

Microwave Treatment for Cardiac Arrhythmias

NASA seeks to transfer the NASA developed microwave ablation technology, designed for the treatment of ventricular tachycardia (irregular heart beat), to industry. After a heart attack, many cells surrounding the resulting scar continue to live but are abnormal electrically; they may conduct impulses unusually slowly or fire when they would typically be silent. These diseased areas might disturb smooth signaling by forming a reentrant circuit in the muscle. The objective of microwave ablation is to heat and kill these diseased cells to restore appropriate electrical activity in the heart.

This technology is a method and apparatus that provides for propagating microwave energy into heart tissues to produce a desired temperature profile therein at tissue depths sufficient for thermally ablating arrhythmogenic cardiac tissue while preventing excessive heating of surrounding tissues, organs, and blood. A wide bandwidth double-disk antenna is effective for this purpose over a bandwidth of about six gigahertz. A computer simulation provides initial screening capabilities for an antenna such as antenna, frequency, power level, and power application duration. The simulation also allows optimization of techniques for specific patients or conditions.

In comparison with other methods that involve direct-current pulses or radio frequencies below 1 GHz, this method may prove more effective in treating ventricular tachycardia. This is because the present method provides for greater control of the location, cross-sectional area, and depth of a lesion via selection of the location and design of the antenna and the choice of microwave power and frequency.

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Technology Transfer Office Description:

Johnson Space Center, the lead NASA center for human exploration for more than 40 years, seeks to create partnerships and cooperative activities with business to develop technology that helps meet NASA mission needs and contributes to commercial competitiveness in global markets.

The Innovative Partnerships Office at JSC serves NASA through developing creative partnerships to develop technology and drive the infusion of technology, and uses traditional business partnerships to license and transfer NASA developed technology to the American marketplace.

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NASA Johnson Space Center
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Microwave Treatment for Cardiac Arrhythmias

- Method & apparatus that provides for propagating microwave energy into heart tissues
- The microwave ablation apparatus consists of three components:
 - Microwave Generator
 - Flexible Coaxial Cable,
 - Microwave Radiator
- Produces a desired temperature profile therein at tissue depths sufficient
- Ablates the diseased cells to restore appropriate electrical activity in the heart
- Treats ventricular tachycardia and other arrhythmias while preventing excessive heating of surrounding tissues, organs, and blood.
- Greater control of the location, cross-sectional area, and depth of a lesion via selection of the location and design of the antenna and the choice of microwave power and frequency

Microwave Treatment for Cardiac Arrhythmias

- **Intellectual property**

- Microwave Treatment for Cardiac Arrhythmias
- In Vivo Simulator
- Transcatheter Antenna
- Directional Microwave Applicator/Antenna

- **Market/Opportunity**

- Cardiac arrhythmias affect more than **5 M** people in the US
- **1.2+ M** hospitalizations and 400,000 deaths per year
- \$8.1 billion in 2003 Product Market Value
- Projected to grow at 9.7% CRA
- Estimated value of \$20.5 billion in the year 2013

- **Developed Work**

- Analytical and experimental study to determine optimum excitation frequency.
- Analytical study to determine input impedance & power radiation pattern.
- Study with tissue-equivalent phantom materials
- Verification of the heating effectiveness of radiators
- Experimental evaluation of frequency effects under constant power delivery and exposure time on the three heating parameters

- **NASA seeks to license this technology to US companies capable of **developing & commercializing** the technology**

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