International Society of University Colon and Rectal Surgeons survey of surgeons’ preference on rectal cancer treatment

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Purpose
To assess the personal opinion of active practicing surgeons on rectal cancer treatment if they were the patient.

Methods
- Participation: A panel of the International Society of University Colon and Rectal Surgeons (ISUCRS)
- From April 16 to 28, 2020
- Questionnaire of 10 questions

| Technique | Question | Answer |
|-----------|----------|--------|
| Open      | If you were diagnosed with early low rectal cancer (T1, T2), what treatment would you choose? | Local excision |
| Laparoscopic | If you were diagnosed with locally advanced low rectal cancer, what surgical approach would you choose? | Laparoscopic |
| HALS      | If all rectal resection techniques were equally safe, which one would you choose? | None |
| Robotic   | What factor would you consider the most important when choosing the surgical technique? | Safety |

Conclusion
Our survey reveals an age-based preference by surgeons for minimally invasive surgical techniques as well as organ-preserving techniques for personal treatment of rectal cancer.

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**INTRODUCTION**

Colorectal cancer remains a major cause of mortality globally [1]. The current status of treatment of patients with rectal cancer requires a multidisciplinary approach that is relatively standardized. For early rectal cancer stage T1 or T2, local excision and close surveillance or adjuvant chemoradiotherapy or radical surgery may be advised according to possible good versus poor prognostic factors [2, 3]. Whereas historically treatment for locally advanced (T3/T4 or node-positive) rectal adenocarcinoma has evolved to require fluorouracil (5-fluorouracil or capecitabine)—based neoadjuvant chemoradiotherapy followed by extirpative total mesorectal excision (TME), rectal resection with or without postoperative adjuvant chemotherapy [4–10]. As the oncological outcomes improve, whether secondary to improved chemotheraphy, radiation or surgical techniques, and the rate of survival increases studies have revealed a significant degree of bowel dysfunction following rectal surgery possibly affecting as much as 90% of patients [11–13]. Moreover, the dysfunction [14] may be long term and therefore many investigators prefer total neoadjuvant therapy with watch-and-wait strategy for patients with complete clinical response [15–18].

Several surveys regarding rectal cancer treatment options have recently been conducted [19–23]. Several studies address insufficient or incomplete or biased patient-physician communication as well as the varying opinions regarding treatment between these 2 groups [19, 21, 22]. Furthermore, several surveys demonstrate the issue of lack of consensus in terms of rectal cancer treatment regarding all parties [20, 23]. All of the studies above addressed rectal cancer treatment issues based on physicians’ opinions as medical professionals for their patients but none questioned what the treatment would be if the surgeon was the patient.

With this as a foundation, the research arm of the International Society of University Colon and Rectal Surgeons (ISUCRS) conducted a global survey of surgeons who manage colorectal cancer to assess the surgeons’ preference for rectal cancer treatment with the assumption of the surgeon as patient. Our hypothesis was that surgeons being a patient would prefer minimally invasive surgery (MIS) with tendency for local excisions and watch-and-wait strategies avoiding radical surgery.

**METHODS**

All procedures involving human participants were performed in accordance with the ethical standards of the institutional and/or national research committee and the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. This article does not contain any studies using animals. The survey filling process was totally voluntary and anonymous and it was available online. The study was exempted from the institutional ethics committee’s approval as this was totally voluntary and anonymous.

To reveal a surgeon’s preference regarding rectal cancer management, ISUCRS designed an open online questionnaire that addressed 10 questions with different clinical scenarios in addition to other demographic data (questionnaire can be found in Supplementary Material 1). A panel of members of ISUCRS developed
these questions regarding rectal cancer treatment. The voluntary questionnaire was widely distributed via the ISUCRS database by emails (300 international surgeons) and was advertised on ISUCRS social media platforms including Facebook, colorectal surgeons, and LinkedIn. The anonymous questionnaire was open from April 16 to 28, 2020. There were 166 respondents. Three respondents (2 hepatobiliary surgeons and 1 medical oncologist) were excluded. The users were informed of the survey goal and the length of data storage (1 year). No personal data was collected.

