Boston University School of Medicine

Optically Guided Cancer Diagnosis of Thyroid Nodules

CIMIT® Center for Integration of Medicine & Innovative Technology

Jennifer E. Rosen, M.D., F.A.C.S.

Young Clinician Award 2009

Investigator Profile

Education
- MD, Jefferson Medical College
- B.A., University of Pennsylvania

Clinical/Professional Appointment
- Assistant Professor of Surgery, Section of Surgical Oncology, Boston Medical Center
- Assistant Professor, Division of Graduate Medical Sciences and Molecular Medicine, Boston University Medical Center

Recent Honors and Awards
- The Laszlo N. Tauber Assistant Professor of Surgery
- Department of Defense Idea Award
- Massage Therapy Foundation Research Award
- Genome Science Institute Research Award
- BU-Bridge Research Award

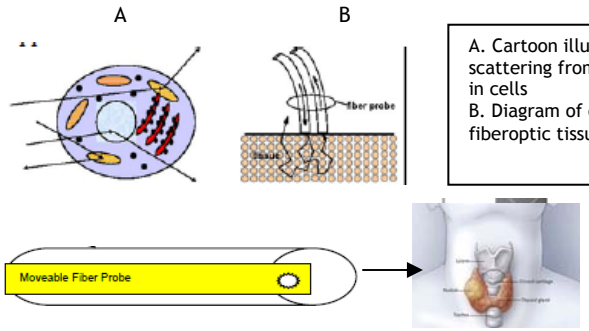
Impact on Care

- Thyroid cancer is the most common endocrine malignancy; 19-35% of the population by ultrasound will develop a thyroid nodule necessitating a workup to exclude malignancy during their lifetime.
- The current standard of care in the management of a patient with a thyroid nodule is fine needle aspiration biopsy (FNA) with cytologic evaluation.
- While 5-10% of nodules are malignant, up to 10-25% of FNAs are indeterminate. Consequently, about twice as many patients undergo surgery for a suspicious lesion that turns out to be benign as undergo surgery for a known malignant lesion.
- Although the development of minimally invasive techniques has helped improve the surgical management of these patients, a more accurate molecular and ultrastructural based algorithm such as one using ESS as proposed would be useful to improve the diagnostic accuracy and prevent patients from undergoing surgery for diagnostic purposes alone.

Abstract

Elastic light-scattering spectroscopy (ESS) is a point spectroscopic measurement technique, which is sensitive to cellular and subcellular morphological features. Normal and abnormal tissues can generate different spectral signatures. ESS is a site-specific measurement that samples a small tissue volume of ≤0.1 cm^2. The light source is broadband, the energy is nondestructive, and each measurement takes about 30 msec all of which are useful in the clinical setting. ESS is optimal for use in the small-volume area as found in thyroid FNA. An important advantage of ESS is that it provides an objective and quantitative assessment of tissue pathology that may not require on-site special expertise and subjective image interpretation as in conventional histopathology.

We hypothesize that we can identify a pattern of ESS expression that can differentiate benign from malignant thyroid lesions, and that this pattern in ex vivo tissue will correlate with the pattern seen in the initial fine needle aspiration biopsy specimens. Our longer term objectives include designing a prospective randomized trial to incorporate optical and genetic patterns into clinical decision making surrounding indeterminate/suspicious thyroid nodules to further improve preoperative diagnosis.



A. Cartoon illustration of optical scattering from density gradients in cells
B. Diagram of optical geometry for fiberoptic tissue measurements

Fine Needle Aspiration Biopsy Optical System (fiberoptic probe in 21 gauge needle)

Award made possible through the support of: Johnson & Johnson