Evaluating Anastomotic Tissue Oxygenation during Colorectal Surgery Using the FUJIFILM ELUXEO Vision System: Is Oxygen Saturation Imaging Comparable to Indocyanine Green?

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Background

- Anastomotic leaks resulting from necrosis of ischemic tissue are devastating complications in colorectal surgery associated with:
  - Significantly higher rates of morbidity and mortality
  - Dramatic increase in hospital cost and length of stay
- Fluorescence guided imaging with indocyanine green (ICG) is widely used to visualize the contrast between perfused and non-perfused bowel when creating an anastomosis. Its use is associated with lower rates of anastomotic leak.
- Limitations to ICG perfusion include:
  - Requires injection of an exogenous fluorescent dye
  - Contraindicated in patients with iodine allergy
  - Timing of contrast injection
  - Subjective nature of determining perfusion
- **Oxygen saturation imaging (OSI)** is alternative technology to evaluate tissues perfusion
  - Can be applied to patients with ICG allergy
  - Can be used repeatedly, in real-time without the use of dye injection
  - Provides absolute tissue oxygen saturation (SO2) value (0-100%)
- OSI may serve as a substitute or a complement to ICG to evaluate tissue perfusion and oxygenation in colorectal surgical anastomoses.

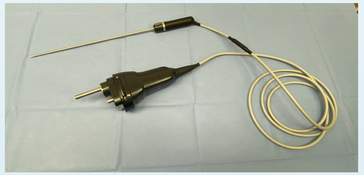
Objective

- OSI was used in conjunction with ICG during a robotic low anterior resection for rectosigmoid cancer
- The perfusion of the bowel serosa at the transection margins and anastomosis were evaluated using ICG and then OSI

Description of the Technology

- **FUJIFILM's ELUXEO Vision System**
  - 5-LED light source is one of the special key-technologies of OSI
  - Uses multispectral illuminations and the different light absorption properties of oxy- and deoxy-hemoglobin in tissue
  - Real-time visualization of tissue SO2 level during both endoscopic and laparoscopic procedures
  - No need for injectable fluorescent dyes
  - Granted a Breakthrough Device Designation by the US FDA in 2020







FUJIFILM Eluxeo Vision Tower with laparoscope and endoscope

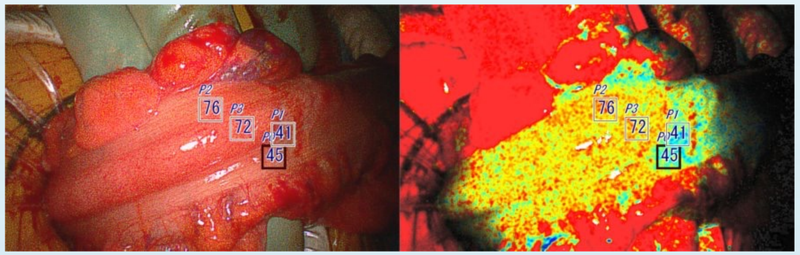
Preliminary Results

- Both ELUXEO Vision and ICG demonstrated a tissue perfusion dermarcation line that was comparable at ~70-80% SO2.
- This line of dermarcation aided in deciding the level of transection when before creating a colorectal anastomosis
- The ELUXEO Vision could be used multiple times throughout the procedure without injection of dye.

Preliminary Results (continued)



Demarcation of perfused and non-fused bowel after ICG injection.



Demarcation of perfused and non-fused bowel using OSI. Comparable to ICG with SO2 value of 70-80%

Conclusions / Future Directions

- ELUXEO Vision may be used in place of or in addition to ICG fluorescence imaging to assess colorectal anastomotic tissue viability.
- This device's capacity to objectively quantify serosal and mucosal SO2 at colorectal anastomoses could represent an advantage over the subjective evaluation provided by ICG fluorescence imaging.
- Further studies evaluating endoluminal perfusion of anastomoses are needed
- Studies with larger sample sizes are needed to compare ICG and OSI in colorectal surgery and to determine if the objective advantage of this technology is associated with a decrease in the rates of anastomotic leak.