Ontario Health
Cancer Care Ontario

Recommendations Report

Microwave ablation and cryoablation

May 1 2021

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Section 1: Guideline Recommendations

Background

Interventional oncology is an emerging field that offers more treatment options for cancer patients. For example, patients who are not eligible for surgery may be eligible for focal tumour ablation. Ontario Health (Cancer Care Ontario), through the Interventional Oncology Steering Committee, continues to look at interventional oncology procedures such as microwave ablation (MWA) and cryoablation (CA) to ensure that, where appropriate, patients have access to evidence informed treatment in Ontario. The Interventional Oncology Steering Committee therefore formed the Interventional Oncology Emerging Technologies Working Group to specifically address MWA and CA and other emerging indications.

At the time of the Focal Tumour Ablation in Ontario: Recommendations Report 2015, it was determined that there was insufficient evidence to support recommendations for treatment of liver, kidney and lung cancer with MWA. CA for liver cancer was not assessed at that time. Ongoing consultation with stakeholders indicates that there is now sufficient evidence in the medical literature and clinical experience to develop clinical guidance for the use of MWA and cryoablation for cancer patients. Some of the important differences among the various ablation modalities include the following: 1) MWA has been shown to produce larger ablation zones[1] [2] and have less mitigation by the heat sink effect compared to radiofrequency ablation (RFA)[3] [4] [5], 2) CA has been shown to cause less adverse effects on the urothelial collecting system compared to RFA[6].

MWA and CA are part of the Interventional Oncology program and as such, anyone performing MWA and CA must conform to the standards set out by the Interventional Oncology program within the multidisciplinary care, Quality Assurance, and value for money sections of this report.

This recommendations report is in alignment with the Ontario Cancer Plan and meets the following goals:

- Ensuring the provision of **effective** cancer care by developing strategies to support evaluation and implementation of innovative technologies and interventions.
- Improving health **equity** across the cancer system by developing health policy advice and implementing strategies for supporting identified underserviced and vulnerable populations.

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[1] Wright, A. S., Lee, F. T., Mahvi, D. M. (2003). Hepatic microwave ablation with multiple antennae results in synergistically larger zones of coagulation necrosis. *Annals of Surgical Oncology, 10, 275-283.*
[2] Lubner, M. G., Brace, C. L., Hinshaw, J. L., Lee, F.T. (2010). Microwave tumor ablation: mechanism of action, clinical results, and devices. *Journal of Vascular and Interventional Radiology, 21(8), 192-203.*
[3] Pillai, K., Akhter, J., Chua, T. C., Shehata, M., Alzahrani, N., Al-Alem, I., Morris, D. L. (2015). Heat sink effect on tumor ablation characteristics as observed in monopolar radiofrequency, bipolar radiofrequency, and microwave, using ex vivo calf liver model. *Medicine, 94(9), 580.*
[4] Poulou, L. S., Botsa, E., Thanou, I., Ziakas, P. D., Thanos, L. (2015). Percutaneous microwave ablation vs radiofrequency ablation in the treatment of hepatocellular carcinoma. *World Journal of Hepatology, 7(8), 1054-1063.*
[5] Simon, C. J., Dupuy, Mayo-Smith, W. W. (2005). Microwave ablation: principles and applications. *Radiographics, 1, 69-83.*
[6] Schmit, G. D., Kurup, A. N., Weisbrod, A. J., Thompson, R. H., Boorjian, S. A., Wass, C. T., … & Atwell, T. D. (2014). ABLATE: a renal ablation planning algorithm. *American Journal of Roentgenology. 202(4).*

Additionally, this recommendations report aims to provide input into the ongoing evolution of the provincial oversight approach for interventional oncology in Ontario cancer patients to ensure timely access to high quality care in alignment with the Provincial Plan for Focal Tumour Ablation Services.

Intended Guideline Users

The primary target audience is health care providers performing or referring patients for these procedures including interventional radiologists, surgical oncologists, radiologists, medical oncologists and radiation oncologists.

Secondary target audiences include patients, hospitals/ cancer centres, Home and Community Care Support Services, government, associations and primary care physicians.

Recommendations

The following recommendations were made by the Interventional Oncology Emerging Technologies Working Group and were endorsed by the Interventional Oncology Steering Committee. These were based on the systematic review of the available evidence, current practice in Ontario, and guidance from other jurisdictions and experts in the field.

Recommendations
1. MWA for treating primary liver cancer: • Based on available evidence, MWA and RFA for hepatocellular carcinoma (HCC) are equivalent treatment modalities. CA was not reviewed for this indication. **2. MWA for treating primary lung cancer and metastases in the lung:** • Based on available evidence, MWA and RFA for lung malignancies are equivalent treatment modalities, although the evidence currently available is not of high quality. CA was not reviewed for this indication. **3. CA for treating primary kidney cancer:** • Based on available evidence, CA and RFA for renal cell carcinoma (RCC) are equivalent treatment modalities. **4. MWA for treating liver metastases from colorectal cancer:** • There is insufficient evidence to recommend 1) MWA over RFA for treating metastatic colorectal cancer (mCRC) to liver, or 2) that MWA and RFA are equivalent treatment modalities.
Qualifying Statements
• Different ablative procedures are often viewed as technologic refinements as opposed to net new treatments. These different ablative procedures can in many cases be considered similar, with differences in use primarily driven by nuanced clinical factors. • Choice of technology used for ablation should be based on multidisciplinary cancer conference (MCC) discussions and MCC decisions – based primarily on the recommendation of the operator (e.g., the operator would have a recommendation for treatment modality in the case of a large liver tumour near a large vein and the need to protect against the heat sink effect).

