

Nicholson Brant* BA¹, Joseph S Lim* DO^{2,3}, J Marcus Downs MD⁴, William Apple⁴, Ronney Stadler MD⁴, Dhires Rohan Jeyarajah MD^{1,2}.

*Co-first authors; contributed equally

1. Department of Surgery, Texas Christian University, Fort Worth, TX 2. Department of Surgery, Methodist Health System, Dallas, TX 3. Department of Surgery, Medical City Healthcare, Plano, TX 4. Texas Colon and Rectal Specialists, Dallas, TX

RESEARCH QUESTION

- In patients undergoing low anterior resections (LAR) for rectal cancer, are the operative approaches (open versus laparoscopic versus robotic) statistically significant in terms of complications and outcomes? Further, does this data, from a large private-practice group, compare to large, tertiary academic institutions?

BACKGROUND

- Colorectal cancer is the third most common cancer diagnosed in both men and women in the United States [1].
- There are estimated to be 44,850 new cases of rectal cancer in the United States in 2022 [2].
- Low anterior resection (LAR) is often the surgical approach of choice for mid-proximal tumors and can be used with a temporary ileostomy for mid-rectal tumors when the anastomosis is low in the pelvis [3].
- Laparoscopic and open techniques have been compared in the resection of colorectal cancer in large multicenter randomized controlled trials, which demonstrated similar perioperative morbidity and mortality.
 - Laparoscopic approach shows decreased operative blood loss, earlier recovery of bowel function, decreased requirements of analgesics, and shorter hospital stay [4-6].
- Laparoscopic, robotic, and open approaches are all viable approaches in the management of rectal cancer, but there is uncertainty as to which provides the best outcomes for the patient.
- Most of the literature has compared the possible surgical approaches between two techniques. However, few have directly examined the three operative techniques for LAR.
- None have reported on the real-world experiences from a non-university setting, arguably the situation where most rectal resections occur.

METHODS

- IRB exempt, retrospective review of a non-university tertiary care center database from 2016 to 2020.
 - Incorporated 15 surgeons across multiple facilities.
- 200 patients underwent elective LAR for rectal cancer, and of these, 130 were included.
 - Only procedures of a LAR with primary anastomosis with or without ileostomy creation were included.
 - Patients with additional secondary procedures were excluded.
- Student t-test and Analysis of Variance (ANOVA) was used to compare numeric groups, while χ^2 test was performed amongst categorical variables.
 - P-value of <0.05 was deemed statistically significant.

- Minimally invasive surgical low anterior resections have a noteworthy advantage over the open approach in terms of length of stay and estimated blood loss.
- Robotic surgery offered better outcomes when compared to laparoscopic low anterior resections.

	Surgical Approaches			p-value
	Open	Laparoscopic	Robotic	
Total Number of Cases	26	25	79	
ORT (min) (mean)	214.88 ± 101.48	231.52 ± 59.33	240.52 ± 95.27	0.459
EBL (cc) (mean)	276.00 ± 239.84	111.00 ± 149.46	169.37 ± 432.64	0.269
LOS (days) (mean)	8.08 ± 4.58	7.04 ± 5.31	4.96 ± 3.89	0.004
Conversion Rate		3 (10.7%)	6 (7.05%)	0.410
30-day ED Return	6 (23%)	5 (20%)	16 (20%)	0.948

Table 1 – Perioperative and Postoperative Outcomes for all 3 different LAR surgical approaches. ORT = Operating room time (min), EBL = Estimated blood loss (cc), LOS = Length of stays (days).

	Surgical Approaches		p-value
	Open	MIS	
Total Number of Cases	26	104	
ORT (min) (mean)	214.88 ± 101.48	230.81 ± 94.19	0.235
EBL (cc) (mean)	276.00 ± 239.84	151.19 ± 375.73	0.021
LOS (days) (mean)	8.08 ± 4.58	5.43 ± 4.24	0.005
30-day ED Return	6	21	0.396

Table 2 – Perioperative and Postoperative Outcomes between open and minimally invasive (MIS) LAR surgical approaches. ORT = Operating room time (min), EBL = Estimated blood loss (cc), LOS = Length of stays (days).