We defined “abdominal surgeon” (or “gastrointestinal surgeon” as sometimes called in the United States) as a surgeon treating gastrointestinal conditions. The survey was tested for consistent reliability. It was administered to 10 random surgeons for repeating the survey 10 to 14 days later. The results were compared using Cronbach α. It is more than 0.7; the consistency is acceptable. We used CHERRIES (Checklist for Reporting Results of Internet E-Surveys). To prevent a single user from filling survey multiple times, we used IP address analysis. All users had to answer all the questions.

All statistical analyses were performed using IBM SPSS ver. 20 (IBM Corp). The chi-square test or Fisher exact test was used to compare qualitative variables, and the Student t-test or the Mann-Whitney U-test was used to analyze quantitative variables between the groups.

RESULTS

Fifteen of the survey participants (9.2%) were female, 141 (86.5%) were male, and 7 (4.3%) were not specified gender status. The surgical specialty distribution was 109 colorectal surgeons (66.9%), 37 general surgeons (22.7%), 8 abdominal surgeons (4.9%), and 9 others (5.5%; 6 surgical oncologists, 2 pediatric surgeons, and 2 gastrointestinal surgical endoscopists). The majority of responders were at age of 35 to 50 years (n = 101, 62.0%). Majority of responders were from China (n = 77, 47.2%), Lithuania (n = 23, 14.1%), and the United States (n = 23, 14.1%). Other respondents’ countries consisted of Denmark, Egypt, Ecuador, India, Russia, Germany, Greece, Italy, Korea, Japan, Poland, Romania, Turkey, the United Kingdom, Ukraine, Belgium, Brazil, Chile, Colombia, Sri Lanka, and Thailand. Twenty-six participants (16.0%) responded positively considering choice of preferring open rectal resection for their personal treatment even if minimally invasive techniques are available. Moreover, using logistic regression, we found a statistical significance between the physician’s age and open rectal resection preference (P = 0.016). Furthermore, there was an age-based bias of older physicians to select open extirpative rectal resection (coefficient $\beta = 0.063887 > 0$). The majority of the surgeons (n = 135, 82.8%) were under 50 years of old.

Priority for open rectal resection differs among different specialties also (86.2% of colorectal surgeons would undergo only MIS compared to 100% of abdominal surgeons). Respondent’s specialty was found to be significant considering the preference for the open procedure ($P < 0.05$) (Table 1). Thirty-five respondents (21.5%) were in their early years of practice (< 5 years); 30 (18.4%) had 5 to 10 years; 31 (19.0%) had 10 to 15 years; 28 (17.2%) had 15 to 20 years; and 38 (23.3%) had > 20 years of practice. One respondent left a blank section.

Considering early low rectal cancer (T1, T2) treatment, most of the respondents (36.8%) selected organ preservation with standard chemoradiation + local excision (Fig. 1). Regarding the treatment of locally advanced low rectal cancer, the first-choice treatment among the responders was laparoscopic surgery with robotic surgery following in second place (Fig. 2).

Seventy-five respondents of the participating physicians (46.0%) were male, 141 (86.5%) were male, and 7 (4.3%) were not specified gender status. The surgical specialty distribution was 109 colorectal surgeons (66.9%), 37 general surgeons (22.7%), 8 abdominal surgeons (4.9%), and 9 others (5.5%; 6 surgical oncologists, 2 pediatric surgeons, and 2 gastrointestinal surgical endoscopists). The majority of responders were at age of 35 to 50 years (n = 101, 62.0%). Majority of responders were from China (n = 77, 47.2%), Lithuania (n = 23, 14.1%), and the United States (n = 23, 14.1%). Other respondents’ countries consisted of Denmark, Egypt, Ecuador, India, Russia, Germany, Greece, Italy, Korea, Japan, Poland, Romania, Turkey, the United Kingdom, Ukraine, Belgium, Brazil, Chile, Colombia, Sri Lanka, and Thailand. Twenty-six participants (16.0%) responded positively considering choice of preferring open rectal resection for their personal treatment even if minimally invasive techniques are available. Moreover, using logistic regression, we found a statistical significance between the physician’s age and open rectal resection preference (P = 0.016). Furthermore, there was an age-based bias of older physicians to select open extirpative rectal resection (coefficient $\beta = 0.063887 > 0$). The majority of the surgeons (n = 135, 82.8%) were under 50 years of old.

