Editorial

Can we predict surgical difficulty of rectal surgery?

Kenji Kawada, Yoshiharu Sakai

Department of Surgery, Graduate School of Medicine, Kyoto University, Kyoto, Japan

Correspondence to: Kenji Kawada, MD, PhD. Department of Surgery, Graduate School of Medicine, Kyoto University, 54 Shogoin- Kawara-cho, Sakyo-ku, Kyoto, 606-8507, Japan. Email: kkawada@kuhp.kyoto-u.ac.jp.

Comment on: Escal L, Nougaret S, Guiu B, *et al.* MRI-based score to predict surgical difficulty in patients with rectal cancer. Br J Surg 2018;105:140-6.

Received: 04 April 2018; Accepted: 17 April 2018; Published: 10 May 2018.

doi: 10.21037/ales.2018.04.09

View this article at: http://dx.doi.org/10.21037/ales.2018.04.09

In rectal surgery, the gold standard of surgical technique is total mesorectal excision (TME) (1). Treatment of rectal cancer has improved by the introduction of TME, which resulted in decreased postoperative local recurrence. Difficulties in TME are assumed to be due to the limited surgical maneuver in the narrow pelvic space: autonomic nerve conservation, sphincter preservation, and anastomosis. Compared with open surgery, laparoscopic surgery enables TME with greater precision by providing a better visibility even in a narrow space of the pelvic cavity. Although laparoscopic rectal surgery has been accepted by accumulated evidence, it remains technically difficult in patients with obesity, a narrow male pelvis, or bulky tumors. Recent large-scale randomized controlled trials (RCTs), such as COREAN and COLOR II, showed favorable outcomes of laparoscopic rectal surgery compared to open rectal surgery (2,3), although the results of other recent RCTs, such as ACOSOG Z6051 and ALaCaRT, were controversial (4,5).

Recent studies have reported that surgical difficulties are affected not only by surgeon's skill but also by the patient's clinical and anatomical factors. However, the objective numerical rating indexes to help surgeons assess the estimated surgical difficulty are not developed yet. Escal *et al.* recently conducted a retrospective study aimed to evaluate the predictability of clinical and MRI-based anatomical factors for surgical difficulty in rectal surgery (6). In their cohort, 164 patients were categorized into the two groups based on the surgical difficulty criteria: low risk group (n=143, 87.2%) and high-risk group (n=21, 12.8%). To measure the surgical difficulty grading, they chose six factors: operation time, intraoperative blood loss, conversion to open surgery, transanal approach added to transabdominal TME, length of hospital stay, and postoperative morbidity. They employed multivariable logistic regression analysis, and found that body mass index (BMI) (>30 kg/m^2), coloanal anastomosis (*vs.* colorectal anastomosis), intertuberous distance (<10.1 cm), and mesorectal fat area (>20.7 cm^2) were significantly associated with a high grade of surgical difficulty. Finally, they proposed a four-item predictive score model in which each variable was scored 0 (absence) or 1 (presence). If patients have a score of 3 or more, they are considered to be at high risk of surgical difficulty. This study demonstrates that a combination of risk factors could affect the surgical difficulty of TME. This novel model could be useful for surgeons to predict the surgical difficulty of rectal surgery related to their experience and skill. The presence of some factors, including BMI, intertuberous distance, and mesorectal fat area, could reduce the pelvic space. Such limited space could cause insufficient counter traction, leading to an unfeasible operation. These results suggest that surgical space and counter traction are significantly related to the surgical difficulty of TME.

High BMI, gender, low tumor location, tumor size, dimensions of the pelvic anatomy have been reported to be predictive factors associated with surgical difficulty. BMI is the most standard factor to evaluate the total body fat. Denost *et al.* analyzed the impact of BMI by classifying into 4 groups (i.e., BMI <20, 20–25, 25–30, and ≥30), and found that BMI influenced the conversion rate but not TME quality, surgical morbidity and long-term survival (7). Akagi *et al.* evaluated the surgical difficulty of laparoscopic low anterior resection by assessing short-term outcomes (operation time, operative blood loss and postoperative morbidity). Multivariate analysis showed that T factor

was correlated with operation time, while a high BMI (>25 kg/m^2) was correlated with operative blood loss (8). Leonard *et al.* analyzed the factors predicting poor TME quality in the context of PROCARE, a Belgian multidisciplinary project on rectal cancer. By multivariate analysis, they identified BMI, absence of down-staging after long-course chemoradiotherapy (CRT), and laparoscopic resection were independently associated with poor TME quality (9). Meanwhile, Chen *et al.* reported that visceral fat area (VFA) was a better parameter to predict the effect of visceral obesity on TME quality and surgical difficulty in laparoscopic TME, although BMI did not reflect the impact of obesity (10). Taken together, some reports indicate that BMI is the better factor to predict surgical outcome, whereas other reports indicate that VFA is a better predictor.

