Colon

Weill Cornell Medicine is an academic medical center that provides exemplary care for our patients. Our Division of Colon and Rectal Surgery includes the nation's leading surgeons for colon and rectal surgical treatments.

Above and beyond caring for patients, our compassionate physicians and surgeons also conduct research to advance medical understanding, treatments and standards. Notable research is written, reviewed by peer physicians, published and shared with physicians around the world.

Dr. Alessio Pigazzi was appointed the chief of Colon and Rectal Surgery at Weill Cornell Medical Center/NewYork-Presbyterian in 2020. His research focuses on minimally invasive techniques to improve recovery after cancer surgery, postoperative chemotherapy and the relationship between diet and colorectal cancer.

In this article, Dr. Pigazzi and his co-authors share their findings from an extensive study about robotic rectal resection (surgical procedure to remove part of the rectum) that was conducted at seven different institutions. The study aimed to find conclusive evidence that robotic surgery is a safe and feasible option for rectal cancer resection.

The data collected from several surgeons at different institutions indicates that robotic-assisted minimally in

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Table 1 Surgeons and their institutions, robotic case volume, and laparoscopic experience

Surgeon	Robotic study case volume	Laparoscopic experience
1	47	H
2	7	M
3	4	L
4	81	L
5	29	M
6	27	H
7	23	M
8	13	L
9	13	L
10	60	H
11	1	L
12	42	L
13	27	H
14	33	H
15	32	M
16	37	H

H high laparoscopic experience: >100 cases, *M* moderate laparoscopic experience: 50–100 cases, *L* low laparoscopic experience: <50 cases

Surgical Technique

A robotic approach was offered to all patients who required rectal resection with cancer-specific mesorectal excision. All study surgeons perform robotic rectal resection as their preferred approach for rectal cancer cases, independent of patients' previous abdominal surgeries or BMI.

The mesorectal excision was performed with the da Vinci System in all cases, and with a sharp dissection technique using either robotic scissors or the robotic hook cautery. A TME with transection of the rectum at the level of the pelvic floor was performed for cancers of the mid to low rectum. For tumors of the upper rectum, the mesorectum was prepared to about 5 cm distal to the tumor where the mesorectum was divided, together with the rectum in a partial mesorectal excision (PME). Surgical technique was otherwise not standardized and involved either a total robotic or hybrid (laparoscopic/robotic) approach. All surgeons performed a medial-to-lateral mobilization of the left and sigmoid colon with high ligation of either the entire inferior mesentery artery trunk or the superior rectal artery only, selective ligation of the inferior mesenteric vein, and selective mobilization of the splenic flexure. The anastomosis was either stapled with a circular stapler inserted transanally or hand-sewn as a coloanal anastomosis with intersphincteric resection for very low tumors. The specimens were removed either through a small suprapubic incision or transanally. Creation of a loop ileostomy was performed at the surgeon's discretion. Bowel preparation, preoperative antibiotic administration, T A 2

Table 3 Operative characteristics and intraoperative complications of all, obese, and non-obese patients

Variable	All patients ($n = 425$)	BMI <30 kg/m^2 ($n = 299$)	BMI C30 kg/m^2 ($n = 126$)	p value
Diverting stoma	238 (56.0)	162 (54.2)	76 (60.3)	0.291

Table 4 Early postoperative outcomes (B30 days postoperative) of all, obese, and non-obese patients

Variable	All patients ($n = 425$)	BMI <30 kg/m^2 ($n = 299$)	BMI C30 kg/m^2 ($n = 126$)	p value
Patients with major postoperative complications[a]	35 (8.2)	25 (8.4)	10 (7.9)	0.884

Table 5 Staging, pathologic data, and postoperative follow-up of all, obese, and non-obese patients