Table 1. The selection of open rectal resection versus minimally invasive procedures distribution among respondent's specialties

| Specialty                     | Would you undergo an open rectal resection if minimally invasive techniques were available? |
|-------------------------------|---------------------------------------------------------------------------------------------|
| Specialty                     | No (%)                                       | Yes (%)                                      |
| Abdominal surgeon             | 100                                          | 0                                            |
| Colorectal surgeon            | 86.2                                         | 13.8                                         |
| Endoscopist                   | 100                                          | 0                                            |
| Gastrointestinal surgeon      | 100                                          | 0                                            |
| General surgeon               | 75.7                                         | 24.3                                         |
| Pediatric surgeon             | 100                                          | 0                                            |
| Surgical oncologist           | 100                                          | 0                                            |
| Total                         | 89.0                                         | 11.0                                         |

Fig. 1. Distribution of the answers to the question, "If you were diagnosed with early low rectal cancer (T1, T2), what treatment would you choose?" TEM, transanal endoscopic microsurgery; TEO, transanal endoscopic operation.
selected robotic surgery when all given surgical treatment techniques were told to be equally safe (Fig. 3). Robotic surgery was preferred by 75 out of 163 surgeons (46.0%) of the varying minimally invasive techniques (Fig. 4). Whereas, single incision laparoscopic surgery (SILS) was ranked second and conventional laparoscopic surgery (CLS) third among the respondents. Respondents were also asked to select priorities for surgical rectal procedures. The highest priority consideration of our respondents was safety of the procedure and then the oncological safety (Table 2). Further priorities were arranged as follows: experience of the surgeon, quality of life after surgery, early recovery, postoperative pain, cosmesis, and cost.

We also found that the questionnaire had a good consistency (Cronbach α, 0.95).

**DISCUSSION**

In this prospective collected study, we showed that surgeons if they were presented with rectal cancer, chose minimally invasive and organ-preserving techniques more often if they were making decisions for themselves as patients. In regards to T1 or T2 rectal cancer, surgeons chose local excision with standard chemotherapy preferentially. Laparoscopy was the first-choice approach for locally advanced cancer. The best minimally invasive approach was selected to be robotic.

We found that older surgeons are prone to doing open despite if minimally invasive techniques are available. This is consistent with other studies; open radical surgery trending toward older surgeons and advanced laparoscopic procedures are performed by younger specialists [24]. However, this underutilization of MIS may be due to the lack of training possibilities globally [25]. Along with expanding indications for MIS techniques [26, 27] and growing international experience with minimally invasive approaches [28], these recommendations and experiences are being shared...
for the MIS training [29, 30].

