INTRAOPERATIVE USE OF OXYGEN SATURATION IMAGING TO ASSESS COLORECTAL PERFUSION

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Background

Oxygen Saturation Imaging (OSI) offers a promising alternative by providing real-time, quantitative tissue oxygen saturation (StO2) measurements through light-enhanced multispectral imaging (without requiring additional medication). OSI **overlays StO2 maps onto laparoscopic and endoscopic visuals**, augmenting traditional evaluation methods using specialized software. Despite safety and feasibility studies, **correlations between mucosal and serosal StO2 measurements, intraoperative findings, and clinical outcomes** remain underexplored. We present **an observational case series** using this technology after intestinal anastomosis creation.

Methods

Using the FUJIFILM Eluxeo Vision system, perianastomotic serosal and mucosal measurements were obtained for **n=10 consecutive patients undergoing left-sided colorectal resection and anastomosis** with the Video Laparoscope EL-R740M and Endoscope EC-740T/L, respectively. StO2 readings were recorded at **four perianastomotic locations**: (1) colon proximal to anastomosis, (2) at staple line (proximal), (3) at staple line (distal), and (4) distal rectum. Demographic and clinical outcomes data were recorded.

Case Summary: Serosa and Mucosa *All measurements highlighted in gray are excluded from statistical analysis

#	Procedure	Serosa						Mucosa					
		Prox. Colon	Prox. SL	Diff.	Distal Rectum	Distal SL	Diff.	Prox. Colon	Prox. SL	Diff.	Distal Rectum	Distal SL	Diff.
1	LAR	67.0%	64.0%	3.0%	N/A	N/A	N/A	81.0%	70.0%	11.0%	N/A	69.0%	N/A
2	LAR	66.0%	N/A	N/A	N/A	N/A	N/A	64.5%	39.5%	25.0%	47.5%	45.5%	2.0%
3	Sigmoidectomy	74.5%	69.0%	5.5%	N/A	N/A	N/A	66.5%	60.5%	6.0%	61.5%	52.0%	9.5%
4	Sigmoidectomy	84.0%	76.0%	8.0%	80.0%	73.0%	7.0%	62.5%	56.0%	6.5%	67.0%	58.5%	8.5%
5	Proctectomy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	LAR	90.0%	80.0%	10.0%	N/A	N/A	N/A	N/A	53.0%	N/A	58.0%	N/A	N/A
7	Sigmoidectomy	78.5%	76.5%	2.0%	N/A	N/A	N/A	69.0%	53.0%	16.0%	63.5%	18.5%	45.0%
8	Sigmoidectomy	88.0%	84.5%	3.5%	81.5%	80.0%	1.5%	61.0%	48.0%	13.0%	61.5%	54.0%	7.5%
9	LAR	86.5%	72.0%	14.5%	N/A	N/A	N/A	74.0%	56.5%	17.5%	69.0%	61.0%	8.0%
10	Sigmoidectomy	91.0%	87.5%	3.5%	84.5%	N/A	N/A	79.5%	69.0%	10.5%	60.0%	52.0%	8.0%
Average		82.4%	76.2%	6.3%	80.8%	76.5%	4.3%	69.8%	56.6%	13.2%	61.4%	48.8%	12.6%
Median		85.3%	76.3%	4.5%	80.8%	76.5%	4.3%	67.8%	56.3%	12.0%	61.5%	52.0%	8.0%
Sample Variance		0.7%	0.6%	0.2%	0.0%	0.2%	0.2%	0.6%	1.0%	0.4%	0.5%	2.0%	2.1%
Sample Standard Deviat		8.4%	7.8%		1.1%	4.9%		7.6%	10.2%		6.9%	14.3%	
T value				4.110			1.545			5.957			2.311
P value				0.005			0.366			0.001			0.060

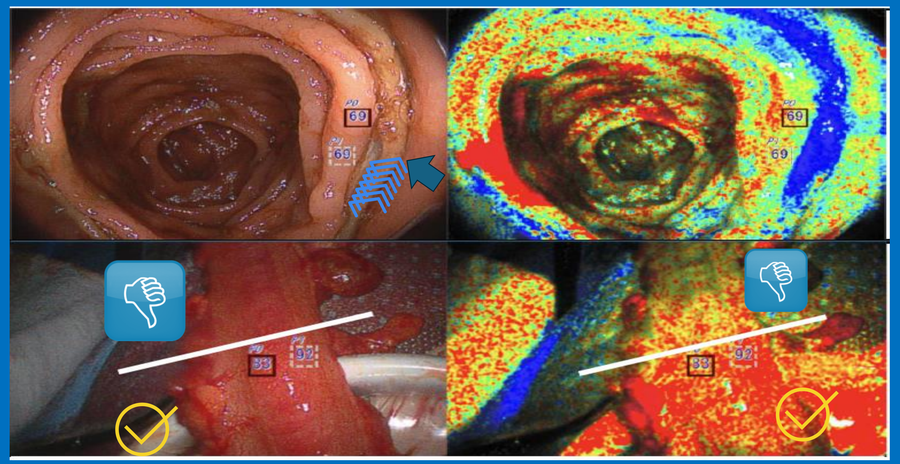


Fig. 1: Endoscopic (top) and laparoscopic (bottom) white light images with StO2 heatmap.



Results

The study cohort (mean age 57.2 years, range 37–77) was predominantly male (80%) with a median ASA class of 3. **Laparoscopic serosal StO2 was significantly higher at the colon proximal to anastomosis (82.4%) than the staple line (proximal) (76.2%, p = 0.005)**, while distal measurements were limited by pelvic calibration issues. Endoscopic mucosal StO2 was 69.8% at the colon proximal to anastomosis, 56.6% at the staple line (proximal), 61.4% at the distal rectum, and 48.8% at the staple line (distal), showing **significant differences between the proximal sites (p = 0.001)** and marginal differences distally (p = 0.06). Serosal and mucosal StO2 were comparable at the colon proximal to anastomosis (p = 0.063) but **significantly different at the staple line (proximal) (p = 0.005)**. The average hospital stay was 4.9 days (range 2.2–9.3), with a mean follow-up of 19.2 days (range 11–31). **No clinical leaks or anastomotic complications were observed at time of operation, during admission or follow-up.**

Discussion

OSI facilitates real-time assessment of perianastomotic tissue perfusion during colorectal surgery. Significant StO2 differences were observed at the serosa of the colon proximal to anastomosis and staple line (proximal), as well as between mucosa and serosa at the staple line (proximal). Further research is required to evaluate the influence of intraoperative StO2 monitoring on surgical decisions and outcomes and to establish a correlation between threshold oxygen tension and anastomotic complications.

Red/yellow = perfused

Blue = not

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