MEDICAL POLICY

Excellus

SUBJECT: RADIOFREQUENCY TUMOR ABLATION	**EFFECTIVE DATE: 02/16/00** **REVISED DATE: 06/21/01, 07/18/02, 05/21/03, 05/19/04, 05/18/05, 02/16/06, 12/21/06, 12/20/07, 12/18/08, 11/19/09, 11/18/10, 12/15/11, 11/15/12, 10/17/13, 09/18/14, 08/20/15, 07/21/16, 07/20/17, 07/19/18**
POLICY NUMBER: 7.01.32 **CATEGORY: Technology Assessment**	**PAGE: 1 OF: 10**

- ***If a product excludes coverage for a service, it is not covered, and medical policy criteria do not apply.***
- ***If a commercial product (including an Essential Plan product) or a Medicaid product covers a specific service, medical policy criteria apply to the benefit.***
- ***If a Medicare product covers a specific service, and there is no national or local Medicare coverage decision for the service, medical policy criteria apply to the benefit.***

POLICY STATEMENT:

I. Based upon our criteria and assessment of peer-reviewed literature, radiofrequency ablation of malignant *hepatic lesions* (primary and metastatic) is considered a **medically appropriate** treatment option for selected patients meeting ALL of the following conditions:
   A. The patient has no evidence of uncontrolled extrahepatic systemic metastatic disease;
   B. The lesions(s) treated by radiofrequency are not amenable to open surgical resection or the patient is considered at high risk for adverse outcomes (morbidity and mortality) during open surgical resection; and
   C. The lesion size is 5 cm or less.

II. Based upon our criteria and assessment of peer-reviewed literature, radiofrequency ablation as a bridge to transplant is a **medically appropriate** treatment option in patients with *hepatocellular carcinoma* who meet liver transplant criteria and are waiting liver transplantation.

III. Based upon our criteria and assessment of peer-reviewed literature, percutaneous radiofrequency ablation of an *osteoid osteoma* is a **medically appropriate** alternative to surgical excision for patients with ALL of the following indications:
   A. The patient can not be managed successfully with medical management;
   B. There is sufficient clinical and imaging evidence that tumor is osteoid osteoma; and
   C. The tumor location allows for safe placement of the radiofrequency catheter (e.g., at least 1 cm away from vascular, neural or other anatomic structures which have the potential for damage,)

IV. Based upon our criteria and assessment of peer-reviewed literature, radiofrequency ablation of *renal tumors* is considered a **medically appropriate** treatment option in the following circumstances:
   A. Patients with a solitary kidney; OR
   B. Patients with a contraindication to surgery (e.g., significant comorbidities location or number of tumors preclude surgical intervention); AND
   C. Tumor size is equal to or less than 4 cm.

   The comorbidities of patients unable to undergo surgery should not be so severe as to limit their life expectancy to less than one year.

V. Based upon our criteria and assessment of peer-reviewed literature, radiofrequency ablation is considered **medically appropriate** when utilized for palliation of pain in patients with *osteolytic bone metastases* who have failed or are poor candidates for standard treatments such as opioids or radiation.

VI. Based upon our criteria and assessment of peer-reviewed literature, radiofrequency ablation has been medically proven effective and therefore is considered **medically appropriate** to treat an *isolated peripheral non-small cell lung cancer lesion* that is no more than 3 cm in size when the following criteria are met:
   A. Surgical resection or radiation treatment with curative intent is considered appropriate based on stage of disease, however, medical co-morbidity renders the individual unfit for those interventions; AND
   B. Tumor is located at least 1 cm from the trachea, main bronchi, esophagus, aorta, aortic arch branches, pulmonary artery and the heart.

VII. Based upon our criteria and assessment of peer-reviewed literature, radiofrequency ablation has been medically proven effective and therefore is considered **medically appropriate** to treat *malignant non-pulmonary tumor(s) metastatic to the lung* that are no more than 3 cm in size when ALL the following criteria are met:
   A. The patient is not considered a surgical candidate or radiofrequency ablation is being performed in order to preserve lung function when surgical resection or radiation treatment is likely to substantially worsen pulmonary status; AND
   B. There is no evidence of extrapulmonary metastases; AND
   C. The tumor is located at least 1 cm from the trachea, main bronchi, esophagus, aorta, aortic arch branches, pulmonary artery and the heart; AND
   D. There are no more than 3 tumors per lung to be ablated; AND
   E. Tumors are amenable to complete ablation; AND
   F. Twelve months have elapsed since the last ablation.

