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Laparoscopic *vs.* Robotic Colorectal Surgery: A Single-Center Experience

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Abstract

Background: Colorectal cancer is a tumor with a great socio-sanitary relevance; in the United States it represents the third, by incidence and mortality, after breast and lung cancer in women and prostate and lung cancer in men. Adjuvant chemotherapy in colon cancer, radiotherapy, and introduction of the total mesorectal excision technique in rectal cancer have increased survival, especially in patients with stage III tumors. The robotic technique is considered by many to be the evolution of the laparoscopic technique, as it maintains its advantages related to the mini-invasiveness and oncological results trying to overcome its technical limits.

Materials and Methods: We conducted a retrospective study of 68 patients who underwent robotic and laparoscopic colectomies (20 and 48, respectively) at our institution (Department of Endoscopic Surgery, Gastroenterology and Endocrinology, Federico II University Hospital Federico II, Naples) between January 2018 and January 2020. For statistical analysis, the P values were calculated using the T test and the chi-square test. The $P<0.05$ is the criterion for statistical significance. All statistical analyzes were performed with the Number Cruncher Statistical System (NCSS) 2020 data analysis version 20.0.1 (Utah, USA).

Results: Conversion rate, recovery of bowel function, blood loss, complications and oncological results had not statistically significant differences between two techniques. Instead, the robotic technique was more expensive and, above all, we highlighted greater operating times.

Conclusion: In our experience we can consider colorectal robotic surgery, a feasible, safe technique; with the same oncological outcomes taking into account both the greater costs and the greater operating times, associated to the greater anesthesiological risks.

Keywords: Colorectal cancer; Laparoscopic surgery; Robotic surgery; Colorectal surgery

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Introduction

Colorectal cancer is a tumor with a great socio-sanitary relevance; in the United States it represents the third, by incidence and mortality, after breast and lung cancer in women and prostate and lung cancer in men. The incidence in Italy in 2015 is estimated to be around 60,000 new cases (35,000 in men and 25,000 in women); overall in Italy there are about 20,000 deaths from cancer of the large intestine every year, which represents 12% of all deaths from cancer in the two sexes [1]. Prognosis associated with this disease has improved due to early diagnosis and changes in medical therapy. Adjuvant chemotherapy in colon cancer, radiotherapy, and introduction of the total mesorectal excision technique in rectal cancer have increased survival, especially in patients with stage III tumors [2]. The first report on Laparoscopic assisted colectomy in colon cancer was published by Jacobs in 1991 [3]. The advantages now recognized for minimally invasive surgery and its application in colorectal surgery are many and concern not only the best aesthetic results, but also less post-operative pain, faster recovery of intestinal function, length of hospital stay, with equivalent oncological results. The laparoscopic technique, however, has intrinsic difficulties represented by the loss of the natural visual perspective due to the two-dimensional vision, the complexity of manipulating rigid instruments through small accesses with an inevitable "lever effect", the lack of the normal coordination between the eye and hand of the surgeon, the lack of ergonomics for the surgeon and the difficulty of operating in small anatomical spaces that are difficult to reach. Some surgeons perceive their hand introduced into the abdomen as a further reduction of space, and therefore also of the visual, operative field, instead of representing a real help.

The robotic technique is considered by many to be the evolution of the laparoscopic technique [1,2], as it maintains its advantages related to the mini-invasiveness and oncological results trying to overcome its technical limits. The robotic surgical technique takes advantage of the intrinsic characteristics deriving from robotic technology such as: A three-dimensional high-definition vision of the operating field with the opportunity to enlarge the intervention site up to 10 times its size; robotic surgical instruments with greater freedom of movement on the surgeon's wrist and hand, with 7 degrees of freedom which allow 360° rotation [3,4]; the possibility of adjusting the position of the pedal and the binocular observer device to obtain an ergonomic position for each operator throughout the operation communication between the operating surgeon and the team at the operating table is guaranteed by an intercom communication system [4].

Materials and Methods

We conducted a retrospective study of 68 patients who underwent robotic and laparoscopic colectomies (20 and 48, respectively) at our institution (Department of Endoscopic Surgery, Gastroenterology and Endocrinology, Federico II University Hospital Federico II, Naples) between January 2018 and January 2020. Experienced general surgeons, trained in minimally invasive techniques using laparoscopic and robotic technology, performed all procedures. The two groups, laparoscopic colectomies and robotic colectomies, were further divided by the anatomical location of tumor into right-sided, left-sided, sigma-rectum and rectum carcinoma. Charts were reviewed and the following patient characteristics were compiled: Age, sex, body mass index, American Society of Anesthesiology (ASA) score, past medical and surgical history, indication for surgery. Perioperative outcomes were analyzed during two techniques including: Operative time (in minutes), time to return of bowel function (in days), length of stay (in days), intraoperative or postoperative complications (based on Dindo-Clavien classification) and number of lymph nodes founded in anatomopathological specimen (Table 1). In our study we included patients affected by carcinoma of the left colon, right colon, sigmoid rectum and rectum. All patients underwent to a preoperative colonoscopy, total body computed tomography, CT and MRI for the rectum for preoperative staging. All rectal carcinomas have been treated with neoadjuvant therapy. We excluded patients with benign pathologies, patients with metastasis or peritoneal carcinosis assessed by exploratory laparoscopy, patients with BMI>30, with ASA 4 and patients undergoing emergency surgery. For statistical analysis, the P values were calculated using the T test and the chi-square test. The P<0.05 is the criterion for statistical significance. All statistical analyzes were performed with the Number Cruncher Statistical System (NCSS) 2020 data analysis version 20.0.1 (Utah, USA).

