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REVIEW

Laparoscopic or Robotic Rectal Cancer Surgery: Where are We Right Now?

Laparoskopik ya da Robotik Rektal Kanser Cerrahisi: Şu Anda Hangi Noktadayız?

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ABSTRACT

Paradigms in rectal cancer surgery have shifted toward minimally invasive techniques in conjunction with the use of chemoradiation. Although laparoscopy is widely used for rectal tumors, debate continues as to whether it is capable of replacing open surgery. Robotic surgery has become a well-known technique that addresses the restrictions of the rigid laparoscopic instruments, but it is also associated with higher costs and longer operative time. Therefore, as the surgical community strives to benefit from minimally invasive surgery, there is still no consensus regarding which method, laparoscopic or robotic, should be offered to the patients. The more widespread use of robotic systems in rectal cancer surgery primarily depends on competitive pricing and increased experience, along with the adaptation to transanal techniques.
Keywords: Rectal cancer, robotic, laparoscopic, robotic surgery

ÖZ

Rektal kanser cerrahisinde yaşanan değişimler minimal invaziv cerrahi ve kemoradyoterapinin yaygınlaşmasını destekler nitelikte gelişim göstermektedir. Laparoskopi her ne kadar rektum kanseri tedavisinde yaygın olarak kullanılsa da açık cerrahinin yerini alıp alamayacağı halen daha bir tartışma konusu olmaya devam etmektedir. Robotik cerrahi ise bu noktada laparoskopinin bazı eksik noktalarını geliştirmeyi hedef alan bir metod olarak ortaya çıkmış ve günümüzde artık bilinen ve kullanılan bir teknik haline gelmiştir. Ancak laparoskopiye kıyasla artmış ekonomik yük ve daha uzun cerrahi süresi robotik cerrahinin yaygınlaşmasının önündeki en büyük engeller olarak göze çarpmaktadır. Bu nedenle rektum kanseri tedavisinde minimal invaziv cerrahinin meziyetlerinden yararlanmak isteyen cerrahi dünyası halen daha robotik veya laparoskopik cerrahinin kullanımında bir mutabakata varamamıştır. Robotik cerrahinin yaygınlaşması şu an için öncelikle robotik cerrahi sektöründeki rekabete ve bu konuda artan bilgi birikimine, sonrasında ise yeni gelişen transanal cerrahi tekniklerine adaptasyonuna bağlıdır.
Anahtar Kelimeler: Rektal kanser, robotik, laparoskopik, robotik cerrahi

Introduction

Following the technologic and methodologic advances, surgical disciplines have witnessed substantial changes in the management of rectal cancer surgery within the last three decades. Introduction of total mesorectal excision and chemoradiation had a considerable impact on survival rates. Performing a complete resection of rectum and mesorectum necessitates a meticulous dissection within the embryologic planes, where rectum is closely located to vital vessels, nerves and adjacent organs. Since its first definition in 1982 by Heald et al.,[1] total mesorectal excision has become the mainstay of the treatment in rectal cancer surgery. Implementation of laparoscopy ignited a global curiosity toward minimizing the overall trauma while sustaining the oncologic principles of the rectal cancer surgery. Transition to minimally invasive surgery has provided substantial advantages over conventional laparotomy by decreasing postoperative pain, length of hospital stay and intraoperative blood loss.[2] Nevertheless, complete adoption of novel techniques has always been a challenging progress, since most of the surgeons experience certain drawbacks due to technical difficulties. First reports pointed to various merits