- Although MWA, CA, and RFA have all been shown to be effective modalities in the ablation of tumours, there are important differences among the modalities in terms of physics and physiologic effects as documented by the scientific community and born out in clinical practice by experts in the field. As such, certain patients may derive clinical benefit with the use of one particular ablation modality compared to another.

The Interventional Oncology Steering Committee emphasized that due to the quickly evolving landscape of ablation methods, the question of which ablation method is optimal for certain disease sites or clinical scenarios persists. Performance of a randomized clinical trial to detect small differences in outcome (i.e., recurrence free survival) between modalities will require large patient populations to detect, and are likely to be subject to various biases (e.g., patient selection, given that optimal choice of technique often depends on specifics of each case). Effectiveness of different technologies may also be different depending on operator experience with tumour ablation with each individual technology.

Multidisciplinary care, including the review of each case at an MCC as expanded upon below, is a key component in determining which option is best for a given patient's care.

Implementation Considerations as Part of a Quality Program

Performance of MWA and CA must conform to the quality standards set out below. Multidisciplinary care, Quality Assurance, and value for money are key components of the quality standard for implementation of the recommendations set out within this report.

Multidisciplinary care

Patients being considered for treatment with ablative therapies should receive care under the oversight of a multidisciplinary care team and have their case reviewed at an MCC (onsite or offsite), which – in addition to the minimum standard requirements for MCCs – must include a surgeon as relevant to the case, and a radiologist or interventional radiologist when patients are being considered for treatment with ablative therapies.

Multidisciplinary discussion via an MCC is an established mechanism to support decision-making and optimize individual patient management. Participation of all relevant disciplines in an MCC helps ensure that all available treatment modalities are considered for each patient and helps guide optimal patient selection.

In addition to patient selection, expert service delivery and management of potential complications demands health care providers who have competencies, which can only be achieved with ongoing clinical practice. Designated Hepato-Pancreatic Biliary (HPB) centres in Ontario are hospitals that meet certain safety and quality standards. For patients with liver disease, it is important to ensure that the surgical expertise from the HPB centre is incorporated into the MCC decision-making process.

Quality Assurance

Procedures are performed within the context of a quality program and the usual quality of care applies as outlined in the Provincial Plan for Focal Tumour Ablation Services. A measurement framework has been put into place to ensure Ontario cancer patients have access to the highest quality interventional oncology services. Benchmarks to establish a minimum level of recurrence

rates and complication rates expected will be put into place. Relevant indicators to measure access to services, patient outcomes including complication rates, and system performance have been developed for this patient population.

Value for Money

To optimize system-level funding and recognizing differences among technologies, sites should be considering the use of lower cost ablative alternatives when appropriate for patient care. Practice amongst the various focal tumour ablative modalities will be monitored and, where possible, evidence-based recommendations will be made to support lower-cost alternatives.

At a system level, in addition to making more treatment options accessible for cancer patients, treatment-related serious complications are less common for interventional oncology procedures than in surgery, resulting in decreased emergency room utilization and added value to the system. In order to ensure access to quality care and improved value for money is supported across Ontario's health system, Ontario Health (Cancer Care Ontario) will work to fund incremental volumes for services for cancer patients in Ontario in accordance with this recommendations report.

Section 2: Evidentiary Base

Methodology

The Interventional Oncology Emerging Technologies Working Group (Appendix A) led development and oversaw execution of the systematic evidence review and summary.

Detailed results and search strategies are outlined by technology and indication in Appendices C and D.

Research Questions

From the Objectives outlined previously in this document, the following research questions were derived and used to direct the search for available evidence to inform decision-making:

For MWA for HCC, and mCRC to liver and lung tumours, and CA for RCC.

- How are these treatments used?
- What is the effectiveness of these treatments?
- What are the associated outcomes (benefits and safety) of treatments?

Clinical recommendations comparing local ablative therapies and all possible treatment alternatives (e.g., surgery, radiation therapy, stereotactic body radiation therapy (SBRT) for lung cancer) were considered out of scope for this evidence summary.

Target population

The target population consists of adult patients 18 years and older who may be eligible to receive MWA for HCC, mCRC to liver and lung tumours and CA for RCC.

Evidence Search and Summary

A limited literature search was conducted on key resources including Ovid MEDLINE(R) (1946 to September Week 36 2017), Ovid Embase (1974 to 2017 Sept 7), a focused Internet search of

key health technology assessment resources, as well as Canadian, US, and international health technology agencies. No filters were applied to limit the retrieval by study type. The search was also limited to English language documents published between January 1, 2014 and September 7, 2017. Supplementary searches were also later conducted to update the lung tumours and/or CA for RCC results for documents published between September 2017 and January 2018. These supplementary searches were also executed in Ovid Medline and Ovid Embase, with no filters applied to limit the retrieval by study type. For specific search strategies used, please consult Appendix C.

The evidence summary was developed using a planned two-stage method summarized here and described in more detail in Appendix C.

1. Search and evaluation of existing systematic reviews: If one or more existing systematic reviews were identified that addressed the research questions and were of reasonable quality, then those systematic reviews would form the core of the evidentiary base.
2. Systematic review of the primary literature: This evidence summary would focus on those areas not covered by existing reviews if any were located and accepted.

Conflicts of Interest

The evidence summary authors and the Interventional Oncology Steering Committee members were asked to disclose potential conflicts of interest. The authors, members and reviewers reported that they had no conflicts of interest.