While radical surgery is a treatment of choice according to the European Society for Medical Oncology (ESMO) and National Comprehensive Cancer Network (NCCN) rectal cancer treatment guidelines [31, 32], only 21% of our respondents chose this option. Obviously, this is influenced by not subdividing the early rectal cancer to very early (T1 without poor prognostic factors, where local excision is sufficient). Selection by the respondents of organ-preserving and minimally invasive conservative treatment was possibly related to the fact that radical surgery is associated with a high percentage of postsurgical complications (3%–30% [33]) and organ dysfunction (defecation disorder up to 75%–90%, sexual dysfunction up to 50%, and urination dysfunction up to 30% [13, 34–40]). Moreover, bowel dysfunction is a long-lasting issue [14]. Considering this, organ-preserving treatment techniques are increasing in popularity, such as local excision, chemoradiation with local excision, or only total neoadjuvant treatment as preferred treatments [41–43]. In addition, our respondents chose laparoscopy and robotics as the first choice for the treatment of locally advanced rectal cancer. The probable justification for the choices is the wide availability of the laparoscopic approach, in contradistinction to robotic surgery. This may reflect the issue that robotic surgery is more expensive, at present, not available internationally in underdeveloped countries and that the operative time is longer [44]. Moreover, the cost and lack of robotic wider spread can be associated with the absence of strong, evidence-based advantages for the patient over the conventional laparoscopy. In the systematic review and meta-analysis by Prete et al. [45], authors showed that the robotic approach for rectal cancer is indistinguishable from conventional laparoscopic treatment considering perioperative oncological procedure oncologic results, although the operating time was significantly longer. However, the learning curve for younger surgeons is shorter and this may consequently make robotic surgery preferred by this group [46]. The experience may be the result of a lower conversion rate to open surgery compared with conventional laparoscopy [45]. On the contrary, the better quality of robotic TME, better urinary function outcomes, lower blood loss (15.4 ± 26.4 mL vs. 39.1 ± 85.1 mL) and conversion rate (0% vs. 3.3%), and shorter hospital stay (7.3 ± 2.3 days vs. 9.3 ± 6.7 days) in comparison with laparoscopic TME were being reported [44]. After all, bowel function and quality-related advantages of robotic TME may in the long-term cause a greater oncological safety. Novel transanal TME (TaTME) sometimes may be attributed to natural orifice transluminal endoscopic surgery (NOTES) [47]. In terms of pathological outcomes, TaTME may be superior to laparoscopic TME, with lower circumferential resection margin and distal resection margin positivity rates [48]. The transanal approach showed better results over laparoscopic techniques in regards to readmission rate (9% after TaTME vs. 18% after laparoscopic TME), major and overall morbidity (8.7% vs. 14% for major morbidity and 34% vs. 41% for overall morbidity), length of hospital stay (95% confidence interval, 3.68–6.66), and anastomotic leak rate (6.4% vs. 11.6%) [44, 49]. It is important to state that most studies are based on nonrandomized trials, and data regarding oncological safety from multicenter studies is inconclusive, at present [44, 49, 50]. Therefore, excluding unreliable NOTES safety criteria and given better cosmetic and perioperative outcomes makes this procedure one of the top choices. Surgical morbidity, oncological suitability, cost, intraoperative bleeding, rate of conversion to open surgery, anastomotic leakage rate, readmission, local recurrence, and distal metastases rates are similar in SILS and CLS [51, 52]. Nevertheless, SILS seems to offer some advantages in relation to a smaller incision, such as shorter length of hospital stay, better cosmetic results, faster return of bowel function, reduced postoperative pain, and overall complication rate [46, 47]. These considerations may reflect the preference in the survey for CLS.

Our respondents answered that surgical and overall safety was the primary goal of the surgery. Other recent studies showed similar tendency; surgeons base treatment decisions on existing information about specific surgical method safety, clinical experience, and patient medical condition preintervention and postintervention [53, 54].

The strength of our study is the novel and original approach to the perceptions by the surgeons of the rectal cancer treatment. Moreover, we have included a high number of homogenous specialists from different countries. However, our study has some limitations. First, the low response rate (54.3%) might not reflect the true experience globally. Relatively low survey response rates are a major and growing problem worldwide. Obviously, they can bias survey results by introducing nonresponse error. Low response rates can be the result of a number of factors including survey mode; nonworking email addresses as all the respondents were reached through emails, the online-based questions, which sometimes might be hard filling for older generation surgeons. Another explanation might be inactivity in these kinds of trials. Second, we could not assess the validity of the survey. Theoretically, the survey results might be different if the respondents really had cancer. However, this is only hypothetical predictions and this was not the goal of our study.

To conclude, our survey revealed an age-based preference by surgeons for minimally invasive surgical techniques as well as organ-preserving techniques for personal treatment of treating rectal cancer. Only one-fourth of specialists do adhere to the international guidelines for treating early rectal cancer.
ARTICLE INFORMATION

Conflict of interest
No potential conflict of interest relevant to this article was reported.

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Author contributions
Conceptualization: AD; Data curation: all authors; Formal analysis: DG, LZ; Visualization: AD, LZ, RF; Writing–original draft: AD, DG, JWNM, PFC; Writing–review & editing: all authors. All authors read and approved the final manuscript.

Additional information
This study was presented as a poster at the European Society of Coloproctology (ESCP) conference on September 21–24, 2021, in Barcelona, Spain.

Supplementary materials
Supplementary Material 1. Survey questionnaire.
Supplementary materials are available from https://doi.org/10.3393/ac.2022.00255.0036.