VIII. Based upon our criteria and assessment of peer-reviewed literature, radiofrequency ablation has not been medically proven to be effective and is considered **investigational** as a treatment method for *other solid tumors*, including, but not limited to pancreatic, thyroid, breast tumors and uterine fibroid tumors.

Refer to Corporate Medical Policy # 7.01.36 regarding Transurethral Radiofrequency Needle Ablation of the Prostate for Benign Prostatic Hyperplasia.

Refer to Corporate Medical Policy # 7.02.03 regarding Cryosurgical Tumor Ablations.

Refer to Corporate Medical Policy # 7.02.07 regarding Liver Transplantation.

Refer to Corporate Medical Policy # 7.01.69 regarding Selective Internal Radiation Therapy (SIRT).

Refer to Corporate Medical Policy # 7.01.78 regarding Peptide Receptor Radionuclide Therapy.

Refer to Corporate Medical Policy # 11.01.03 regarding Experimental and Investigational Services.

POLICY GUIDELINES:

The Federal Employee Health Benefit Program (FEHBP/FEP) requires that procedures, devices or laboratory tests approved by the U.S. Food and Drug Administration (FDA) may not be considered investigational and thus these procedures, devices or laboratory tests may be assessed only on the basis of their medical necessity.

DESCRIPTION:

Radiofrequency is an ablative technique that relies on heat to effect tumor killing. A radiofrequency electrode is passed into a tumor under sonographic, CT or MR-guidance. In radiofrequency ablation (RFA), tumors are destroyed in situ by thermal coagulation and protein denaturation. High frequency alternating current flows from un-insulated electrode tips into surrounding tissue. As the tissue ions attempt to follow the change in the direction of the alternating current, ionic agitation results in frictional heating. The tissue surrounding the electrode, rather than the electrode itself, is the primary source of heat. It is presumed that tissue heating drives extracellular and intracellular water out of the tissue, resulting in coagulative necrosis. RFA is usually used to treat inoperable tumors or to treat patients who are ineligible for surgery due to advanced age or co-morbidities. RFA was developed initially to treat inoperable tumors of the liver. RFA is now being proposed as a minimally invasive treatment alternative for other solid tumors such as breast, pancreas, pulmonary renal and bone.

Radiofrequency ablation can be administered by open surgery, laparoscopic surgery or percutaneously.

RATIONALE:

Radiofrequency ablation of liver tumors is not subject to FDA approval. However, several devices/probes used to ablate tumors have received FDA marketing clearance. Current studies have demonstrated that RFA is most effective (causes tissue necrosis) in the treatment of small lesions confined to the liver. Studies of RFA of small liver tumors have provided

similar outcomes in terms of local recurrence and overall survival for patients with unresectable hepatic malignancy compared to alternative therapies such as percutaneous ethanol injection (PEI).

Overall, most studies of RFA for miscellaneous malignant solid tumors (other than liver) consist of case studies, which have reported only short-term outcomes such as tumor response and immediate tumor control. These studies have not determined RFA's effect on the overall survival and net health benefit of these patients compared to the well established local and systemic treatments currently available for these tumors. More rigorous scientific reviews, long-term follow-up and randomized prospective trials are needed to help better define the role of RFA in oncology.

Renal tumors

The majority of studies were small case series of individual institution experiences with this treatment modality. Patients in these case series had small renal tumors and were unsuitable for surgical management (e.g., severe co-morbidities, a solitary kidney, or multiple renal tumors). Outcomes of these case series have demonstrated that RFA for renal cell carcinoma is a promising treatment and creates tumor necrosis, but longer-term outcomes are needed to determine if RFA provides a durable survival benefit. RFA as an alternative to surgical intervention requires comparative studies to determine if it provides a similar survival benefit.

Lung tumors

In summary, while the available studies are limited by study design, accumulating evidence from case series suggests that RFA may be a treatment option in selected patients with primary, non-small cell lung cancer and metastatic pulmonary tumors. Evidence suggests RFA may have survival rates and have rates of procedure-related complications and mortality similar to surgery. Surgical resection remains the treatment of choice, but in patients unable to tolerate surgery due to medical comorbidities, RFA may be considered a treatment option.