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Appendices

Appendix A: Interventional Oncology Emerging Technologies Working Group Members

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Appendix C: Results and Search Strategies by Technology and Indication

MWA for treating primary liver cancer

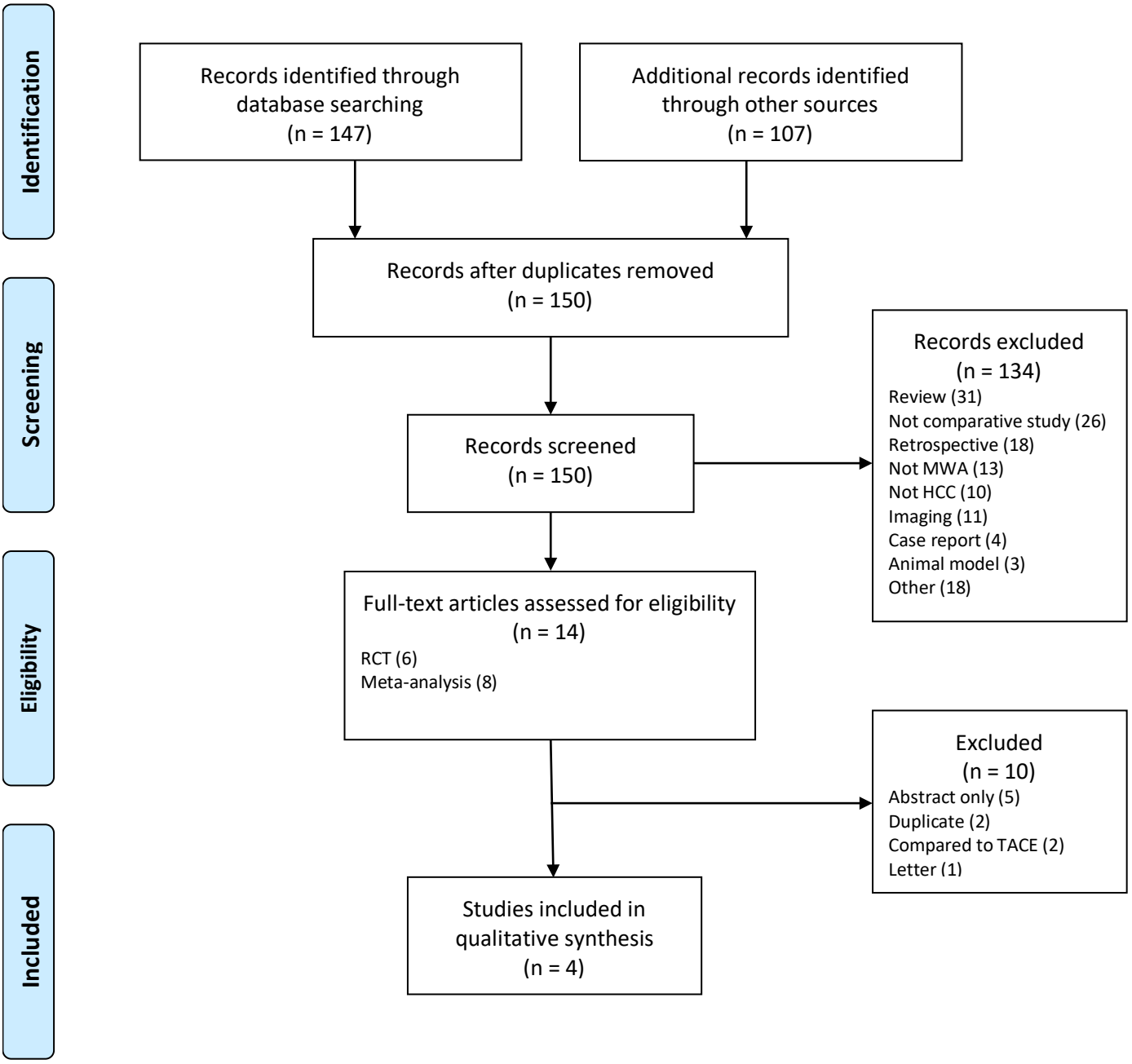

Figure 1. Search strategy for MWA for treating primary liver cancer.

Table 2. Results of search strategy for MWA for treating primary liver cancer.

Author	Year	Journal	Title	Review Conclusions	Study Type
Yi et al.	2014	Chinese Journal of Cancer Research	"Radiofrequency ablation or microwave ablation combined with transcatheter arterial chemoembolization in treatment of hepatocellular carcinoma by comparing with radiofrequency ablation alone"	Excluded – compared with TACE	Randomized Controlled Trial
Abdelaziz et al.	2015	Scandinavian Journal of Gastroenterology	"Microwave ablation versus transarterial chemoembolization in large hepatocellular carcinoma: prospective analysis"	Excluded – compared with TACE	Randomized Controlled Trial
Fong et al.	2016	Surgical Practice	"Preliminary results on microwave versus radiofrequency ablation for hepatocellular carcinoma: A randomized controlled trial"	Excluded – same abstract as Chong 2017	Randomized Controlled Trial
Sheta et al.	2016	European Journal of Gastroenterology and Hepatology	"Comparison of single-session transarterial chemoembolization combined with microwave ablation or radiofrequency ablation in the treatment of hepatocellular carcinoma: A randomized-controlled study"	Excluded – combined with TACE, large tumours	Randomized Controlled Trial
Yu et al.	2016	Journal of Clinical Oncology	"Comparison of cooled-probe microwave and radiofrequency ablation treatment in incipient hepatocellular carcinoma: A phase III randomized controlled trial with 6-year follow-up"	Excluded – same abstract as Yu 2017	Randomized Controlled Trial
Chong et al.	2017	Journal of Hepato-Biliary-Pancreatic Sciences	"Microwave versus radiofrequency ablation for hepatocellular carcinoma: A randomized controlled trial"	Excluded - abstract – not published	Randomized Controlled Trial
Vietti-Violi et al.	2017	CardioVascular and Interventional Radiology	“Prospective randomized controlled trial comparing efficacy of microwave ablation and radiofrequency ablation for the treatment of hepatocellular carcinoma in patients with a chronic liver disease”	Excluded - abstract – not published	Randomized Controlled Trial
Yu et al.	2017	Gut	"Percutaneous cooled-probe microwave versus radiofrequency ablation	Excluded - abstract – not published	Randomized Controlled Trial