REFERENCES

1. Rawla P, Sunkara T, Barsouk A. Epidemiology of colorectal cancer: incidence, mortality, survival, and risk factors. Prz Gastroenterol 2019;14:89–103.
2. Keller DS, Berho M, Perez RO, Wexner SD, Chand M. The multidisciplinary management of rectal cancer. Nat Rev Gastroenterol Hepatol 2020;17:414–29.
3. Cutting JE, Hallam SE, Thomas MG, Messenger DE. A systematic review of local excision followed by adjuvant therapy in early rectal cancer: are pT1 tumours the limit? Colorectal Dis 2018;20:854–63.
4. Fisher B, Wolmark N, Rockette H, Redmond C, Deutsch M, Wickerham DL, et al. Postoperative adjuvant chemotherapy or radiation therapy for rectal cancer: results from NSABP protocol R-01. J Natl Cancer Inst 1988;80:21–9.
5. Krook JE, Moertel CG, Gunderson LL, Wieand HS, Collins RT, Beart RW, et al. Effective surgical adjuvant therapy for high-risk rectal carcinoma. N Engl J Med 1991;324:709–15.
6. NIH Consensus Conference. Adjuvant therapy for patients with colon and rectal cancer. JAMA 1990;264:1444–50.
7. Swedish Rectal Cancer Trial; Cedermark B, Dahlberg M, Glimelius B, Pahlman L, Rutqvist LE, et al. Improved survival with preoperative radiotherapy in resectable rectal cancer. N Engl J Med 1997;336:980–7.
8. van Gijn W, Marijnen CA, Nagtegaal ID, Kranenbarg EM, Putter H, Wiggers T, et al. Preoperative radiotherapy combined with total mesorectal excision for resectable rectal cancer: 12-year follow-up of the multicentre, randomised controlled TME trial. Lancet Oncol 2011;12:575–82.
9. Pahlman L, Glimelius B. Pre- or postoperative radiotherapy in rectal and rectosigmoid carcinoma: report from a randomized multicenter trial. Ann Surg 1990;211:187–95.
10. Kapiteijn E, Marijnen CA, Nagtegaal ID, Putter H, Steup WH, Wiggers T, et al. Preoperative radiotherapy combined with total mesorectal excision for resectable rectal cancer. N Engl J Med 2001;345:638–46.
11. Bryant CL, Lunniss PJ, Knowles CH, Thaha MA, Chan CL. Anterior resection syndrome. Lancet Oncol 2012;13:e403–8.
12. Dulskas A, Smolskas E, Kildusiene I, Samalavicius NE. Treatment possibilities for low anterior resection syndrome: a review of the literature. Int J Colorectal Dis 2018;33:251–60.
13. Samalavicius NE, Dulskas A, Lasinskas M, Smailyte G. Validity and reliability of a Lithuanian version of low anterior resection syndrome score. Tech Coloproctol 2016;20:215–20.
14. Dulskas A, Kavalikauskas P, Pilipavicius L, Jodinskas M, Mikalonis M, Samalavicius NE. Long-term bowel dysfunction following low anterior resection. Sci Rep 2020;10:11882.
15. Glynne-Jones R, Grainger J, Harrison M, Ostler P, Makris A. Neoadjuvant chemotherapy prior to preoperative chemoradiation or radiation in rectal cancer: should we be more cautious? Br J Cancer 2006;94:363–71.
16. Garcia-Aguilar J, Chow OS, Smith DD, Marcet JE, Cataldo PA, Varma MG, et al. Effect of adding mFOLFOX6 after neoadjuvant chemoradiation in locally advanced rectal cancer: a multicentre, phase 2 trial. Lancet Oncol 2015;16:957–66.
17. Hartley A, Ho KF, McConkey C, Geh JI. Pathological complete response following pre-operative chemoradiotherapy in rectal cancer: analysis of phase II/III trials. Br J Radiol 2005;78:934–8.
18. Dattani M, Heald RJ, Goussous G, Broadhurst J, São Julião GP, Habr-Gama A, et al. Oncological and survival outcomes in watch and wait patients with a clinical complete response after neoadjuvant chemoradiotherapy for rectal cancer: a systematic review and pooled analysis. Ann Surg 2018;268:955–67.
19. Kennedy ED, Borowiec AM, Schmocker S, Cho C, Brierley J, Li
S, et al. Patient and physician preferences for nonoperative management for low rectal cancer: is it a reasonable treatment option? Dis Colon Rectum 2018;61:1281–9.

