Background and Aim(s)

Duodenal gastrinomas (DGASTs) are a type of gastroenteropancreatic neuroendocrine tumor (NET) that produce the hormone gastrin. Secretion of the hormone gastrin from DGASTs can lead to the development of Zollinger-Ellison Syndrome (ZES) which is tied to the overproduction of stomach acid. Symptoms of ZES includes chronic diarrhea, stomach ulcers, tissue adhesions with increased risk of rupture, and malabsorption. DGASTs typically develop as small, diffuse, lesions within the submucosa of the proximal small intestine. [1]

Methods

Endogenous fluorescence was measured in formalin-fixed paraffin-embedded (FFPE) DGAST samples from 12 patients using two-photon microscopy (Zeiss LSM 880 NLO microscope). Excitation wavelengths and detection bands (Figure 3) were chosen to acquire two-photon excited fluorescence (2PEF) predominantly from NADH, FAD, porphyrin, and lipofuscin fluorophores that have abundances related to common markers of cancer. [2]

Second-harmonic generation (SHG) is a light-scattering phenomena that is elicited by anti-centrosymmetric structures such as collagen. SHG was measured with an 880 nm excitation and 430 - 450 nm detection band.

Multiphoton microscopy and immunostained images of duodenal gastrinoma

Hypothesis

Illustration of gastrinoma development and spread, showing the multifocal nature of the tumor and gastric damage secondary to acid hypersecretion. Endoscopic resection of duodenal NETs is an increasingly popular means of treating this disease but suffers from discrepancies between endoscopically and pathologically complete resections has been shown to increase the likelihood of NET recurrence. [2]

Results

Comparison of outcomes between endoscopic mucosal resection (EMR), EMR with precutting (EMR-P) and ligation device (EMR-L), EMR with precutting (EMR-P) and endoscopic submucosal dissection (ESD) for duodenal carcinoid tumors. Endoscopic complete resection 16 (89%) 16 (100%) 3 (100%) 4 (100%) ***

Mean resection size (range, mm) 7 (2-18) 7 (5-12) 12 (8-17) * 12 (10-5) *

Bleeding 1 (6%) 0 (0%) 1 (33%) 3 (75%) ***

Table 1: Comparison of outcomes between endoscopic mucosal resection (EMR), EMR with precutting (EMR-P) and ligation device (EMR-L), EMR with precutting (EMR-P) and endoscopic submucosal dissection (ESD) for duodenal carcinoid tumors.

Conclusions

Significant differences in signal intensity of endogenous 2PEF and SHG is measurable in FFPE samples of duodenal gastrinoma using two-photon microscopy. This suggests that MPM can be used as a label-free approach for distinguishing DGASTs from normal tissue. Early models using image texture features show high classification accuracy, implying future utility in computer vision-aided diagnostics and potential for detecting early neoplasms with the differentiation between normal/abnormal BGs.

Hypothetical Differencess

The abundance of endogenous fluorophores in DGASTs and normal duodenal tissue will result in inherent autofluorescent contrasts measurable with multiphoton microscopy, providing a method for performing label-free in vivo tumor analysis.

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