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Tri-Modal Mosquito Bite Needle Endoscopy (MBNE) for Breast Cancer Diagnostics

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Purpose and Hypothesis: To lessen patient discomfort and improve breast cancer biopsy efficacy, a smaller, acupuncture sized needle should be used for core needle biopsies. Minimally invasive Mosquito Bite Needle Endoscopy (MBNE) using a 34-gauge acupuncture-sized needle with WAR tri-modal imaging could improve diagnostic accuracy and reduce unnecessary biopsies.

Methods: An 85-micron multi-core imaging fiber is threaded within the lumen of a 34-gauge needle, creating a probe design. The proximal end of the probe (i.e. the tip of the needle housing the proximal end of the imaging fiber) is inserted into the breast tissue. The distal end of the probe (i.e. the distal end of the imaging fiber) is secured beneath a confocal microscope and aligned with the objective lens. The microscope uses WAR tri-modal imaging to identify the chemical composition of the tissue spot seen by the 85-micron fiber and characterize the tissue spot as healthy or cancerous. WAR tri-modal imaging includes: (W) white light reflectance RGB imaging, (A) autofluorescence contrast imaging, and (R) point Raman spectra collection.

Results: A 34-gauge needle endoscope with 85- μ m multi-core optical fiber was developed to capture high-resolution WAR images of breast tissue. A machine learning algorithm was implemented to classify tissue regions using the captured images. The accuracy of the algorithm is being refined via comparison to pathologist-marked images.

Conclusions: A 34-gauge acupuncture-sized needle endoscope integrated with WAR tri-modal imaging demonstrates potential for accurate classification of breast tissue pathology. Thus, the minimally invasive system has the potential to improve patient comfort during breast cancer biopsies and reduce the number of unnecessary 14-18G breast biopsies.

Keyword-1

Micro-endoscopy

Keyword-2

Cancer

Keyword-3

Diagnostics

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