

Radiofrequency Ablation

Patient Information

Cancer has traditionally been approached either systemically with chemotherapy, or locally with surgery or radiotherapy. Recent advancements in minimally-invasive therapies are adding another tool to the anti-cancer arsenal. Thermal ablation is heating tumors so hot that the tumor cells die. It has been studied in many forms, including microwave, laser, high-intensity focused ultrasound, and cryotherapy (freezing below -20 C). Radiofrequency thermal ablation or radiofrequency ablation (RFA) has emerged as the most commonly used technology for thermal ablation in the bone, liver, kidney, lung, heart, breast, lymph nodes, nerve ganglia, and soft tissue. Microwave, cryotherapy, and high intensity focused ultrasound devices are available and being studied at the NIH as well. At this time, it is unclear which technology is advantageous in which clinical scenarios.

Recent developments in radiofrequency ablation technology make large-volume tissue ablation (or cooking tumors) effective for local control of some cancer. Local tumor control is an attractive option for some patients who are not ideal surgical candidates, have failed conventional therapies, or have contraindications to surgery or recurrent tumors. Radiofrequency ablation may also expand surgical options. For example, RFA may convert an inoperable patient into a surgical candidate by treating small liver lesions that are too difficult or too spread out to remove with surgery.

Needle-based tissue ablation techniques performed through the skin may provide alternatives to open surgical procedures in certain patients, and may augment conventional therapies.

RFA provides safe and effective local treatment of some cancers, with very small complication rates and survival curves similar to surgery for colorectal carcinoma liver metastases <4 cm, and hepatocellular carcinomas <5 cm. RFA could also impact palliative treatments for incurable disease, and it may allow an increase in the rate of curative liver resection.

How does it work? The patient is made into an electrical circuit by placing grounding pads on the thighs. The procedure may be performed on an outpatient basis under general anesthesia or conscious sedation. A 14 to 17.5 gauge needle-electrode with an insulated shaft and non-insulated tip, is inserted through the skin with imaging guidance using ultrasound, CT scan, or MRI. A treatment session has only 10 to 60 minutes of active ablation or cooking. The energy at the exposed tip causes ionic agitation and frictional heat, which cooks the tumor and leads to cell death and coagulation necrosis, if hot enough (above 50 degrees C). This is gradually replaced by fibrosis and scar tissue. Over the coming months, the treated tissue shrinks in volume. If there is local recurrence, it occurs at the margin, and in some cases may be retreated. The active tip may be different lengths or configurations. The interventionalist uses knowledge of the underlying

mechanism of thermal tissue ablation and the specific heat effects upon tissue to accurately predict ablation volume and shape, and to plan for disease-free treatment margins.

Heat has been used in medicine as long as history. Ancient Hindu medicine used heated metal bars and the Greeks used heated stones to stop bleeding. Electrocautery has been used for decades in surgery to fulgurate, cauterize, cut tissue, and to stop bleeding. The RFA generator uses a slight modification of the old technology to deposit the energy over a larger volume. The RFA generator also cauterizes tissue as it heats it, thus limiting blood loss and decreasing the risk of bleeding.

Percutaneous, minimally-invasive, local treatment is an attractive new tool for the cancer patient, especially for disease in the liver. There is no existing effective treatment for the vast majority of patients with liver metastases. Most primary liver tumors are unresectable at the time of discovery. Recurrence is common, even in candidates undergoing curative resection. Local treatment preserves uninvolved liver tissue, has potentially fewer systemic complications and side-effects than systemic treatment options like chemotherapy, and avoids the morbidity and mortality of major liver surgery. It is not a replacement for surgery, however.

RFA is fast, easy, predictable, safe, and relatively cheap. A multidisciplinary team approach is vital to the care of the oncology patient at the National Institutes of Health. Interventional radiologists work closely with oncology and surgical specialists to plan the best treatment for the cancer patient. Ask your physician about treatment options. Have your physician or oncologist contact us directly to see if you might benefit from treatment.