Results

Sixty-eight patients were recruited, including 20 treated with robotic technique and 48 patients treated with laparoscopic technique. Of those treated with robotic technique, 4 were operated for carcinoma of the left colon, 3 for sigma-rectum, 4 for the rectum and 9 for the right colon. While, of the treated patients in laparoscopy, 18 for left colon, 3 for the sigma-rectum, 7 for the rectum and 20 for the right colon. Table 1 contains the stratification of patients by age, sex, body mass index, American Society of Anesthesiology (ASA) score, past medical and surgical history, indication for surgery. Analyzing (Table 2) the operation time, was higher in robotic left hemicolectomy (p:0.003, average time 277.5 min *vs.* 210.83 min) and right (p:0.004, mean time 255.55 m *vs.* 180.5 m). Surgical procedure

Sex	**Male**	46 68,65%	Robotic 11 VL 35
	Female	21 31,35%	Robotic 9 VL 12
Age	**Male**	65,25	
	Female	68,42	
ASA	**2**	25 (36,8%)	Robotic (7) 10,3% VL (18) 26,5%
	3	43 (63,2%)	Robotic (13) 19,1% VL (30) 44,1%

Table 1: Patients demographic data and other study parameters (n=67).

for sigma-rectum (p:0.656) and rectum (p:0.801) were not statistically significant. When analyzing time to recovery bowel function, there are no statistically significant differences between left hemicolectomy (p:0.952), right hemicolectomy (p:0.46), rectum (p:0.375) and sigma rectum (p:0.25). In terms of length of stay, there are no statistically significant differences between left hemicolectomy (p:0.746), right hemicolectomy (p:0.765), rectum (p:0.422) and rectum sigma (p:0.089). In our case studies, there are no statistically significant differences in terms of complications (p:0.44). For the robotic left hemicolectomy, no complications were found, while in patients treated with laparoscopy, 4 Grade I complications were found according to the classification of Dindo-Claivien and one of Grade IIIb (occlusion); about right hemicolectomy, in robotic surgery there were 3 Grade I complications, one Grade II complications (transfusion) and one Grade IIIb complications (perforation), while in laparoscopy, two Grade I and one Grade II complications (wound infection) and one of Grade IIIb (perforation); in both robotic and laparoscopic rectum surgery, there were two Grade I complications; about sigma rectum surgery in both techniques, there were no complications. As regards lymphadenectomy, the number of lymph nodes excised is not statistically significant between the two techniques. In robotics there was a case of conversion to open, while in laparoscopy, we had 2 cases for the left hemicolectomy, two for the right and two for the rectum. There are no statistically significant differences between the two methods (p:0.3960). In terms of length of specimen, there are no statistically significant differences between the two techniques.

Discussion

The introduction of the robotic technique in colorectal oncological surgery was aimed at overcoming the known limits of laparoscopy (limited dexterity, flat two-dimensional vision and unnatural hand–eye coordination) and has been successfully applied to urology, general surgery, gynecology and other surgical fields [5]. Several meta-analyses have suggested that robotic surgery is safe, feasible and has the same perioperative outcomes and oncological results. In a meta-analysis of 2012 were producted similar results between robotic and laparoscopic colorectal surgery. Additionally, the benefits of robotic surgery for colorectal disease remain controversial [6]. On 2014 Liao et al. [7] published the first meta-analyses based only on RCTs concluded a reduced conversion rate, reduced blood loss and reduced time to recovery of bowel function in robotic *vs.* laparoscopic surgery. Regarding the other variables, such as operation time, complication rate and length of stay, there were no significant differences between the two groups. However, robotic surgery was associated with a significant increase in total costs relative to laparoscopic approach [6,8]. In our study we compared laparoscopic and robotic colorectal surgery, evaluating 68 patients operated in our department. About operation time we did not show a statistically significant difference

Table 2: Results.