The anatomical parameters, such as prominence of sacral promontory, size of the pelvis, and degree of sacral curve, can be correlated with surgical difficulty. High-resolution MRI has a high accuracy to predict the status of circumferential resection margin (CRM), extramural vascular invasion, and the pre-treatment tumor staging, which can be used for planning the treatment strategy (11,12). The MERCURY (Magnetic Resonance Imaging and Rectal Cancer European Equivalence) study showed intense association between MRI findings and histopathological findings (e.g., depth of tumor invasion and involvement of CRM) (13,14). In addition, MRI pelvimetry can be used to predict the surgical difficulty during TME dissection.

Concerning the MRI pelvimetry, various dimensions of the bony pelvis are reported to be important to evaluate the breadth and depth of the pelvis; anteroposterior (AP) measurements and transverse measurements (15-17). In general, operation time, operative blood loss, TME quality, and postoperative morbidity were chosen as the primary measures of surgical difficulty. In previous studies, many pelvic parameters have been applied to predict their effects on surgical difficulty; however, the results are inconsistent.

Regarding the association between pelvic anatomy and TME quality, Fernández Ananín *et al.* analyzed whether MRI-based pelvic anatomy and tumor characteristics could influence the TME quality of laparoscopic rectal surgery in a prospective study of 64 patients. Multivariate analysis indicated that promontorium-subsacrum angle was the only independent predictor of CRM status (18). Kim *et al.* analyzed the factors related to the pelvic dissection time of laparoscopic TME surgery in a prospective study of 74 patients. Multivariate analysis suggested that narrow intertuberous diameter, long sacral length, and shallow sacral angle on MRI images were significantly associated with longer pelvic dissection time, but not with increased postoperative complications (19). Chen *et al.* retrospectively analyzed the factors contributing to the surgical difficulty of laparoscopic low anterior resection with 199 rectal cancer patients (20). Data of 155 patients from one surgeon indicated that prior abdominal surgery, preoperative CRT, low tumor location, interspinous distance and BMI were significantly associated with operation time. Importantly, the model built for the operation time could demonstrate good predictability for 44 patients from the other surgeon. Li *et al.* have recently analyzed the factors influencing surgical difficulty of laparoscopic abdominoperineal resection with 117 patients (21). Multivariate analysis identified BMI, interspinous distance, tumor location, prior abdominal surgery, preoperative CRT and concurrent disease (hypertension and/or diabetes mellitus) were predictors for operation time, that age and concurrent disease were factors related to blood loss, and that BMI was the only predictor for postoperative morbidity.

The evidence of a subgroup of patients with an increased surgical difficulty has intense interest concerning alternative methods for dissection of the lower rectum, such as the robotic approach or transanal approach. Robotic surgery has the potential to overcome the surgical difficulty due to its technical advantages over laparoscopic surgery. Gorgun *et al.* compared the robotic surgery with the laparoscopic surgery in obese patients, and found that robotic surgery exhibited short-term outcomes similar to laparoscopic surgery, but accelerated postoperative recovery (22). Baek *et al.* evaluated the surgical difficulty of 182 robotic rectal surgeries between difficult, moderate and easy groups classified based on MRI-based pelvimetry (23). Retrospective analysis indicated that high BMI, lower tumor level, and preoperative CRT were significantly associated with longer operation time, but the pelvimetric parameters was not, which suggest that the robotic surgery may overcome the difficulties associated with pelvic anatomy. Ferko *et al.* recently reported that a CT/MRI pelvimetric parameter (i.e., the angle between the symphysis longitudinal axis and the line from the symphysis to the promontory) was correlated to the TME quality. They also proposed a new model to preoperatively choose the patients suitable for transanal TME (24).

In conclusion, the studies dealing with the prediction of the surgical difficulty have provided inconsistent results.

This may be the result of small sample size and the different scoring system of surgical difficulty. Larger and comparative studies are needed to draw the definitive conclusion in the matter.

Acknowledgments

Funding: None.

Footnote

Provenance and Peer Review: This article was commissioned by the editorial office, *Annals of Laparoscopic and Endoscopic Surgery*. The article did not undergo external peer review.

Conflicts of Interest: Both authors have completed the ICMJE uniform disclosure form (available at http://dx.doi.org/10.21037/ales.2018.04.09). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