The December 2010 guidance from National Institute for Clinical Excellence (NICE) states: "Current evidence on the efficacy of percutaneous radiofrequency ablation (RFA) for primary or secondary lung cancers is adequate in terms of tumor control. There is a small incidence of complications, specifically pneumothorax, which may have serious implications for these patients with already compromised respiratory reserve. This procedure may be used provided that normal arrangements are in place for clinical governance, consent and audit. Patient selection for percutaneous RFA for primary or secondary lung cancers should be carried out by a multidisciplinary team, which will usually include a thoracic surgeon, an oncologist and a radiologist. This procedure should only be carried out by radiologists who regularly undertake image guided interventional procedures…"

The 2011 National Comprehensive Cancer Network (NCCN) Practice Guideline on NSCLC states RFA may be an option for node-negative patients who either refuse surgery or cannot tolerate surgery because of poor performance status, significant cardiovascular risk, poor pulmonary function, and/or comorbidities.

Transplant Setting

The drop out rates of patients with hepatocellular carcinoma from liver transplant lists have been reported to range from 20-40% due to tumor progression. Recent studies utilizing radiofrequency ablation as a bridge to transplant have increased days on the transplant list considerably and decreased dropout rates to 12-15%.

The evidence related to the use of RFA in patients with HCC to specifically downsize/downgrade tumors to meet priority transplant criteria is insufficient at this time due to inconsistent outcomes reported in the literature. Data related to tumor recurrence in this patient population requires longer-term follow-up.

Osteoid Osteomas

Studies investigating the efficacy of radiofrequency ablation for osteoid osteomas provide evidence that RFA provides comparable outcomes to surgical excision in regards to tumor destruction and pain relief and allows for a decrease in hospital stay and quicker postoperative recovery. RFA treatment of osteoid osteoma is not appropriate for large lesions or for lesions whose location make it technically difficult to perform percutaneously.

Breast Tumors

There is insufficient evidence in the literature related to the effectiveness of RFA in the treatment of patients with breast cancer. The outcome data from current clinical trials is inconsistent and no conclusions can be drawn on the effect of RFA on recurrence or disease-free survival rates. Studies are also limited by small sample populations, short-term follow-up and a lack of comparative studies with already established breast conserving therapies.

Bone Metastases

The majority of literature consists of uncontrolled studies with only a limited number of cases. However, the patient populations comprised individuals with limited or no treatment options, for whom short-term pain relief is an appropriate outcome.

Thyroid Tumors

The evidence for RFA in thyroid tumors is primarily limited to case series and uncontrolled studies. While RFA has been shown to reduce thyroid tumor volume and improve clinical symptoms, complications can be common and available evidence is insufficient to determine the impact of RFA on net health outcomes.

CODES: Number Description

Eligibility for reimbursement is based upon the benefits set forth in the member's subscriber contract.

CODES MAY NOT BE COVERED UNDER ALL CIRCUMSTANCES. PLEASE READ THE POLICY AND GUIDELINES STATEMENTS CAREFULLY

Codes may not be all inclusive as the AMA and CMS code updates may occur more frequently than policy updates.

Code Key: Experimental/Investigational = (E/I), Not medically necessary/ appropriate = (NMN).

CPT:	20982	Ablation therapy for reduction or eradiation of 1 or more bone tumors (e.g., metastasis) including adjacent soft tissue when involved by tumor extension, percutaneous, including imaging guidance when performed; radiofrequency
	32998	Ablation therapy for reduction or eradication of one or more pulmonary tumor(s) including pleura or chest wall when involved by tumor extension, percutaneous, radiofrequency, unilateral
	47370	Laparoscopy, surgical, ablation of one or more liver tumor(s); radiofrequency
	47380	Ablation, open, of one or more liver tumor(s); radiofrequency
	47382	Ablation, one or more liver tumor(s), percutaneous, radiofrequency
	50592	Ablation, one or more renal tumor(s), percutaneous, unilateral, radiofrequency
	58674 **(E/I)**	Laparoscopy, surgical, ablation of uterine fibroid(s), including intraoperative ultrasound guidance and monitoring, radiofrequency ~~effective 1/1/2017~~
	76940	Ultrasound guidance for, and monitoring of, parenchymal tissue ablation
	77013	Computerized axial tomographic guidance for, and monitoring of, parenchymal tissue ablation
	77022	Magnetic resonance guidance for, and monitoring of, parenchymal tissue ablation
	0404T **(E/I)**	Transcervical uterine fibroid(s) ablation with ultrasound guidance, radiofrequency

