Detecting Cancer Cells Using Fluorescence Polarization

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Technology description

A novel approach to the real-time, quantitative analysis of cancerous cells on the singlecell levelin vivousing fluorescence polarization technology.

Background

In current medical strategies to remove cancerous cells, surgeons remove what appears to be the affected tissue while excising and freezing any suspicious tissue left in the body. This suspicious tissue is tested post-surgery using dyes that are not approved for human use, such as hematoxylin, to stain different parts of the cells. If the subsequent testing of the suspicious tissue comes back positive, the surgery did not remove all of the cancerous cells and the patient must return for additional removal surgeries. This causes added stress and medical costs for the patient as the cancer treatment time period is extended. For diagnosing carcinoma specifically, fine needle aspiration (FNA) can be utilized to quickly diagnose breast cancer. However, many other types of cells can simulate cancerous cells, leading to false-positive results. A single cell detection technology would be needed to differentiate between these similar cells.

Technology

UMass Lowell researchers have developed a new technology for the detection of cancerous cells that can be usedin vivoduring removal surgery. Utilizing methylene blue (MB) and eosin dyes that are approved for human use, cells can be stained during surgery and analyzed using fluorescence polarization. The novel fluorescence polarization device uses high resolution and wide-range imaging to scan the stained cells of the tissue with lasers to excite the fluorescence of the dyes. The device then displays color-coded fluorescence and fluorescence polarization images of the tissue region, allowing surgeons to know immediately if they have removed all of the cancerous cells.
In addition, researchers have created a quantitative analysis involving an algorithmic ratio to devise a measurable approach to detecting cancer at the single cell level. Using this ratio, it was found that certain cancerous cells exhibit higher fluorescence polarization values when compared with values exhibited by normal cells. This quantitative analysis can be used in a fluorescence polarization device to efficiently detect cancerous cellsin vivo. Thus, this method can lead to an effective way for intraoperative quantification and differentiation of cancerous cells from normal cells.

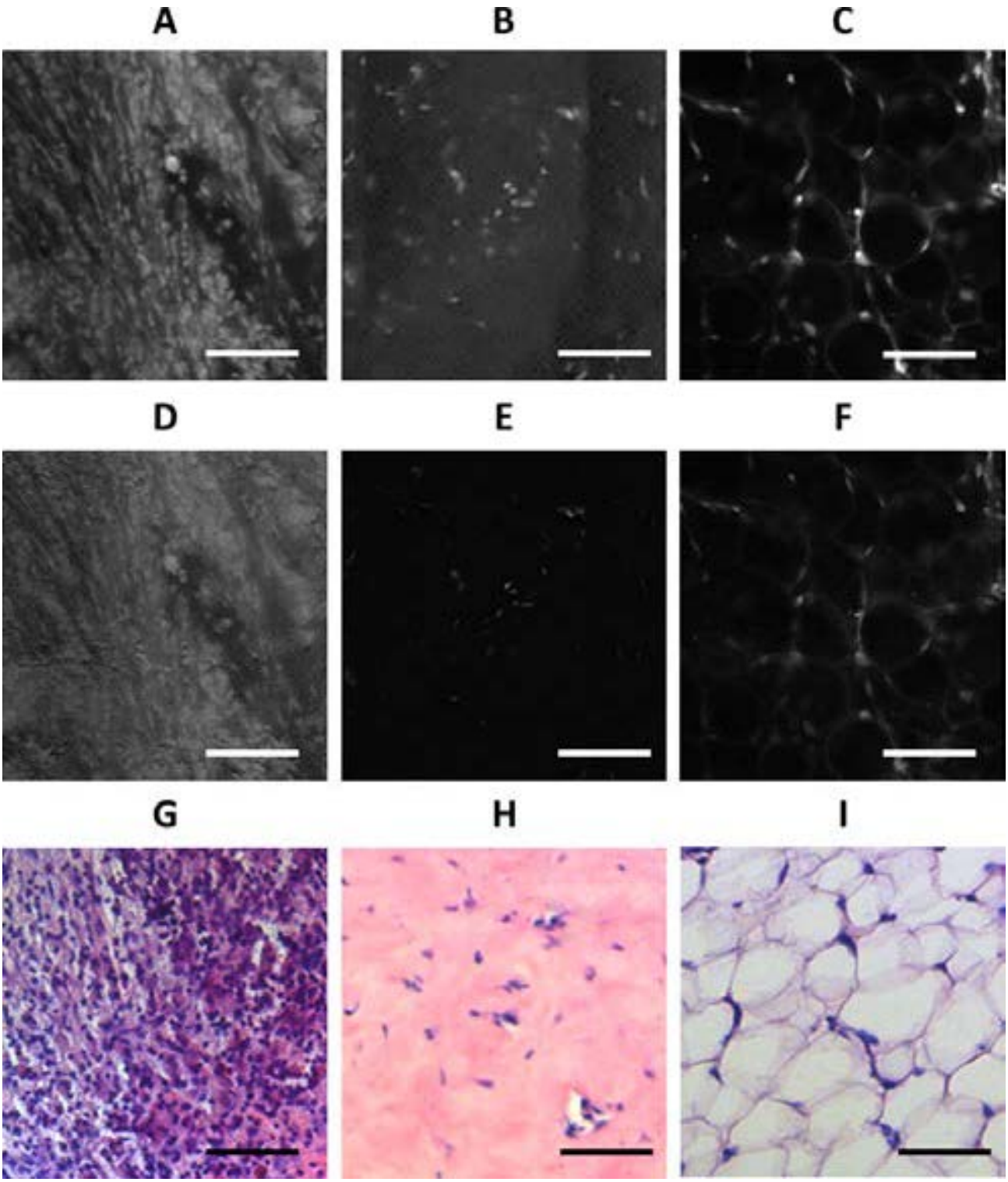

Figure 1: Images of invasive ductal carcinoma; scale bar: 0.1 mm. Fluorescence emission of tumor (A), fibroblasts (B), and adipose tissue (C). Corresponding fluorescence polarization of tumor (D), fibroblasts (E), and adipose tissue (F). Histopathology of tumor (G), fibroblasts (H), and adipose tissue sections (I).

