Original Article

Oncological and functional outcomes of sphincter saving procedures versus abdominoperineal resection for low rectal cancer: A comparative prospective cohort study

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ABSTRACT

Background: Despite the advantages of sphincter-saving procedures (SSP), its oncologic and functional outcomes are still questionable in low rectal cancer patients. This study was done to compare the oncologic and functional outcomes of abdominoperineal resection (APR) and SSP.

Patients and Methods: Forty-six low rectal cancer patients who underwent either APR or SSP were included in this prospective cohort study. The SSP included either 'intersphincteric resection' (ISR) or 'ultralow anterior resection' (ULAR). The two groups were compared regarding survival and quality of life. Additionally, a functional outcome comparison was done between ULAR and ISR.

Results: The 1-, 2-, and 3-year overall survival rates for APR were 100, 100, and 92.9%, respectively, compared with 100, 84.6, and 84.6%, respectively, for the SSP group. During the same previous follow-up visits, the disease-free survival rates for APR were 90.5, 84.8, and 84.8%, respectively, compared with 96, 85.3, and 56.9%, respectively, for the SSP. The median Wexner score was 0 in the ULAR group compared with 7.5 in the ISR group. The median Low anterior resection syndrome score was 11 in the ULAR group versus 25 in the ISR group. The stoma group was inferior to the non-stoma group in terms of physical function, social, psychological, and body image affection.

Conclusion: Sphincter preservation, including ULAR and ISR, can be used to treat low rectal malignancies with higher quality of life and oncologic outcomes similar to APR. However, before surgery, patients should be counselled about the possibility of bowel dysfunction following ISR.

Key Words: Intersphincteric resection, Low rectal cancer, Quality of life, Sphincter preservation.

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INTRODUCTION

Surgical excision with clear-cut margins is the main option for the management of malignant rectal neoplasms[1]. According to traditional research, a minimal distal cut margin of five cm was needed when resecting such lesions[2]. That made 'abdominoperineal resection' (APR) the traditional option for managing low-lying rectal cancer. Although that procedure offers excellent oncological outcomes, the permanent stoma significantly impairs the patient's quality of life (QOL) and leads to major psychological morbidity like depression[3,4].

Some studies have contradicted the traditional belief regarding the distal resection margin for such lesions. Some surgical reports stated that malignant rectal neoplasms rarely spread beyond 2 cm distally, and a distal resection margin of 2 cm does not significantly compromise oncological outcomes[5,6]. Moreover, others confirmed the safety of a 1 cm distal margin when a multimodality treatment approach is commenced along with the achievement of clear radial margins[1,7].

Based on previous research advances, sphincter-saving procedures (SSP) have emerged as good alternatives for APR for patients diagnosed with low-lying rectal malignancies[8]. These procedures include 'ultra-low anterior resection' (ULAR) and 'intersphincteric resection' (ISR)[9,10].

SSP has a great advantage over APR, which is omitting the creation of permanent fecal diversion[11]. However, its oncological outcomes are still questioned[12,13]. Additionally, the ISR procedure carries a potential risk of postoperative fecal incontinence, as the internal sphincter is partially or excised[14].

To the best of our knowledge, the Egyptian literature is poor with studies comparing APR and SSP in patients with low rectal malignancy. That is why we conducted

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the present trial to compare the perioperative, functional, and oncological outcomes of APR versus SSP (including ULAR and ISR).

PATIENTS AND METHODS:

A total of 46 low rectal cancer patients were included in this prospective cohort study, which was carried out between January 2021 and December 2022 in the Gastrointestinal Surgical Center (GISC), Department of Surgery, Mansoura University, Egypt. Our 'Institutional Review Board' approved the study protocol (IRB code: MD.21.04.458). In addition, a written informed consent was signed by each patient during the interview conducted between the doctor and the patient illustrating the benefits and risks of the two surgical options.

Eligibility criteria

Patients of both genders, whose ages ranged between 18 and 80 years, with histologically proven lower rectal cancer (distal tumor edge within 3-7 cm from the anal verge (AV) as assessed by per rectal examination, imaging, and colonoscopy) were included. Patients with upper or middle rectal cancer, recurrent tumors, inflammatory bowel diseases, and familial polyposis were excluded.

