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Short-term Outcomes of Laparoscopic-assisted Anterior Perineal PlanE for Ultralow Anterior Resection for Low Rectal Cancer: A Single Center Experience

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Abstract

Background: The anterior perineal PlanE for ultra-low anterior resection (APPEAR) methodology was designed specifically for cases of extremely low rectal cancer. Its purpose is to aid with the removal of the most distant part of the rectum. This technique enables the maintenance of the sphincter and minimizes the necessity over abdominal resection (abdominoperineal resection) and permanent stomas.

Aim: Our study evaluated the surgical, short-term oncological and functional outcomes of laparoscopic-assisted APPEAR procedure.

Patients and methods: A prospective study was conducted on a cohort of 20 patients diagnosed with low rectal cancer, who were administered neoadjuvant chemoradiation. They underwent preoperative evaluation and were reevaluated for a median of 18-month postsurgery.

Results: Among the 20 studied cases, two (10%) patients showed a complete response after neoadjuvant chemotherapy, and eight (40%) cases had positive lymph node metastasis. The distal resection margin was less than 1 cm and 1–2 cm in seven (35%) and 13 (65%) of patients, respectively. Systemic recurrence was seen in one (5%) patient after 14 months of surgery who had been subjected to systemic chemotherapy. The functional outcome has been evaluated in 19 (95%) cases. The postoperative Wexner continence score was at a median of 6, and major low anterior resection syndrome was noticed in only two (10.52%) patients.

Conclusion: The laparoscopic-assisted APPEAR technique can be considered an alternative approach to provide good anal function and maintain oncologic safety, sphincter-preserving operations for patients with low-rectal cancer are comparable to other surgical procedures.

Keywords: Anterior perineal PlanE for ultra-low anterior resection technique, Low anterior resection, Rectal cancer, Sphincter-preserving operations

1. Introduction

Rectal cancer management has modified over time, moving from the liberal use of radical abdominoperineal resection (APR) to the current multimodal regimens and sphincter-saving techniques, which decline the necessity for APR and permanent stomas.^{1–3}

While oncologic cure remains the main objective of surgical treatment for rectal cancer, sphincter

function preservation and maintaining intestinal continuity are of utmost importance.² The ideal ultra-low anterior resection procedure therefore aims to achieve complete disease removal, performing a secure connection between the colon and anus while directly observing the procedure, and fully maintaining the functionality of the anal sphincter mechanism.⁴

Nevertheless, the limitations imposed by the traditional surgical method for low anterior

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resection can pose significant challenges in attaining a highly positioned anastomosis in numerous instances.^{4,5}

Consequently, multiple techniques have been developed to assist in maintaining the proper function of the sphincter and restoring the connection of the gastrointestinal tract.⁶

These methods consist of transanal procedures including transanal minimally invasive surgery and transanal total mesorectal excision, inter-sphincteric resection, conformal sphincteric resection, as well as the anterior perineal PlanE for ultra-low anterior resection (APPEAR) technique.^{3,4,7,8}

Each of these approaches has inherent limits, which include technical complexity, unsuitability for locally advanced situations, and, in the case of inter-sphincteric resection, an unavoidable compromise in preserving the sphincters to a tolerable extent.^{4,5,8,9}

The APPEAR technique was updated and published in a formal description in 2008 by Williams et al.⁴ and it has since been widely adopted. During the procedure, the most distal part of the rectum, which cannot be accessed through the abdomen through the pelvic floor muscles, is accessed by means of a crescentic incision made in the anterior perineum.^{4,5,10} The length of this segment of the rectum varies from 4 to 13 cm, named 'rectal no man's land'.¹¹

The objective of this study was to assess the surgery, short-term oncological, and functional results of the laparoscopic-assisted APPEAR technique.

2. Patients and methods

Ethical statement was approved by faculty in 2023.