Variable	All patients [n = 425]	BMI <30 kg/m^2 [n = 299]	BMI C30 kg/m^2 [n = 126]	p value
AJCC staging[a] [n (%)]				
I	125 (29.4)	81 (27.1)	44 (34.9)	0.456
II	103 (24.3)	75 (25.1)	28 (22.2)	
III	131 (30.8)	95 (31.8)	36 (28.6)	
IV	32 (7.5)	21 (7.0)	11 (8.7)	
Missing	34 (8.0)	27 (9.0)	7 (5.6)	
Pathologic tumor stage [n (%)]				
pT0	52 (12.2)	42 (14.1)	10 (7.9)	0.309
pT1	60 (14.1)	42 (14.1)	18 (14.3)	
pT2	119 (28.0)	76 (25.3)	43 (34.1)	
pT3	167 (39.3)	118 (39.5)	49 (38.9)	
pT4	13 (3.1)	10 (3.3)	3 (2.4)	
pTx	4 (0.9)	2 (0.7)	2 (1.6)	
Missing	10 (2.4)	9 (3.0)	1 (0.8)	
Pathologic nodal stage [n (%)]				
pN0	282 (66.4)	199 (66.6)	83 (65.9)	0.524
pN1	97 (22.8)	69 (23.1)	28 (22.2)	
pN2	42 (9.9)	28 (9.3)	14 (11.1)	
pNx	1 (0.2)	0 (0.0)	1 (0.8)	
Missing	3 (0.7)	3 (1.0)	0 (0.0)	
Lymph nodes resected (n; mean ± SD)	17.4 ± 8.7	17.2 ± 9.1	17.7 ± 7.6	0.589
Positive CRM [n (%)]	4 (0.9)	3 (1.0)	1 (0.8)	1.000
CRM (cm; mean ± SD)	1.0 ± 1.3	1.0 ± 1.2	1.0 ± 1.4	0.549
Distal resection margins (cm; mean ± SD)	3.0 ± 2.0	3.1 ± 2.0	2.9 ± 1.9	0.340
Tumor size (cm; mean ± SD)	3.1 ± 2.0	3.0 ± 2.0	3.3 ± 1.9	0.197
Mesorectum [n (%)]				
Complete	288 (67.8)	198 (66.2)	90 (71.4)	0.624
Nearly complete	32 (7.5)	23 (7.7)	9 (7.2)	
Incomplete	6 (1.4)	5 (1.7)	1 (0.8)	
Missing	99 (23.3)	73 (24.4)	26 (20.6)	
Last follow-up (months; mean ± SD)	13.9 ± 11.0	14.3 ± 11.2	13.3 ± 10.6	0.402
Adjuvant treatment [n (%)]	224 (53.1)	154 (52.0)	70 (55.6)	0.578
Disease status at last follow-up [n (%)]				
Remission	248 (58.4)	173 (57.9)	75 (59.5)	0.773
Active disease	43 (10.1)	30 (10.0)	13 (10.3)	
Deceased due to disease	13 (3.1)	10 (3.3)	3 (2.4)	
Deceased due to others	6 (1.4)	5 (1.7)	1 (0.8)	
Unknown	11 (2.6)	10 (3.3)	1 (0.8)	
Missing	104 (24.5)	71 (23.8)	33 (26.2)	
Local recurrence [n (%)]	7 (1.7)	4 (1.3)	3 (2.4)	0.427

BMI body mass index, *AJCC* American Joint Committee on Cancer, *CRM* circumferential resection margin

[a] AJCC staging manual, 6th edition

reported a CRM positivity of 2.5 %.[39] We were also able to show a very low positive CRM rate of 0.9 %, with obesity not adversely affecting the outcome.

Conversion to open surgery is another important parameter that is used as a surrogate for technical feasibility of minimally invasive approaches.[40] Rates of conversion for laparoscopic low anterior resection are reported to be between 7 and 34 %, with most studies being between 10 and 20 %.[2,3,5–7,10,12,13] A recent nationwide analysis [illegible] use of fluorescence imaging, and new stapling technology may identify methods to decrease the risk of leakage and to allow for more selective creation of ileostomies.

Moreover, our study suggests that a proper oncologic resection can be achieved independent of the surgeon's practice environment. The logistic regression analysis did not show any relation of postoperative complications with the surgeon's previous laparoscopic experience. Our analysis included first robotic cases within the expected learning curve by all but two surgeons. Despite this wide range of experience of the participating surgeons, we were able to present comparable short-term outcomes. These findings suggest that robotics could be an equalizer for less-experienced laparoscopic surgeons, and improving minimally invasive mesorectal excision.

Despite these encouraging outcomes, there were some study shortcomings. These findings are based on retrospectively collected data without direct comparisons to open or laparoscopic surgery. The retrospective nature of these data creates a certain potential for bias and limitations to the generalization of findings.

Alternatively, the heterogeneity of participating surgeons demonstrates the feasibility of robotic cancer-specific mesorectal excision in a variety of approaches and setups. These data represent a cross-section of dedicated robotic colorectal cancer programs with excellent oncological and clinical outcomes, even in obese patients. We believe that the robotic approach will become the preferred surgical technique for rectal cancer once larger-scale prospective studies are available.

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