SSP was offered to cases whose magnetic resonance (MRI) assessment excluded puborectalis or external sphincter invasion, with satisfactory preoperative sphincter function and continence. Moreover, ISR was selected for patients with tumors not reaching the external sphincter and who had an anticipated distal safety margin of at least 1 cm. APR was chosen for patients whose MRI assessment confirmed puborectalis or external sphincter invasion by the tumor, tumors invading the internal sphincter that did not respond to neoadjuvant chemoradiotherapy (CRT), and patients with unsatisfactory preoperative sphincter function and continence.

Preoperative evaluation

Preoperative assessment included detailed history taking, clinical examination (including perrectal examination), and routine preoperative laboratory workup (including tumor markers). Preoperative colonoscopy, pelvic MRI, and metastatic work-up were ordered for all participants. Anorectal manometry was ordered for all cases and the following parameters were recorded; squeeze pressure (SP), resting pressure (RP), and maximum tolerable volume (MTV). Patients with locally advanced neoplasms received neoadjuvant CRT (5-fluorouracil-based chemotherapy and 45–50 Gy radiotherapy in 25–28 fractions), and the surgical procedure was performed within 6 to 8 weeks after the patients had completed their prescribed their CRT course.

The APR group comprised 21 (45.7%) patients, whereas the SSP group comprised 25 (54.3%) patients. Of the SSP group, 13 (52%) patients underwent ISR, while 12 (48%) patients were subjected to ULAR.

The surgical procedures

The Abdominal phase was the same in the two groups. It was started by incision of the mesosigmoid and extension of the Toldts gap. Double ligation of the inferior mesenteric artery (IMA) was done, followed by its division. A total mesorectal resection (TME) was performed as low as possible down to the puborectalis muscle, and special attention was given to maintain the integrity of the related autonomic nerves. Splenic flexure was mobilized to avoid anastomotic tension. At the level of the pelvic floor, the rectal tube was exposed and then dissected downwards along the plane between the external and internal sphincters.

ULAR was conducted in tumors lying within 7 cm from the AV; total proctectomy was done followed by a stapled coloanal anastomosis. A defunctioning stoma was created in most patients except when a favorable anastomotic condition was suspected.

While ISR was conducted for patients with tumors at or below the anorectal ring with no expected satisfactory safety margin could be obtained by double stapling provided that no infiltration of the external sphincter. ISR was done according to the instructions of Schiessel *et al*.[15]. The surgical specimen was removed. Then, the anastomosis was created manually between the anal canal and the descending colon. No pouch or coloplasty was performed. A defunctioning stoma was performed in all patients (Figs 1, 2). All patients were instructed to perform Kegel's exercises after and they were also subjected to routine biofeedback sessions before stoma reversal.

When APR was planned, the abdominal phase was ended by division of the colon at the level of the sigmoid colon then shifted to the perineal phase which started with placing a purse string suture around the anal margin. Then, perineal dissection started with a perianal circumferential incision, and the dissection was deepened using electrocautery or scissors. First lateral and posterior dissections were performed till reaching the plane of dissection reached abdominally. Lastly, anterior dissection was done to complete the dissection of the anal canal then transanal extraction of the specimen. Finally wound closure and colostomy exteriorization.

Postoperative follow-up

Early positive adverse events were recorded in the two groups. Additionally, the patients were referred to the medical oncology department at our university to have their adjuvant CRT based on the analysis of the excised surgical specimen.

Patients were routinely evaluated every 4-6 months after the procedure until the 3-year visit. That routine evaluation included history taking and clinical examination. Moreover, laboratory and radiological assessments for systemic and local recurrences were performed every 6 months for the first year, and then yearly until the 3-year follow-up visit. A colonoscopy was done at the second-year visit or during the first year after the procedure (if the patient had an incomplete preoperative colonoscopy). Oncologic outcomes of patients were assessed, including their 1-, 2-, and 3-year overall survival (OS) and disease-free survival (DFS).

Functional and quality of life assessment

In the sphincter-saving group, the stoma was planned to be closed four months after the primary procedure as long as there was no morbidity or need for early adjuvant chemotherapy. Anorectal manometry was repeated 6 months after the surgical procedures, and the same three parameters mentioned previously were recorded.

After the reversal of the stoma, fecal incontinence was assessed using the Wexner[16] and 'Low anterior resection syndrome' (LARS) scoring systems[17], and both scores were assessed half a year after the stoma reversal. The former score was graded into minor and major incontinence (< 8 and ≥ 8, respectively)[18], while the latter was classified as major (30–42), minor (21–29), and no LARS (0–20)[17]. QOL assessment was conducted using a modified questionnaire based on EORTC QLQ-CR38[19] and colostomy questionnaires[20]. The former was compared between patients with and without stoma, while the latter was applied in the former group only.

