Is robotic approach better than laparoscopic approach in rectal cancer?

Marcus Valadão *, Rodrigo Otavio Araujo, Eduardo Linhares, José Paulo de Jesus

Marcus Valadão, Rodrigo Otavio Araujo, Eduardo Linhares, José Paulo de Jesus. Is robotic approach better than laparoscopic approach in rectal cancer?. General Surgery: Open Access 2019;2(1):6

The treatment of rectal cancer is complex and responsible for sequelae due to the various therapeutic modalities, especially the surgical resection. The advent of minimally invasive surgery provided a faster postoperative recovery and a lower complication rate when compared to conventional surgery. The implementation of laparoscopic approach in rectal cancer was responsible for these better results, but the limitations of this method added to the development of robotics, raised the question of which minimally invasive method would be more advantageous in the approach of rectal cancer. Our paper published on Journal of Coloproctology this year (https://doi.org/10.1016/j.jcol.2019.05.003) addressed the most recent data regarding the comparison between the laparoscopic and robotic approach in rectal cancer. Here we make a mini-review on our previous publication.

Key Words: *Rectal cancer; Minimally invasive surgery; Robotic surgery; Laparoscopic surgery*

BACKGORUND

Laparoscopic surgery offers the same oncologic results of conventional surgery associated with a faster postoperative recovery. However, although laparoscopic treatment of colon cancer has proven to be feasible and oncologically safe, on the other hand, the treatment of laparoscopic rectal cancer has been less adopted for several reasons: need for a long and arduous learning curve, technical difficulties related to the limitations of the method itself and by the anatomical aspects of the rectal surgery [1-4]. Therefore, robotic surgery was developed as a new technique capable of overcoming the limitations of laparoscopy in the pelvis and thus making the minimally invasive TME more adoptable and reproducible.

COMPARISON OF LAPAROSCOPY VS. ROBOTICS IN RECTAL CANCER

Until 2016 four meta-analysis investigated the role of robotic surgery in rectal cancer compared to the laparoscopic approach [5-8]. These 4 meta-analysis were concordant in some aspects: they showed that the robotic approach presented similar results to laparoscopy regarding morbimortality, oncological outcomes of short and medium term, as well as identifying a significantly lower rate of conversion in the robotic group. These 4 meta-analysis had limitations: the small number of studies published at that time included in the analysis. From 2017 to 2019, three meta-analysis were published addressing this topic [9-11]. Below we summarize the findings of the most recent meta-analysis mentioned above.

There was no difference in the length of hospital stay between robotics and laparoscopy in the 2 meta-analysis cited [9,10].Regarding the return of the intestinal function, Li et al. did not show any difference between the 2 groups. On the other hand, Prete et al. showed an earlier bowel function return in the robotic group (statistically significant different), but the quality of the evidence was considered low. Moreover, Ng and et al. showed that the robotic group had a significantly shorter duration of hospitalization, time to oral diet and lesser intraoperative blood loss [11].

Three meta-analysis were concordant regarding operative time. Li and colleagues found that robotic surgery was longer than laparoscopic surgery on average 57 minutes and this difference was statistically significant ($p<0.001$). Similarly, Prete et al. identified that the robotic group had a significantly longer operative time than laparoscopy (an average of 38 minutes longer) [9]. Ng et al. also found longer duration of the operative time in the robotic approach [11]. This increase in total operative time is explained by the additional time required for the robot to be docked to the patient associated with the need to change the position of the robotic arms during the rectal surgery since the second generation robotic platform (da Vinci Si) does not allows the approach of the splenic flexure and the pelvis with the same positioning of the robotic arms. In this way, the inferior mesenteric vein, inferior mesenteric artery and the splenic angle are approached with an initial positioning of the robotic arms, and a different configuration of the arms is made to approach the pelvis. The third generation robotic platform (da Vinci Xi) allows the work in these two fields with the same arrangement of the arms, and there is no need to change the configuration of the arms during the surgical procedure.