Results	Laparoscopic	Robotic	P
Conversion	6 (12.5%)	1 (5%)	0.396
Complications	11 (23%)	7 (3%)	0.44
Blood Loss (ml)	500 ml	400 ml	0.364
Operation time (m): • Left sided • Right Sided • Rectum • Sigma - rectum	 210.8 180.5 302.8 270	 277.5 255.5 312.5 300	 0.003 0.004 0.656 0.801
Mean recovery of bowel function (days): • Left sided • Right Sided • Rectum • Sigma-rectum	 3.5 3.1 1.7 2.6	 3.5 3.5 1 1.6	 0.952 0.460 0.375 0.250
Mean length of stay (days): • Left sided • Right Sided • Rectum • Sigma - rectum	 5.9 6.5 6.8 6.3	 5.5 7.1 5.7 4.6	 0.746 0.765 0.422 0.089
Mean length of lymph nodes • Left sided • Right Sided • Rectum • Sigma - rectum	 14.7 18.4 15 20.6	 20.5 18.11 21.75 15.3	 0.181 0.931 0.130 0.529
Mean length of Specimen (cm) • Left sided • Right Sided • Rectum • Sigma - rectum	 22.6 27.9 27.1 26.8	 28.5 33 21.7 37	 0.182 0.323 0.212 0.158
Total Costs (€)	15.250 €	16.948 €	0.003 €

between robotic and laparoscopic surgical procedure except for right and left sided cancer; the mean operative time in these surgical treatments were respectively 277.5 min and 255.5 min in left and right robotic hemicolectomy and 210.8 min 180.5 min left and right laparoscopic hemicolectomy. These results can be attributed to the docking and changing of the robotic arms, instruments during surgery. We evidenced no difference about operation time in sigma rectum and rectal surgery; Deutsch et al. [9] demonstrated there is evidence to support the robot when operating in the pelvis, during rectal and low rectal procedures, where dissection and operation is extremely difficult and dangerous for surgeon; therefore the similar operating time between the two techniques is compensated by a higher vision of the pelvis in robotic surgery then laparoscopic surgery; thanks to the three-dimensional vision it is possible to guarantee a nerve sparing rectal surgery [8,9]. Regarding time to recovery bowel function, length of stay, were no significant differences between laparoscopic and robotic surgery. According to the ROLARR trial that investigated the conversion rate to open laparotomy in robotic (8.1%) *vs.* laparoscopy colorectal surgery (12.2%) and demonstrated a non-significantly lower conversion rate for the robotic surgery, our results were similar; the conversion rate were 5% in robotic *vs.* 12.5% in laparoscopic surgery (p:0.396) [9,10]. According to data literature about post-operative complications we demonstrated no statistically difference between two techniques (23% LS *vs.* 35% RS; p:0.44). In our institution robotic surgery increase the total costs [11].

Conclusion

Regarding our single center experience we can consider colorectal robotic surgery, a feasible, safe technique; with the same oncological outcomes; taking into account both the greater costs and the greater operating times, associated to the greater anesthesiological risks, was verified and actually supports the surgeon to overcome the technical limits of laparoscopic surgery in pelvic surgery. There are, however excellent scenarios, for an improvement of the results, taking into account also the recent utilization of this surgical technique in the colon-rectal surgery in our institution.

References

1. Siegel R, Naishadham D, Jemal A. Cancer statistics, 2013. CA Cancer J Clin. 2013;63(1):11-30.
2. Lacy AM, García-Valdecasas JC, Delgado S, Castells A, Taurá P, Piqué JM, et al. Laparoscopy-assisted colectomy versus open colectomy for treatment of non-metastatic colon cancer: A randomised trial. Lancet. 2002;359(9325):2224-9.
3. Jacobs M, Verdeja JC, Goldstein HS. Minimally invasive colon resection (laparoscopic colectomy). Surg Laparosc Endosc. 1991;1(3):144-50.
4. Shin JY. Comparison of short-term surgical outcomes between a robotic colectomy and a laparoscopic colectomy during early experience. J Korean Soc Coloproctol. 2012;28(1):19-26.
5. Challacombe B, Wheatstone S. Telementoring and telerobotics in urological surgery. Curr Urol Rep. 2010;11(1):22-8.
6. Compagna R, Aprea G, De Rosa D, Gentile M, Cestaro G, Vigliotti G, et al. Fast track for elderly patients: Is it feasible for colorectal surgery? Int J Surg. 2014;12(Suppl 2):S20-S22.
7. Yang Y, Wang F, Zhang P, Shi C, Zou Y, Qin H, et al. Robot-assisted versus conventional laparoscopic surgery for colorectal disease, focusing on rectal cancer: A meta-analysis. Ann Surg Oncol. 2012;19(12):3727-36.
8. Liao G, Zhao Z, Lin S, Li R, Yuan Y, Du S, et al. Robotic-assisted versus laparoscopic colorectal surgery: A meta-analysis of four randomized controlled trials. World J Surg Oncol. 2014;12:122.
9. Deutsch GB, Sathyanarayana SA, Gunabushanam V, Mishra N, Rubach E, Zemon H, et al. Robotic *vs.* laparoscopic colorectal surgery: An institutional experience. Surg Endosc. 2012;26(4):956-63.
10. Hidetoshi K, Tsunekazu H, Koji M, Yoshikazu K, Keigo A, Hiroshi M, et al. Robotic surgery for rectal cancer: Operative technique and review of the literature. J Anus Rectum Colon. 2020;4(1):14-24.
11. Kulaylat AS, Mirkin KA, Puleo FJ, Hollenbeak CS, Messaris EJ. Robotic versus standard laparoscopic elective colectomy: Where are the benefits? J Surg Res. 2018;224:72-8.