

# Radiofrequency Ablation Energy for Liver Cancer Applications

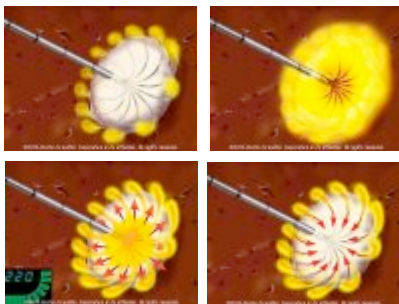
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Primary liver cancer and intrahepatic bile duct cancer was estimated to target nearly 21,370 new patients (15,190 in men and 6,180 in women) in 2008 (4). A medical device capable of therapeutically treating patients for this strain of cancer could dramatically decrease this number while lowering health insurance costs for drug treatments.

The liver is the largest organ in the human body and is located behind the ribs. Its main function is to keep the human body healthy by removing foreign materials from the blood. This organ revives its blood via the hepatic portal vein and artery (1). Liver cancer is more frequent in men than in women with men having a 1% chance and women have a 0.4% chance (4).

Boston Scientific, a leading research and medical device company, has developed a medical device that uses radiofrequency ablation (RFA) energy, an electrical current, to ablate lesions located in the liver. This electrical current is delivered to the site using a needle electrode and generates enough heat to ablate the lesion. Ions within the tissues flow towards the change is current direction which produces ionic agitation, thus resulting in ionic heating. A process called “desiccation” occurs when the heating of soft tissue exceeds 50 degrees Celsius. These changes have a major affect on the cellular level including the denaturing of proteins and loss of intracellular fluids. The thermal effect of RFA causes a decrease in the cells ability to conduct electrical current and thus causes a resistance to current flow or tissue impedance. The measure of the tissue impedance can then be measured to determine the progress of the RFA treatment (2). This thermal energy therapy is less invasive and is now becoming a promising tactic in the fight against liver cancer. Only 15-30% of patients with hepatic lesions are eligible for this treatment(2).



The physical device for the RFA therapy is a monopolar system consisting of a generator, an active electrode, the patient, and the dispersive (or passive) electrode. The dispersing electrode is typically called the “grounding pad.” The RF circuit is made when the current from the generator is given to the patient via the active electrode and returns to the generator via the dispersive electrodes (2).

A study was done to determine the safety and efficacy of the RFA system. Thirty five patients (age 63,9 +/- 12,6 years, range 22 - 83) a total of 65 liver tumors were percutaneously treated using the RFA system (using a 200 watt radiofrequency generator and a LeVeen 4 cm array probe (RF3000, Boston Scientific)). The procedures were done using a local anesthesia and sedation under CT guidance. The results included a 1 to 4 metastases were treated per patient during one or up to 4 procedure sessions. Mean lesion size was 2,3 +/- 1,2 cm (range 0,2 to 7,0). The corresponding size of the necrosis achieved was 4,6 +/- 1,4 cm (range 2,0 - 8,2). sixty of the 65 lesions had successfully ablated and only 4 cases needed two treatments. This study proved that this procedure could be done using local anesthesia and a sedation with low peri interventional morbidity and mortality. Also, using the RF system a necrosis could be achieved. CT follow-ups every three months were determined to be necessary because of the recurrence rate of the tumors. Lastly, reinterventions may be required in order to fully destroy the lesions (3).

## References

1. <http://www.cancer.gov/cancertopics/wyntk/liver/page2>
2. [http://www.bostonscientific.com/Device.bscti?page=HCP\\_Overview&navRelId=1000.1003&method=DevDetailHCP&id=10005431&pageDisclaimer=Disclaimer.ProductPage](http://www.bostonscientific.com/Device.bscti?page=HCP_Overview&navRelId=1000.1003&method=DevDetailHCP&id=10005431&pageDisclaimer=Disclaimer.ProductPage)
3. [http://www.ncbi.nlm.nih.gov/pubmed/14610704?ordinalpos=1&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_DiscoveryPanel.Pubmed\\_Discovery\\_RA&linkpos=3&log\\$=relatedarticles&logdbfrom=pubmed](http://www.ncbi.nlm.nih.gov/pubmed/14610704?ordinalpos=1&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DiscoveryPanel.Pubmed_Discovery_RA&linkpos=3&log$=relatedarticles&logdbfrom=pubmed)
4. [http://www.cancer.org/docroot/CRI/content/CRI\\_2\\_4\\_1X\\_What\\_are\\_the\\_key\\_statistics\\_for\\_liver\\_cancer\\_25.asp](http://www.cancer.org/docroot/CRI/content/CRI_2_4_1X_What_are_the_key_statistics_for_liver_cancer_25.asp)