This investigation was carried out on 20 patients between January 2021 and January 2023 using pelvic MRI, PET-CT, clinical evaluation, colonoscopy, and histological assessment. Rectal tumors up to T3N2M0 in stage were found 3–6 cm from the anal margin in the patients who were included. Every patient in the study had undergone long-course neoadjuvant chemoradiotherapy (nCRT), with a median follow-up of 8 weeks (with a range of 6–11 weeks) following nCRT. Every patient included in this investigation gave written, informed permission.

2.1. Operative procedures

Abdominal phase: out of the 20 cases, the procedure was completed laparoscopically in 19 patients. One case had been converted to the open conventional technique since rupture of the colic artery (LCA) was encountered and its laparoscopic control was not feasible. Following the achievement of closed

capnoperitoneum via veress needle, four ports were added, including one that was 10 mm above the umbilical level, a 12 mm port in the right iliac fossa, a 5 mm port along the left midclavicular line at the level of the umbilicus, and a 5 mm port along the right midclavicular line at the umbilical level. An extra 5 mm suprapubic assistant port was occasionally placed as needed (Fig. 1).

The inferior mesenteric artery, which splits after the left colic artery's first proximal branch (LCA) (Fig. 2), is low-ligated in order to preserve the left colic artery's ability to deliver blood to the marginal artery. Following the mobilization of the splenic flexure and the distal portion of the transverse colon, the left colon becomes freely mobilized and the full paracolic mobilization is completed (Fig. 3).

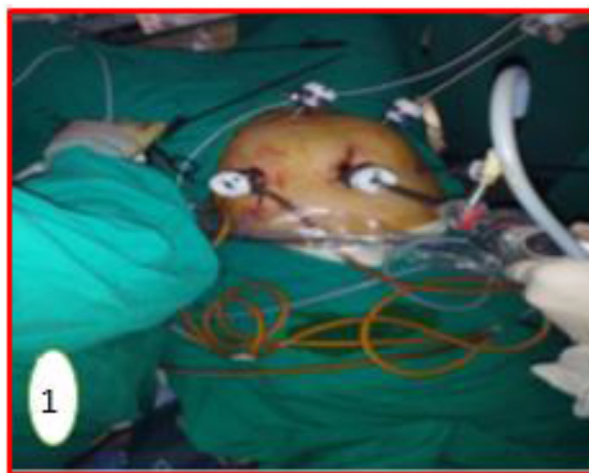


Fig. 1. Position of ports in one case when the extra fifth suprapubic port was needed to assist the mesorectal dissection.

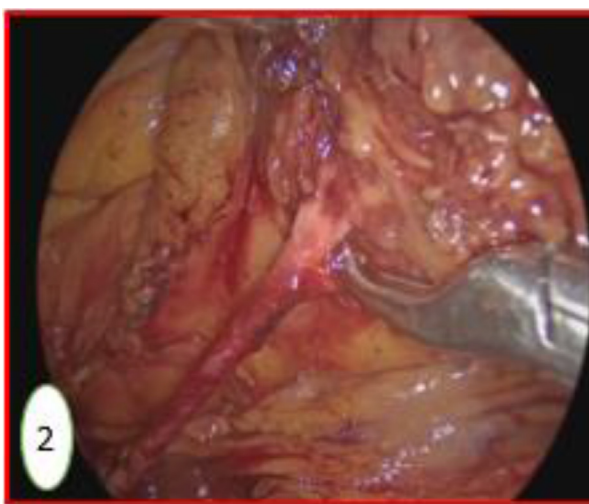


Fig. 2. Dissection of the IMA after its first proximal branch LCA. IMA, inferior mesenteric artery.

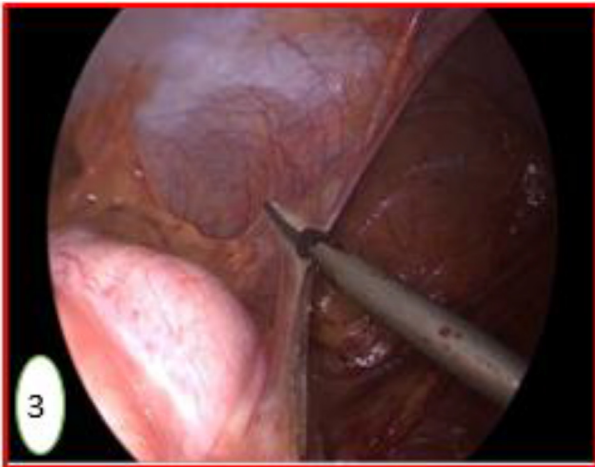


Fig. 3. Left paracolic dissection to complete left colon mobilization.