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of laparoscopic surgery, and it has gained broader popularity after the comparison of open versus laparoscopic surgery for mid or low Rectal cancer After Neoadjuvant (COREAN) chemoradiotherapy and Colon carcinoma Laparoscopic or Open Resection (COLOR II) randomized controlled trials, in which authors compared open and laparoscopic rectal cancer surgery.[3,4] Initially, Medical Research Council CLASICC trial assessed laparoscopy against open surgery for both colon and rectal etiologies and their result supported the use of laparoscopy since it was as effective as open surgery.[5] The COLOR II trial addressed the same comparison in which they compared 699 laparoscopic cases to 345 open rectal cancer surgeries. They stated that laparoscopic surgery had less blood loss during the surgery (median 200 vs. 400 mL), earlier recovery of bowel function (2 days vs. 3 days), and shorter hospital stay (8 days vs. 9 days) whereas operation time was longer in the laparoscopic group (240 minutes vs. 180 minutes). Similarly, the COREAN trial included 340 patients dispersed in 1:1 fashion to open and laparoscopic arms, and the authors stated that three-year survival rates did not differ between both groups. These two studies granted a more extensive appliance for the laparoscopic technique in selected patients with rectal cancer. On the other hand, more recent Australasian Laparoscopic Cancer of the Rectum Trial (ALaCaRT) and American College of Surgeons Oncology Group (ACOSOG) Z6051 trials failed to reproduce similar results and failed to show noninferiority of the laparoscopic technique against laparotomy.[6,7] The ALaCaRT study randomized 238 laparoscopic cases and 235 open cases to evaluate whether the laparoscopic approach is sound in oncological basis and they concluded that even though laparoscopic surgery offers an increased quality of surgery, its role in the rectal cancer surgery still cannot be standardized. In conclusion, there seems to be skepticism about the laparoscopic surgery and its long-term oncologic outcomes in rectal cancer as both ACOSOG and ALaCaRT studies present early pathologic results, but increased quality of life after surgery remains as a huge attraction. All of these limitations have led to further discoveries to enhance the minimally invasive surgery, especially the instrumentation-related restrictions. At this standpoint, robotic surgery has emerged as an alternative for the laparoscopy, by providing three-dimensional and high definition vision, increased articulation by endo-wristed equipment, enhanced surgeon comfort and stable retraction. Adorned with an increased range of motion and wrist-like movements, robotic surgery is thought to be superior to laparoscopy especially in male and obese patients, where surgical exposition of the deep pelvis is more strenuous in these patients.[8] Robotic surgery can overcome the difficulties of the inline, rigid instruments of the laparoscopy to perform total mesorectal excision, and has potential to confer advantages in terms of oncological safety. Early studies indicated fewer complications, earlier recoveries, lower visual analog scale scores and most significantly fewer conversions to open surgery compared to laparoscopy.[9,10,11,12,13,14] Kang et al.[15] analyzed the outcomes of the robotic, laparoscopic and open surgery in a propensity score case-matched patient population for rectal cancer, and concluded that the robotic surgery is associated with earlier soft diet resumption, lower visual analog scale scores and shorter length of stay than laparoscopic surgery, as well as less voiding problems and circumferential resection margin involvement. Furthermore, Memon et al.[16] compared robotic surgery and laparoscopic surgery in their meta-analysis, and stated that conversion rate was significantly lower in robotic group. Eventually, robotic surgery was correlated with lower conversion rates to open in these nonrandomized studies, as one might expect, since dissection in the deep pelvis was more comfortable than that of laparoscopy with endo-wristed equipment. Besides its virtues, concerns have been raised about robotic surgery due to worse financial outcomes and longer operative times than laparoscopy.[17] There is a vast preponderance of reports in the literature indicating the cost of robotic surgery is higher than other methods in the rectal cancer surgery, which makes a technique inevitably "financially vain" since money is a variable that attains great importance. The prolonged operative time, thought to be one of the contributors of the higher costs, is also a drawback for the surgeons, although robotic surgery offers better ergonomics. Therefore robotic surgery contains some essential problems, and these problems are yet to be addressed. Most concrete evidence in robotic surgery has appeared in late 2017, an eagerly awaited study Robotic versus Laparoscopic Resection for Rectal Cancer (ROLARR) randomized trial assessed the implementation of da Vinci robotic platform (Intuitive Inc. Sunnyvale, CA). Two hundred and thirty-seven robotic-assisted cases were compared with 234 laparoscopic counterparts.[18] They reported no difference concerning conversion to open, circumferential resection margin positivity, intraoperative complications, postoperative complications and quality of life parameters (bladder dysfunction, sexual dysfunction). In conjunction with longer operative time, as expected, economic outcomes of the robotic surgery were significantly worse than laparoscopy, by adding an average of 1132$ per patient.[18] Nevertheless, the ROLARR trial still implies that robotic surgery can be beneficial in male patients. Furthermore, minimally invasive surgery was tailored to give rise to single-incision surgery and natural orifice transanal endolumenal surgery, where the invasiveness is even more minimized. Decreasing the port numbers and using natural orifices as introduction sites subsequently increased the cosmetic outcomes, but brought technical

challenges due to crowding especially with the inline, rigid instruments of the laparoscopy. With combination of these two techniques, a new "bottom-to-up" transanal total mesorectal excision technique has been proposed to aim low lying rectal lesions, where transabdominal approaches fail to provide an optimal exposure.[19] Features of the robotics are magnified in this transanal technique, since the breadth is narrower than the abdomen and high maneuverability is extremely warranted.[20,21,22] Even though the transanal total mesorectal excision is itself a new entity, robotics carry potential to create a new facet for this technique after careful vetting. In conclusion, robotic technology brings ample opportunities to develop and modify the surgical experience, but further investigations are warranted to reveal its possible advantages. For now, the touted features of the robotic surgery are not enough to justify the global use of robotics in light of its financial burden. Future of the robotic surgery depends on the competition in the market, which would decrease the per capita costs and provide better economic results. As technology advances to produce novel robotic systems and as new generation surgeons utilize these robots more efficiently, we may rationalize the implementation of robotic platforms in the colorectal surgery settings.

Ethics

Peer-review: Internally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: E.G., Concept: T.B.C., E.G., Design: T.B.C., E.G., Data Collection or Processing: T.B.C., E.G., Analysis or Interpretation: T.B.C., E.G., Literature Search: T.B.C., E.G., Writing: T.B.C., E.G.

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