

Histotripsy

Power Of Sound (Histotripsy): An Amplifier in Cancer Cure

Dr. Ketki Kalele
Vice President, POPMA

Approval of Histotripsy by FDA: A Non-Invasive Alternative to Traditional Liver Cancer Therapies

The U.S. Food and Drug Administration (FDA) has approved histotripsy for treating liver cancer cases. It is a groundbreaking technique that uses sound waves to break down tumors. This is a major advancement in the pursuit of less invasive and more effective cancer treatments. Pioneered by researchers at the University of Michigan (U-M), histotripsy offers a much gentler alternative to conventional treatments like surgery, radiation, and chemotherapy, which frequently have unpleasant side effects. With the application of concentrated ultrasonic waves, this non-invasive technique accurately locates and eliminates malignant tissue while sparing nearby healthy tissues.

Development of Histotripsy: The Efforts of a Decade of Research and Collaboration

This innovative development is the result of years of research and collaboration. In 2009, U-M engineers and medical professionals co-founded HistoSonics, a company that has been instrumental in the advancement of histotripsy. With FDA approval, this enterprise may now provide hospitals and healthcare providers with this revolutionary technology as a liver cancer therapy alternative. Since 2021, human trials have been conducted at the U-M Rogel Cancer Center and other locations, focusing on patients with primary and metastatic liver tumors. Promising outcomes from the studies indicate that this technique is capable of effectively eliminating specific liver tissue while adhering to crucial safety requirements.

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Image 1: Zhen Xu, Professor of Biomedical Engineering, points to a bubble cloud generated by the Edison Platform's transducer head during a histotripsy demonstration at HistoSonics. Image credit: Erica Bass, Rogel Cancer Center, Michigan Medicine.

How Histotripsy Works: Sound Waves as a Weapon Against Tumors

Histotripsy operates by delivering precise, high-energy ultrasound waves to the tumor. Within the malignant tissue, these waves produce microbubbles, and the quick development and collapse of these bubbles produce forces that cause the tumor to fracture. Following that, the body's immune system removes any leftover material, facilitating a more organic healing process (Images 1, 2).

Benefits of Histotripsy:

The FDA's approval of histotripsy as a treatment for liver cancer is a significant development since it gives patients a cutting-edge method that is less physically taxing than conventional therapies. This non-invasive method has the potential to revolutionize the treatment of cancer.

1- Patient-Friendlier

Histotripsy may allow patients to receive treatment without the severe side effects of chemotherapy or radiation. In addition, the technique offers significantly shorter recovery times than surgery because it is non-invasive. Patients will also not have to worry about medication compatibility, which is a common issue with chemotherapy treatments. All things considered, it offers a less taxing and more comfortable course of therapy.

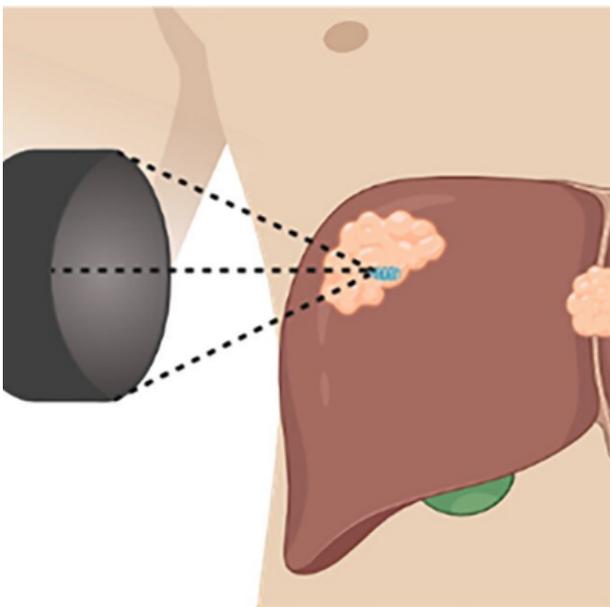


Image 2: Schematic diagram showing an external ultrasound transducer

Precision Targeting: Avoiding Damage to Healthy Tissues

The accuracy of histotripsy is one of its greatest benefits. Histotripsy can precisely target the tumor while sparing healthy tissue, in contrast to radiation, which damages everything in its course through the body. By focusing high-energy ultrasonic vibrations on the tumor, the procedure produces bubbles that disintegrate malignant tissue. The Edison platform from HistoSonics makes sure that this energy stays inside the tumor, improving the treatment's precision.

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Real-Time Imaging for Effective Treatment

The histotripsy system also includes onboard diagnostic ultrasound imaging—similar to the ultrasound used to see babies during pregnancy. This imaging capability allows physicians to plan and monitor relevant treatment in real-time. As the treatment progresses, doctors can observe the "bubble cloud" forming within the tumor and see how the tissue is responding. This live feedback provides an extra layer of precision and control, making histotripsy even more effective and safer for patients.

Associated Clinical Aspects

As histotripsy technology continues to evolve, it holds the potential to become a leading cancer treatment. Patients and medical professionals searching for more efficient, patient-friendly treatments can find histotripsy beneficial in accurately targeting tumors, reducing side effects, and speeding up recovery times.