There was no difference between groups regarding the rate of postoperative complications in 2 meta-analysis. Both Li et al. and Prete et al. demonstrated similar anastomotic fistula rate, operative bleeding amount and surgical wound infection rate. Li et al. also described similar 30-day reoperation rate between robotic and laparoscopic groups. Prete et al. showed a similar mortality rate between the 2 groups (0.58% in the robotic group and 0.59% in the laparoscopy group) [9,10]. On the other hand, Ng et al. [11], demonstrated that robotic cohort was associated with significant reduction in the mortality rate (overall) as compared to the laparoscopic group. Similarly, in the subgroup of non-randomized trials, the all-cause mortality rate was significantly lower in robotic group. However, in the subgroup of randomized trials, the all-cause mortality rate was significantly lower in robotic group. However, in the subgroup of randomized trials, all-cause mortality rate in robotic group was similar to laparoscopic group. Moreover, there was a significant difference in the incidence of surgical site infection, the risk being lower in the robotic than laparoscopic group. In the subgroup of non-randomized trials, surgical site infection (SSI) was more likely to occur in laparoscopic compared to robotic group. However, in the subgroup of randomized trials, no difference in SSI was observed [11].

Several cases'series of robotic rectal cancer surgery demonstrated a low conversion rate [12-14]. When compared to the large multicenter studies of laparoscopy [15,16]. Conversion rates on robotic series ranged from 0% to 5% while the laparoscopy series reported rates of up to 34% of conversion 2-3 [12-14]. This higher conversion rate of laparoscopy is directly related to anatomical issues, since patients with a higher BMI (body mass index) presented a greater chance of conversion than the leaner patients, as evidenced in several publications [17-19].On the other hand, obesity does

Department of Abdominal and Pelvic Surgery, Instituto Nacional de Câncer, Rio de Janeiro, Brazil

*Correspondence: *Marcus Valadão, Department of Abdominal and Pelvic Surgery, Instituto Nacional de Câncer, Rio de Janeiro, Brazil, Tel: +552132071161; E-mail: drmarcusvaladao@gmail.com*

Received: September 09, 2019; Accepted: September 19, 2019; Published: September 26, 2019

not seem to influence the rate of conversion in robotics as demonstrated by Pai et al. [20], in which the authors compared the conversion rate between 2 groups of patients undergoing robotic surgery (a group of obese and other non-obese) and showed the same conversion rate. To answer this question a prospective multicenter randomized trial comparing robotics and laparoscopy in rectal cancer was conducted. This study ROLARR aimed to evaluate the conversion rate in these two groups and randomized a total of 471 patients (237 patients in the robotic group and 234 in the laparoscopic group). ROLARR trial showed a slightly higher conversion rate in the laparoscopy group, but with no statistically significant difference (laparoscopy 12.2% and robotic 8.1%, p=0.16). Despite this, it is worth mentioning an interesting data from the study: the analysis of subgroups identified that male and obese patients had a lower rate of conversion in the robotic group [21].

Regarding the last three meta-analysis, there was agreement regarding the conversion rate for open surgery. Li et al, Prete et al. and Ng et al. showed that the conversion rate was significantly lower with robotics. A subgroup analysis performed by Prete et al. (Prete et al. included the ROLARR study in the analysis) showed that male patients had a significantly lower conversion risk when compared to the laparoscopy group [9-11]. The most recent published meta-analysis showed that robotic group had significantly lower incidence of open conversion rate compared with the laparoscopic group. In the subgroup of non-randomized trials, the open conversion rate was more likely to occur in laparoscopic group as compared to robotic, although the heterogeneity in this subgroup was substantial. However, no significant difference was observed in the subgroup of randomized controlled trials (RCTs). Based on all the included RCTs, the trial sequential analysis of a diversity-adjusted required information size for incidence of conversion rate was 2.140 patients, based on 5% risk of type I error (two-sided), power 80%, low bias-based relative risk reduction of 36.47% and incidence in control arm of 8.38% with a model variance-based heterogeneity correction. Thus, this meta-analytic data based on 4 RCTs analyzed in the aforementioned meta-analysis were inconclusive that robotic approach reduces the incidence of open conversion rate for colorectal cancer [11].

Numerous studies have shown that robotic surgery in rectal cancer is safe from the cancer standpoint, offering the same results of open and laparoscopic surgery: both for the short-term (number of resected lymph nodes, compromised circumferential margin, quality of mesorectal excision) and long-term oncological results (relapse rate, disease free survival and overall survival) [11-14,20-22]. All published meta-analysis corroborate this data [5-11].

