Optimising the TME Dissection during Robotic Low Anterior Resection with Three New Instruments

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ABSTRACT

A key oncological principle of rectal cancer surgery is en bloc removal of the rectum and mesorectum around the avascular fascia propria; in other words, a total mesorectal dissection. To appreciate this avascular plane, broad traction and countertraction are needed. While retractors, such as St. Mark's retractor, exist for open surgeries, there are currently no such retractors for minimally invasive approaches. In this video, we describe 3 atraumatic retractors that we have developed to optimize robotic total mesorectal excision dissection.

Keywords: Rectal neoplasm; Robotic surgical procedures; Proctectomy

The last few decades have seen dramatic advances in minimally invasive approaches in the field of colorectal surgery. Five landmark randomized controlled trials (CLASSIC, COLOR II, COREAN, ASOSOG, and ALaCART) were unable to show that the laparoscopic approach is better than the open approach for rectal cancer, which remains the gold standard [1-5]. Robotic rectal surgery using a platform such as the Da Vinci-Xi system™ (Intuitive Surgical, Sunnyvale, CA, USA) has been proposed to improve the laparoscopic approach, with better 3-dimensional visualization, 7 degrees of motion (as opposed to 4 degrees), fluidity of motion that allows precise dissection, minimization of tremor transmission, and ability to control 4 robotic arms. In a comparison of the robotic versus laparoscopic approach, the ROLARR trial showed no difference in conversion rate, circumferential resection margin involvement, complication rate, and survival [6,7]. However, in a large propensity-matched study, robotic surgery was a good prognostic factor for overall survival and cancer-specific survival [8].

The key principle of rectal cancer surgery is en bloc removal of the rectum and the accompanying mesorectum along the avascular plane, as described by Heald [9]. Circumferential dissection around the fascia propria is performed, anteriorly dissecting through Denonvillier’s fascia (Fig. 1). Care is taken during dissection to preserve the laterally lying pelvic plexus. At the level of the sacral promontory, the hypogastric nerves are located posteriorly and must be preserved. This dissection is called total mesorectal excision (TME).

Technical challenges associated with rectal cancer surgery are anatomical and include a narrow pelvis (male narrower than females), which becomes narrower, and the mesorectum, which becomes thinner as you approach the pelvic floor. The quality of TME dissection is
measured by the ability to dissect the mesorectum without breaching through the fascia propria. In order to perform high-quality TME dissection with intact fascia propria, adequate visualization of the avascular plane from multiple angles is facilitated by broad traction and countertraction. The countertraction is provided by peripheral anatomical attachments, such as the lateral wall and presacral fascia. During open TME dissection, broad retraction is usually provided by St. Mark’s retractor (Fig. 2).

In robotic colorectal surgery, there are no available retractors to date that can provide such retraction. The instruments available for the Da Vinci-Xi system (Intuitive Surgical) are usually too short to provide adequately broad retraction. Of all the EndoWrist™ instruments, the fenestrated bipolar forceps, Cadiere forceps, and tip-up fenestrated graspers are generally the longest and most widely used for retraction. In this article, we describe 3 instruments that we developed at the Korea University Anam Hospital. They are easy to operate at the time of operation using the available equipment in the operating room. A Supplementary Video 1 shows these instruments in use during the robotic low anterior resection.
The first instrument is a large gauze, which is folded and wrapped around a k-wire (Fig. 3). A large gauze is folded into a rectangular shape, and the peripheral edges are stitched with silk sutures. The k-wire provides rigidity and, along with the soft texture of the gauze, provides a broad atraumatic retraction, which is especially helpful in medial to lateral dissection of the descending colon mesocolon (Fig. 4). Because of its shape and rigidity, we have called it ‘Jook-bu-in’ (meaning ‘bamboo pillow’ in Korean). After the inferior mesenteric artery and vein are transected, the ‘Jook-bu-in’ is inserted medially and held in place by a single robotic grasper. This allows broad traction and countertraction, and also frees up 2 robotic arms (Maryland on the left hand and dissecting scissors on the right hand) to allow medial to lateral dissection to be extended superiorly toward the splenic flexure and inferiorly toward the pelvic inlet.

The second instrument is a simple gauze folded and then stitched into a rectangular shape (Fig. 5). The folded gauze is stitched using a simple running suture on the periphery. Due to its shape, we call it ‘Bae-gae’ (meaning ‘pillow’ in Korean) at our institution. The ‘Bae-gae’ is used to broadly retract the rectum/mesorectum and be moved around during TME dissection (Fig. 6). The ‘Bae-gae’ and ‘Jook-bu-in’ are inserted through the 12-mm robotic port in the right iliac fossa at the start of the operation, before the robot is docked.
The final instrument provides continuously adjusted traction on the divided end of the right lateral peritoneum of the rectum. At the start of the TME dissection, the groove between the arch of the inferior mesenteric artery and sacral promontory was dissected. The right lateral peritoneal attachment of the mesentery of the rectosigmoid junction is observed, and the avascular space TME space is entered. A traction device, fashioned from a sterile rubber band folded onto itself, is stitched at one end to the divided right lateral peritoneal edge (Fig. 7). The other end of the rubber band is secured to another silk tie and pulled anteriorly through the anterior abdominal wall (Fig. 8). As the dissection down the TME plane continues inferiorly, the anterior silk tie can be pulled up and secured to the anterior abdominal wall with artery forceps. The elasticity of the rubber band ensures that the pull on the peritoneal edge is not too strong to avulse the peritoneal edge, and lax enough to result in inadequate traction. Due to its shape, it has been called ‘Nabi’ (meaning ‘butterfly’ in Korean) at our institution. The ‘Nabi’ and the ‘Bae-gae’ are used together to optimize TME dissection (Fig. 9). The ‘Nabi’
Robotic surgery offers an optimized 3-dimensional view and maneuverability of articulating instruments. We believe that traction/countertraction will provide optimization of TME dissection with the 3 aforementioned instruments. The 3 instruments allow the surgeon to provide the required traction/countertraction without assistance.
SUPPLEMENTARY MATERIAL

Supplementary Video 1
New helpful instruments during robotic low anterior resection.

Click here to view

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Fig. 9. ‘Nabi’ and ‘Bae-gae’ used to provide broad traction/countertraction during total mesorectal excision dissection.
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