Better effect of Robotic Colectomy application within an Enhanced Recovery After Surgery protocol: A single-institution retrospective study

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Background

The robotic platform Xi system expanded the surgical working field and made colectomy more feasible than before. However, studies have compared outcomes and compliance between robotic and laparoscopic colon resection surgery with ERAS care are still lacking. The purpose of this study is to evaluate the difference between two ways of minimally invasive approaches in colectomy.

Methods

We retrospectively review patients underwent laparoscopic and robotic colectomy within an ERAS protocol from June 2019 to August 2022. Patient demographics, perioperative data, short-term surgical outcomes and compliance of ERAS protocol were collected and analyzed from patient charts and our ERAS database. The analyses of short-term surgical outcomes and part of perioperative data excluded the patient undergoing conversion to open surgery.

Table 1. Patient Demographic

Parameters	Overall	Laparoscopic	Robotic	P value
Number of patients	171	89	82	
Males	87 (51)	50 (56)	37 (45)	0.196[v]
Mean age, years (SD)	60.5 (12.8)	61.1 (13.1)	59.9 (12.6)	0.543[t]
BMI, kg/m2 (SD)	24.7 (4.0)	24.8 (4.3)	24.7 (3.6)	0.993[m]
ASA≦2, *n* (%)	123 (72)	61 (69)	62 (76)	0.391[v]
Cigarette use, *n* (%)	31 (18)	18 (20)	13 (16)	0.587[v]
Any comorbidity, *n* (%)	109 (64)	57 (64)	52 (63)	1.000[v]
Hypertension, *n* (%)	79 (46)	39 (44)	40 (49)	0.620[v]
Diabetes, *n* (%)	44 (26)	21 (24)	23 (28)	0.624[v]
Cardiovascular disease, *n* (%)	34 (20)	19 (21)	15 (18)	0.758[v]
Pulmonary disease, *n* (%)	9 (5)	4 (4)	5 (6)	0.739[f]
Hepatobiliary disease, *n* (%)	5 (3)	4 (4)	1 (1)	0.370[f]
Chronic kidney disease, *n* (%)	6 (4)	2 (2)	4 (5)	0.428[f]
Multiple primary cancers, *n* (%)	15 (9)	10 (11)	5 (6)	0.360[v]
Previous abdominopelvic surgery, *n* (%)	37 (22)	20 (22)	17 (21)	0.928[v]
T4 lesions, *n* (%)	26 (15)	17 (19)	9 (11)	0.206[v]

SD: standard deviation; ASA: American Society of Anesthesiologists; CCRT: Concurrent Chemo-radiotherapy
[m] Mann-Whitney U test, [t] Independent t-test, [f] Fisher's exact test, [v] Yates' Correction for Continuity.

Table 2. Operative Details

Parameters	Overall (n=171)	Laparoscopic (n=89)	Robotic (n=82)	P value
Surgery method				
Right-sided colectomy, *n* (%)	57 (33)	37 (42)	20 (24)	0.026[v]
Left-sided colectomy, *n* (%)	111 (65)	50 (56)	61 (74)	0.020[v]
Total colectomy, *n* (%)	3 (2)	2 (2)	1 (1)	1.000[f]
Combined liver metastasectomy, *n* (%)	5 (3)	3 (3)	2 (2)	1.000[f]
Conversion to open surgery, *n* (%)	11 (6)	10 (11)	1 (1)	0.019[v]
***Operative time, min**				**<0.0001[m]**
Mean (SD)	**251.0 (82.2)**	**230.0 (78.7)**	**271.5 (80.9)**	
Median (IQR)	**237.0 (77.3)**	**220.0(79.5)**	**254.0 (80.0)**	
*Minimal blood loss, *n* (%)	143 (89)	68 (86)	75 (93)	0.404[v]
***Drainage tube placement, *n* (%)**	**45 (26)**	**36 (43)**	**11 (14)**	**<0.0001[v]**

* The analysis of operative time, minimal blood loss and drainage tube placement excluded the patient undergoing conversion to open surgery.
IQR: interquartile range
[m] Mann-Whitney U test, [f] Fisher's exact test, [v] Yates' Correction for Continuity