Statistical analysis

Sample size

We used the PASS software to calculate the proper sample size. (Version 15). Based on prior research findings, the authors hypothesize a statistically significant difference in the oncologic and functional outcomes between the two study groups with a 0.8 effect size. Employing an equal allocation ratio between APR and ULAR/ISR, and when the 'two-sample equal variance t-test' was applied, we needed at least 20 patients in each group to yield a power of 81.7% to reject the null hypothesis and achieve a 0.05 significance level when the population effect size is 0.80.

The SPSS program for Windows was used to analyze the previous data (Version 26, IBM Corp; Chicago, IL). One of the following three tests were applied according to the nature of the variable compared between the two groups; the χ^2 test (for categories), the Mann–Whitney test (for medians), and the student–test (for means). Kaplan–Meier curves were used to present OS and DFS. Any obtained *P value* was considered significant if it was less than 0.05.

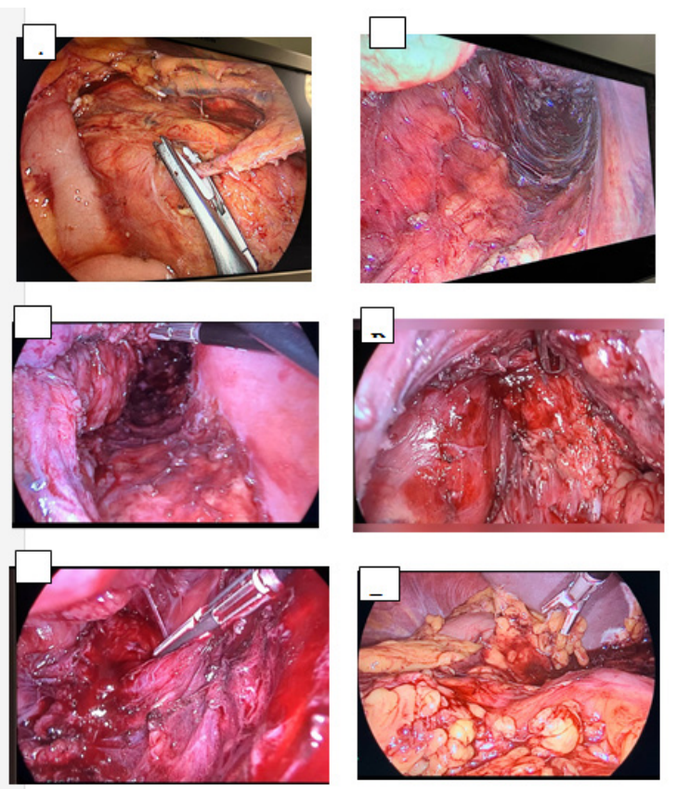

Fig. 1: (a) Inferior mesenteric artery clipping. (b) Posterior rectal mobilization till levator ani muscle with preservation of autonomic nerves. (c) Lateral rectal mobilization. (d) Anterior rectal mobilization. (e) Dissection medial to puborectalis muscle and entering inter-sphincteric plane abdominally. (f) Splenic flexure mobilization.

