

Robotic NICE Procedure Using Handsewn Technique

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INTRODUCTION: In 2018, we described a robotic natural orifice-assisted left-sided colorectal resection with intracorporeal anastomosis and transrectal extraction of the specimen and termed it the natural orifice intracorporeal anastomosis with transrectal extraction procedure. More recently, we have explored the feasibility, safety, and utility of performing total handsewn intracorporeal anastomosis. We present a technical video and initial experience depicting the unique steps to accomplish this procedure with colorectal end-to-end handsewn anastomosis.

TECHNIQUE: Twenty natural orifice intracorporeal anastomosis with transrectal extraction procedures with end-to-end handsewn intracorporeal anastomosis were performed. A video depicting the essential steps with 2 variations of the handsewn techniques is presented along with short-term outcomes.

RESULTS: The most common indication was complicated diverticulitis followed by rectal cancer and deep infiltrative endometriosis of the rectum. The mean operative time was 235 minutes (99–294 min), and there were no intraoperative complications or conversions.

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Handsewn end-to-end intracorporeal anastomosis was successful in all patients. Natural orifice transrectal extraction was successful in 17 of 20 (85%) patients. The mean postoperative length of stay was 2.1 days (± 1.05 SD). There were 3 major complications. One patient developed a deep surgical site infection, and another patient had an organ space abscess. Both patients required readmission and were treated with antibiotics alone. One patient, who had a diverting ileostomy performed at the time of the index procedure, developed subclinical dehiscence of the anastomosis, which healed without intervention but resulted in a delay in ileostomy reversal. There were no additional readmissions and no reoperations or mortalities.

CONCLUSIONS: Robotic natural orifice intracorporeal anastomosis with transrectal extraction procedure and colorectal end-to-end handsewn anastomosis was feasible and safe in this initial series. This technique can be successfully performed in a total intracorporeal manner without the need for an abdominal wall extraction incision or any circular stapling devices.

KEY WORDS: Handsewn anastomosis; Intracorporeal anastomosis; Minimally invasive surgery; Natural orifice; Natural orifice IntraCorporeal anastomosis with transrectal Extraction procedure; Robotic low anterior resection.

Minimally invasive colorectal resection using natural orifice transrectal extraction and intracorporeal anastomosis (ICA) was first described in 1993.¹ Avoidance of an abdominal wall extraction incision as well as completion of ICA has been shown to offer numerous patient benefits,^{2–8} with reports of less pain, lower opioid requirements, reduced surgical site infection rates, and elimination of hernia formation. However, it is estimated that less than 1% of elective colorectal resections in the United States are performed in this manner, mainly because of technical challenges. In 2018, we described the Natural orifice IntraCorporeal anastomosis with transrectal Extraction (NICE) procedure.⁴ During this technique, we

resect and extract the specimen transrectally and then perform an end-to-end colorectal anastomosis using the circular stapler. We place a pursestring suture to secure the anvil to the proximal colon and a second pursestring around the rectal cuff to close it about the spike of the stapler. In this manner, we avoid crossing staple lines at the anastomosis. More recently, we have explored the feasibility, safety, and utility of performing total handsewn ICA without using any stapler devices for benign disease and without using a circular stapler in malignant disease. Our aim is to present a technical video depicting the unique steps to accomplish the NICE procedure with a colorectal end-to-end handsewn anastomosis as well as display our initial outcomes. See **Video** at <http://links.lww.com/DCR/B935>.



TECHNIQUE

Technique for Benign Disease

For benign disease, we use three 8-mm robotic ports and a 5-mm AirSeal port (Optiview, Inc., Jacksonville, FL) as depicted in Figure 1. We do not need to use the linear stapler in these cases; therefore, we avoid not only an extraction incision but also the use of a 12-mm port, thus reducing the risk of a Richter hernia. The patient is positioned with an 8-degree left side elevation and 18 to 20 degrees of Trendelenburg, and the robot is docked. We perform a previously described lateral to medial mesenteric sparing approach.^{5,6} In brief, we begin the dissection by incising the white line of Toldt along the left colon and exposing the paracolic gutter by retracting on the colonic mesentery. We then proceed with splenic flexure take-down when performed. We turn our attention to the pelvis and release the lateral attachments along the intersigmoid

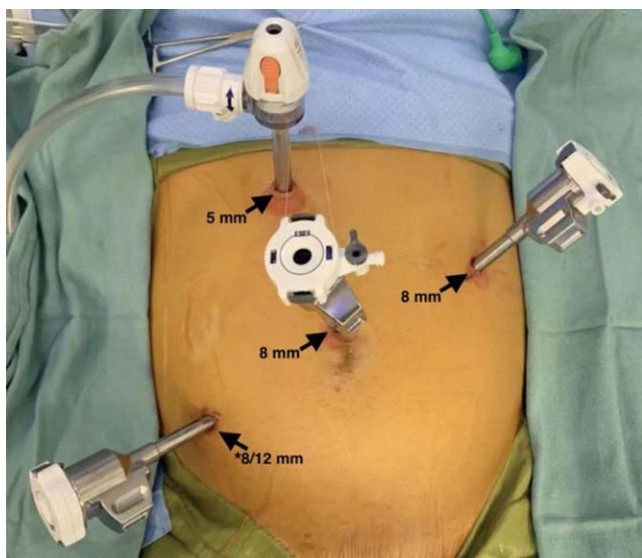


FIGURE 1. Port placement. *Right lower quadrant 8-mm port in benign disease and 12-mm port in malignant disease for the use of a robotic linear stapler.

