



Robotic versus conventional laparoscopic colorectal operations: a single center experience

Mehmet Abdussamet Bozkurt, Ali Kocataş, Eyüp Gemici, Mustafa Uygur Kalaycı, Halil Alış

ABSTRACT

Objective: Robotic surgery was first introduced in 2000 especially to overcome the limitations of low rectum cancer surgery. There is still no consensus regarding the standard method for colorectal surgery. The aim of this study was to compare robotic surgery with laparoscopic colorectal surgery.

Material and Methods: This is a retrospective study. Data of patients with a diagnosis of colon or rectal cancer were analyzed for robotic colorectal surgery and laparoscopic colorectal surgery.

Results: The cost of robotic surgery group was statistically higher than the laparoscopic surgery group ($p=0.032$). The average operation duration was 178 minutes in the laparoscopic surgery group and 228 minutes in the robotic surgery group, and this difference was statistically significant ($p=0.044$). There was no statistically significant difference between the groups regarding other parameters.

Discussion: Disadvantages of robotic surgery seem to be its higher cost and longer operation duration as compared to laparoscopic surgery. We claim that an increase in the number of cases and experience may shorten the operation time while the increase in commercial interest may decrease the cost disadvantage of robotic surgery.

Keywords: Robotic surgery, colorectal surgery, laparoscopy

INTRODUCTION

Minimally invasive surgical techniques, the most significant contribution to modern surgery, contain many advantages over traditional open surgical techniques. Many benefits of laparoscopic surgery have been reported including shortened length of hospital stay, decreased morbidity and faster recovery time (1, 2).

Robotic laparoscopic surgery has been first introduced in 2000 especially to address the limitations of lower rectum cancer surgery (3). However, there is still no consensus regarding the standard method. The robotic system eliminates tremor, provides three-dimensional image and an ability of rotation, which are the major advantages of robotic surgery as compared to laparoscopic procedures. However, how this advantage is reflected in clinical practice and what impact it has on morbidity and mortality continues to be debated (4, 5).

We compared robotic surgery, which is preferred in colorectal surgery, with laparoscopic colorectal surgery.

MATERIAL AND METHODS

Our study is a retrospective study. Data of patients diagnosed with colon or rectal cancer at Bakırköy Dr. Sadi Konuk Training and Research Hospital Department of General Surgery between January 2009-February 2013 were analyzed for robotic and laparoscopic colorectal surgery.

Patients with left-sided colon cancer and rectum cancer on colonoscopy were included in the study. The staging was performed with abdominal computed tomography for colon tumors, and with pelvic magnetic resonance imaging and thoracic and abdominal tomography for rectal cancer. Patients with rectum cancer received long-term neoadjuvant radiotherapy before the operation. Robotic surgery was performed after obtaining patient consent. The type of operation was selected randomly.

Patients who were operated for non-malignant pathologies, who had metastatic lesions in the liver or peritoneal surface that were detected during exploration, right-sided colon cancers, patients who had previous open surgical procedures and emergency operations were excluded from the study.

Four trocars were placed in the laparoscopic technique. Three of the trocars were placed to the right mid-clavicular line and one for retraction, which was placed in the upper left quadrant for left colon and sigmoid colon tumors.

Clinic of General Surgery, Bakırköy
Dr. Sadi Konuk Training and
Research Hospital, Istanbul, Turkey

Address for Correspondence

Mehmet Abdussamet Bozkurt

e-mail:
msametbozkurt@yahoo.com

Received: 19.12.2014

Accepted: 21.03.2015

©Copyright 2016
by Turkish Surgical Association
Available online at
www.ulusalcerahidergisi.org

The specimen was taken out from a 4 cm. suprapubic incision. The anvil was placed on the proximal colon segment through the same incision. The anastomosis was performed trans-rectally. After camera trocar placement, two working trocars were placed in the bottom right quadrant for rectum tumors. One working trocar was placed in the upper left quadrant. The procedure was the same as in left colon anastomosis.