20. Keikes L, van Oijen MG, Lemmens VE, Koopman M, Punt CJ. Evaluation of guideline adherence in colorectal cancer treatment in the netherlands: a survey among medical oncologists by the Dutch Colorectal Cancer Group. Clin Colorectal Cancer 2018;17:58–64.

21. Chen TY, Emmertsen KJ, Laurberg S. Bowel dysfunction after rectal cancer treatment: a study comparing the specialist’s versus patient’s perspective. BMJ Open 2014;4:e003574.

22. El Turabi A, Abel GA, Roland M, Lyratzopoulos G. Variation in reported experience of involvement in cancer treatment decision making: evidence from the National Cancer Patient Experience Survey. Br J Cancer 2013;109:780–7.

23. Augestad KM, Lindsetmo RO, Reynolds H, Stulberg J, Senagore A, Champagne B, et al. International trends in surgical treatment of rectal cancer. Am J Surg 2011;201:353–8.

24. Lomboy JR, Graves JL, Smith AB, Nielsen ME, Wallen EM, Raynor MC, et al. Impact of surgeon age on preference for open vs laparoscopic/robotic partial and radical nephrectomy: potential implications of an aging workforce. J Am Coll Surg 2018;227:S281.

25. Ghadban T, Reeh M, Bockhorn M, Heumann A, Grotelueschen R, Bachmann K, et al. Minimally invasive surgery for colorectal cancer remains underutilized in Germany despite its nationwide application over the last decade. Sci Rep 2018;8:15146.

26. Conrad LB, Ramirez PT, Burke W, Naumann RW, Ring KL, Munsell MF, et al. Role of minimally invasive surgery in gynecologic oncology: an updated survey of members of the Society of Gynecologic Oncology. Int J Gynecol Cancer 2015;25:1121–7.

27. Warmann S, Fuchs J, Jesch NK, Schrappe M, Ure BM. A prospective study of minimally invasive techniques in pediatric surgical oncology: preliminary report. Med Pediatr Oncol 2003;40:155–7.

28. Tsui C, Klein R, Garabrant M. Minimally invasive surgery: national trends in adoption and future directions for hospital strategy. Surg Endosc 2013;27:2253–7.

29. Sharif S, Afsar A. Learning curve and minimally invasive spine surgery. World Neurosurg 2018;119:472–8.

30. Schreuder HW, Oei G, Maas M, Borleffs JC, Schijven MP. Implementation of simulation in surgical practice: minimally invasive surgery has taken the lead: the Dutch experience. Med Teach 2011;33:105–15.

31. Glyne-Jones R, Wywicz L, Turet E, Brown G, Rödel C, Cervantes A, et al. Rectal cancer: ESMO clinical practice guidelines for diagnosis, treatment and follow-up. Ann Oncol 2017;28(Suppl 4):iv22–40.

32. Benson AB, Venook AP, Al-Hawary MM, Arain MA, Chen YJ, Ciombor KK, et al. NCCN guidelines insights: rectal cancer, version 6.2020. J Natl Compr Canc Netw 2020;18:806–15.

33. Paun BC, Cassie S, MacLean AR, Dixon E, Buie WD. Postoperative complications following surgery for rectal cancer. Ann Surg 2010;251:807–18.

34. Dulksas A, Samalavicius NE. A prospective study of sexual and urinary function before and after total mesorectal excision. Int J Colorectal Dis 2016;31:1125–30.

35. Dulksas A, Miliauskas P, Tikuitis R, Escalante R, Samalavicius NE. The functional results of radical rectal cancer surgery: review of the literature. Acta Chir Belg 2016;116:1–10.

