor recurrence as defined by Goldberg et al. and Ahmed et al. to infer residual unablated tumor undetected at previous follow up due to imaging limitations.


**THIS CONCLUDES THE CLINICAL SYNOPSIS OF THIS PUBLICATION**
Medtronic provides the following synopsis of a preclinical presentation involving the Emprint™ ablation system.

**STUDY DESIGN:**
The Emprint™ ablation system with Thermosphere™ technology (Medtronic, Boulder, CO) was evaluated at 45W, 75W, and 100W over a range of time settings (1:00–10:00 minutes) in liver (n=53 ablations) and lung (n=73 ablations) in an in vivo porcine model (n=16 animals). Following ablation, animals were euthanized for tissue collection and gross measurement of ablation zone length (along the probe) and width (cross-axis). Internal Preclinical Study

**KEY FINDINGS:**
- Ablation zone width and length gross measurements were fit to a natural logarithmic regression curve and the derived ablation zone aspect ratio was calculated as the ratio of the derived minimum diameter to the derived maximum diameter, where 1 suggests a perfect circle.
- Gross ablation dimensions increased as power and time increased; ablation zone sizes and shapes were consistent and predictable, regardless of tissue type. Average ratios in the probe plane approached a perfect circle after 10 minutes of ablation at 75W or 100W.
- Challenges in measurement methodology limit the interpretation of these preliminary data.
- Future studies are underway to confirm the technology performs similarly in clinical practice.

**THIS CONCLUDES THE CLINICAL SYNOPSIS OF THIS PUBLICATION**
Medtronic provides the following synopsis of a preclinical presentation involving the Emprint™ ablation system.

**TITLE**  
Performance of the Emprint™ Ablation System in an In Vivo Porcine Lung Model: Correlation between CT and Gross Measurements

**AUTHOR**  
Howk K, Brannan J, Ladtkow C, Peterson D, Cafaro A (Medtronic, Boulder, CO)

**JOURNAL**  

**PUB DATE**  
Presented at WCIO2015

**KEY FINDINGS:**

- In this feasibility study, ablation zones created with the Emprint™ ablation system with Thermosphere™ technology demonstrated a good correlation between CT imaging and gross in vivo measurements at higher generator power.

- Ablation at 75W and 100W generator power produced the best agreement between CT and gross measurements ($R^2 = 0.51$). Correlation was lower at 45W generator power ($R^2 = 0.28$).

- These preliminary results support both clinical practice and future clinical studies by suggesting that desired ablation zone sizes correlate with what is measured via CT immediately post-ablation.

- Additional studies are underway to confirm and extend these findings.

**STUDY DESIGN:**

The Emprint™ ablation system with Thermosphere™ technology (Medtronic, Boulder, CO) was evaluated in an in vivo porcine lung model (n=73 ablations in 16 animals). Following ablation, a subset of target zones underwent unenhanced CT imaging. Correlation of ablation zone sizes measured by gross examination versus CT was assessed across generator power (45W, 75W, 100W) and time (1-10 minutes) settings. Internal Preclinical Study

**THIS CONCLUDES THE CLINICAL SYNOPSIS OF THIS PUBLICATION**
Medtronic provides the following synopsis of an independent clinical publication utilizing the Emprint™ ablation system with Thermosphere™ technology.

**TITLE**
Laparoscopic microwave thermosphere ablation of malignant liver tumors: an initial clinical evaluation

**AUTHOR**
Berber E. (Departments of General and Endocrine Surgery, Cleveland Clinic, Cleveland, Ohio, USA)

**JOURNAL**
Surgical Endoscopy

**PUB DATE**
June 2015 (Epub ahead of print)

**KEY FINDINGS:**
- 18 patients with an average of 3 liver tumors each (range 1-12) measuring a mean 1.4 cm (range 0.2 – 4.4 cm) were ablated (15 laparoscopic, 3 with combined liver resection).
- The indications for MWA in the 15 laparoscopic patients were unresectable disease in 8 (inadequate liver remnant in 4 and underlying cirrhosis with portal hypertension in 4) and patient decision in 7 patients after the pros and cons of resection versus ablation were discussed.
- Mean ablation time per patient was 15.6±1.9 minutes. The locations of the lesions were peripheral 48.1% and central 51.9% with blood vessel proximity of near 48.1% and away 51.9%.
- Ablation was for primary HCC tumors in 3 (16.7%) patients and metastatic tumors in 15 (83.3%) patients, 7 of which were for colorectal metastases. A total of 54 tumors were ablated.
- Single ablation in 72% of lesions and overlapping ablations* in 28% required for complete coverage of the ablation zone. A single probe was used in all patients.
- 100% tumor destruction seen on 2-week CT scans with no residual lesions**.
- Author states that spherical indices were all very close to 1 (1.1, 0.9, 0.9), validating the ability of the MWA system used to create spherical zones of ablation. This feature overcomes the limitations of previous microwave systems.
- Patients who underwent laparoscopic MWA were discharged home the next day.
- Study is ongoing; patients will be followed to determine local control rate.