A Boost to the Immune System

The potential of histotripsy goes well beyond merely eliminating malignancies. According to new preclinical research, the immune system might be stimulated during the procedure, learning to identify and combat cancer cells even after the course of therapy is over.



Harnessing the Immune System to Fight Cancer

Two significant rodent studies conducted in the past year have demonstrated how histotripsy can elicit a natural immunological response. The immune system seems to "learn" how to recognize cancer cells as threats as it clears away the debris left by destroyed tumor cells. In addition to assisting with the removal of the original tumor, this procedure may fortify the body's defenses against the spread of cancer in the future (Image 3).

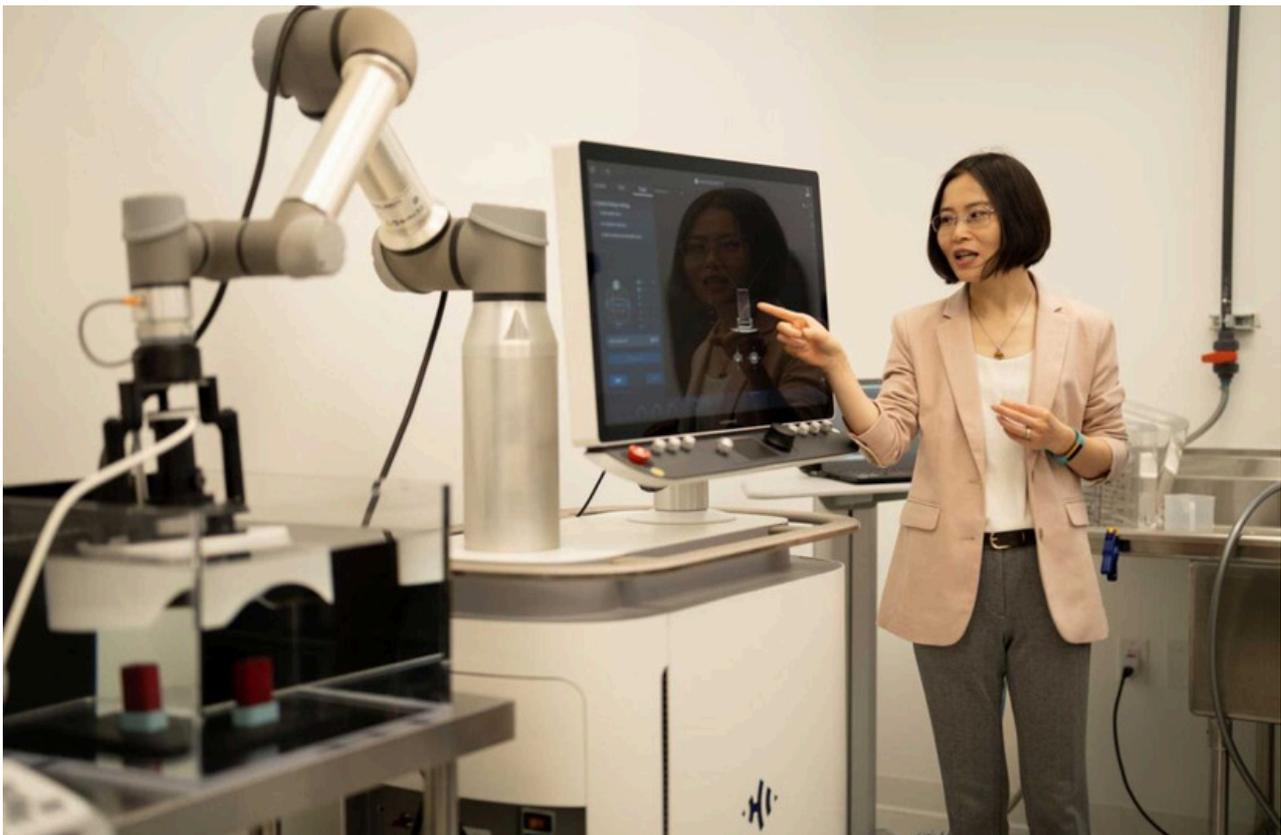
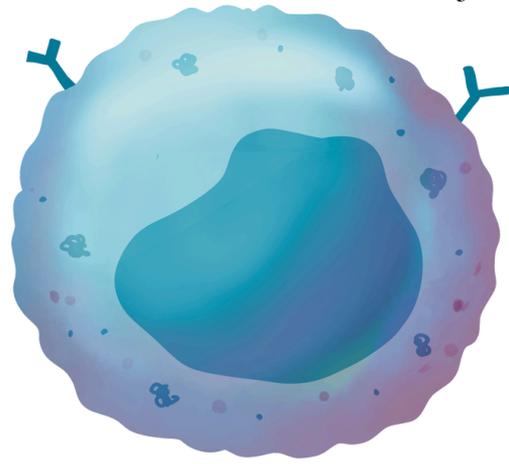