Robotic surgical procedures were performed with the da Vinci SI TM surgical system (Intuitive Surgical Inc., Sunnyvale, CA, USA). After docking, a supraumbilical trocar was placed for the camera, the working trocars were introduced at the right upper and lower quadrants, and an assistant port was placed in the upper left quadrant. The specimen was removed from the rectum in Miles' procedure and was taken out from the suprapubic incision in patients with an anastomosis. The anvil was placed into the proximal colon segment from the same area. The anastomosis was performed by the trans-rectal route.

The total cost was calculated for each patient.

Statistical Analysis

Statistical analysis was performed with the Number Cruncher Statistical System (NCSS) 2007 Statistical Software (Utah, USA) package.

RESULTS

Demographic data and other results are shown in Table 1 and 2.

Sixteen patients were operated for rectal cancer and 45 patients with colon cancer. All patients with colon cancer had left-sided tumors.

Eleven patients with rectum cancer received neoadjuvant radiotherapy before the operation.

Patient classification according to TNM system is shown in Table 3 and 4.

There were no statistically significant differences between laparoscopic surgery and robotic surgery groups in terms of mean age, gender, the rate of complications, conversion to open surgery, the length of hospital stay, and positive surgical margins in extracted specimens.

There was no need for blood transfusion in the robotic surgery group ($p=0.045$).

Complications in the laparoscopic group included surgical site infection in 4 patients, anastomosis leak in 2 patients, bowel obstruction in 2 patients, a port-side hernia in 1 patient and intra-abdominal abscess in 1 patient. In the robotic surgery group, three patients had surgical site infection, and one patient had a colo-cutaneous fistula.

The cost of robotic surgery group was significantly higher than the laparoscopic surgery group ($p=0.032$).

The mean operation duration was 178 minutes in the laparoscopic surgery group and 228 minutes in the robotic surgery group, and this difference was statistically significant ($p=0.044$).

Table 1. Patients' demographic data and other study parameters

| | Laparoscopic group | | Robotic group | | | |
|-----------------------|-----------------------|--------|------------------|--------|--------|-------|
| Age | 56.71±8.18 | | 57.56±8.91 | | 0.703 | |
| Sex | Male | 10 | 26.30% | 8 | 34.80% | 0.482 |
| | Female | 28 | 73.70% | 15 | 65.20% | |
| Complication | 10 | 26.30% | 4 | 17.40% | 0.422 | |
| Blood transfusion | 6 | 15.80% | 0 | 0.00% | 0.045 | |
| Conversion | 9 | 23.70% | 6 | 26.10% | 0.883 | |
| Cost (TL) | 4324 (3189.25-7472.5) | | 5700 (4600-9800) | | 0.032 | |
| Surgical margins (cm) | 3.5 (2-5.75) | | 3 (2-5) | | 0.641 | |

Table 2. Patient groups of rectal and colon cancer

| | Laparoscopic rectal cancer group | Laparoscopic colon cancer group | Robotic rectal cancer group | Robotic colon cancer group |
|--------------------------------|----------------------------------|---------------------------------|-----------------------------|----------------------------|
| Patient number | 8 | 30 | 8 | 15 |
| Length of hospital stay (days) | 8 (5-8.25) | 6 (5-8.25) | 6 (5-11) | 6 (5-11) |
| Surgical duration (min) | 210 (155-230) | 165 (135-215) | 245 (192.5-270) | 218 (172.5-252) |

Table 3. Radiologic T classification of patients

| | Robotic | Laparoscopic |
|----|---------|--------------|
| T1 | 0 | 0 |
| T2 | 4 | 8 |
| T3 | 12 | 18 |
| T4 | 7 | 12 |
| | 23 | 38 |

Table 4. Radiologic N classification of patients

| | Robotic | Laparoscopic |
|----|---------|--------------|
| N0 | 16 | 29 |
| N1 | 7 | 9 |

DISCUSSION

Fung et al. (6) reviewed 15 studies including those on robotic colorectal surgery. In their review of 351 patients, they compared robotic surgery with laparoscopic surgery and reported that the operation time was longer in the robotic surgery group, the cost was higher, however, there was no difference in terms of postoperative complications and length of hospital stay.