			in early-stage hepatocellular carcinoma: A phase III randomised controlled trial"		
Huo et al.	2015	Journal of Vascular & Interventional Radiology	"Microwave Ablation Compared to Radiofrequency Ablation for Hepatic Lesions: A Meta-Analysis"	MW ablation and RF ablation had similar 1–5-year overall survival, disease-free survival, local recurrence rate, and adverse events. Claim better OS at 6 years based on 3 studies, with no difference in the first 5 years of follow-up.	Meta-analysis
Chinnaratha et al.	2016	Journal of Gastroenterology and Hepatology (Australia)	"Percutaneous thermal ablation for primary hepatocellular carcinoma: A systematic review and meta-analysis"	Overall, both RFA and MWA are equally effective and safe, but MWA may be more effective compared to RFA in preventing local tumor progression when treating larger tumors.	Meta-analysis
Facciorusso et al.	2016	Digestive and Liver Disease	"Microwave ablation versus radiofrequency ablation for the treatment of hepatocellular carcinoma: A systematic review and meta-analysis"	Our results indicate a similar efficacy between the two percutaneous techniques with an apparent superiority of MWA in larger neoplasms, when “only studies enrolling patients with larger tumour size were considered, MWA significantly outperformed RFA (OR 0.46, 95% CI 0.24–0.89, p<0.02)”.	Meta-analysis
Fazli et al.	2016	Asia-Pacific Journal of Clinical Oncology	"Microwave ablation versus radiofrequency ablation for hepatocellular carcinoma: A systematic review and meta-analysis of randomized controlled trials"	Excluded – abstract	Meta-analysis
Huang et al.	2016	International Journal of Hyperthermia	"Microwave ablation versus radiofrequency ablation for the treatment of hepatocellular carcinoma: a systematic review and meta-analysis': Two issues should be noted"	Excluded – letter	Meta-analysis
Roberts et al.	2016	Journal of Hepatology	"Microwave ablation versus radiofrequency	Excluded - abstract	Meta-analysis

			ablation for hepatocellular carcinoma: A systematic review and meta-analysis of randomised controlled trials"		
Majumdar et al.	2017	Cochrane Database of Systematic Reviews	"Management of people with early- or very early-stage hepatocellular carcinoma: an attempted network meta-analysis"	Comprehensive analysis of all possible treatment for early stage HCC. No clear assumption can be made regarding MWA, other than Shibata 2002 results.	Meta-analysis
Luo et al.	2017	World Journal of Surgical Oncology	"Effects of radiofrequency ablation versus other ablating techniques on hepatocellular carcinomas: a systematic review and meta-analysis"	No difference in complete tumor ablation, OS 1 and 3 years, Recurrence or complications.	Meta-analysis