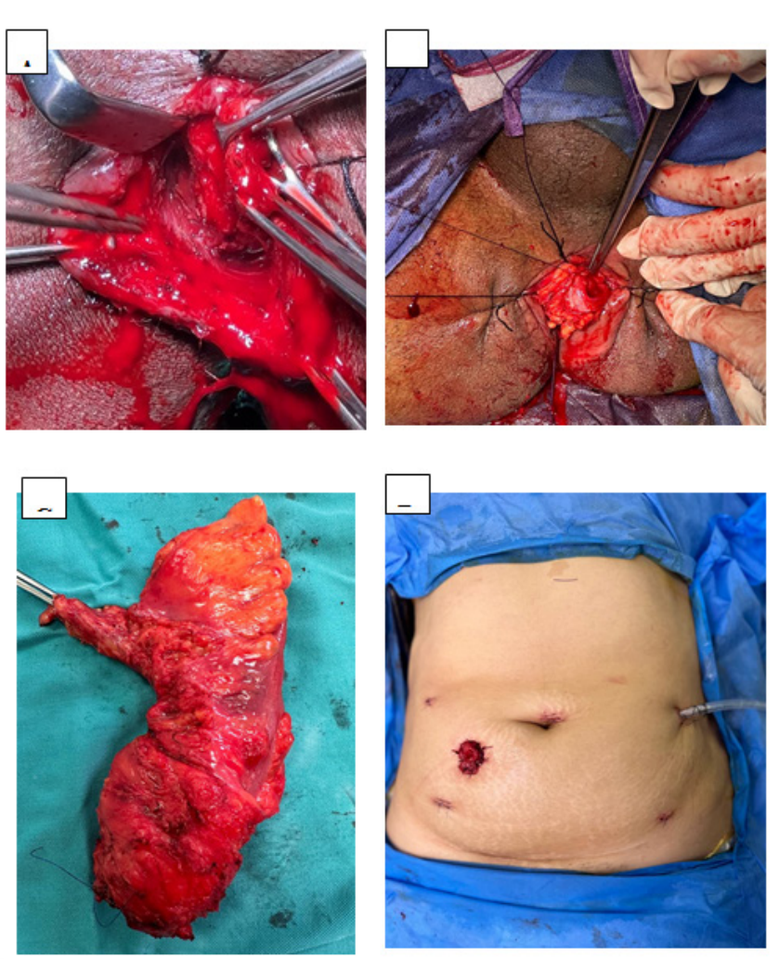

Fig. 2: (a) Perineal dissection of the inter-sphincteric plane. (b) Colo-anal anastomosis. (c) Postoperative specimen of rectum and mesorectum. (d) Final shape of port design and defunctioning stoma.

RESULTS:

As expressed in (Table 1), the two study groups did not differ statistically in terms of preoperative demographic criteria, tumor marker levels, body mass index (BMI), or tumor distance from the AV. History of preoperative CRT was positive in 42.9% of APR cases versus 60% of SSP cases (*P=0.25*).

Regarding the surgical approach, the rate of laparoscopic surgery was notably higher in the SSP group (72%) than in the APR group (33.3%) (*P=0.02*). Within the SSP group, all cases were subjected to defunctioning stoma except for 2 (8%) ULAR cases that did not require diversion during the primary surgical procedure. Two (8%) cases were subjected to transverse colostomy whereas the remainder 21 (84%) cases had had a covering ileostomy.

The APR group had a larger median blood loss (250 ml) than the SSP group (100 ml), with a significant difference between the two groups (*P=0.001*). Conversely, the duration of surgery did not show notable differences between the two groups (median = 300 min).

Regarding short-term results, there was no discernible difference between the two groups' hospital stays or surgical morbidity rates (*P=0.09* and 0.2, respectively).

Within the SSP group, anastomotic leakage was noted in two (8%) ULAR cases, one case was managed radiologically guided percutaneous tube drainage, whereas the other case necessitated exploration with toilet and lavage. Moreover, 4 (16%) cases of the ISR group developed anastomotic stricture before reversal of ileostomy, and all of them responded to endoscopic dilatation.

As regards reoperation, a single case (4.8%) of the APR group was subjected to exploration due to intestinal obstruction secondary to a parastomal hernia, in addition to the SSP group case which necessitated exploration for leakage management.

The median follow-up duration was 22 months (range, 11–36), with the APR group experiencing a longer follow-up period.

Postoperative pathological examination of the excised surgical specimen is illustrated at (Table 2).

Despite the sphincter-saving group comprising 25 cases, only 24 (96%) cases were evaluated for bowel function and degree of fecal incontinence after reversal of diversion, due to refusal from one (4%) patient to reverse ileostomy for fear of incontinence after closure (Table 3).

Pre- and postoperative manometric features did not show notable differences between the two groups, apart from the resting pressure (RP) which was significantly higher in the ULAR group at both time points. The two groups' median Wexner scores differed considerably (*P=0.045*), with the ISR group scoring 7.5 and the ULAR group scoring 0. Despite this, when categorizing patients into minor and major fecal incontinence at a cut-off score of 8, no statistical difference was noted (*P=0.4*).

The two groups' median LARS scores differed considerably (*P=0.03*), with the median score in the ISR group (25) being higher than the median score in the ULAR group (11). In addition, LARS score categories differed significantly between the two groups (*P=0.001*).

Out of the 46 patients observed, nearly 22 patients were noted to have a permanent stoma. Of these, the majority (21 cases) were APR patients with permanent colostomy. Meanwhile, one patient within the SSP group maintained a loop ileostomy which was not reversed, so was included in the stoma group.