In another study comparing robotic surgery and laparoscopic surgery, robotic surgery was found to be disadvantageous in terms of cost and duration of the operation. However, conversion rates were lower in obese patients, in patients with pre-operative chemotherapy and those with distal rectal tumors.

According to the same study; anastomotic leak rate, autonomic function impairment, and resection margin positivity rates were lower in robotic surgery than laparoscopic surgery (7).

Du et al. (8) compared 22 patients who underwent anterior resection for rectal cancer either with laparoscopic or robotic surgery, and they reported that there was no difference between the two methods in terms of operation duration, the number of lymph nodes removed and positive surgical margins.

In our study, the duration of operation was longer, and the cost of robotic surgery was higher as compared to colorectal surgery. The length of hospital stay and complication rate was not statistically different.

Patients with advanced disease and a history of previous surgery were preferentially operated laparoscopically, which is one of the limitations of our study.

Another study examined 128,800 patients who underwent surgery for cancer, benign polyps, and diverticular disease. 2.78% percent of the operations for colorectal benign or malignant diseases was performed by robotic surgery. The cost of robotic surgery and the incidence of postoperative bleeding were higher than laparoscopy. The length of hospital stay, rates of morbidity, anastomotic leak and bowel obstruction did not differ between the two groups. It was concluded that robotic surgery is superior to open surgery (9).

In our study, the majority of elective cases had colorectal cancer, and 70% of them underwent robotic or laparoscopic surgery. If emergent cases were to be included, then the ratio would decrease to 35%.

Robotic colorectal surgery may have a better long-term effect on urinary and sexual functions. Due to robotic surgical dissection of lymph nodes around main arteries, robotic surgery may offer a longer disease-free survival with better quality of life (10). However, we need long-term follow-up results to reach such conclusions. In our study, the maximum follow-up was 1.5 years, which is a short period to comment on long-term survival or the positive contributions of robotic surgery on this issue. There was no difference between the two groups in terms of urinary and sexual function.

Zawadzki et al. (11) compared laparoscopy and robot-assisted methods in 77 patients, and they determined that robotic surgery was advantageous regarding positive resection margin and anastomotic leak. In our study, there were no differences between the two groups in terms of complication rate.

In another study with 171 patients, there were no statistically significant differences between the groups of robotic and laparoscopic surgery regarding length of hospital stay, time to regaining normal bowel function, the amount of patient-controlled analgesia and the duration of the operation. In the same study, left and right hemicolectomy groups were also compared, and they concluded that the operation time was shorter in the left hemicolectomy group (12).

The disadvantages of robotic surgery seem to be its high cost and longer operation time (13, 14). Other procedures such as appendectomy and cholecystectomy can be performed lapa-

roscopically, which provides an opportunity to improve the laparoscopic skills of the surgeons and contribute to their laparoscopic colorectal surgery experience. On the other hand, robotic surgery experience of the surgeons is only limited to colorectal surgery and the reason for the longer operation time in robotic surgery is probably due to this relative inadequate experience. In laparoscopic surgery, the presence of various devices as disposable trocars give a chance to choose a cost effective material; however, in robotic surgery, the devices are being produced, and their prices are being determined by one company alone. It is reported that the urinary and sexual complication rates are low in robotic surgery, and although their long-term impacts are yet unknown, this may be a reason to opt for robotic surgery in the following years.

CONCLUSION

We advocate that an increase in the number of cases and experience may shorten operation duration while an increase in commercial interest may decrease the cost disadvantage of robotic surgery.