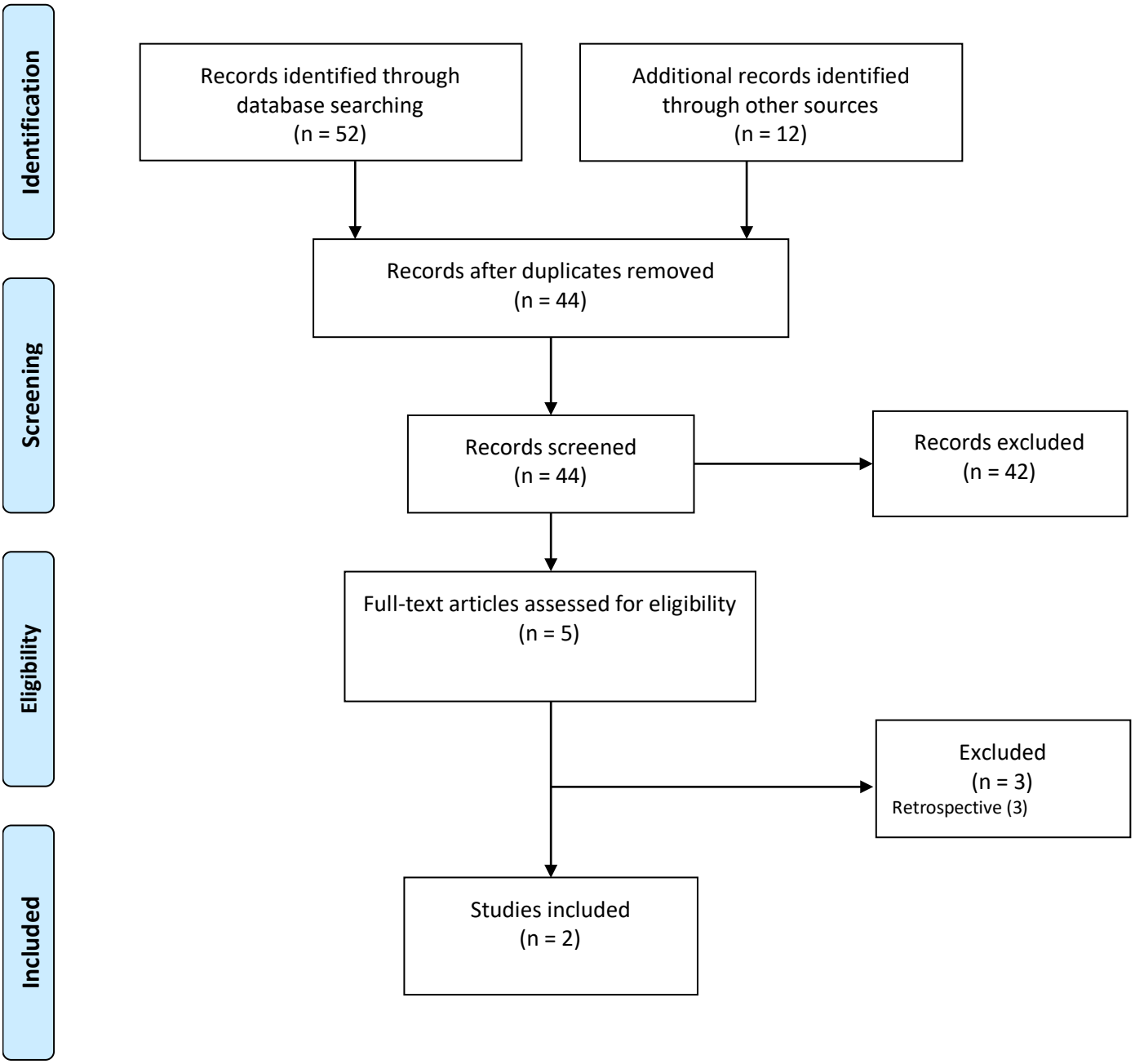

Figure 2. Search strategy for MWA for treating lung cancer and metastases in the lung.

Table 3. Results of search strategy for MWA for treating lung cancer and metastases in the lung.

Author	Year	Journal	Title	Review Conclusions	Study Type
Macchi et al.	2017	Medical Oncology	"Radiofrequency versus microwave ablation for treatment of the lung tumours: LUMIRA (lung microwave radiofrequency) randomized trial"	LUMIRA trial Lung Tumors - stage IV disease radiofrequency (RFA) and microwave ablation (MWA) 52 patients There was significant reduction in tumor size in MWA group No difference in survival time (p= 0.883) 12 months MWA had less intraprocedural pain than in RFA (1.79\3.25, p=0.0043) MWA had more "Suffering pleura" than RFA (4/20) vs (0/25) p=0.0163	*Randomized Controlled Trial*
Vogl et al.	2016	American Journal of Roentgenology	"Thermal Ablation of Colorectal Lung Metastases: Retrospective Comparison Among Laser-Induced Thermotherapy, Radiofrequency Ablation, and Microwave Ablation"	Excluded	*Retrospective*
Nour-Eldin et al.	2017	International Journal of Hyperthermia	"Ablation therapy of non-colorectal cancer lung metastases: retrospective analysis of tumour response post-laser-induced interstitial thermotherapy (LITT), radiofrequency ablation (RFA) and microwave ablation (MWA)"	Excluded	*Retroscpective*
Shi et al.	2017	Oncotarget	"Microwave ablation versus radiofrequency ablation for the treatment of pulmonary tumors"	Excluded	*Retrospective*
Vogl et al.	2017	RoFo	"Thermal Ablation of Lung Tumors: Focus on Microwave Ablation"	Limited non-systematic review of the literature Primary and metastatic lung cancer 10 studies accessing MWA Non comparative – single arm studies Author's Conclusion: MWA systems has	*Systematic Review*

Author	Year	Journal	Title	Review Conclusions	Study Type
				comparable clinical outcomes to those of RFA	

