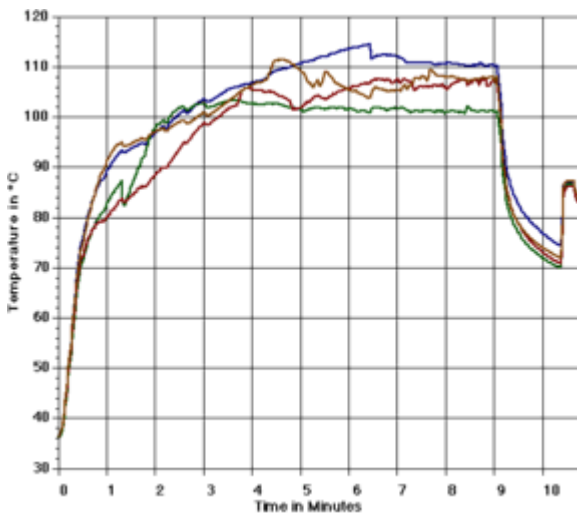




The principal setting is shown in the picture. A generator establishes the high frequency power, which is then passing through a special needle into the tumor. A grounding pad closes the electric circle.

The current causes the ions (charged atoms in tissues) to vibrate at very high speeds. The ions move back and forth so rapidly that they create friction, which produces heat. Heat is a very effective means of killing tissue. As tissue temperature rises above 45° C (113° F), protein is permanently damaged and cell membranes fuse.

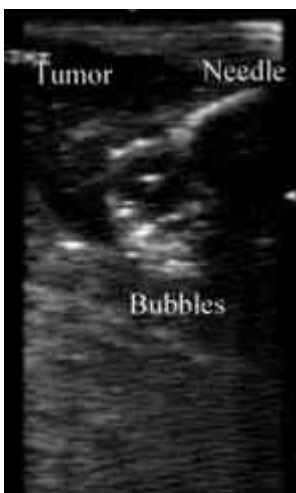
[See Larger View](#)



The process is rapid, requiring less than 15 minutes exposure time.

Thermosensors at the tip of the needle measure the temperature during the delivery of energy and after one ablation. In this example the 4 needle tips were pushed back in the tissue after the ablation. (the jump at 10.2 minutes) Without delivering energy, the thermosensors show then the temperature in the - now dead - tissue itself.

[See larger view](#)



As tissue is heated, dissolved gases (primarily nitrogen) are released from cells forming micro-bubbles within the tissue. This is visible on ultrasound as a hyperechoic (bright) image allowing visual confirmation of the ablated area.

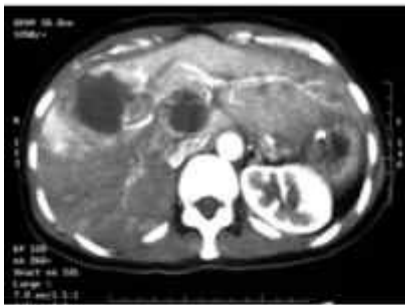
[See larger view](#)



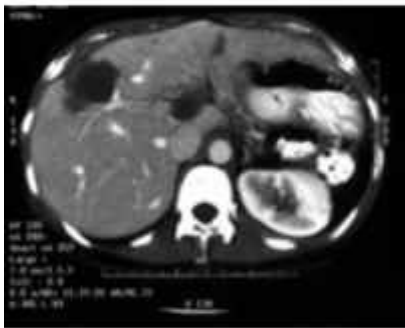
The blood supply of the liver is enormous and blood has a high effective heat capacity. The heat delivered from the needle is therefore rapidly taken away and no cell damage occurs after a specific distance from the needle. In fact the ablation zone fits pretty close the dimension of the prongs.

As you can see in the left picture taken during experiments with a liver model, there is a sharp boundary between killed tumor and unaffected surrounding tissue. Thus liver tumors can be ablated without much sacrifice of surrounding normal liver tissue. However, to kill the tumor completely, we ablate a small rim of healthy tissue around the lesion.

[See larger view](#)



Postoperative CT



after 3 months



after 6 months

After the operation tumors are controlled by CT scans. A successful ablated lesion shows an increased volume in the first week After three months the lesion shrinks in size. Sometimes treated lesions disappear totally.

We don't know the cause and any details of this phenomenon. A immunologic reaction and the liquidation of the dead tumor cells through macrophages (big eater cells) is the most likely reason.

[See larger view](#)

[next section](#)

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