Radiofrequency Ablation (RFA)

Printed from https://www.cancerquest.org/patients/treatments/radiofrequency-ablation on 05/13/2024

It has been known for a long time that normal cellular functions will stop if the temperature is raised to 42°C/108°F, and that large-scale cell death--necrosis--will occur at temperatures above 46°C/115°F. Killing cells with heat presents a possible method of cancer treatment; measures must be taken to minimize the heating of surrounding healthy cells.

Radiofrequency ablation (RFA) is an invasive procedure that uses electrical pulses to heat a probe that is placed in a tumor. The probe can be a single, straight rod-like structure or it can be a hollow rod that contains several smaller wires. Once inserted into the tumor, the smaller wires can be pushed out to reach a larger amount of the tumor.[1] [2]

RFA can be performed in an open procedure with full anesthesia or by insertion of the probe through the skin. Placement of the probe can be guided by ultrasound, magnetic resonance imaging (MRI) and/or computer assisted tomography (CAT or CT). After the treatment, the cells in the tumor will die, leaving behind only a scar.

Cancers treated with RFA include liver cancer[3] [4] , metastatic colorectal cancer[5] , lung cancer[6] [7] [8] and kidney (renal) cancer.[9]

RFA can be performed more than one time if additional tumors arise.
The effectiveness of the procedure compared to surgical removal of tumors is still being determined.[10] [11]

More information on this topic may be found in Chapter 16 of The Biology of Cancer by Robert A. Weinberg.

A Closer Look at Killing Cancer Cells with Heat

In a study conducted on mice engineered to contain human breast cancer cells examined the use of nanoprobes targeted to tumor cells as a method to direct heat to a tumor. Anti-tumor antibodies were linked to very small spheres containing iron oxide pellets. Injection of these 'bioprobes' led to binding of the particles on the surface of the tumor cells.

The chemical nature of the iron in the complexes causes them to rotate rapidly when an alternating magnetic frequency (AMF) is applied in the vicinity of the tumor. The spinning motion generates heat that quickly raises the temperature of tumor cells above 46°C/115°F, causing death of the tumor cells. For this technique to be useful, it is critical that the applied frequency is not harmful to surrounding tissues.

In the mouse experiments the applied treatment significantly decreased tumor growth. Importantly, the affect was proportional to the amount of heat delivered via AMF. The most effective, non-toxic treatment corresponded to low amplitude AMF with a prolonged delivery time. Since this study was performed, new nanoparticles have been developed that respond better to AMF potentially reducing the amount of AMF necessary to treat tumors. 12

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