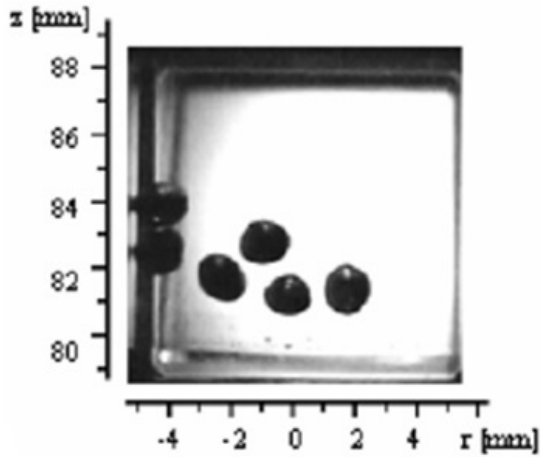


3D Targeting Machine

A sure thing to clear up tumors and cancer cells

1. Significance and Scientific rationale: We will create the 3D Targeting Machine based on the principle of the diamagnetic repulsion as shown below:



(b)

A Magnet levitates Bismuth particles



A magnet repels red diamagnetic nanoparticles

Our 3D Targeting Machine uses external magnets to push and maintain in vivo diamagnetic nanoparticles as a swarm, move the swarm to a tumor; push the swarm into the tumor, then uses ~500 KHz electromagnetic waves to heat the nanoparticles and the tumor to 55-70 °C to destroy the tumor. Once a tumor is destroyed, we can push the swarm to another tumor, so to destroy all tumors.

2. How the machine would be innovative:

2.1. This machine is an invention. We have obtained a patent (Title: 3D Tumor Targeting with Diamagnetic Repulsion; Patent #: 9833415; Issue Date: 12/05/2017). We are developing more utility patents to protect this machine.

2.2 Only diamagnetic repulsion can gather together nanoparticles into a swarm. All other means will only disperse nanoparticles.

2.3. Only diamagnetic nanoparticles can weakly repel each other so that they will not aggregate, enabling us to easily push and move the swarm to anywhere in vivo through the interstitial spaces among the cells.

2.4. Our competitor is the "Proton Therapy" which is getting popular now. It uses ionizing proton beams to precisely destroy a tumor. Drawbacks are: 1 Very inconvenient, it needs strict dosage control, otherwise, you will damage the tissues in the pass way and cause more cancers, so you need 8 treatments in 8 consecutive days, which is very inconvenient. 2. Very expensive, it costs a billion dollars to establish a treatment center with only one line of proton accelerator, and costs a lot of money to accelerate the protons for each treatment. 3. Very controversial treatment, only about 50% treated patients survive 3 years.

Our treatment is: 1. very convenient, need only one treatment; 2 cost effective, costing only 1/100th of the proton treatment. 3. it's a sure thing; completely destroy the tumor by thermo ablation, while clearing up cancer cells in the surrounding tissues by hyperthermia treatment.

3. Impact in the field, clinic, and patient.

3.1 Since the diamagnetic nanoparticles can themselves be medicines or can carry medicines, we open the door for targeted cancer treatment with all current medicines as well as with small and dangerous chemicals such as KCN.

3.2 Since the diamagnetic nanoparticles can themselves be nano-robots, we open the door for nano-robots treatments.

3.3. Since we can also ablate all other bad tissues in vivo, we open the door for noninvasive surgeries, such as the liver surgery, heart surgery, brain surgery, etc, without opening the body.

3.4. The most important Impact is saving patients. Rare tumor of liver Fibrohamellar carcinoma is most common in Children. Without surgery only 2% survive 5 years, and with surgery only 44% survive 5 years. Many patients disqualify the surgery upon diagnosis because the cancer has already spread too much.

Our machine is right for this rare cancer. When the cancer is still localized to a few spots, we can do the targeted ablations, similar to conventional surgeries do but without opening the body. When the cancer is spread over too much, we can move the swarm around in the liver to cover all the affected areas, doing thermo ablations (55-70°C) to heavily affected areas while hyperthermia treatments (43-47 °C) to lightly affected areas, to selectively kill cancer cells, while keeping normal cells alive. This way, we can significantly elongate patients' lives, possibly to keep them alive for their normal life spans to 80-100 years old, as we can go after the cancers wherever they go and do the treatment whenever needed without harming the patients. In addition, the nanoparticles can carry toxins to the tumor.