Cryoablation for treating primary kidney cancer

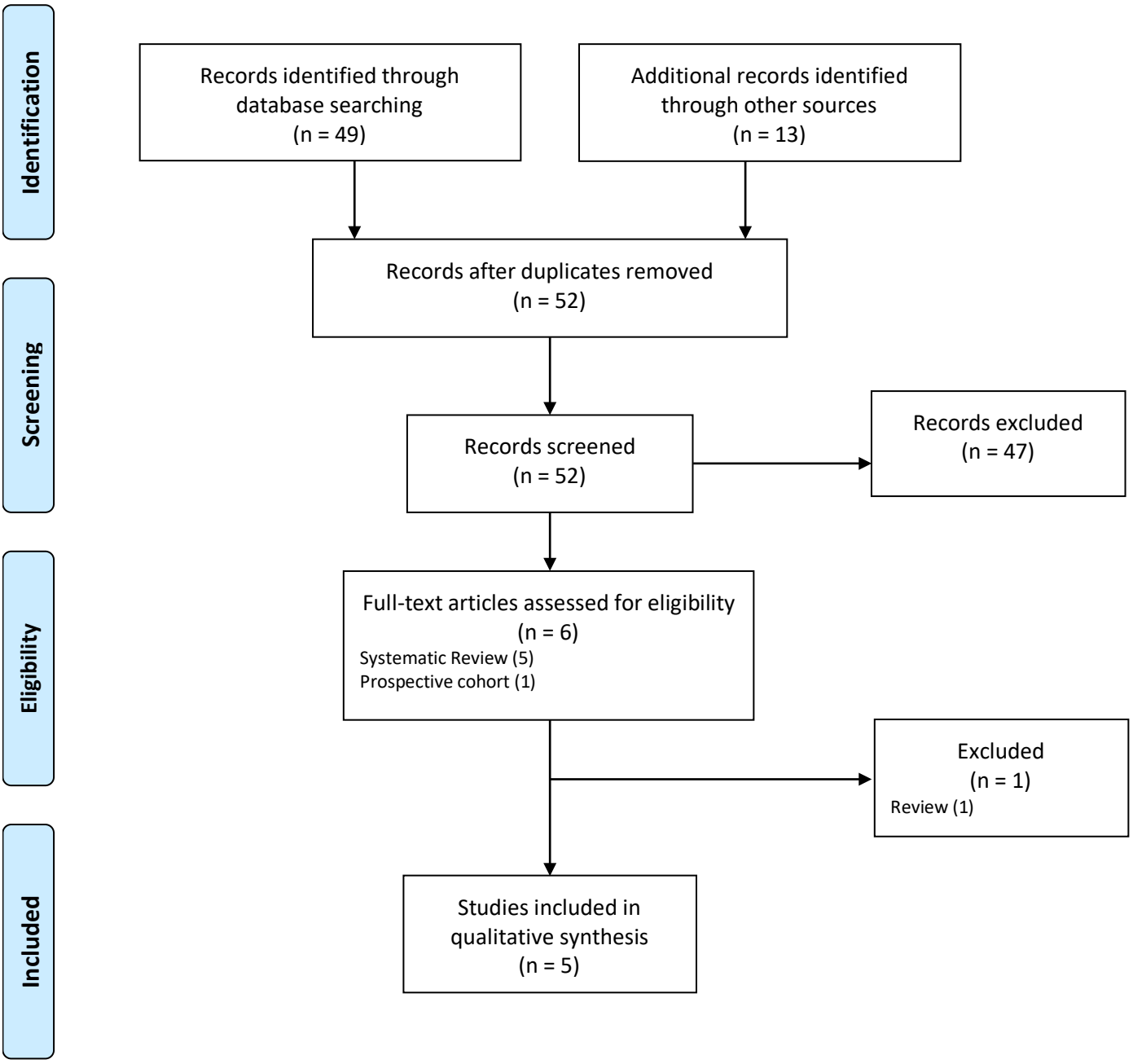

Figure 3. Search strategy for cryoablation for treating primary kidney cancer.

Table 4. Results of search strategy for cryoablation for treating primary kidney cancer.

Author	Year	Journal	Title	Review Conclusions	Study Type
Klatte et al.	2014	World Journal of Urology	"The contemporary role of ablative treatment approaches in the management of renal cell carcinoma (RCC): focus on radiofrequency ablation (RFA), high-intensity focused ultrasound (HIFU), and cryoablation"	Excluded – review article	Review
Gkentzis & Oades	2016	Scottish Medical Journal	"Thermal ablative therapies for treatment of localized renal cell carcinoma: a systematic review of the literature"	Systematic review of the literature without meta-analysis Small renal masses retrieved studies mainly one-arm, uncontrolled and observational Individual description of studies with no summarization. Describe a meta-analysis from 2008 comparing cryoablation with RFA.	Systematic Review
Griffith et al.	2017	American Journal of Transplantation	"Solid Renal Masses in Transplanted Allograft Kidneys: A Closer Look at the Epidemiology and Management"	Not included – Not assessing cryoablation specifically	Systematic Review
Prins et al.	2017	Journal of Endourology	"Renal Cell Carcinoma: Alternative Nephron-Sparing Treatment Options for Small Renal Masses, a Systematic Review"	Systematic review of the literature Small renal masses 22 studies accessing Cryoablation Summarize studies without meta-analysis Recurrent free survival and Cancer specific survival favorable Debetable long term results with some studies suggesting a poor outime while other show a beneficial outcome.	Systematic Review
Kunkle et al.	2008	Cancer	"Cryoablation or Radiofrequency Ablation of the Small Renal Mass - a Meta-analysis"	Systematic review of the literature and meta-analysis Small renal masses 47 studies – 1382 lesions treated Meta-analysis of non-controlled studies.	Systematic Review

Author	Year	Journal	Title	Review Conclusions	Study Type
Thompson et al.	2015	European Urology	"Comparison of partial nephrectomy and percutaneous ablation for cT1 renal masses"	Compared Partial Nephrectomy, RFA and cryoablation (CA) 1803 patients with primary cT1N0M0 renal masses 1057 PN, 180 RFA and 187 CA local recurrence-free survival was similar among the three treatments (p=0.49) metastases-free survival significantly better for PN (p=0.005) and CA (p=0.021) No difference in overall survival between RFA and CA (p=0.042)	Prospective

