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WHEN TO RECONSIDER MINIMALLY INVASIVE SURGERY FOR LOCALLY ADVANCED COLON CANCER

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Objective:

- There is increasing evidence of the benefits for utilizing minimally invasive surgery (MIS) for locally advanced colon cancer; however, it is not clear when MIS should be avoided.
- The objective of this study is to evaluate the risk factors for conversion to open surgery on short term outcomes for the resection of T4 colon cancer.

Methods:

- Retrospective review of all T4 Colon Cancer Resections from National Surgical Quality Improvement Program (NSQIP) between 2012-2019.
- Cases were divided into a MIS and a MIS Converted to Open cohorts.
- Cancer TNM staging and Conversion to open were identified by the the targeted colectomy dataset.
- Excluded emergency cases, or patients with ASA Class 5, preoperative renal failure, sepsis, ascites, ventilator dependence, metastatic disease, and disseminated cancer discovered intraoperatively.
- Associations between categorical variables were analyzed using Chi-squared or Fisher's exact test. A two-tailed t-test or Mann-Whitney U-test were used for continuous variables.
- Variables with a significant association were entered into multivariate regression models for death and conversion to open surgery.

Results:

- Evaluated 5,399 MIS colectomies, including 880 that were converted to open.
- The converted cohort had higher rates of male gender, smoking, preoperative weight loss, non-elective status, bleeding disorders, DM, HTN, CHF, , dependent functional status, wound class 4, and higher mean age and BMI.
- Controlling for confounders, conversion to open was an independent predictor for increased risk of death.
- Higher BMI, smoking, preoperative weight loss, non-elective case status, stage T4b, wound class 4 and laparoscopic approach were independent predictors for increased risk of conversion.

Table 1. Postoperative Outcomes by Conversion Status.

Variables	Overall Population N=5399	Conversion Status: MIS (n=4519)	Conversion Status: Converted to Open (n=880)	P value	OR	95% CI
Death (%)	81 (1.5%)	54 (1.2%)	27 (3.1%)	<.001	2.698	1.781-4.085
>12 Lymph Node Harvest (%)	5094 (94.4%)	4274 (94.6%)	820 (93.2%)	.076	.769	.581 - 1.018
OR Time (mean +/- SD)	185.75±88.64	173.55±79.28	205.91±91.32	<.001		
Anastomotic Leak (%)	146 (2.8%)	99 (2.2%)	47 (5.4%)	<.001	2.536	1.819 - 3.418
Ileus (%)	648 (12.1%)	438 (9.7%)	210 (23.9%)	<.001	2.978	2.475 - 3.433
Wound Infection (%)	405 (7.6%)	275 (6.1%)	130 (14.8%)	<.001	2.835	2.196 - 3.262
Dehiscence (%)	26 (0.5%)	18 (0.4%)	8 (1.0%)	.012	2.760	1.319 - 5.776
Pneumonia (%)	96 (1.8%)	63 (1.4%)	33 (3.8%)	<.001	2.670	1.956 - 4.171
Reintubation (%)	85 (1.6%)	64 (1.4%)	21 (2.4%)	.025	1.700	1.094 - 2.642
Pulmonary Embolism (%)	34 (0.7%)	22 (0.5%)	12 (1.4%)	.002	2.684	1.458 - 4.940
Deep Venous Thrombosis (%)	50 (1.0%)	31 (0.9%)	19 (1.8%)	.005	2.244	1.194 - 3.394
Prolonged Intubation (%)	89 (0.9%)	38 (0.7%)	19 (2.2%)	<.001	3.261	2.004 - 5.544
Urinary Tract Infection (%)	91 (1.7%)	67 (1.5%)	24 (2.7%)	.007	1.825	1.196 - 2.784
Bleeding Requiring Transfusion (%)	567 (10.6%)	397 (8.8%)	170 (19.4%)	<.001	2.296	2.089 - 2.963
Sepsis (%)	114 (2.1%)	76 (1.7%)	38 (4.3%)	<.001	2.604	1.818 - 3.684
Return to OR (%)	217 (4.0%)	167 (3.7%)	50 (5.7%)	.021	1.503	1.181 - 2.100
Readmission (%)	442 (8.3%)	338 (7.5%)	104 (11.9%)	<.001	1.852	1.350 - 2.041
Hospital Length of Stay	6.39±5.71	5.84±5.14	8.82±7.22	<.001		

Conversion was associated with higher rates of death, ileus, wound infection, sepsis, reoperation, readmission, and anastomotic leak.

Table 2. Logistic Regression for Mortality and Conversion to Open.

Covariates	p-value	OR	95% CI
Model for Mortality			
Conversion	<.001	3.401	1.665 - 4.155
CHF	<.001	9.954	2.043 – 12.103
Oral Antibiotics	.012	0.414	.977– 27.259
Higher ASA	.040	3.025	1.526 – 4.285
Age	<.001	1.077	1.049 – 1.098
Hispanic Ethnicity	.014	3.493	1.362 – 5.798
Model for Wound Infection			
Male Sex	.009	1.204	1.048 -1.382
Stage T4B	<.001	3.070	2.355-3.197
Robotic Approach	<.001	0.487	0.388 - 0.647
Non-Elective	<.001	1.740	1.473 - 2.054
CHF	.006	0.231	0.081 - 0.656
Wound Class 4	<.001	5.666	3.586 - 6.147
Age	<.001	1.011	1.006 – 1.016
BMI	.043	1.015	1.017 - 1.038
Smoking	.019	1.383	1.063 - 1.566
Preop Weight Loss	.021	1.498	1.242 - 2.024

Conclusions:

- Outcomes for MIS surgery for locally advanced colon cancer are significantly worse when converted to open.
- Patients with a laparoscopic approach, older age, higher BMI, CHF, preoperative weight loss, non-elective surgeries, T4B tumors, higher wound classifications, males and smokers are at high risk for conversion to open.
- Locally advanced cancer cases with these risk factors should consider optimization of modifiable risk factors prior to operation or a planned open approach to avoid unplanned conversion to open.