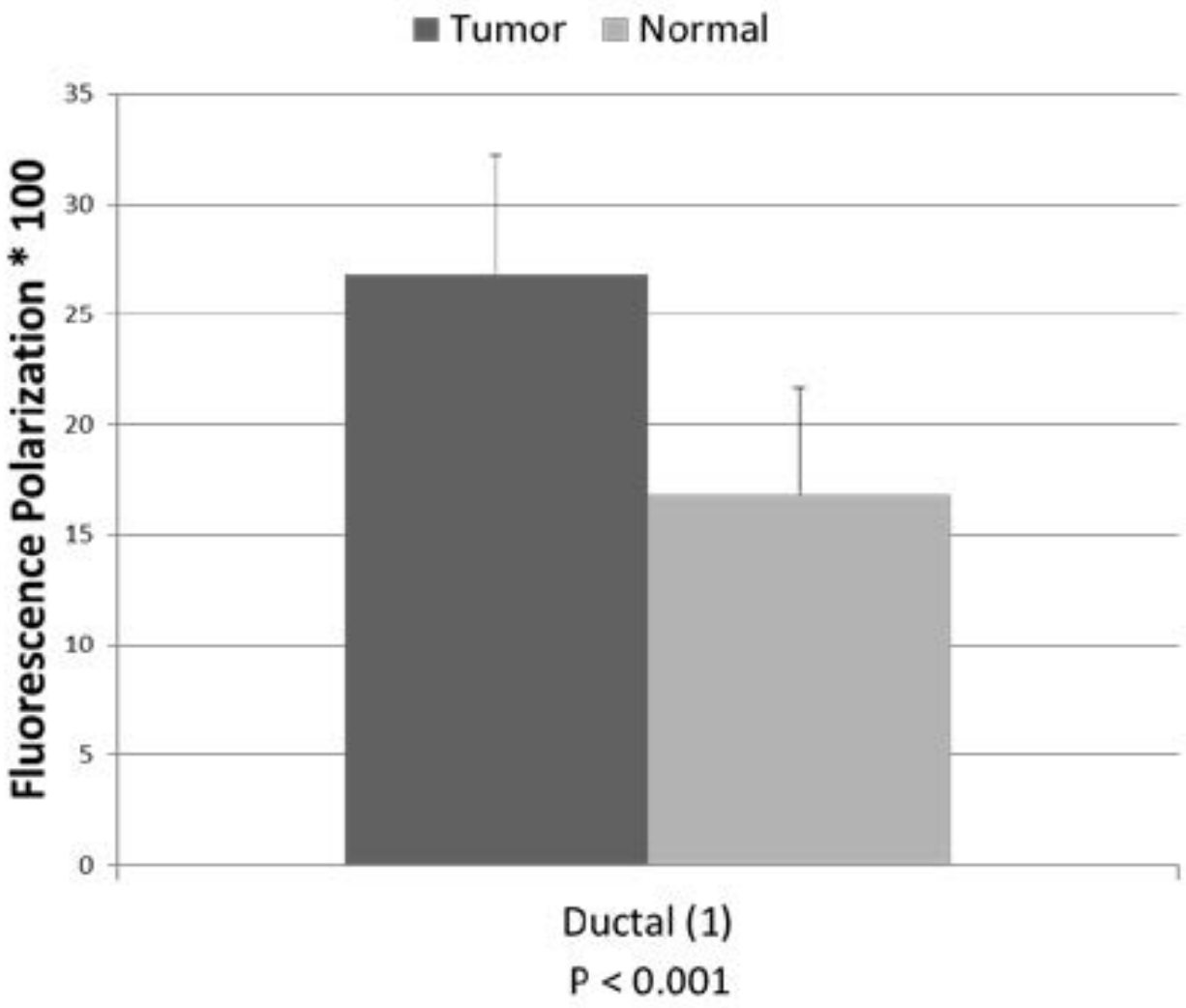

Figure 2: Confocal fluorescence polarization values (x100) averaged over cancer (dark gray) andnormal cells (light gray) of a ductal carcinoma specimen. Bars show standard deviations. P value is given for student’ s t-test of two independent populations.

Market Potential

There is a growing market forin vivomethods for detection of cancerous cells to help reduce medical costs and efficiently treat certain cancers. Although there are already devices that can detect fluorescence polarization, there has not been a device developed to quantify the cancerous cell polarizationin vivo. Intraoperative cancerous cell detection technology is in high demand among medical professions as a surgeon typically performs 5-6 cancerous cell removal surgeries a day. Additionally, the global intraoperative imaging market is projected to grow at a CAGR of 3.5% from $1.8B in 2014 to $2.1B by 2019.

References

Al-Arashi, Munir Y., Elena Salomatina, and Anna N. Yaroslavsky. "Multimodal confocal microscopy for diagnosing nonmelanoma skin cancers."Lasers in surgery and medicine39.9 (2007): 696-705.

Application area

Intraoperative detection of cancerous cells and cancerous cell margins.
Monitoring cancer patients in remission.

Advantages

Thein vivousage of the device allows for real-time detection of cancerous cells.
Device uses high resolution and wide-range imaging for efficient and accurate imaging.
Use of fluorescence polarization differentiates certain cancerous cells from normal cells.

Institution

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