HCPCS: No specific code(s)

ICD10:	C22.0-C22.9	Malignancies of liver (code range)
	C34.90-C34.92	Malignant neoplasm of unspecified part of bronchus or lung (code range)
	C64.1-C64.9	Malignant neoplasm kidney, except renal pelvis (code range)
	C65.1- C65.9	Malignant neoplasm renal pelvis (code range)
	C66.1-C66.9	Malignant neoplasm ureter (code range)
	C78.7	Secondary malignant neoplasm of liver and intrahepatic bile duct
	D16.00-D16.8	Benign neoplasm bones (code range)
	D16.9	Benign neoplasm bone and articular cartilage, unspecified
	Investigational diagnosis codes:	
	174.0-174.9	Malignant neoplasm of female breast (code range)
	218.0-218.9	Uterine leiomyoma (code range)
	610.2	Fibroadenosis of breast
	C50.011-C50.919	Malignant neoplasm of breast (code range)
	D25.0-D25.9	Leiomyoma of uterus (code range)
	N60.21-N60.29	Fibroadenosis of breast (code range)

REFERENCES:

Alvarez-Sanchez MV, et al. Review of endoscopic radiofrequency in biliopancreatic tumours with emphasis on clinical benefits, controversies and safety. World J Gastroenterol 2016 Oct 7;22(37):8257-8270.

Berman JM, et al. Three years' Outcome from the halt trial: a prospective analysis of radiofrequency volumetric thermal ablation of myomas. J Min Invasive Gynecol 2014 Nov-Dec;21(6):S18.

Blue Cross BlueShield Association. Radiofrequency of primary or metastatic liver tumors. Medical Policy Reference Manual Policy #7.01.91. 2017 Aug 10.

BlueCross BlueShield Association. Radiofrequency ablation of miscellaneous solid tumors excluding liver tumors. Medical Policy Reference Manual Policy #7.01.95. 2017 Sept 14.

*BlueCross BlueShield Association Technology Evaluation Center (TEC). Radiofrequency ablation of unresectable hepatic tumors. 2003 Nov;18(13).

*Bouza C, et al. Meta-analysis of percutaneous radiofrequency ablation versus ethanol injection in hepatocellular carcinoma. BMC Gastroenterol 2009 May 11;9:13.

*Brouquet A, et al. Hepatectomy for recurrent colorectal liver metastases after radiofrequency ablation. Br J Surg 2011 Jul;98(7):1003-9.

Brucker SY, et al. Laparoscopic radiofrequency volumetric thermal ablation of fibroids versus laparoscopic myomectomy. Int J Gynecol Obstet 2014 Jun;125(3):261-5.

Cai H, et al. Radiofrequency ablation versus reresection in treating recurrent hepatocellular carcinoma: a meta-analysis. Medicine 2014 Nov;93(22):e122.

*Chan VO, et al. Percutaneous radiofrequency ablation of lung tumors: evaluation of the literature using evidence-based techniques. J Thorac Imaging 2011 Feb;26(1):18-26.

Chen F, et al. Radiofrequency ablation for treatment of benign thyroid nodules: A PRISMA-compliant systematic review and meta-analysis of outcomes. Medicine 2016 Aug;95(34):e4659.

Chen X, et al. Radiofrequency ablation versus surgical resection for intrahepatic hepatocellular carcinoma recurrence: a meta-analysis. J Surg Res 2015 May 1;195(1):166-74.

*Cheng BQ, et al. Chemoembolization combined with radiofrequency ablation for patients with hepatocellular carcinoma larger than 3 cm: a randomized controlled trial. JAMA 2008 Apr 9;299(14):1669-77.

Cho JY, et al. Clinical significance and predictive factors of early massive recurrence after radiofrequency ablation in patients with a single hepatocellular carcinoma. Clin Mol Hepatol 2016 Dec;22(4):477-486.

*Cho YK, et al. Systematic review of randomized trials for hepatocellular carcinoma treated with percutaneous ablation therapies. Hepatology 2009 Feb;49(2):453-9.

*Cho YK, et al. Radiofrequency ablation versus surgical resection as primary treatment of hepatocellular carcinoma meeting the Milan criteria: a systematic review. J Gastroenterol Hepatol 2011 Sep;26(9):1354-60.