fold and then divide the right and left rectal reflection as well as the anterior reflection to release all the peritoneal attachments. We then choose our proximal line of resection and divide the colon using the vessel sealer extend with a minimal use of energy. We then perform a mesenteric sparing dissection, staying close to the bowel and preserving the superior rectal artery. Dissection is carried to the distal level of resection in the rectum, which is then transected with the vessel sealer extend. Sizers are then passed through the rectal cuff followed by placement of the small Alexis wound retractor (Applied Medical, Rancho Santa Margarita, CA) and extraction of the specimen. The retractor is then removed in preparation for the end-to-end handsewn anastomosis.

Technique for Malignant Disease

For malignant disease, the port site configuration is the same as in benign disease, except that we use a 12-mm robotic port (instead of an 8-mm port) in the right lower quadrant to facilitate the use of a robotic stapler. We use the linear stapler to close and divide the specimen to avoid intra-abdominal contamination in the presence of malignant pathology. We perform a previously described medial to lateral approach with high ligation of the pedicle and oncologic lymph node dissection.⁴ Following the dissection and mobilization, we use the robotic linear stapler to divide the bowel at the proximal and distal levels of resection, thereby keeping the specimen intact. We then remove the staple line along the proximal colon and rectum, extract the specimen, and prepare for the handsewn ICA. In cases in which there is a concern for trauma to the rectum because of a bulky specimen, we complete the handsewn anastomosis and thereafter extract the specimen through a Pfannenstiel incision.

Colorectal Handsewn End-to-End Anastomosis

For the handsewn single layer end-to-end ICA, we present 2 techniques. In the first technique, we use two 6-inch and one 9-inch 3.0 V-Loc suture (V-Loc 180, Covidien, Mansfield, MA) on a v20 needle (Fig. 2). The first suture bite is taken in the posterior wall of the bowel in the midline, and once it is passed through the loop, a full-thickness running layer is completed in the left direction and then locked by taking a bite in the reverse direction. Similarly, the second 6-inch suture is placed in the posterior midline and a running layer is formed in the right-sided direction and then locked. The anterior wall of the anastomosis is completed by placing the 9-inch suture in the left lateral position at the level of the first locked suture and running it baseball style until the locked suture on the right is met. Any gaps are reinforced by placing interrupted 3.0 Vicryl sutures (Ethicon; Cincinnati, OH). For the second technique, only two 9-inch V-Loc sutures are used (Fig. 3). The first suture is placed in the posterior midline and run in a baseball style to the left. At the left lateral portion of the anastomosis, a transition bite is taken to change the direction of the suture bites to facilitate closure of the anterior

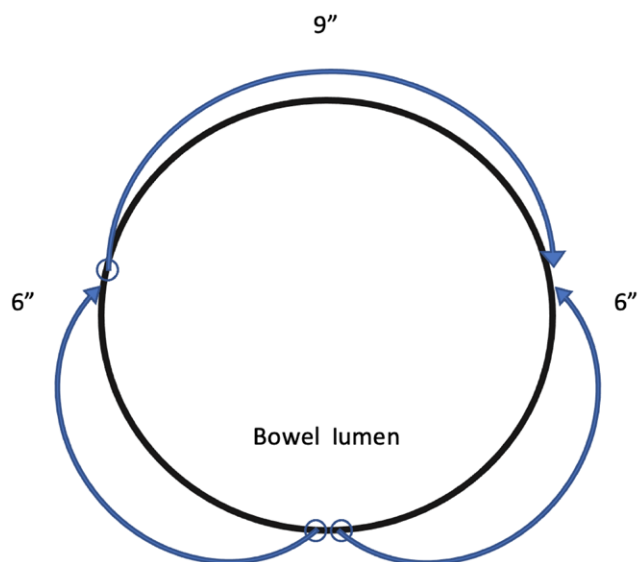


FIGURE 2. End-to-end handsewn colorectal anastomosis with 6-6-9 barbed suture technique.

wall. Once one-third of the anterior wall is closed, the second suture is secured in the posterior midline and run to the right and then transitioned along the anterior wall. The anterior portion of the anastomosis is completed by resuming the left-sided suture along the anterior layer to meet the right-sided suture. Reinforcing interrupted 3.0 Vicryl is then placed as indicated. We evaluate the integrity of the anastomosis with both direct endoscopic visualization as well as an air insufflation test.

RESULTS

We analyzed our results with an intention-to-treat analysis including all 20 patients. Intracorporeal handsewn anastomosis was successfully accomplished in all cases (100%).