Ethics Committee Approval: Ethical approval was not obtained because of the retrospective design of the study.

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - M.A.B.; Design - M.A.B., A.K.; Supervision - H.A., M.U.K.; Resources - M.A.B., E.G.; Materials - M.A.B.; Data Collection and/or Processing - M.A.B., E.G.; Analysis and/or Interpretation - M.A.B., H.A.; Literature Search - M.A.B., A.K.; Writing Manuscript - M.A.B.; Critical Review - H.A., M.U.K., A.K.; Other - E.G.

Acknowledgments: The authors would like to thank Emire Bor for statistical analyzes.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study has received no financial support.

REFERENCES

1. Law WL, Lee YM, Choi HK, Seto CL, Ho JW. Impact of laparoscopic resection for colorectal cancer on operative outcomes and survival. *Ann Surg* 2007; 245: 1-7. [CrossRef]
2. Milsom JW, Böhm B, Hammerhofer KA, Fazio V, Steiger E, Elson P. A prospective, randomized trial comparing laparoscopic versus conventional techniques in colorectal cancer surgery: a preliminary report. *J Am Coll Surg* 1998; 187: 46-54. [CrossRef]
3. Jayne DG, Culmer PR, Barrie J, Hewson R, Neville A. Robotic platforms for general and colorectal surgery. *Colorectal Dis* 2011; 13: 78-82. [CrossRef]
4. Maeso S, Reza M, Mayol JA, Blasco JA, Guerra M, Andradas E, et al. Efficacy of the da Vinci surgical system in abdominal surgery compared with that of laparoscopy: a systematic review and meta-analysis. *Ann Surg* 2014; 252: 254-262. [CrossRef]
5. Wexner SD, Bergamaschi R, Lacy A, Udo J, Brölmann H, Kennedy RH, et al. The current status of robotic pelvic surgery: results of a multinational interdisciplinary consensus conference. *Surg Endosc* 2009; 23: 438-443. [CrossRef]
6. Fung AK, Aly EH. Robotic colonic surgery: is it advisable to commence a new learning curve? *Dis Colon Rectum* 2013; 56: 786-796.

7. Du XH, Yao YM, Li R, Shen CA, Yin HN. Does robotic rectal cancer surgery offer improved early postoperative outcomes? *Dis Colon Rectum* 2013; 56: 253-262.
8. Du XH, Shen D, Li R. Robotic anterior resection of rectal cancer: technique and early outcome. *Chin Med J* 2013; 126: 51-54.
9. Halabi WJ, Kang CY, Jafari MD, Nguyen VQ, Carmichael JC, Mills S. Robotic-assisted colorectal surgery in the United States: A nationwide analysis of trends and outcomes. *World J Surg* 2013; 6.
10. Baek SK, Carmichael JC, Pigazzi A. Robotic surgery: colon and rectum. *Cancer J* 2013; 19: 140-146. [\[CrossRef\]](#)
11. Zawadzki M, Velchuru VR, Albalawi SA, Park JJ, Marecik S, Prasad LM. Is hybrid robotic laparoscopic assistance the ideal approach for restorative rectal cancer dissection? *Colorectal Dis* 2013; 15: 1026-1032.
12. Deutsch GB, Sathyanarayana SA, Gunabushanam V, Mishra N, Rubach E, Zemon H. Robotic vs. laparoscopic colorectal surgery: an institutional experience. *Surg Endosc* 2012; 26: 956-963. [\[CrossRef\]](#)
13. Bedirli A, Aslan O, Kozan R, Alkan A. Our initial experience with robotic laparoscopic surgery. *Ulus Cerrahi Derg* 2012; 28: 8-12. [\[CrossRef\]](#)
14. Alış H, Gönenç M, Deniztaş C, Kapan S, Turhan AN, Aygün E. Robotic abdominal surgery: Initial experiences of a single center. *Ulus Cerrahi Derg* 2011; 27: 90-93.