Choe WH, et al. Short-term interval combined chemoembolization and radiofrequency ablation for hepatocellular carcinoma. World J Gastroenterol 2014 Sep 21;20(35):12588-94.

*Cioni R, et al. CT-guided radiofrequency ablation of osteoid ostetoma: long-term results. Eur Radiol 2004 Jul;14(7):1203-8.

Cirocchi R, et al. Radiofrequency ablation in the treatment of liver metastases from colorectal cancer. Cochrane Database Syst Rev 2012 Jun 13;6:CD006317.

de Baere T, et al. Radiofrequency ablation is a valid treatment option for lung metastases: experience in 566 patients with 1037 metastases. Ann Oncol 2015 May;26(5):987-91.

Dong W, et al. Clinical outcome of small hepatocellular carcinoma after different treatments: a meta-analysis. World J Gastroenterol 2014 Aug 7;20(9):10174-82.

*Dupuy DE, et al. Percutaneous radiofrequency ablation of painful osseous metastases: a multicenter American College of Radiology Imaging Network trial. Cancer 2010 Feb 15;116(4):989-97.

Dupuy DE, et al. Radiofrequency ablation of stage 1A non-small cell lung cancer in medically inoperable patients: results from the American College of Surgeons Oncology Group Z4033 (Alliance) trial. Cancer 2015 Oct 1;121(19):3491-8.

Fairweather M, et al. Management of neuroendocrine tumor liver metastases: long-term outcomes and prognostic factors from a large prospective database. Ann Surg Oncol 2017 Aug;24(8):2319-2325.

Fegrachi S, et al. Radiofrequency ablation for unresectable locally advanced pancreatic cancer: a systematic review. HPB (Oxford) 2014 Feb;16(2):119-23.

*Ferakis N, et al. Long-term results after computed-tomography-guided percutaneous radiofrequency ablation for small renal tumors. J Endourol 2010 Dec;24(12):1909-13.

Ferguson J, et al. Long term results of RFA to lung metastases from colorectal cancer in 157 patients. Eur J Surg Oncol 2015 May;41(5):690-5.

Fu C, et al. Radiofrequency ablation vs. surgical resection on the treatment of patients with small hepatocellular carcinoma: a system review and meta-analysis of five randomized controlled trials. Hepatogastroenterology 2014 Sep;61(134):1722-9.

Fukuhara T, et al. Efficacy of radiofrequency ablation for initial recurrent hepatocellular carcinoma after curative treatment: Comparison with primary cases. Eur J Radiol 2015 Aug;84(8):1540-5.

*Galandi D, et al. Radiofrequency thermal ablation versus other interventions for hepatocellular carcinoma. Cochrane Database Syst Review 2004;(2):CD003046.

*Garrean S, et al. Radiofrequency ablation of primary and metastatic liver tumors: a critical review of the literature. Am J Surg 2008 Apr;195(4):508-20.

Han K, et al. Radiofrequency ablation in the treatment of unresectable intrahepatic cholangiocarcinoma: systematic review and meta-analysis. J Vasc Interv Radiol 2015 Jul;26(7):943-8.

Han Y, et al. Radiofrequency ablation versus liver resection for colorectal cancer liver metastasis: an updated systematic review and meta-analysis. Chin Med J 2016 Dec 20;129(24):2983-2990.

Hof J, et al. Outcome after resection and/or radiofrequency ablation for recurrence after treatment of colorectal liver metastases. Br J Surg 2016 July;103(8):1055-1062.

Hua YQ, et al. Radiofrequency ablation nfor hepatic oligometastatic pancreatic cancer: an analysis of safety and efficacy. Pancreatology 2017 Nov-Dec;17(6):967-973.

Hwang JE, et al. Combination of percutaneous radiofrequency ablation and systemic chemotherapy are effective treatment modalities for metachronous liver metastases from gastric cancer. Clin Exp Metastasis 2014 Jan;31(1):25-32.

Iannucilli JD, et al. Effectiveness and safety of computed tomography-guided radiofrequency ablation of renal cancer: a 14-year single institution experience of 203 patients. Eur Radiol 2016 June;26(6):1656-1664.

Imai K, et al. Long-term outcomes of radiofrequency ablation combined with hepatectomy compared with hepatectomy alone for colorectal liver metastases. Br J Surg 2017 April;104(5):570-579.