TME was performed by entering the fascial holy plane of Heald¹² with care toward preserving the autonomic nerves. The plane between the rectum and prostate/vagina was entered and dissected towards the pelvic floor.

Perineal phase: the technique outlined by Williams et al.⁴ was mostly employed. In the perineum, a convex crescentic skin incision of 12 cm was made (Fig. 4).

The transverse perineal muscles and external anal sphincter were carefully separated from the epidermis and subcutaneous tissue (Fig. 5). The urethrorectal muscle fibers were dissected. Up till the plane formed from above during the abdominal stage was reached, the dissection proceeded upward. After that, the puborectal muscle's medial fibers are separated and dissected from the rectum. Subsequently, a linear stapler was positioned



Fig. 5. Precise dissection, and complete preservation of the external anal sphincter.

slightly above the external anal sphincter plane across the rectum and then fired. The rectum is delivered out of the perineal wound (Fig. 6), and then a scalpel is used to transect the proximal end between two intestinal clamps. Afterward, after checking the donuts, the anastomosis is completed by inserting a 33-mm circular stapler into the anus (Figs. 7 and 8). The perineal wound is then closed.

The procedure is completed with re-establishing the capnoperitoneum for a drain insertion and the construction of a diversion ileostomy on the right side via one of the laparoscopic ports.

Following surgery, the patients were monitored for tumor recurrence at a median of 18 months (range, 9–32) using a computed tomography scan, tumor marker CEA, and clinical evaluation at 3, 6, 12, and 24 months. Following ileostomy closure, the



Fig. 4. A crescentic perineal skin incision between the anal orifice and the vagina.



Fig. 6. Delivery of the rectum through the perineal wound.



Fig. 7. Creating the colo-anal stapler anastomosis.



Fig. 8. Complete donuts of both resection ends.

low anterior resection syndrome (LARS) scores and the Wexner continence score were evaluated.

The quality of the specimen, quantity, and positivity of harvested lymph nodes, circumferential resection margin, and distal resection margin (DRM) of pathological specimens were all assessed (Fig. 9).

2.2. Statistical analysis

The computer was fed data, and IBM SPSS software package, version 20.0, was used for analysis (IBM Corp., Armonk, New York, USA). Numbers and percentages were used to describe the qualitative data. The distribution's normality was confirmed using the Kolmogorov–Smirnov test. The terms range (minimum and maximum), SD, average, median, and interquartile range were used to characterize quantitative data. At the 5% level, the



Fig. 9. Demonstration of the good quality of the TME specimen with intact mesorectal fascia.

results' significance was assessed. For nonparametric quantitative variables, the Wilcoxon test was utilized to compare two repeated measures.

3. Results

Table 1.

The mean age was 59.93 ± 9.30 SD, with a range of 32–69. Among the studied cases, there were six (30%) females. There were six (30%) patients with T2 tumors and 14 (70%) cases with T3, while the lymph nodes were found positive in 16 (80%) patients. All patients (100%) had undergone preoperative chemoradiotherapy. In six (30%), nine (45%), and five (25%) of the patients, the tumor's distance from the anal verge was 4, 5, and 6 cm, with a median of 4.8 cm (Table 2).

The mean operative time of the studied cases was 240.3 (± 33.29 SD) with a range of 195–310, and the

Table 1. Distribution of the cases under study based on baseline information.

Participated cases (N = 20)	
Age (years)	
Mean \pm SD	59.93 \pm 9.30
Range	32–69
Sex [n (%)]	
Male	14 (70)
Female	6 (30)
nCRT [n (%)]	
Yes	20 (100)
No	0
Tumor stage [n (%)]	
T2N+	6 (30)
T3N0	4 (10)
T3N+	10 (50)
Distance from AV [n (%)]	
4 cm	6 (30)
5 cm	9 (45)
6 cm	5 (25)

AV, anal verge; nCRT, neoadjuvant chemoradiation.