References

1. Heald RJ, Husband EM, Ryall RD. The mesorectum in rectal cancer surgery--the clue to pelvic recurrence? Br J Surg 1982;69:613-6.
2. Bonjer HJ, Deijen CL, Abis GA, et al. A randomized trial of laparoscopic versus open surgery for rectal cancer. N Engl J Med 2015;372:1324-32.
3. Jeong SY, Park JW, Nam BH, et al. Open versus laparoscopic surgery for mid-rectal or low-rectal cancer after neoadjuvant chemoradiotherapy (COREAN trial): survival outcomes of an open-label, non-inferiority, randomised controlled trial. Lancet Oncol 2014;15:767-74.
4. Fleshman J, Branda M, Sargent DJ, et al. Effect of Laparoscopic-Assisted Resection vs Open Resection of Stage II or III Rectal Cancer on Pathologic Outcomes: The ACOSOG Z6051 Randomized Clinical Trial. JAMA 2015;314:1346-55.
5. Stevenson AR, Solomon MJ, Lumley JW, et al. Effect of Laparoscopic-Assisted Resection vs Open Resection on Pathological Outcomes in Rectal Cancer: The ALaCaRT Randomized Clinical Trial. JAMA 2015;314:1356-63.
6. Escal L, Nougaret S, Guiu B, et al. MRI-based score to predict surgical difficulty in patients with rectal cancer. Br J Surg 2018;105:140-6.
7. Denost Q, Quintane L, Buscail E, et al. Short- and long-term impact of body mass index on laparoscopic rectal cancer surgery. Colorectal Dis 2013;15:463-9.
8. Akagi T, Inomata M, Etoh T, et al. Multivariate evaluation of the technical difficulties in performing laparoscopic anterior resection for rectal cancer. Surg Laparosc Endosc Percutan Tech 2012;22:52-7.
9. Leonard D, Penninckx F, Fieuws S, et al. Factors predicting the quality of total mesorectal excision for rectal cancer. Ann Surg 2010;252:982-8.
10. Chen B, Zhang Y, Zhao S, et al. The impact of general/visceral obesity on completion of mesorectum and perioperative outcomes of laparoscopic TME for rectal cancer: A STARD-compliant article. Medicine (Baltimore) 2016;95:e4462.
11. Glimelius B, Tiret E, Cervantes A, et al. Rectal cancer: ESMO Clinical Practice Guidelines for diagnosis, treatment and follow-up. Ann Oncol 2013;24 Suppl 6:vi81-8.
12. São Julião GP, Habr-Gama A, Vailati BB, et al. The good, the bad and the ugly: rectal cancers in the twenty-first century. Tech Coloproctol 2017;21:573-5.
13. Taylor FG, Quirke P, Heald RJ, et al. One millimetre is the safe cut-off for magnetic resonance imaging prediction of surgical margin status in rectal cancer. Br J Surg 2011;98:872-9.
14. Taylor FG, Quirke P, Heald RJ, et al. Preoperative high-resolution magnetic resonance imaging can identify good prognosis stage I, II, and III rectal cancer best managed by surgery alone: a prospective, multicenter, European study. Ann Surg 2011;253:711-9.
15. Killeen T, Banerjee S, Vijay V, et al. Magnetic resonance (MR) pelvimetry as a predictor of difficulty in laparoscopic operations for rectal cancer. Surg Endosc 2010;24:2974-9.
16. Salerno G, Daniels IR, Brown G, et al. Magnetic resonance imaging pelvimetry in 186 patients with rectal

cancer confirms an overlap in pelvic size between males and females. Colorectal Dis 2006;8:772-6.
17. Boyle KM, Petty D, Chalmers AG, et al. MRI assessment of the bony pelvis may help predict resectability of rectal cancer. Colorectal Dis 2005;7:232-40.
18. Fernández Ananín S, Targarona EM, Martinez C, et al. Predicting the pathological features of the mesorectum before the laparoscopic approach to rectal cancer. Surg Endosc 2014;28:3458-66.
19. Kim JY, Kim YW, Kim NK, et al. Pelvic anatomy as a factor in laparoscopic rectal surgery: a prospective study. Surg Laparosc Endosc Percutan Tech 2011;21:334-9.
20. Chen W, Li Q, Fan Y, et al. Factors Predicting Difficulty of Laparoscopic Low Anterior Resection for Rectal Cancer with Total Mesorectal Excision and Double Stapling Technique. PLoS One 2016;11:e0151773.
21. Li Q, Li D, Jiang L, et al. Factors Influencing Difficulty of Laparoscopic Abdominoperineal Resection for Ultra-Low Rectal Cancer. Surg Laparosc Endosc Percutan Tech 2017;27:104-9.
22. Gorgun E, Ozben V, Costedio M, et al. Robotic versus conventional laparoscopic rectal cancer surgery in obese patients. Colorectal Dis 2016;18:1063-71.
23. Baek SJ, Kim CH, Cho MS, et al. Robotic surgery for rectal cancer can overcome difficulties associated with pelvic anatomy. Surg Endosc 2015;29:1419-24.
24. Ferko A, Malý O, Örhalmi J, et al. CT/MRI pelvimetry as a useful tool when selecting patients with rectal cancer for transanal total mesorectal excision. Surg Endosc 2016;30:1164-71.

doi: 10.21037/ales.2018.04.09
Cite this article as: Kawada K, Sakai Y. Can we predict surgical difficulty of rectal surgery? Ann Laparosc Endosc Surg 2018;3:44.