36. Varela C, Kim NK. Surgical treatment of low-lying rectal cancer: updates. Ann Coloproctol 2021;37:395–424.

37. Piozzi GN, Kim SH. Robotic intersphincteric resection for low rectal cancer: technical controversies and a systematic review on the perioperative, oncological, and functional outcomes. Ann Coloproctol 2021;37:351–67.

38. Eldamshety O, Kolb S, Khater A, Roshyd S, Elshary M, Zahi MS, et al. Early and late functional outcomes of anal sphincter-sparing procedures with total mesorectal excision for anal rectal adenocarcinoma. Ann Coloproctol 2020;36:148–54.

39. Oh CK, Huh JW, Lee YJ, Choi MS, Pyo DH, Lee SC, et al. Long-term oncologic outcome of postoperative complications after colorectal cancer surgery. Ann Coloproctol 2020;36:273–80.

40. Huh JW, Maeda K, Liu Z, Wang X, Rosland AC, Lee WY. Current status of “watch-and-wait” rectal cancer treatment in Asia-Pacific countries. Ann Coloproctol 2020;36:70–7.

41. Borstlap WA, van Oostendorp SE, Klaver CE, Hahnloser D, Cunningham C, Rullier E, et al. Organ preservation in rectal cancer: a synopsis of current guidelines. Colorectal Dis 2018;20:201–10.

42. Stijns RC, Tromp MR, Hugen N, de Wilt JH. Advances in organ preserving strategies in rectal cancer patients. Eur J Surg Oncol 2018;44:209–19.

43. Habr-Gama A, Lynn PB, Jorge JM, São Julião GP, Proscurshim I, Varela C, Kim NK. Surgical treatment of low-lying rectal cancer: a synopsis of current guidelines. Colorectal Dis 2016;18(Suppl 4):iv22–40.

44. Matsuda T, Yamashita K, Hasegawa H, Oshikiri T, Hosono M, Higashino N, et al. Recent updates in the surgical treatment of colorectal cancer. Ann Gastroenterol Surg 2018;2:129–36.

45. Prete FP, Pezzolla A, Prete F, Testini M, Marzaoli R, Patriti A, et al. Robotic versus laparoscopic minimally invasive surgery for rectal cancer: a systematic review and meta-analysis of random-
ized controlled trials. Ann Surg 2018;267:1034–46.

46. Huang YM, Huang YJ, Wei PL. Outcomes of robotic versus laparoscopic surgery for mid and low rectal cancer after neoadjuvant chemoradiation therapy and the effect of learning curve. Medicine (Baltimore) 2017;96:e8171.

47. Marks JH, Salem JF. From TATA to NOTES, how taTME fits into the evolutionary surgical tree. Tech Coloproctol 2016;20:513–5.

48. Jiang HP, Li YS, Wang B, Wang C, Liu F, Shen ZL, et al. Pathological outcomes of transanal versus laparoscopic total mesorectal excision for rectal cancer: a systematic review with meta-analysis. Surg Endosc 2018;32:2632–42.

49. Aubert M, Mege D, Panis Y. Total mesorectal excision for low and middle rectal cancer: laparoscopic versus transanal approach: a meta-analysis. Surg Endosc 2020;34:3908–19.

50. Simo V, Tejedor P, Jimenez LM, Hernan C, Zorilla J, Arredondo J, et al. Oncological safety of transanal total mesorectal excision (TaTME) for rectal cancer: mid-term results of a prospective multicentre study. Surg Endosc 2021;35:1808–19.

51. Daher R, Chouillard E, Panis Y. New trends in colorectal surgery: single port and natural orifice techniques. World J Gastroenterol 2014;20:18104–20.

52. Liu X, Li JB, Shi G, Guo R, Zhang R. Systematic review of single-incision versus conventional multiport laparoscopic surgery for sigmoid colon and rectal cancer. World J Surg Oncol 2018;16:220.

53. van Groningen JT, Marang-van de Mheen PJ, Henneman D, Beets GL, Wouters MW. Surgeon perceived most important factors to achieve the best hospital performance on colorectal cancer surgery: a Dutch modified Delphi method. BMJ Open 2019;9:e025304.

54. Gunaratnam C, Bernstein M. Factors affecting surgical decision-making: a qualitative study. Rambam Maimonides Med J 2018;9:e0003.