FOCUSED ULTRASOUND FOUNDATION

Focused Ultrasound *for Cancer*

Overview

Focused Ultrasound is an early-stage, non-invasive, therapeutic technology with the potential to improve the quality and longevity of life and decrease the cost of care for certain patients with cancer. It offers an alternative or complement to each of the four pillars of cancer treatment: surgery, radiation therapy, chemotherapy, and immunotherapy.

This novel therapy utilizes multiple intersecting beams of ultrasound energy accurately focused on precise targets deep in the body to create a variety of biological effects without damaging surrounding tissue. The therapeutic effects of focused ultrasound are achieved without incisions or the use of ionizing radiation.

There are currently 18 known bio-mechanisms by which focused ultrasound affects tissue. This diversity of biological effects creates the potential for focused ultrasound to become a multipurpose technology for treating cancer—offering non-invasive tumor destruction, and enhancing radiation therapy, chemotherapy, and immunotherapy. With further research, focused ultrasound could become integrated into the standard of care for all four pillars of cancer treatment and decrease death, disability, and suffering for many patients.

Benefits

As a non-invasive, real-time, image-guided technology, focused ultrasound provides a number of benefits when used as an alternative or complement to traditional cancer therapy.

SURGERY

Non-Invasive tumor destruction

- Less pain and discomfort, no scars
- Fewer complications: infection, bleeding, collateral tissue damage
- Real-time visualization and control
- Accurate targeting and localization
- Sharp margins

RADIATION THERAPY

Replacement for radiotherapy & radiation sensitization

- Single treatment
- Immediate and verifiable effect
- 100% cell death
- No secondary malignancies
- No cumulative dose effects
- No limitations on lesion size or number of treatments
- Sharp margins
- Real-time image guidance and control
- Decreased dose

CHEMOTHERAPY

Enhanced delivery of chemotherapy

- Higher tumor drug concentrations
- Lower systemic toxicity and side effects

IMMUNOTHERAPY

Enhanced immunotherapy

- Increasing immune cells in tumor
- Higher tumor drug concentrations
- Priming of the immune system could increase percentage of responders
- Potential response in primary and secondary tumors

The Problem

Unfortunately, it can take decades for a new therapeutic technology like focused ultrasound to become mainstream. Every year we shave off that process could reduce death, disability and suffering for countless people.

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Focused Ultrasound Mechanisms

In addition to destroying tumors, focused ultrasound can enhance the delivery and effectiveness of chemotherapy, radiation therapy, and immunotherapy.

TISSUE DESTRUCTION

- **Thermal ablation**: coagulative cell death
- **Histotripsy**: mechanical cell disruption
- **Microvascular disruption**: ischemic cell death
- **Sonodynamic therapy**: activation of cell toxic drugs

IMMUNOMODULATION

- **Tumor cell disruption**: exposure of tumor antigens and release of cytokines to increase immune cell trafficking
- **Augmentation of immunotherapy drugs**
- **Enhanced drug delivery**

DRUG DELIVERY

- **Focal delivery of therapeutic agents**
- **Increase vascular permeability and blood-brain barrier opening**
- **Increased cell membrane permeability**

RADIOTHERAPY

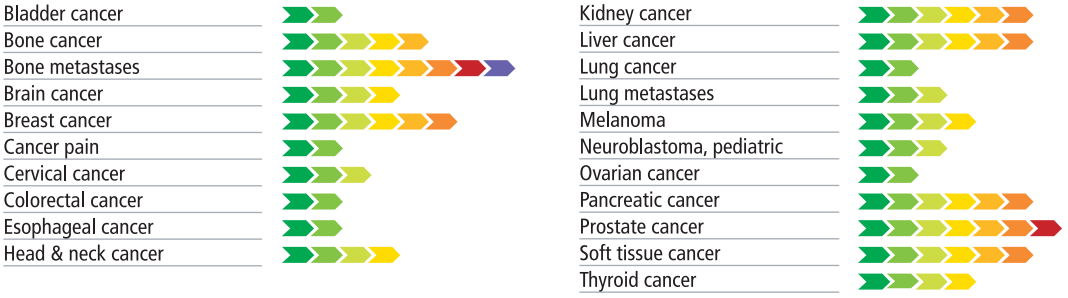
- **Alternative to ionizing radiation**
- **Decreased radiation dose**: tumor hyperthermic preconditioning and sensitization

State of the Field

There are currently more than 100 clinical indications or disorders, 21 cancer related, in various stages of development and the number is increasing rapidly. Most are early stage. Worldwide 23 indications have regulatory approval and in the US five have been approved by the FDA. Focused ultrasound is not for every patient or every disorder. Much work remains to be done to determine where this technology provides unique cost effective value. For a list of all clinical indications, see the Foundation's website www.fusfoundation.org/diseases-and-conditions-all/overview.

Development stage

Oncological



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