The comparison between robotics and laparoscopy published by Kim et al. demonstrated a reduction of sexual desire and urinary function in both groups 1 month after surgery with a faster and more complete recovery of the two parameters in the robotic group. Luca et al. found better preservation of urinary and sexual functions in the robotic group compared to the open and laparoscopic surgery groups, with complete recovery of functions at 1 year post-surgery. Broholm et al. published a meta-analysis in 2014 on this topic [23-25]. The authors included 4 studies in the analysis of urinary and sexual function using the IPSS (International Prostate Symptom Score) and IIEF (International Index of Erectile Function) questionnaires. IPSS is a subjective score system that evaluates urinary function in 7 categories (incomplete voiding, frequency, intermittence, urgency, weak flow, urinary power and nocturia) with a score between 0 and 35. High scores mean a higher degree of dysfunction. IIEF is a self-administered score system that includes questions that explore 5 domains (erectile function, orgasm function, sexual desire, sexual satisfaction and overall satisfaction) with a score between 0 and 75. The higher the score the better erectile function. The meta-analysis mentioned above showed better urinary function in 3 and 12 months, as well as better sexual function in 3 and 6 months in the robotic group when compared to the laparoscopic group [24]. The ROLARR study also evaluated urinary and sexual function between the 2 groups as one of the secondary objectives but did not find differences between the groups [21]. It is worth noting that the IPSS and IIEF questionnaires were answered in only 75.3% and 56.6%, respectively, a fact that compromised the accurate analysis of the results.

To the present the main limitation to widespread adoption of the robotic surgery is its high cost. Several studies have confirmed the greater cost with the use of robotics compared to laparoscopy [21,26-28].

CONCLUSION

The rational of the robotic approach in rectal cancer is to overcome the technical difficulties of laparoscopy, provide oncological outcomes similar to those of laparoscopy, but offer better functional results and a lower conversion rate.

REFERENCES

1. Siegel R, Cuesta MA, Targarona E, et al. Laparoscopic extraperitoneal rectal cancer surgery2011: the clinical practice guidelines of the European Association for Endoscopic Surgery (EAES). Surg Endosc 2011;25:2423-2440.
2. Laurent C, Leblanc F, Wütrich P, et al. Laparoscopic vs. open surgery for rectal cancer: long-term oncologic results. Ann Surg 2009;250:54-61.
3. Huang MJ, Liang JL, Wang H, et al. Laparoscopic-assisted vs. open surgery for rectal cancer: a meta-analysis of randomized controlled trials on oncologic adequacy of resection and long-term oncologic outcomes. Int J Colorectal Dis 2011;26:415-421.
4. Ng SS, Lee JF, Yiu RY, et al. Long-term oncologic outcomes of laparoscopic vs. open surgery for rectal cancer: a pooled analysis of 3 randomized controlled trials. Ann Surg 2014;259:139-147.
5. Trastulli S, Farinella E, Cirocchi R, et al. Robotic resection compared with laparoscopic rectal resection for cancer: Systematic review and meta-analysis of short-term outcome. Colorectal Dis 2012;14:e134-156.
6. Xiong B, Ma L, Huang W, et al. Robotic vs. laparoscopic total mesorectal excision for rectal cancer: a meta-analysis of eight studies. J Gastrointest Surg 2014;19:516-526.
7. Wang Y, Zhao GH, Yang H, et al. A pooled analysis of robotic vs. laparoscopic surgery for total mesorectal excision for rectal cancer. Surg Laparosc Endosc Percutan Tech 2016;26:259-264.
8. Araújo SEA, Seid VE, Klajner S. Robotic surgery for rectal cancer: Current immediate clinical and oncological outcomes. World J Gastroenterol 2014;39:14359-14370.
9. Li X, Wang T, Yao L, et al. The safety and effectiveness of robot-assisted vs. laparoscopic TME in patients with rectal cancer. A meta-analysis and systematic review. Medicine 2017;96:29(e7585).
10. Prete FP, Pezzolla A, Prete F, et al. Robotic vs. laparoscopic minimally invasive surgery for rectal cancer. A systematic review and meta-analysis of randomized cotrolled trials. Ann Surg 2018;267:1034-1046.
11. Ng KT, Tsia Tsia AKV, Chong VYL. Robotic vs. conventional laparoscopy surgery for colorectal cancer: A systematic review and meta-analysis with trial sequential analysis. World J Surg 2019;43:1146-1161.
12. Hellan M, Anderson C, Ellenhorn JD, et al. Short-term outcomes after robotic-assisted total mesorectal excision for rectal cancer. Ann Surg Oncol 2007;14:3168-3173.
13. Baik SH, Kwon HY, Kim JS, et al. Robotic vs. laparoscopic low anterior resection of rectal cancer: Short-term outcome of a prospective comparative study. Ann Surg Oncol 2009;16:1480-1487.
14. Choi DJ, Kim SH, Lee PJ, et al. Single-stage totally robotic dissection for rectal cancer surgery: Technique and short-term outcome in 50 consecutive patients. Dis Colon Rectum 2009;52:1824-1830.
15. Jayne DG, Thorpe HC, Copeland J, et al. Five-year follow-up of the Medical Research Council CLASICC trial of laparoscopically assisted vs. open surgery for colorectal cancer. Br J Surg 2010;97:1638-1645.
16. Guillou PJ, Quirke P, Thorpe H, et al. Short-term endpoints of conventional vs. laparoscopic-assisted surgery in patients with colorectal cancer (MRC CLASICC trial): multicentre, randomized controlled trial. Lancet 2005;365:1718-1726
17. Rottoli M, Bona S, Rosati R, et al. Laparoscopic rectal resection for cancer: Effects of conversion on short term outcome and survival. Ann Surg Oncol 2009;16:1279-1286.