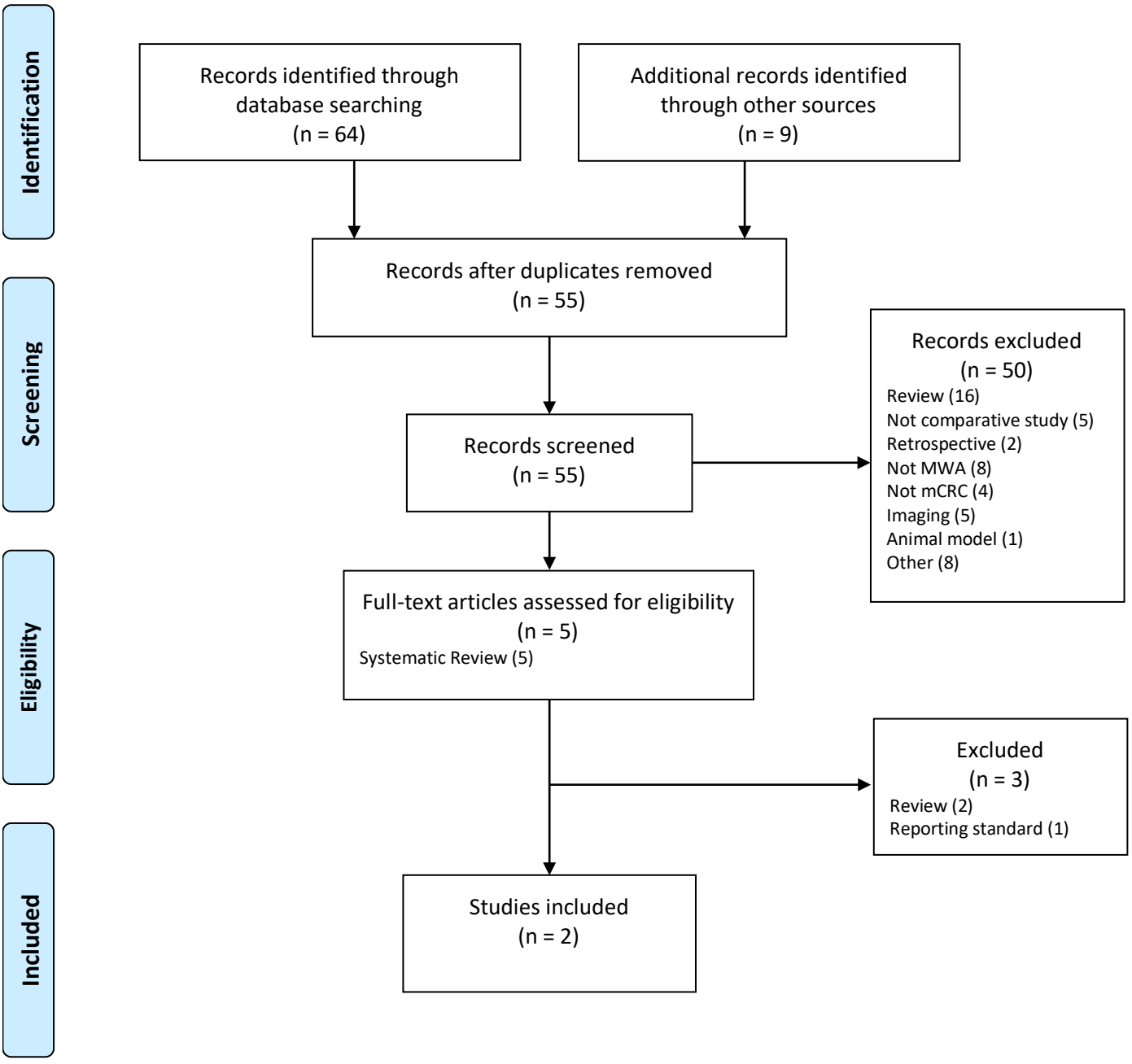

Figure 4. Search strategy for MWA for treating liver metastases.

Table 5. Results of search strategy for MWA for treating liver metastases.

Author	Year	Journal	Title	Review Conclusions	Study Type
North et al.	2014	American Journal of Surgery	"Microwave ablation for hepatic malignancies: a call for standard reporting and outcomes"	Excluded – focused on reporting standards	Review
Vogl et al.	2014	Radiologia Medica	"Thermal ablation of liver metastases from colorectal cancer: radiofrequency, microwave and laser ablation therapies"	Although not significantly different, the mean of 1-, 3- and 5-year survival rates for RFA and MWA lesions was (92.6, 44.7, 31.1 %) and (79, 38.6, 21 %), respectively. The median survival in these methods was 33.2 and 29.5 months, respectively.	Systematic Review
Loveman et al.	2014	Health Technology Assessment	“The clinical effectiveness and cost-effectiveness of ablative therapies in the management of liver metastases: systematic review and economic evaluation”	One randomized controlled trial assessed a microwave ablation compared with surgical resection. It found no statistically significant difference between the interventions on measures of survival. Benefits were shown in terms of surgical invasiveness. Comprehensive analysis of ablative treatments for mCRC. No clear assumption can be made regarding MWA	Systematic Review
Wong et al.	2016	Cancer Control	"Local Ablation for Solid Tumor Liver Metastases: Techniques and Treatment Efficacy"	Excluded – review article	Review
Petre et al.	2017	Visceral Medicine	"Thermal Ablation in the Management of Colorectal Cancer Patients with Oligometastatic Liver Disease"	Excluded – review article	Review
Correa-Gallego et al.	2014	Annals of Surgical Oncology	"A retrospective comparison of microwave ablation vs. radiofrequency ablation for colorectal cancer hepatic metastases"	Excluded - retrospective	Retrospective
van Tilborg et al.	2016	CardioVascular and Interventional Radiology	"MWA Versus RFA for Perivascular and Peribiliary CRLM: A Retrospective Patient- and Lesion-Based Analysis of Two Historical Cohorts"	Excluded - retrospective	Retrospective

Appendix D: Literature search strategies

MWA for treating primary liver cancer

Medline MEDLINE(R) <1946 to September week 36 2017>

4	exp Microwaves/tu
5	((Microwave* or Electromagnetic or thermal* or MWA or thermotherapy*) adj ablat*).ti,ab,kw.
6	4 or 5
7	exp Catheter Ablation/
8	((Radiofrequency or radio frequency or RF or RFA or RITA or impedance or temperature or percutaneous or interstitial or electric or transvenous or catheter or monopolar or bipolar) adj ablat*).ti,ab,kw.
9	7 or 8
25	exp Carcinoma, Hepatocellular/ or Liver Neoplasms/su
26	((carcinoma* or cancer* or neoplas* or tumor or tumour or tumors or tumours) adj (HCC or hepatocellular or liver cell or hepatoma)).ti,ab,kw.
27	25 or 26
28	27 and 9 and 6
29	limit 28 to (english language and yr="2014 -Current")
30	from 29 keep 1-147

Embase <1974 to 2017 September 9>

1	*liver cell carcinoma/ or *liver cancer/su or ((carcinoma* or neoplas* or cancer* or tumor or tumour or tumors or tumours) adj (HCC or hepatocellular or liver cell or hepatoma)).ti,ab,kw.
2	*microwave thermotherapy/ or ((Microwave* or Electromagnetic or thermal* or MWA or thermotherap*) adj ablat*).ti,ab,kw.
3	*radiofrequency ablation/ or ((Radiofrequency or radio frequency or RF or RFA or RITA or impedance or temperature or percutaneous or interstitial or electric or transvenous or catheter or monopolar or bipolar) adj ablat*).ti,ab,kw.
4	1 and 2 and 3
5	limit 4 to (english language and em="201400 - 201801")