Jiang L, et al. Comparison of outcomes of hepatic resection and radiofrequency ablation for hepatocellular carcinoma patients with multifocal tumors meeting the Barcelona-Clinic liver cancer stage A classification. J Am Coll Surg 2015 Nov;221(5):951-61.

Kang TW, et al. Small hepatocellular carcinoma: Radiofrequency ablation versus nonanatomic resection-propensity score analyses of long-term outcomes. Radiology 2015 Jun;275(3):908-19.

Kim GA, et al. Radiofrequency ablation as an alternative to hepatic resection for single small hepatocellular carcinomas. Br J Surg 2016 Jan;103(1):126-35.

Kim JH, et al. Efficacy and safety of radiofrequency ablation for treatment of locally recurrent thyroid cancers smaller than 2 cm. Radiology 2015 Sept;276(3):909-918.

Kim SS, et al. Radiofrequency ablation and transarterial chemoembolization as first-line treatment for recurrent hepatocellular carcinoma or isolated intrahepatic recurrent hepatocellular carcinoma in transplanted livers. Clin Radiol 2017 Feb;72(2):141-149.

Klimberg VS, et al. Long-term results of phase II ablation after breast lumpectomy added to extend intraoperative margins (ABLATE I) trial. J Am Coll Surg 2014 Apr;218(4):741-9.

Knudsen M, et al. Computed tomography-guided radiofrequency ablation is safe and effective treatment of osteoid osteoma located outside the spine. Dan Med J 2015 May;62(5).

Lan T, et al. Comparative efficacy of interventional therapies for early-stage hepatocellular carcinoma: a PRISMA-compliant systematic review and network meta-analysis. Medicine 2016 April;95(15):e3185.

*Lanuti M, et al. Radiofrequency ablation for treatment of medically inoperable stage I non-small cell lung cancer. J Thorac Cardiovasc Surg 2009 Jan;137(1):160-6.

Lanza E, et al. Osteoid osteoma treated by percutaneous thermal ablation: when do we fail? A systematic review and guidelines for future reporting. Cardiovasc Intervent Radiol 2014 Dec;37(6):1530-9.

Lee DH, et al. Radiofrequency ablation of hepatocellular carcinoma as first-line treatment: long-term results and prognostic factors in 162 patients with cirrhosis. Radiology 2014 Mar;270(3):900-9.

Lee SJ, et al. Radiofrequency ablation to treat loco-regional recurrence of well-differentiated thyroid carcinoma. Korean J Radiol 2014 Nov-Dec;15(6):817-26.

Lee BC, et al. The role of radiofrequency ablation for treatment of metachronous isolated hepatic metastasis from colorectal cancer. Medicine 2016 Sept;95(39):e4999.

*Lencioni RA, et al. Small hepatocellular carcinoma in cirrhosis: randomized comparison of radiofrequency thermal ablation versus percutaneous ethanol injection. Vasc Interven Radiol 2003 Jul;228(1):236-9.

*Lencioni R, et al. Response to radiofrequency ablation of pulmonary tumours: a prospective, intention-to-treat, multicentre clinical trial (RAPTURE study). Lancet Oncol 2008 Jul;9(7):621-8.

*Lin SM, et al. Randomized controlled trial comparing percutaneous radiofrequency thermal ablation, percutaneous ethanol injection, and percutaneous acetic acid injection to treat hepatocellular carcinoma of 3 cm or less. Gut 2005 Aug;54(8):1151-6.

Liu B, et al. Effect of percutaneous radiofrequency ablation after thoracoscopic pleurodesis for treating non-small cell lung cancer patients with malignant pleural effusion and/or pleural dissemination. Thorac Cancer 2016 Sept;7(5):549-555.

Lyons NJ, et al. Percutaneous management of pulmonary metastases arising from colorectal cancer: a systematic review. Eur J Surg Oncol 2015 Nov;41(11):1447-55.

Ma Y, et al. Long-term outcomes in healthy adults after radiofrequency ablation of T1a renal tumors. BJU Int 2014 Jan;113(1):51-5.

Mohan H, et al. Radiofrequency ablation for neuroendocrine liver metastases: a systematic review. J Vasc Interv Radiol 2015 July;26(7):935-942.

Napoleone M, et al. Local tumor progression patterns after radiofrequency ablation of colorectal cancer liver metastases. Diagn Interv Radiol 2016 Nov-Dec;22(6):548-554.