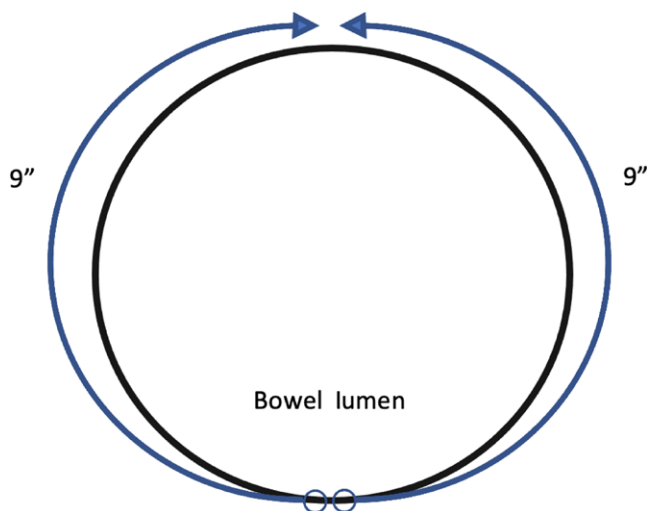


FIGURE 3. End-to-end handsewn colorectal anastomosis with 9-9 barbed suture technique.

TABLE 1. Demographic data on patients undergoing the NICE procedure and handsewn anastomosis

Variable	n = 20
Age, y, mean (range)	54 (32–81)
Sex, n	
Female	12
Male	8
BMI, kg/m ² , mean (range)	30.8 (20.2–57.9)
ASA classification, n (%)	
I	0 (0)
II	10 (50)
III	10 (50)
IV	0 (0)
Diagnosis, n (%)	
Diverticulitis	15 (75)
Cancer	3 (15)
Endometriosis	2 (10)

NICE = Natural orifice IntraCorporeal anastomosis and transrectal Extraction.

Natural orifice transrectal extraction was successfully achieved in 17 of 20 patients (85%). Three patients with malignant disease required a Pfannenstiel incision because of a bulky specimen that prevented extraction through the rectum. Twenty patients underwent the NICE procedure for complicated diverticulitis (75%), colorectal cancer (15%), and deep infiltrative endometriosis of the rectum (10%). The mean age was 54 years and most patients were female (60%). The mean BMI was 30.8 kg/m², and 50% of the patients were classified as ASA II and 50% as ASA III (Table 1). The mean operative time was 235 minutes (99–294 min) and mean estimated blood loss was 61 mL (15–200 mL). There were no intraoperative complications and no conversions. For patients with benign disease, bulky specimens necessitated intracorporeal shaving of the mesentery for safe transrectal extraction. A total of 5 patients underwent diverting loop ileostomy, all of whom underwent successful closure at a median of 9 weeks (Table 2). Malignant cases (15%) required an abdominal wall extraction incision because of bulky disease. The mean time to first flatus was 16.4 hours, and the mean hospital length of stay was 2.1 days (± 1.05 SD). There were of 3 complications. One patient developed a deep surgical site infection, and another patient had an organ space

TABLE 2. Intraoperative outcomes of patients undergoing the robotic NICE procedure with handsewn anastomosis

Variable	n = 20
Operative time, min, mean (range)	235 (99–294)
Estimated blood loss, mL, mean (range)	61 (15–200)
Splenic flexure takedown, n (%)	16 (80)
Intraoperative complications, n (%)	0 (0)
Loop ileostomy, n (%)	5 (25)
Time interval for ileostomy closure, wk, median	9
Thin mesentery, n (%)	6 (30)
Transrectal extraction, n (%)	17 (85)

NICE = Natural orifice IntraCorporeal anastomosis and transrectal Extraction.

TABLE 3. Postoperative outcomes of patients undergoing robotic NICE procedure and handsewn anastomosis

Variable	Value (n = 20)
Time to first flatus, h, mean (range)	16.4 (5–38)
Length of hospital stay, d, mean \pm SD	2.10 \pm 1.05
POD 1–2, n (%)	14 (73.7)
POD 2–3, n (%)	6 (26.3)
POD >3, n (%)	0 (0)
Major complication rate, n (%)	3 (15)
Postoperative ileus	0 (0)
Anastomotic dehiscence	1 (5)
Deep/organ space abscess	2 (10)
Readmission, n (%)	2 (10)
Reoperation, n (%)	0 (0)

NICE = Natural orifice IntraCorporeal anastomosis and transrectal Extraction; POD = postoperative day.

abscess. Both patients required readmission and were treated with antibiotics alone. The third patient, who had a diverting ileostomy performed at the time of the index procedure, developed subclinical dehiscence of the anastomosis, which healed without intervention but resulted in a delay in ileostomy reversal. There were no additional readmissions and no reoperations or mortalities (Table 3). Additionally, there were no reports of incontinence to gas or stool at the final postoperative follow-up.

CONCLUSION

We present our technique for an end-to-end handsewn colorectal anastomosis. The NICE procedure for benign and malignant disease can be successfully performed in a total intracorporeal manner without the need for any

circular stapling devices. Furthermore, it obviates the need for an abdominal wall extraction incision.

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