The comparison of the two groups' questionnaires revealed that the stoma group experienced lower scores for physical function compared with the nonstoma group. Moreover, social affection and psychological and body image affection were significantly better in the stoma group versus the nonstoma group. Sexual activity, male, and female sexual function did not express notable differences between the two groups. Nevertheless, male enjoyment was significantly better in the nonstoma group (Table 4). The colostomy questionnaire assessment in the stoma group is expressed in (Table 5).

After a median follow-up duration of 22 months (range, 11–36), recurrence occurred in 7 (15.2%) cases, 3 (14.3%) cases in the APR and 4 (16%) cases in the SSP with 39 (84.8%) censored cases. All recurrence in the SSP group occurred in the ULAR group with no detected cases in the ISR group (Fig. 3a). The 1-, 2-, and 3-year DFS rates for APR were 90.5, 84.8, and 84.8%, respectively. The 1-, 2-, and 3-year DFS rates for SSP were 96, 85.3, and 56.9%, respectively, (Log-Rank test: χ^2: 0.942 – df: 1 – *P value* = 0.332) (Fig. 3b).

The 1-, 2-, and 3-year OS rates for APR were 100, 100, and 92.9%, respectively. The 1-, 2-, and 3-year OS rates for SSP were 100, 84.6, and 84.6%, respectively, (Log-Rank test: χ^2: 0.899 – df: 1 – *P value*: 0.343) (Fig. 3c and d).

Table 1: Baseline preoperative criteria, operative data, and postoperative complications in the study groups

Variables	Surgery type (n=46)		Total	*p*
	APR (n=21)	**SSP (n=25)**		
Age(years)	50.7 (10.2)	51.2 (11.3)	51(10.7)	0.9
Sex, n (%)				0.7
Male	7 (33.3%)	15 (60%)	22 (47.8%)	
Female	14 (66.7%)	10 (40%)	24 (52.2%)	
BMI (kg/m^2)	32.6 (6.7)	28.4 (4.1)	30.3(5.8)	0.17
Pre CEA	2.4 (0.5-613)	2.5 (0.8-21)	2.4 (0.5-613)	0.8
Pre CA-19-9	7.95 (0.6-121)	11.95 (1.1-317)	8(0.6-317)	0.74
Preoperative CRT, n (%)				0.25
No	12 (57.1%)	10 (40%)	22 (47.8%)	
Yes	9 (42.9%)	15 (60%)	24 (52.2%)	
Preoperative endoscopy				
Distance from AV (cm)	3 (2-5)	5 (1-7)	4 (1-7)	0.92
Surgical approach, n (%)				**0.02**
Open	12 (57.1%)	6 (24%)	18 (39%)	
Lap	7 (33.3%)	18 (72%)	25 (54.3%)	
Lap converted to open	2 (9.5%)	1 (4%)	3 (6.5%)	
IMA ligation				**0.001**
Low ligation	0	18 (72%)	18 (39.1%)	
High ligation	21 (100%)	7 (28%)	28 (60.9%)	

Operation time(min) median(range)	300 (180-480)	300 (180-480)	300 (180-480)	0.7
Estimated blood loss (ml) median(range)	250 (100-700)	100 (50- 400)	200 (50-700)	**0.001**
Hospital stay (days)	5 (3-15)	4 (3-15)	5 (3 – 15)	0.09
Wound infection	3 (14.3%)	1 (4%)	4 (8.7%)	
Ileus	3 (14.3%)	2 (8%)	5 (10.9%)	
Pneumonia	0 (0%)	1 (4%)	1 (2.2%)	
Abdominal collection	1 (4.8%)	0 (0%)	1 (2.2%)	
Leakage	0 (0%)	2 (8%)	2 (4.3%)	
Intestinal obstruction	1 (4.8%)	0 (0%)	1 (2.2%)	
Postoperative thirty-day reoperation	1 (4.8%)	1 (4%)	2 (4.3%)	0.9
Anastomotic Stricture	—	4 (16%)		0.2

AV, anal verge; BMI, body mass index; CA19-9, carbohydrate antigen 19-9; CEA, carcinoembryonic antigen; CRT, chemoradiotherapy; IMA, inferior mesenteric artery.