National Comprehensive Cancer Network (NCCN). Clinical practice guidelines in oncology v.4.2018. Kidney cancer. [http://www.nccn.org/professionals/physician_gls/pdf/kidney.pdf] accessed 7/3/18.

National Comprehensive Cancer Network (NCCN). Clinical practice guidelines in oncology v.1.2018. Pancreatic adenocarcinoma tumors. [http://www.nccn.org/professionals/physician_gls/pdf/pancreatic.pdf] accessed 7/3/18.

National Comprehensive Cancer Network (NCCN). Clinical practice guidelines in oncology v.2.2018. Neuroendocrine tumors. [http://www.nccn.org/professionals/physician_gls/pdf/neuroendocrine.pdf] accessed 7/3/18.

National Comprehensive Cancer Network (NCCN). Clinical practice guidelines in oncology v.2.2018. Small cell lung cancer. [http://www.nccn.org/professionals/physician_gls/pdf/sclc.pdf] accessed 7/3/18.

National Comprehensive Cancer Network (NCCN). Clinical practice guidelines in oncology v.2.2018. Colon cancer. [http://www.nccn.org/professionals/physician_gls/pdf/colon.pdf] accessed 7/3/18.

National Comprehensive Cancer Network (NCCN). Clinical practice guidelines in oncology v.2.2018. Hepatobiliary cancer. [http://www.nccn.org/professionals/physician_gls/pdf/hepatobiliary.pdf] accessed 7/3/18.

National Comprehensive Cancer network (NCCN). Clinical practice guidelines in oncology v.1.2018. Thyroid carcinoma. [http://www.nccn.org/professionals/physician_gls/pdf/thyroid.pdf] accessed 7/3/18.

National Institute for Health and Clinical Excellence (NICE). Percutaneous radiofrequency for renal cancer. 2010 Jul [https://www.nice.org.uk/guidance/ipg353] accessed 7/3/18.

National Institute for Health and Clinical Excellence. Percutaneous radiofrequency ablation for primary and secondary lung cancers. Dec 2010 [https://www.nice.org.uk/guidance/ipg372] accessed 7/3/18.

National Institute for Health and Excellence (NICE). Radiofrequency ablation for colorectal liver metastases. Dec 2009 [https://www.nice.org.uk/guidance/ipg327] accessed 7/3/18.

Paiella S, et al. Local ablative strategies for ductal pancreatic cancer (radiofrequency ablation, irreversible electroporation): a review. Gastroenterol Res Pract 2016;2016:4508376.

Pantelidou M, et al. Percutaneous radiofrequency ablation versus robotic-assisted partial nephrectomy for the treatment of small renal cell carcinoma. Cardiovasc Intervent Radiol 2016 Nov;39(11):1595-1603.

*Park S, e al. Outcomes of radiofrequency ablation for kidney cancer. Cancer Control 2007 Jul;14(3):205-10.

Peng ZW, et al. Radiofrequency ablation versus open hepatic resection for elderly patients (> 65 years) with very early or early hepatocellular carcinoma. Cancer 2013 Nov 1;119(21):3812-20.

Pompili M, et al. Bridging and downstaging treatments for hepatocellular carcinoma in patients on the waiting list for liver transplantation. World J Gastroenterol 2013 Nov 21;19(43):7515-30.

Qi X, et al. Radiofrequency ablation versus hepatic resection for small hepatocellular carcinoma: a meta-analysis of randomized controlled trials. J Clin Gastroenterol 2014 May-Jun;48(5):450-7.

Ramirez D, et al. laparoscopic radiofrequency ablation of small renal tumors: long-term oncologic outcomes. J Endourol 2014 Mar;28(3):330-4.

Schlijper RC, et al. What to choose as radical local treatment for lung metastases from colorectal cancer: surgery or radiofrequency ablation? Cancer Treat Rev 2014 Feb;40(1):60-7.

Shady W, et al. 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.

Shao GL, et al. Evaluation of efficacy of transcatheter arterial chemoembolization combined with computed tomography-0guided radiofrequency for hepatocellular carcinoma using magnetic resonance diffusion weighted imaging and computed tomography perfusion imaging: a prospective study. Medicine 2017 Jan;96(3):e5518.

Sharr WW, et al. Section 3. Current status of downstaging of hepatocellular carcinoma before liver transplantation. Transplantation 2014 Apr 27;97 Suppl 8:S10-17.

