In Vivo Microscopy for the Evaluation of Pancreatic Lesions

In vivo microscopy (IVM) applies light directly to living tissues to produce images that may be interpreted by a trained pathologist for diagnosis. One important application is imaging of pancreatic lesions via endoscopic procedures.

Overview of In-vivo Microscopy Technologies Used for its Evaluation

**Optical Coherence Topography (OCT)**
- OCT-based IVM provides ultra-sound like cross sectional images at microscopy resolutions (up to a few microns)
- OCT provides information about cyst architecture and content for diagnosis of serous and mucinous cysts

**Assessment of Cystic Pancreatic Strictures**
- Ex-vivo studies show the ability of OCT in differentiating mucinous from serous content of cysts based on the scattering properties of the cyst contents
- Cross sectional imaging using OCT allows for assessment of cyst size, wall thickness and extent of septation for differentiation of serous and mucinous cysts

**Assessment of Malignant Pancreaticobiliary Strictures**
- OCT probes may be passed through the main pancreatic duct and bile duct during endoscopic procedures for the diagnosis of malignant strictures
- OCT of a normal main pancreatic duct shows a tri-layered architecture representing the epithelial lining, fibromuscular layer surrounding the epithelium and loose connective tissue / acini surrounding them
- Adenocarcinoma involving the main pancreatic duct shows loss of the tri-layered architecture and multiple minute non-reflective areas seen on OCT
- OCT can detect main pancreatic duct adenocarcinoma with an accuracy approaching 100%
**Needle-Based Confocal Endomicroscopy (nCLE)**

- In needle-based endomicroscopy, an optical probe is passed through a 19-gauge needle during endoscopic ultrasound, fine needle aspiration (EUS-FNA) procedures and produces images in concert with injected Fluorescein contrast.
- The probe is placed directly against the cyst wall.
- Vascular and epithelial fluorescence and patterns allow for diagnosis of various pancreatic lesions.

**Fluorescent Agents Used in CLE**

Appearance of tissue using CLE often depends on the contrast agent used.

- The widespread use of injectable contrast agents such as fluorescein has led to the development of diagnostic criteria based on vascular architecture and hemo-dynamics.
- “Leaky vessels” showing leakage of fluorescent agents usually signify malignancy.
- Topical fluorescent agents such as acriflavine and proflavine stain nuclei allow for assessment of nuclear morphology, distribution and size analogous to classic histopathology.
- Research in in-vivo molecular fluoroprobes that are specific for pancreatic adenocarcinoma may increase sensitivity and specificity of in-vivo diagnoses using CLE.1

---

**CLE Images**

- Complete “finger-like” papillary projections with vascular cores (lamina propria)1
- IPMN, gastric subtype with high-grade dysplasia2
- “Fern pattern” of vascularity2
- Serous cystadenoma2
- Horizon-like bands with incomplete papillary formation3
- Adenocarcinoma
- Intraductal Papillary Mucinous Neoplasm
- Mucinous Cystic Neoplasm

---

**Assessment of Cystic Pancreatic Structures**

- Papillary structures are easily identified using probe-based CLE in intraductal papillary mucinous Neoplas
- CLE probes allow the visualization of a superficial vascular network in the cyst walls of serous cystadenomas, a sign that is highly specific for the disease

**Assessment of Malignant Pancreaticobiliary Structures**

- CLE probes may be passed through the main pancreatic duct and bile duct during endoscopic procedures for the diagnosis of malignant strictures
- Criteria suggestive of a malignant stricture involving a pancreatic or biliary duct include:
  - Thick dark bands (>40 microns)2, 3, 4
  - Thick white bands (>20 microns)2, 3, 4
  - Dark Clumps2, 3, 4
  - Fluorescein leakage2, 3, 4

---

**Text References**


---

**Image References**


© 2018 College of American Pathologists. All rights reserved.