RESULTS

- A total of 130 LAR were performed between 2016 and 2020 utilizing three different approaches – open (OLAR), laparoscopic (LLAR), and robotic (RLAR).
- Demographics**
 - Total mean age was 61.2 years for OLAR, 56.73 years for LLAR, and 59.6 years for RLAR.
 - Total female percentage of 42% for OLAR, 32% for LLAR, and 32% for RLAR, respectively.
 - The average Body Mass Index (BMI) was 27.51 for OLAR, 25.1 for LLAR, and 26.3 for RLAR.
 - The demographic population showed no statistical variance between all these categories for all three approaches.
- Operative and Postoperative Results**
 - Only Length of Stay (LOS) showed statistical significance when comparing all three approaches (p = 0.004) (Table 1).
 - Open conversion rates were the same.
 - When the laparoscopic approach was directly compared with robotic approach, only LOS was statistically significant (p<0.05).
 - Additional postoperative complications such as acute blood loss anemia, anastomotic leak, surgical site infection, deep venous thrombosis, bowel obstruction, ileus, stroke, heart attack, pneumonia, urinary tract infection, 30-day return ED visit were analyzed but showed no statistical significance between the 3 groups.
 - When the open approach was compared directly with the 2 MIS approaches combined (LLAR or RLAR), both EBL and LOS were statically significant (p = 0.021 and p=0.005 respectively) (Table 2).

FUTURE DIRECTIONS

- This experience in the private practice world raises the question as to whether the robotic approach should be considered the standard of care for patients undergoing low anterior resection for rectal cancer.

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REFERENCES

- Siegel RL, Miller KD, Goding Sauer A, Fedewa SA, Butterly LF, Anderson JC, Cercek A, Smith RA, Jemal A. Colorectal cancer statistics, 2020. *CA Cancer J Clin.* May 2020;70(3):145-164. doi:10.3322/caac.21601
- Siegel RL, Miller KD, Fuchs HE, Jemal A. Cancer statistics, 2022. *CA Cancer J Clin.* Jan 2022;72(1):7-33. doi:10.3322/caac.21708
- Xynos E, Tekkis P, Gouvas N, Vini L, Chrysou E, Tzardi M, Vassiliou V, Boukovinas I, Agalianos C, Androulakis N, Athanasiadis A, Christodoulou C, Dervenis C, Emmanouilidis C, Georgiou P, Katopodi O, Kountourakis P, Makatsoris T, Papakostas P, Papamichael D, Pechlivanides G, Pentheroudakis G, Pilpilidis I, Sgouros J, Triantopoulou C, Xynogalos S, Karachaliou N, Ziras N, Zoras O, Souglakos J. Clinical practice guidelines for the surgical treatment of rectal cancer: a consensus statement of the Hellenic Society of Medical Oncologists (HeSMO). *Ann Gastroenterol.* Apr-Jun 2016;29(2):103-26. doi:10.20524/aog.2016.0003
- Guillou PJ, Quirke P, Thorpe H, Walker J, Jayne DG, Smith AM, Heath RM, Brown JM. Short-term endpoints of conventional versus laparoscopic-assisted surgery in patients with colorectal cancer (MRC CLASICC trial): multicentre, randomised controlled trial. *Lancet.* May 14-20 2005;365(9472):1718-26. doi:10.1016/S0140-6736(05)66545-2
- van der Pas MH, Haglind E, Cuesta MA, Furst A, Lacy AM, Hop WC, Bonjer HJ, Group COCoORIS. Laparoscopic versus open surgery for rectal cancer (COLOR II): short-term outcomes of a randomised, phase 3 trial. *Lancet Oncol.* Mar 2013;14(3):210-8. doi:10.1016/S1470-2045(13)70016-0
- Kang SB, Park JW, Jeong SY, Nam BH, Choi HS, Kim DW, Lim SB, Lee TG, Kim DY, Kim JS, Chang HJ, Lee HS, Kim SY, Jung KH, Hong YS, Kim JH, Sohn DK, Kim DH, Oh JH. Open versus laparoscopic surgery for mid or low rectal cancer after neoadjuvant chemoradiotherapy (COREAN trial): short-term outcomes of an open-label randomised controlled trial. *Lancet Oncol.* Jul 2010;11(7):637-45. doi:10.1016/S1470-2045(10)70131-5