Table 2. Distribution of the studied cases according to operative data.

Participated cases (N = 20)		
Operative time (min)		
Range	195–310	
Mean ± SD	240.3 ± 33.29	
Estimated blood loss (ml)		
Range	90–350	
Mean ± SD	157.5 ± 56.72	
Covering stoma		
No stoma	n	%
Stoma	0	0
	20	100
Open or laparoscopic		
Laparoscopic	19	95
Open	1	5
Transfer to ICU		
ICU	7	35
Ward	13	65
Hospital stay (days)		
Range	6–20	
Mean ± SD	11.2 ± 3.53	

mean blood loss was 157.5 (± 56.72 SD) with a range of 90–350. All 20 (100%) cases underwent diverting ileostomies. The abdominal phase for 19 (95%) cases had been successfully completed laparoscopically, and only one patient initially was operated upon laparoscopically before conversion to conventional open laparotomy was deployed. Seven (35%) out of the 20 patients required postsurgical ICU admission and the mean hospital stay was 11.2 (± 3.53 SD) (Table 3).

Among the studied cases, intraoperative bleeding was encountered in a single case who ended up with the conversion to open method for proper control of the accidentally ruptured LCA during the dissection of the inferior mesenteric artery. And according to general complications, there were two (10%) patients who experienced chest infections, and one

Table 3. Distribution of the studied cases according to perioperative complication data.

Complications	Participated cases (N = 20)	
Intraoperative		
Bleeding	1	5
Mortality	0	0
Postoperative		
General		
Chest infection	2	10
DVT	0	0
UTI	1	5
Local		
Hemorrhage	0	0
Anastomotic Leak	2	10
Perineal wound infection	3	15
Anastomotic fistula	2	10
Stenosis	0	0

DVT, deep venous thrombosis; UTI, urinary tract infection.

(5%) patient developed UTI, and they were medically treated. Two patients developed an anastomotic leak; one of them was grade A and required no treatment to get resolved. The other patient turned out to have a perineal fistula that was managed conservatively with prolonged suction drainage. The second fistula case was a female patient who developed a vaginal fistula and required reoperation for the fistula repair (Table 4).

The mean harvested lymph node number was 13.2 ± 1.76 , ranging between 8 and 19, with negative lymph node tumor deposits in eight (40%) cases. Two patients showed a complete response to the preoperative chemoradiation therapy, while T2 and T3 tumors were noticed in 11 (55%) and seven (35%), respectively. The achieved free DRM was less than 10 mm in seven (35%) patients and 1–2 cm in 13 (65%) patients. The mean DRM was 11.2 ± 2.76 mm, ranging between 0.6 and 1.8 cm, while circumferential resection margin was found positive in one out of the 20 patients. In regard to the tumor recurrence during the follow-up period, we experienced no cases of local tumor recurrence; nevertheless, we have had a single case of distant nodal spread. The patient has been subjected to systemic chemotherapy (Table 5).

Within the allotted time frame (8–12 weeks), 16 patients had their ileostomy closed; two patients who experienced an anastomotic leak had their

Table 4. The patients under study were distributed based on the oncologic results.

Oncologic outcome	Participated cases (N = 20)
LN harvested	
Range	8–19
Mean ± SD	13.2 ± 1.76
Tumor stage	n (%)
T stage	
T0	2 (10)
T1	0
T2	11 (55)
T3	7 (35)
N stage	
N0	8 (40)
N1	7 (35)
N2	5 (25)
DRM	
<1 cm	7 (35)
1–2 cm	13 (65)
>2 cm	0
CRM	
+ve	1 (5)
–ve	19 (95)
Tumor recurrence	
Local	0
Systemic	1 (5)

CRM, circumferential resection margin; DRM, distal resection margin; LN, lymph nodes.

