Ultrasound effect on cancerous versus non-cancerous cells

Cancer research is one of the most researched topics over the past decade. The reason for that is obvious, in 2016 alone, 1,685,210 new cancer cases and 595,690 cancer deaths are projected to occur in the United States. There are two main challenges in fighting cancer. First, there are so many types of cancer and each one requires a different strategy for treatment. This makes cancer research a very broad and unique disease. The second challenge is targeting the cancer cells, which can be very tricky. Current chemotherapies for cancer will not only kill cancer cells, but healthy cells too, leaving the patient very weak. We need to find a way to detect and target only cancer cells and subsequently deliver the chemotherapeutic agent. Our work has tried to solve these issues by exploiting the unique properties of cancer cells and thus making these cells the target for drugs to act on.

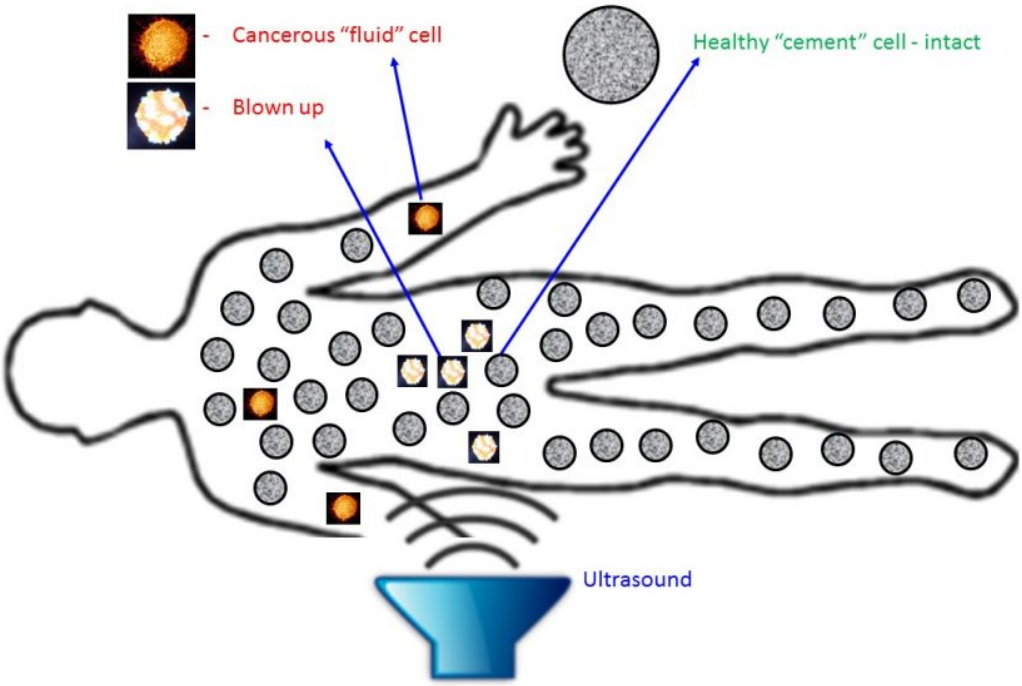

Fig. 1.

Previous studies have already shown that cancer cells are more vulnerable to mechanical stress-induced trauma to their cytoskeleton, compared to benign cells. In other words, cancer cells are more fluidic than benign cells. You might think of it this way; a cancer cell is like a balloon full of water while a healthy cell is more like a balloon full of cement. Our idea is to “hit” the cells of the body with enough force to blow up the “water balloon” cells without harming or with minimal damage to the “cement balloon” cells. Ultrasound induces mechanical stresses as it propagates

through a medium. By tweaking its parameters, we can determine the force of the “blow.” Our *in vitro* results[4] show that almost 90% of cancer cells with a lower metastatic potential (MP) cancer cells die after exposure to ultrasound while healthy cells suffered a mortality rate of 21% for the same applied ultrasound parameters. Our *in vivo* results show that tumor growth can be inhibited by applying ultrasound with some minimal damage to the surrounding tissue. These effects can be further controlled by varying the ultrasound parameters such as intensity, duration, and duty cycle. However it is very important to note that these are still only the first steps and much more needs to be researched and understood in order to make this technology usable. For now, the results of our research provide a proof-of-concept suggesting the application of ultrasound to discriminate between healthy and cancer cells.

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