MWA for treating primary lung cancer and metastases in the lung

MEDLINE(R) <1946 to December week 51 2017>

1	exp Lung Neoplasms/
2	((carcinoma* or cancer* or neoplas* or tumor or tumour or tumors or tumours or malignan*) adj (metasta* or primary or small cell or peripheral) adj (lung* or pulmonary* or thoracic)).ti,ab,kw.
3	1 or 2
4	exp Microwaves/tu
5	((Microwave* or Electromagnetic or thermal* or MWA or thermotherap*) adj ablat*).ti,ab,kw.
6	4 or 5
7	exp Catheter Ablation/

8	((Radiofrequency or radio frequency or RF or RFA or RITA or impedance or temperature or percutaneous or interstitial or electric or transvenous or catheter or monopolar or bipolar) adj ablat*).ti,ab,kw.
9	7 or 8
10	3 and 6 and 9
11	limit 10 to yr="2017 - 2018"
12	limit 11 to english language

Embase <1974 to 2017 December 19>

1	*lung cancer/
2	((carcinoma* or cancer* or neoplas* or tumor or tumour or tumors or tumours or malignan*) adj (metasta* or primary or small cell or peripheral) adj (lung* or pulmonary*)).ti,ab,kw.
3	1 or 2
4	*microwave thermotherapy/
5	((Microwave* or Electromagnetic or thermal* or MWA or thermotherapy*) adj ablat*).ti,ab,kw.
6	4 or 5
7	*radiofrequency ablation/
8	((Radiofrequency or radio frequency or RF or RFA or RITA or impedance or temperature or percutaneous or interstitial or electric or transvenous or catheter or monopolar or bipolar) adj ablat*).ti,ab,kw.
9	7 or 8
10	3 and 6 and 9
11	limit 10 to english language
12	limit 11 to yr="2017 - 2018"

Cryoablation for treating primary kidney cancer

MEDLINE(R) <1946 to December week 51 2017>

#	**Searches**
1	exp Carcinoma, Renal Cell/
2	((carcinoma* or neoplas* or cancer* or tumor or tumour or tumors or tumours or mass) adj (Renal cell or nephroid or grawitz or hypernephroid or kidney or collecting duct or RCC)).ti,ab,kw.
3	1 or 2
4	exp Cryosurgery/
5	(Cryoablat* or cryosurg* or freez* or froze* or "Percutaneous cryoablation").ti,ab,kw.
6	4 or 5
7	exp Microwaves/tu
8	((Microwave* or Electromagnetic or thermal* or MWA or thermotherap*) adj ablat*).ti,ab,kw.
9	7 or 8
10	exp Catheter Ablation/
11	((Radiofrequency or radio frequency or RF or RFA or RITA or impedance or temperature or percutaneous or interstitial or electric or transvenous or catheter or monopolar or bipolar) adj ablat*).ti,ab,kw.

12	10 or 11
13	3 and 6 and (9 or 12)
14	limit 13 to (english language and yr="2017 - 2018")

Embase <1974 to 2017 December 19>

#	Searches
1	*kidney carcinoma/
2	((carcinoma* or cancer* or neoplas* or tumor or tumour or tumors or tumours or mass) adj (Renal cell or nephroid or grawitz or hypernephroid or kidney or collecting duct or RCC)).ti,ab,kw.
3	1 or 2
4	*cryoablation/
5	(Cryoablat* or cryosurg* or freez* or froze* or "Percutaneous cryoablation").ti,ab,kw.
6	4 or 5
7	*radiofrequency ablation/
8	((Radiofrequency or radio frequency or RF or RFA or RITA or impedance or temperature or percutaneous or interstitial or electric or transvenous or catheter or monopolar or bipolar) adj ablat*).ti,ab,kw.
9	7 or 8
10	*microwave thermotherapy/
11	((Microwave* or Electromagnetic or thermal* or MWA or thermotherap*) adj ablat*).ti,ab,kw.
12	10 or 11
13	3 and 6 and (9 or 12)
14	limit 13 to (english language and yr="2017 - 2018")

MWA for treating liver metastases

Medline<1946 to September week 36 2017>

1	exp Colorectal Neoplasms/ or exp Liver Neoplasms/se [secondary]
2	((carcinoma* or cancer* or neoplas* or tumor or tumour or tumors or tumours or malignan* or metasta*) adj (colorectal or hepatic or liver or CRLM or mCRC)).ti,ab,kw.
3	1 or 2
4	exp Microwaves/tu
5	((Microwave* or Electromagnetic or thermal* or MWA or thermotherapy*) adj ablat*).ti,ab,kw.
6	4 or 5
7	exp Catheter Ablation/
8	((Radiofrequency or radio frequency or RF or RFA or RITA or impedance or temperature or percutaneous or interstitial or electric or transvenous or catheter or monopolar or bipolar) adj ablat*).ti,ab,kw.
9	7 or 8
10	3 and 6 and 9
11	limit 10 to (english language and yr="2014 -Current")

Embase<1974 to 2017 September 9>

7	*radiofrequency ablation/
8	((Radiofrequency or radio frequency or RF or RFA or RITA or impedance or temperature or percutaneous or interstitial or electric or transvenous or catheter or monopolar or bipolar) adj ablat*).ti,ab,kw.
9	7 and 8
10	*microwave thermotherapy/
11	((Microwave* or Electromagnetic or thermal* or MWA or thermotherap*) adj ablat*).ti,ab,kw.
12	10 or 11
27	*metastatic colorectal cancer/
28	((carcinoma* or cancer* or neoplas* or tumor or tumour or tumors or tumours or malignan* or metasta*) adj (colorectal or hepatic or liver or CRLM or mCRC)).ti,ab,kw.
29	27 or 28
30	29 and 12 and 9
31	limit 30 to (english language and yr="2014 -Current")