Table 5. Distribution of the studied cases according to the functional outcomes.

Wexner score	Participated cases (N = 19)		Test of significance	P
	Preoperation	Postoperation		
Range	0–6	0–9	Z = 1.942	0.082
Median (IQR)	4 (2.75–5.31)	6 (3.75–7.95)		
Low anterior resection syndrome (LARS)			Participated cases (N = 19) [n (%)]	
No LARS			8 (42.1)	
Major LARS			2 (10.52)	
Minor LARS			9 (47.3)	

IQR, interquartile range; Z, Wilcoxon test.

stoma closed between 6 and 9 months; one patient whose developed a vaginal fistula and needed reoperation was determined to have been fit to close the stoma only one year later; and one patient with a conservatively treated perineal fistula still has an open stoma that has not been included in a functional outcome analysis. After the 19 patients' ileostomy was closed, the postoperative Wexner continence score was assessed. As Table 5 illustrates, there was not statistically significant difference between the scores obtained prior to and following the APPEAR technique, with the median score for the patients under study being four before surgery and six afterward.

Regarding the LARS, two (10.52%) patients developed major LARS, while nine (47.3%) patients developed minor LARS, and eight (42.1%) cases experienced no LARS.

4. Discussion

The primary objective in the surgical treatment of rectal cancer is to achieve oncological clearance, while also considering the need of optimizing bowel function and ensuring long-term quality of life.¹³

Thus, a number of novel approaches, like the APPEAR technique, have been developed recently to aid in sphincter preservation and GI continuity restoration and have gained popularity in treating very low rectal cancers.^{3,5,8,14} The anterior perineal plane is utilized to surgically remove the lower part of the rectum, known as the distal rectum, for various medical conditions. These conditions can be either benign or malignant and would usually necessitate a traditional procedure called abdominoperineal excision.^{4,5,15}

Like shown by Williams et al.,⁴ when they formally described the APPEAR technique, they included patients with rectal trauma, ulcerative colitis, and rectal tumors in their study. Also, when the French surgeons¹⁰ first published their results. They included certain patients with upper rectal cancer who, under on current care guidelines, would not typically qualify for an APPEAR surgery.^{5,16}

In this study, the APPER technique has only been applied to ultralow rectal cancers that, in the absence of sphincter-preserving techniques, would have required APR. While other studies^{4,5,10,16} have combined the APPEAR technique with the traditional 'open' technique for the abdominal part, in this study the abdominal part was operated upon laparoscopically. Only one instance was transformed into the open approach. Laparoscopic methods for the abdominal stage of this surgery are rarely documented in case reports and succession, with most of them focusing on evaluating the APPEAR technique's viability rather than its functional consequences.^{15,17–20}

In this study, that the mean operative time was 240.3 (± 33.29 SD), and the mean blood loss was 157.5 (± 56.72 SD), and all patients (100%) underwent covering stoma, and the mean hospital stay was 11.2 (± 3.53 SD). Those clinical data are comparable with the results of the few studies that accompanied the APPEAR technique with laparoscopic resections similar to this study.^{5,17,19,20}

Each patient in this research got nCRT. Thus, all of the patients underwent diversionary stomas, in accordance with the explicit guidelines for ultra-low anterior resection of the rectum. The functional stoma was implemented to effectively decrease the risk of septic sequelae resulting from a potential anastomotic leak.^{21,22}

In this series, the mean DRM was 11.2 ± 2.76 mm. 1–2 cm is a widely accepted margin distally in very low rectal cancer cases.²³

Our investigation found no statistically significant disparity in the Wexner continence score between the patients examined before and after the procedure. All patients exhibited fecal continence for both solid and liquid feces, except for two patients who experienced fragmented evacuation.

4.1. Conclusion

The laparoscopic-assisted APPEAR approach is a feasible alternative for specific individuals with

operable ultra-low rectal tumors that have traditionally been managed with APR. This approach is medically sound and ensures the full preservation of the external anal sphincter, resulting in satisfactory functional outcomes.

Conflict of interest

There are no conflicts of interest.

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