18. Agha A, Furst A, Iesalnieks I, et al. Conversion rate in 300 laparoscopic rectal resections and its influence on morbidity and oncological outcome. Int J Colorectal Dis 2008;23:409-417.
19. Yamamoto S, Fukunaga M, Miyajima N, et al. Impact of conversion on surgical outcomes after laparoscopic operation for rectal carcinoma: A retrospective study of 1073 patients. J Am Coll Surg 2009;208:383-389.
20. Pai A, Melich G, Marecik SJ, et al. Current status of robotic surgery for rectal cancer: A bird's eye view. J Min Access Surg 2015;11:29-34.
21. Jayne D, Pigazzi A, Marshal H, et al. Effect of robotic-assisted vs conventional laparoscopic surgery on risk of conversion to open laparotomy among patients undergoing resection for rectal cancer. The ROLARR randomized clinical trial. JAMA 2017;318:1569-1580.
22. Jesus JP, Valadão M, Araújo RO, et al. The circumferential resection margins status: A comparrison of roboti, laparoscopic and open total mesorectal excision for mid and low rectal cancer. Eur J Surg Oncol 2016;42:808-812.
23. Kim JY, Kim NK, Lee KY, et al. A comparative study of voiding and sexual function after total mesorectal excision with autonomic nerve preservation for rectal cancer: Laparoscopic vs. robotic surgery. Ann Surg Oncol 2012;19:2485-2493.
24. Luca F, Valvo M, Ghezzi TL, et al. Impact of robotic surgery on sexual and urinary functions after fully robotic nervesparing total mesorectal excision for rectal cancer. Ann Surg 2013;257:672-678.
25. Broholm M, Pommergaard HC, Gögenür I. Possible benefits of robot-assisted rectal cancer surgery regarding urological and sexual dysfunction: a systematic review and meta-analysis. Colorectal Dis 2014;17:375-381.
26. Baek SJ, Kim SH, Cho JS, et al. Robotic vs. conventional laparoscopic surgery for rectal cancer: a cost analysis from a single institute in Korea. World J Surg 2012;36:2722-2729.
27. Delaney CP, Lynch AC, Senagore AJ, et al. Comparison of robotically performed and traditional laparoscopic colorectal surgery. Dis Colon Rectum 2003;46:1633-1639.
28. Kim CW, Baik SH, Roh YH, et al. Cost-effectiveness of robotic surgery for rectal cancer focusing on short-term outcomes. A propensity score-matching Analysis. Medicine 2015;22:1-6.