What Can We See in the Different Lights?

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In the study "Usefulness of Autofluorescence Imaging for the Estimating the Extent of Gastric Neoplastic Lesions: a Prospective Multicenter Study" by Lee *et al*, the authors investigated autofluorescence imaging (AFI) videoendoscopy system for the diagnosis of tumor extent of gastric neoplasms. They suggested that this new imaging system would be beneficial for determining tumor boundary of gastric epithelial neoplasia before endoscopic resection in selected patients. In this commentary, I would like to add some explanations about the principle of autofluorescence endoscopy and our interpretation of AFI images in the stomach. I believe that the basic knowledge on AFI mechanisms would facilitate the readers in understanding the findings of this new technology.

AFI illuminates blue excitation light (390-470 nm) and green light (540-560 nm) that are sequentially provided from a light source instead of ordinary white light through an endoscope to the mucosa. Since the vital organs including the digestive tracts contain certain biomolecules that act as endogeneous fluorophores, they emit natural tissue fluorescence i.e., autofluorescence by the excitation light. The autofluorescence is too weak to be detected by naked eyes of a human being. However, AFI captures it with a high sensitivity charged coupled device (CCD) at the tip of the endoscope and processes real-time pseudocolor images by computation on a video screen. Although the fluorophores exist in both mucosa and submucosa, collagen in the submucosa discharges strong autofluorescence in the green region light. AFI represents difference of autofluorescence property, which is mainly determined by intensity, as color difference, so areas with strong autofluorescence appear bright green and areas with weak autofluorescence appear purple or greenish purple in the images.

In the AFI images, normal mucosa in the digestive tract looks green, whereas that in the gastric fundus looks purple. The reason why the gastric body shows unique color is probably because thick fundic mucosa, that has proper gastric function such as acid secretion, reduces autofluorescence from the submucosa. In patients with *Helicobacter pylori*-associated atrophic gastritis, the fundic mucosa becomes thin, and thus the atrophic mucosa looks green similar to the intestinal mucosa.¹

For a tumor in the digestive tract, it basically appears as a purple area in the green mucosa by AFI because autofluorescence is reduced at tumor. Most of the gastric tumors show similar pattern to tumors in other digestive tract, but some of the tumors look different, green in the AFI images. Our data suggested that tumor color in AFI images has the strongest association with morphology but not with histology.² Therefore elevated or flat tumors look purple probably because of reduction of autofluorescence at the lesion, while most of superficial depressed tumors look green in AFI (Fig. 1). In this study by Lee *et al*, they enrolled patients undergoing endoscopic treatment for gastric neoplasm. Therefore, most of the tumors should appear purple areas in green mucosa since candidates of endoscopic treatment has elevated or flat lesion in the pyloric or atrophic mucosa. Mucosal thickening or increased blood flow caused by non-specific changes such as hyperplasia, inflammation or edema cause reduction of autofluorescence showing similar color changes to an elevated tumor. Such changes sometimes interfere diagnosis. We suspect hyperplastic change around tumors might cause overestimation of the sizes by AFI.

In summary, autofluorescence is speculated to be originated mainly from collagen in the submucosa in the digestive tract, and the mucosa looks green in AFI images.

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Fig. 1. Color differences in autofluorescence image of the tumor according to their morphology.

Mucosal thickening caused by presence of fundic mucosa, elevated or flat neoplasm, hyperplasia, inflammation, etc decrease the autofluorescence from the submucosa and represents it as purple or dark green color. A depressed type tumor does not affect autofluorescence intensity so it looks green, and when it surrounded by fundic mucosa it appears green areas in purple background.

The AFI is the first autofluorescence endoscopy system, which incorporates CCD in tip of the endoscope resulting to provide as same appearance and maneuverability as conventional videoendoscope. Therefore, it enables us to use it widely in a clinical practice. However, its actual usefulness in clinical settings is still under investigation, so the comparison with standard diagnostic methods by appropriate study design is important to clarify its bene-

fits in what patients, for what purpose, by what strategies, and so forth. On the other hand, it is still under investigation, so we are having a chance to discover new findings that are absolutely different from those of white light in images of the different lights.

REFERENCES

1. Uedo N, Ishihara R, Iishi H. Autofluorescence imaging video-endoscopy system for diagnosis of superficial gastric neoplasia. In: Tajiri H, Nakajima M, Yasuda K, eds. *New challenges in gastrointestinal endoscopy*. Tokyo: Springer, 2008:191-199.
2. Kato M, Uedo N, Iishi H. Analysis of color pattern of early gastric cancer by autofluorescence imaging videoendoscopy system. *Gastrointest Endosc* 2007;65:AB356.