*Shiina S, et al. A randomized controlled trial of radiofrequency ablation with ethanol injection for small hepatocellular carcinoma. Gastroenterol 2005 Jul;129(1):122-30.

Song KD, et al. Repeated hepatic resection versus radiofrequency ablation for recurrent hepatocellular carcinoma after hepatic resection: A propensity score matching study. Radiology 2015 May;275(2):599-608.

Stang A, et al. Selection criteria for radiofrequency ablation for colorectal liver metastases in the era of effective systemic therapy: a clinical score based proposal. BMC Cancer 2014 Jul 9;14:500.

Suh CH, et al. Efficacy and safety of radiofrequency and ethanol ablation for treating locally recurrent thyroid cancer: a systematic review and meta-analysis. Thyroid 2016 March;26(3):420-428.

Takaki H, et al. Radiofrequency ablation versus radical nephrectomy: clinical outcomes for stage T1b renal cell carcinoma. Radiology 2014 Jan;270(1):292-9.

Valls C, et al. Safety and efficacy of ultrasound-guided radiofrequency ablation of recurrent colorectal cancer liver metastases after hepatectomy. Scand J Surg 2015 Sep;104(3):169-75.

Vollherbst D, et al. Treatment failure after image-guided percutaneous radiofrequency ablation (RFA) of renal tumors- a systematic review with description of type, frequency, risk factors and management. Rofo 2017 March;189(3):219-227.

Wang Y, et al. Radiofrequency ablation versus hepatic resection for small hepatocellular carcinomas: a meta-analysis of randomized and nonrandomized controlled trials. PLoS One 2014 Jan 3;9(1):e84484.

Wang K, et al. Early intrahepatic recurrence of hepatocellular carcinoma after hepatectomy treated with re-hepatectomy, ablation or chemoembolization: a prospective cohort study. Eur J Surg Oncol 2015 Feb;41(2):236-42.

Wang C, et al. Multicenter randomized controlled trial of percutaneous cryoablation versus radiofrequency ablation in hepatocellular carcinoma. Hepatology 2015 May;61(5):1579-90.

Weis S, et al. radiofrequency (thermal) ablation versus no intervention or other interventions for hepatocellular carcinoma. Cochrane Database Syst Rev 2013 Dec 19: CD003046.

*Wong SL, et al. American Society of Clinical Oncology 2009 clinical evidence review on radiofrequency ablation of hepatic metastases from colorectal cancer. J Clin Oncol 2010 Jan 20;28(3):493-508.

Wu S, et al. Cryoablation versus radiofrequency ablation for hepatic malignancies: a systematic review and literature-based analysis. Medicine 2015 Dec;94(49):e2252.

Yang R, et al. Laparoscopic radiofrequency ablation with intraoperative contrast-enhanced ultrasonography for T1bN0M0 renal tumors: initial functional and oncologic outcomes. J Endourol 2014 Jan;28(1):4-9.

Yin X, et al. Radiofrequency ablation versus partial nephrectomy in treating small renal tumors: a systematic review and meta-analysis. Medicine 2015 Dec;94(50):e2255.

Yu SJ, et al. Percutaneous ethanol injection therapy is comparable to radiofrequency ablation in hepatocellular carcincoma smaller than 1.5 cm: a matched case-controlled comparative analysis. Medicine 2016 Aug;95(35):e4551.

*Zhang HJ, et al. Hepatocellular carcinoma ablation with or without ethanol injection: a prospective randomized trial. Radiol 2007 Aug;244(2):599-607.

Zhao Q, et al. Meta-analysis of radiofrequency ablation for treating the local recurrence of thyroid cancers. J Endocrinol Invest 2016 Aug;39(8):909-916.

Zheng X, et al. Endoscopic radiofrequency ablation may be preferable in the management of biliary obstruction: a systematic review and meta-analysis. J Dig Dis 2016 Nov;17(11):716-724.

*Zhu JC, et al. Radiofrequency ablation of lung tumors: feasibility and safety. Ann Thorac Surg 2009 Apr;87(4):1023-8.

Zhu ZX, et al. Radiofrequency ablation with or without ethanol injection for hepatocellular carcinoma: a systematic review and meta-analysis. Minerva med 2016 Dec;107(6):381-391.

* Key articles

KEY WORDS:

Radiofrequency ablation.

CMS COVERAGE FOR MEDICARE PRODUCT MEMBERS

Based on our review, there is no specific regional or national coverage determination for Radiofrequency Tumor Ablation.