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PRedictive nomogram for Anastomotic leak and Implementation of intraoperative procedures to prevent it (PRAI study): a novel technique to evaluate anastomotic vascularization

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OBJECTIVE OF THE NEW TECHNOLOGY

Although altered microcirculation is defined as an independent risk factor for anastomotic leak few studies evaluated its impact on anastomotic leak and using different devices, although, none has become widely accepted. This report shows our initial experience measuring gut microcirculatory density and flow with the aid of incidence dark-field (IDF) videomicroscopy (Cytocam, Braedius, Amsterdam, The Netherlands) comparing their operative outcomes using a propensity score matching (PSM) model based on age, gender and Charlson Comorbidity Index (CCI).

DESCRIPTION OF THE TECHNOLOGY

Videos from 5 different sites (at least 10 sec/site) were recorded from both the mucosal and serosal site of the left colon end once the colonic resection was performed. At both time points with adequate focus and contrast and every effort was made to avoid movement and pressure artefacts. Poor-quality images were discarded and 3 images for each time point were selected and analyzed using a computer software package (Automated Vascular Analysis Sofware, Microvision Medical BV, Amsterdam, The Netherlands). According to the consensus report on the performance and evaluation of microcirculation using IDF imaging, total vessel density (TVD) and perfused vessel density (PVD) were calculated for small vessels (diameter <20 µm). The De Backer score was calculated as described previously. The proportion of perfused vessels (PPV) and the microvascular flow index (MFI), reflecting microcirculatory blood flow velocity, were analyzed semi-quantitatively in small vessels, as de- scribed elsewhere.

The flow heterogeneity index (HI) was also calculated as the highest MFI minus the lowest MFI divided by the mean MFI, providing an index of heterogeneous microcirculatory perfusion.

At each recording noninvasive measurement of blood pressure, heart rate, temperature, use of vasoactive drugs and peripheral oxygen saturation (measured with a probe on a digit or ear) were simultaneously recorded. The association between post-operative outcomes and microcirculation evaluation were investigated using propensity score matching and multivariable logistic regression models.

PRELIMINARY RESULTS

Nineteen patients were considered eligible for the study (males=8, 42.1%; mean age=61.2), all of them underwent laparoscopic rectal anterior resection.

Results from microvascularization assessment

- The mean TVD 8.85 (95%CI=7.33-10.36)
- PPV was 100 in all patients but 2
- mean MFI was 2.79 (95%CI= 2.33-3.23)
- mean PVD was 8.63 (95%CI=5.75-11.52)
- mean De Becker score was 4.51 (95%CI= 3.73- 5.28)

Intra-operative and post-operative outcomes

- No intraoperative complications were recorded
- One patient experienced major bleeding managed with a second laparoscopy.
- No anastomotic leak was observed
- Anastomotic leak occurred in 2 patients in (p=0.811)

The evaluation of microvascularization was not associated with post-operative complications in unmatched (OR=1.15, 95% CI=0.734-13.705) nor in matched patients (OR=6.538, 95%CI= 0.678-62.989)

CONCLUSIONS

Though the results are preliminary this type of anastomotic evaluation showed to be feasible, safe and useful to easily detect any alteration of the resected colon before anastomotic construction. Moreover, in times when the constant increasing awareness for costs of the healthcare system could pose a limit to the spread of new technologies this type of anastomotic evaluation offers a in a more cost-effective manner than other devices.

Patient	Age	Gender	BMI	Tumor site	OT	Conversion
1	83	M	27	Mid rectum	160	0
2	59	F	30	Rectosigmoid junction	135	0
3	49	M	26	High rectum	150	0
4	68	F	25	Rectosigmoid junction	140	0
5	58	M	21	Low rectum	140	0
6	50	M	25	Sigmoid colon	120	0
7	74	F	21	Mid rectum	150	0
8	72	M	27	Low rectum	210	0
9	68	F	25	Sigmoid colon	100	0
10	65	M	23	Rectosigmoid junction	140	0
11	72	M	26.51	Low rectum	210	0
12	68	F	25.4	Sigmoid colon	100	0
13	65	M	23.14	Rectosigmoid junction	140	0
14	70	F	19.35	Sigmoid colon	175	0
15	84	F	27.12	Sigmoid colon	140	0
16	67	F	21.79	Sigmoid colon	115	0
17	74	F	31.99	Sigmoid colon	160	0
18	64	F	25.15	Rectosigmoid junction	190	0
19	61	F	37.11	Rectosigmoid junction	152	0

***Table 1**. Characteristics of the included population*

Variables	Before matching		p	After matching	p
	No Cytocam (n=39)	Cytocam (n=19)		No Cytocam (n=19)	
Gender [m, n(%)]	20 (51.3)	8 (42.1)	0.403	8 (42.1)	ns
Age [mean, years±SD]	64 (13.4)	66.6 (9.8)	0.713	66.5 (10.3)	0.792
BMI [mean, Kg/m²±SD]	24.7 (3.5)	25.9 (4.3)	0.265	25.7 (3.9)	0.840
ASA I [n(%)]	10 (25.6)	6 (31.6)	0.225	5 (26.3)	0.127
ASA II [n(%)]	22 (56.4)	12 (63.1)	0.239	9 (4.7)	0.958
ASA III [n(%)]	7 (17.9)	1 (5.3)	0.729	5 (26.3)	0.075
CCI [mean ± SD]	3.6 (2.9)	3.8 (2.2)	0.830	3.8 (2.1)	0.939
Cardiovascular disease [y, n(%)]	8 (20.5)	2 (10.5)	0.893	4 (21)	0.373
Pulmonary disease [y, n(%)]	1 (2.6)	3 (15.8)	0.348	1 (5.3)	0.290
Neurocognitive dis [y, n(%)]	2 (5.1)	2 (10.5)	0.579	1 (5.3)	0.547
Diabetes [y, n(%)]	3 (7.7)	2 (10.5)	0.130	2 (10.5)	ns
Comorbidities >1 [y, n(%)]	3 (7.7)	5 (26.3)	0.372	3 (26.3)	0.426

***Table 2**. Comparisons of demographic data between the two groups*

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