Table 3. Short-term surgical outcomes

Parameters	Overall (n=160)	Laparoscopic (n=79)	Robotic (n=81)	P value
Visual Pain scale≦3, *n* (%)	**138 (86)**	**61 (77)**	**77 (95)**	**0.002[v]**
Mean duration of first stool, day (SD)	**2.6 (1.6)**	**3.1 (1.7)**	**2.0 (1.2)**	**<0.0001[m]**
Tolerate early oral intake of fluid within 24 hours, *n* (%)	145 (91)	68 (86)	77 (95)	0.093[v]
Tolerate oral intake of solid food within 3 days, *n* (%)	133 (83)	64 (81)	69 (85)	0.622[v]
Hospital stays after surgery, days				**0.016[m]**
Mean (SD)	**5.9 (4.8)**	**6.5 (5.7)**	**5.4 (3.8)**	
Median (Q1-Q3)	**5 (4-6)**	**5 (4-7)**	**4 (4-6)**	
Any complications, *n* (%)	40 (25)	24 (30)	16 (20)	1.000[v]
*Low grade (1-2), *n* (%)	38 (24)	21 (27)	15 (19)	0.302[v]
Ileus, *n* (%)	17 (11)	10 (13)	7 (9)	0.570[v]
Anemia requires a blood transfusion, *n* (%)	8 (5)	4 (5)	4 (5)	1.000[f]
Fever, *n* (%)	7 (4)	3 (4)	4 (5)	1.000[f]
Surgical site infection, *n* (%)	5 (3)	3 (4)	2 (2)	0.680[f]
Acute urine retention after Foley removal, *n* (%)	**8 (5)**	**7 (9)**	**1 (1)**	**0.033[f]**
*High grade (3-4), *n* (%)	2 (1)	1 (1)	1 (1)	1.000[f]
Anastomotic leakage, *n* (%)	2 (1)	1 (1)	1 (1)	1.000[f]
Mortality	0	0	0	
Readmission within 30 days, *n* (%)	6 (4)	3 (4)	3 (4)	1.000[f]

* Complications were graded by Calvin-Dindo classification,
[m] Mann-Whitney U test, [f] Fisher's exact test, [v] Yates' Correction for Continuity.

Table 4. ERAS compliance rate

Parameters	Overall	Laparoscopic	Robotic	P value
Total ERAS protocol, % (Median, range)	**88.9 (55.6-100.0)**	**83.3 (55.6-94.4)**	**88.9 (72.2-100.0)**	**<0.0001[m]**
Preadmission items	100.0 (50.0-100.0)	87.5 (50.00-100.0)	100.0 (50.0-100.0)	0.014[m]
Preoperative items	100.0 (75.0-100.0)	100.0 (75.00-100.0)	100.0 (75.0-100.0)	0.100[m]
Intraoperative items	**100.0 (33.3-100.0)**	**66.7 (33.33-100.0)**	**100.0 (33.3-100.0)**	**<0.0001[m]**
Postoperative items	**85.7 (28.8-100.0)**	**71.4 (28.8-100.0)**	**85.7 (42.9-100.0)**	**<0.0001[m]**

[m] Mann-Whitney U test.

Results

A total of 171 patients were included. There were 89 patients in laparoscopic group and 82 patients in robotic group. Robotic surgery had lower rate of conversion to open surgery (1% vs 11%) and drainage tube placement (14% vs 43%) but longer operative time (mean, 271.5min vs 230min). Robotic surgery had better surgical outcomes on postoperative pain (visual pain scale≦3, 95% vs 77%), duration of first stool (mean, 2.0 days vs 3.1 days), hospital stays after surgery (mean, 5.4 days vs 6.5 days). There were no significant differences between the two groups for readmission within 30 days. Compliance to ERAS protocol was higher in the robotic group with regard to the intraoperative and postoperative items.

Conclusion

In our study, robotic surgery is better than laparoscopic surgery for patients undergoing elective colectomy with ERAS care. Robotic surgery has lower rates of conversion to open surgery, better short-term surgical outcomes, and higher compliance with ERAS protocol.