Image 3: Zhen Xu, Professor of Biomedical Engineering, describes a demonstration of histotripsy treatment. Image credit: Erica Bass, Rogel Cancer Center, Michigan Medicine

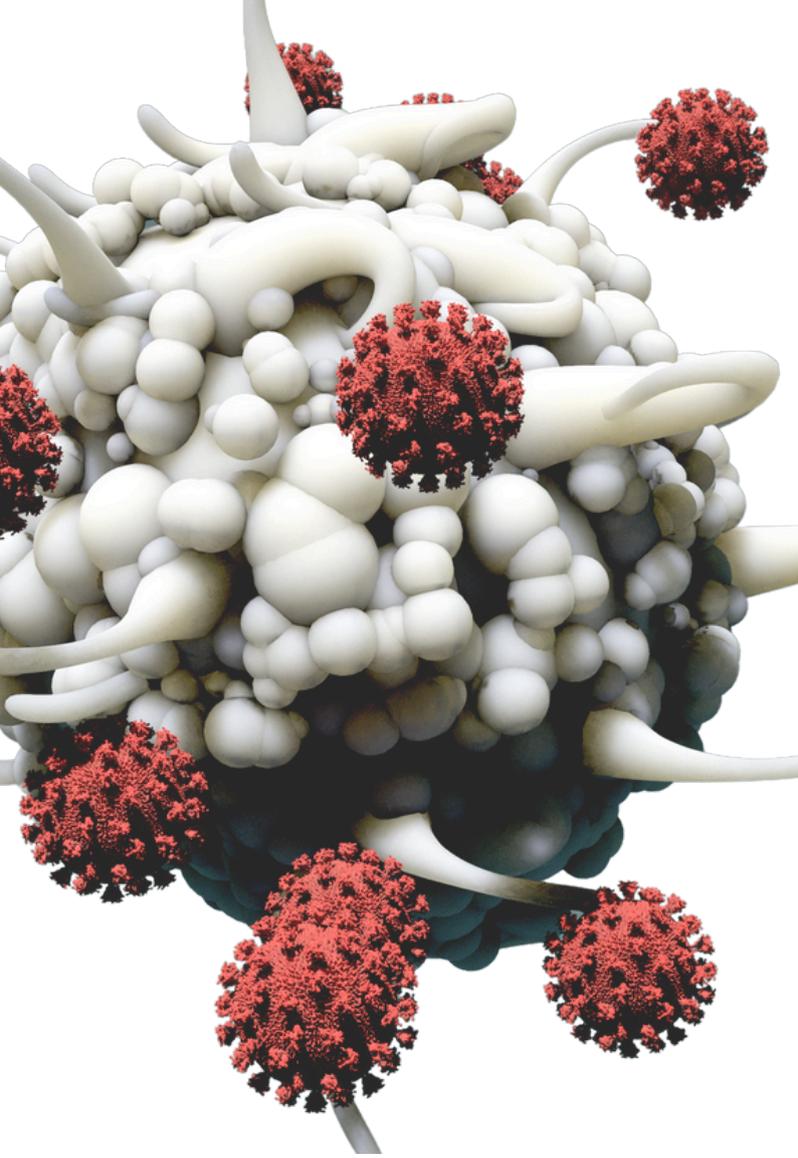
Following are a few studies on histotripsy, cementing its role as an innovative cancer therapy

Study 1: Tumor Elimination Without Recurrence

According to one study, the immune system was able to eliminate the remaining cancer cells even when histotripsy only removed 50% to 75% of the liver tumor volume. Surprisingly, almost 80% of the animals that received therapy did not develop metastases or recurrences, indicating the robust ability of histotripsy to activate the body's immune system to combat cancer.

Study 2: Unmasking Tumor Antigens for Immune System Targeting

Earlier this year, a second study found that histotripsy's capacity to show tumor antigens is a significant advantage. Antigens are proteins that the immune system can utilize to recognize cancer cells when the cancer cell wall breaks down during histotripsy. On the other hand, these antigens are frequently eliminated after surgery or eliminated by radiation and chemotherapy. Histotripsy allows the immune system to more efficiently target cancer cells, not only at the initial tumor location but possibly elsewhere in the body, by preserving the tumor's "identity."



Histotripsy: New Frontier in Cancer Immunotherapy

The approval of histotripsy marks the beginning of a new era in cancer treatment. Given that histotripsy is non-invasive, which results in fewer side effects and faster recovery times, this discovery may lessen the psychological and physical burden on liver cancer patients. As the technology continues to advance, histotripsy has the potential to become a leading treatment in global cancer care. This breakthrough not only provides a new non-invasive option for liver cancer patients but also paves the way for future applications. Combining histotripsy with other treatments may increase its efficacy. Histotripsy may soon be a key component of cancer treatment, giving patients and medical professionals new hope as clinical studies and technology advance.

According to the aforementioned research, histotripsy may be a useful tool for cancer immunotherapy in addition to being a tumor-targeting technique. Histotripsy can target cancer cells that may have spread to other parts of the body and prevent recurrence by assisting the immune system in identifying cancer cells and triggering a long-term response.