4. Collaborating organizations: Dr. Zen at MRI animal center, UMass Medical School. We have used his Lab twice. They charge \$500 per hour.

5. Brief description of the activities proposed for the project period.

5.1 Get the strength of magnetic field that is needed for our machine. We have tested 0.5 T and found it could already push and move the diamagnetic nanoparticles (see the red figure above), but the movement was slow, not practical for clinical use. We want to test the 1.5 T at Dr. Zen's Lab. We believe it will be good enough, however, if possible, we will also test the 3 T or 7 T for better efficiency.

5.2 Get the arrangement of the magnets. We will test the "Strong Focusing" and many other arrangements, for steeper gradients.

5.3 Get the most favorable nanoparticles. Our candidates are those that are made of Bismuth, pyrolytic graphite, and polyethylene. They are all biocompatible. They will be coated with polyethylene glycol to avoid interaction with our tissues and being expelled out of the body too quickly. They will be about 50 nm in size, so that they will not get into our capillaries.

When we get here, we are ready for our prototype of the machine.

5.4 If we have more time, we will also get the best frequencies of the heating electromagnetic waves. We know 0.3 – 300 MHz can penetrate our tissues and heat the nanoparticles, due to the 100 times larger of the magnetic susceptibility of the nanoparticles. We will start with 0.3 MHz. In addition, when we get close to 281 MHz, which is the frequency of the Brownian motion of our nanoparticles, we will get more heat by creating resonances.

The above tests will be carried out with agarose gels, fresh pig-livers, and /or live pigs.

The criteria for assessing technical success is: we can push a swarm of nanoparticles to 5 inches away in seconds, so it is clinically feasible. Extra+ heat the target to 55°C in seconds or take medicines to the target with existing technologies.

Timeframe:

- 1st year: Feasibility tests by finishing all the above tests. This is covered by this topic.
- 2nd year: With a new SBIR and/or private money, clinical trials on terminally ill cancer patients
- 3rd year: manufacture the machine, sell the machine and/or build treatment centers.

What our machine looks like:

Our 3D Targeting Machine is similar to a MRI machine, but, we will arrange the superconductor-magnets in our way so to enable it generate strong magnetic gradient. We will add some mechanical arms so that we can control the positions of the superconductors. This will enable us to maneuver and control the strength, the direction, the movement, and the focus of the magnetic gradient.

FDA approval:

The FDA will easily approve our machine and our whole system. The 3T or 7T magnetic fields are already been used in the clinics. We use the magnetic fields only for moving the diamagnetic nanoparticles, it will not cause significant electricity. The ~500 KHz electromagnetic wave will not hurt the tissues and is already been used clinically. The bismuth or graphite nanoparticles are biocompatible and were clinically used as contrast agents.

Pricing and business model:

We can build the machine with about \$100k - \$200k, but sell at tentative \$2 million dollars, so Hospitals can afford to purchase them for their hospitalized patients. We can also spend about \$2-4 million dollars to build a treatment center in each city. The price for each targeted thermo ablation of a tumor in the liver will be determined soon.

Budgeting:

We have some money, once we get additional \$500,000, we can finish up this feasibility tests.

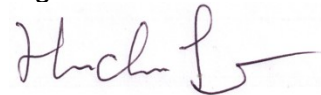
About us:

Huanchen Li, PhD, MD. Published 10 scientific papers and obtained 5 patents. Successful invented, patented, manufactured, got FDA approved, and marketed a medical device: Electronic Itch Stopper

Wendy Wang, MS.. Published 3 scientific papers using the NMR (MRI) machine and obtained 4 patents. Worked with Huanchen Li in Successful invented, patented, manufactured, got FDA approved, and marketed a medical device: Electronic Itch Stopper

We will hire more professionals whenever we need them.

Sign



4/26/2023

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