**SURGICAL TECHNIQUE LESSONS:**
- The Emprint™ ablation system antenna was introduced thru a 3- to 5-mm trocar in order to minimize trauma to the antenna. Insertion thru a trocar also enabled the proper angle of entry into the liver parenchyma to successfully access lesions distributed across all liver segments without bending the needle.
- For capsular lesions, an initial ablation at 45 W for 30 seconds was performed to prevent rupture of the liver parenchyma, followed by a cycle at 100 W. The antenna was then pulled out, by applying track ablation at 50-100 W of power and staying at each centimeter of depth for 2-3 seconds.
- The ablation zone should be monitored with intraoperative ultrasound to ensure that the whole lesion is encompassed by the ablation zone*.
Author stated that ablation times were shorter with Emprint™ ablation system than with RFA technology, mentioning that a 5-cm RF ablation may take up to 25-30 minutes, while a 5-cm spherical ablation with Emprint™ was created in 15 minutes in the current study.

Author mentioned that MWA has a significant advantage over RFA in terms of needle placement. For complete tumor ablation, RFA requires the needle to be placed exactly at the center of the tumor, while with Emprint™ the ablation develops away from the antenna and achieves complete tumor ablation even if the needle is not placed in the center of the lesion.

STUDY DESIGN:
Prospective, single-center, single-arm study of 18 patients with 54 malignant liver tumors treated with the Emprint™ ablation system with Thermosphere™ technology between September 2014 and January 2015. Imaging studies included triphasic liver CT scans obtained within a month before and 2 weeks after the MWA procedure. All ablations were done at 100W (2.5 min for 3 cm ablation, 10 min for 4 cm, 15 min for 5 cm) based on manufacturer’s reference standards. The ablation zones were assessed for complete tumor response and spherical geometry. Based on real-time ultrasound feedback, repeat ablations were performed if necessary. (Level 4) Independent Study

*Medtronic does not currently provide guidelines around multiple overlapping ablations for the Emprint™ ablation system. This technique is based on the experience, results, and recommendations of eth author and may not reflect those of Medtronic.

**Residual lesions (i.e., local tumor recurrence) as defined by Goldberg et al.¹ and Ahmed et al.² to infer residual unablated tumor undetected at previous follow up due to imaging limitations.


**THIS CONCLUDES THE CLINICAL SYNOPSIS OF THIS PUBLICATION**
Medtronic provides the following synopsis of a clinical publication involving the Emprint™ ablation system with Thermosphere™ technology.

**TITLE**
A New System of Microwave Ablation at 2450 MHz: Preliminary Experience

**FIRST AUTHOR**
Ierardi A. M. et al (Interventional Radiology, University of Insubria, Varese, Italy)

**JOURNAL**
Updates in Surgery

**PUB DATE**
March 17, 2015 (published online)

**KEY FINDINGS:**

- **Technical success** (correct positioning of antennae within the lesion) was 100%
- **Mean diameter** of hepatic lesions (n=10) was 24.9 mm (range 16-35 mm)
- **Mean ablation time** was 3.85 minutes (range 3-5 minutes) with a single antenna
- **Follow-Up Imaging**: CT scan performed after 1 month revealed complete ablation* of all treated lesions with no residual disease
- **Spherical Ablation Zone Shape**: Measured the 3 perpendicular dimensions of the ablation zone (A**, B**, L**) from an image obtained by multiplanar reformatting reconstruction. Author concludes that a spherical shape of ablation zone was achieved. The mean Roundness indexes (perfect circle=1) were calculated for Index A (A/L) = 0.80; Index B (B/L) = 0.79; Index Traverse (B/A) = 0.94

**Safety**: No major complications were recorded and the 30-day mortality rate was 0%. One patient had mild perihepatic fluid collection that disappeared by 1-month CT scan.

**Thermosphere™ Technology**: Author discusses the three different kinds of control contributing to creation of a predictable active spherical ablation zone

- **Field Control**: New antenna has a geometry that focuses energy at the tip of the device
- **Thermal Control**: Enabled by the advanced cooling system of the antenna shaft
- **Wavelength Control**: Active antenna buffering maintains a spherical electromagnetic field

*The longitudinal diameter (L) was measured along the electrode axis on the plane in which the electrode shaft was located, and two transverse diameters (A and B) were examined on the planes perpendicular to the electrode shaft. A value near 1 for A/L, B/L, and B/A would represent a more spherical ablation zone shape.
STUDY DESIGN:

**Prospective single arm study** reporting on 10 patients receiving percutaneous liver tumor ablation (8 hepatocellular carcinomas and 2 metastases) between April 2014 and August 2014 using the Emprint™ Microwave Ablation (MWA) System with Thermosphere™ technology. **Patient selection** was age =>18 years, malignancy confirmed by a histologic report, unresectable tumor, unresponsive to chemotherapy (for metastasis), normal coagulation parameters, patients’ refusing surgery, comorbidities, and percutaneous or laparoscopic access. All patients received MWA under moderate sedation. Procedure was performed according to manufacturer specifications by inserting the antenna within the lesion and maintaining a power of 100 W at 2450 MHz for a total ablation time of 2–5 minutes to obtain the optimal necrosis volume. Immediate follow-up CT scans were utilized to determine shape of ablation zone. A CT scan was performed at 1 month using contrast enhancement to view treated lesions. Technical success, ablation duration time, shape of ablation zone, and safety were recorded.

*Independent Study (Oxford Level 4)*

*Complete ablation (i.e., local tumor recurrence) as defined by Goldberg et al.¹ and Ahmed et al.² to infer residual unablated tumor undetected at previous follow up due to imaging limitations.


**THIS CONCLUDES THE CLINICAL SYNOPSIS OF THIS PUBLICATION**
This page intentionally left blank.