Table 2: Pathological outcomes in the study groups

	Surgery type(*n*=46)			
Variables	APR	SSR	Total	*P*
Pathology type *n* (%)				
Adenocarcinoma	9 (42.9)	17 (68)	26 (56.5)	
Mucoid adenocarcinoma	10 (47.6)	1 (4)	11 (23.9)	
Signet ring carcinoma	1 (4.8)	1 (4)	2 (4.3)	**0.001**
Basaloid rectal SCC	1 (4.8)	0	1 (2.2)	
GIST	0	1 (4)	1 (2.2)	
Complete response	0	5 (20)	5 (10.9)	
Pathological lesion size (cm)	4.6 (1.6)	4.5 (2)		0.2
Distal margin (cm)	30 (15–40)	15 (10–30)	20(10–40)	**0.001**
LVI (Positive) *n* (%)	5 (23.8)	6 (24)	11 (23.9)	0.98
PNI (Positive) *n* (%)	3 (14.3)	7 (28)	10 (21.7)	0.3
Pathological complete response	0	5 (20)	5 (10.9)	**0.05**
Pathological LNs number	15 (3–24)	10 (1–44)	13(1–44)	0.22
Pathological positive LNs	1.5 (4.4)	1.2 (2.2)	1.3(3.3)	0.72
Pathologic T staging *n* (%)				
T 0–2	3 (14.3)	13 (52)	16 (34.8)	**0.007**
T 3–4	18 (85.7)	12 (48)	30 (65.2)	
Pathologic N staging *n* (%)				
N0	14 (66.7)	18 (72)	32 (69.6)	
N1	5 (23.8)	4 (16)	9 (19.6)	0.9
N2	2 (9.5)	3 (12)	5 (10.9)	
Pathologic TNM staging *n* (%)				
0	0	5 (20)	5 (10.9)	
I	2 (9.5)	6 (24)	8 (17.4)	
II	13 (61.9)	5 (20)	18 (39.1)	**0.01**
III	6 (28.6)	7 (28)	13 (28.3)	
IV	0	2 (8)	2 (4.3)	

GIST, gastrointestinal stromal tumor; LVI, lymphovascular invasion; PNI, perineural invasion; SCC, squamous cell carcinoma.

Table 3: Low anterior resection syndrome and Wexner scores for the sphincter-saving group

	Surgery type(*n*=24)			
Variable	ISR (*N*=12) [*n* (%)]	ULAR (*N*=12) [*n* (%)]	Total	Significance
Interval for diversion closure	4.25 (2–7)	4.25 (1.5–12)	4.25 (1.5–12)	0.9
Pre-operative Manometric measurements				
RP	60 (40–76)	70 (60–80)		**0.006**
SP	140 (90–243)	150 (90–190)		0.38
MTV	155 (90–250)	180 (130–250)		0.1
Postoperative Manometric measurements				
RP	37.50 (20–55)	50 (20–65)		**0.005**
SP	119 (63–180)	115 (80–160)		0.98
MTV	105 (0–180)	120 (50–150)		0.38
Wexner score	7.5 (2–12)	0 (0–19)	4 (0–19)	**0.045**
Wexner score				
Major FI ≥8	6 (50)	3 (25)	9 (37.5)	0.4
Minor FI < 8	6 (50)	9 (75)	15 (62.5)	
LARS score	25 (18–37)	11 (0–41)	23 (0–41)	**0.03**
LARS score				
No	1 (8.3)	9 (75)	10 (41.7)	
Minor	7 (58.3)	0	7 (29.2)	**0.001**
Major	4 (33.3)	3 (25)	7 (29.2)	

FI, fecal incontinence; LARS, low anterior resection syndrome; MTV, maximum tolerable volume; RP, resting pressure; SP, squeeze pressure.

Table 4: Comparison of the mean values of the quality of life questionnaire between the stoma and nonstoma groups

	Surgery type (*n*=46)		
Variables	Stoma group (*N*=22) [*n* (%)]	Nonstoma group (*N*=24) [*n* (%)]	*P*
Physical function	6 (4–10)	8 (4–10)	**0.001**
Psychological affection and body image	18 (81.8)	3 (12.5)	**0.001**
Social affection	13 (59.1)	2 (8.3)	**0.001**
Micturition problems	3 (13.6)	1 (4.2)	0.34
Sexual function			
Active	13 (59)	17 (70.8)	0.40
Inactive	9 (40.9%)	7 (29.2)	
Male sexual function	*N*=6	*N*=13	
Enjoyment	7 (4–9)	9 (6–10)	**0.03**
Erection	8.5 (4–10)	9 (6–10)	0.44
Ejaculation	8.5 (7–10)	8 (6–10)	0.89
Female sexual function	*N*=7	*N*=4	
Dry vagina	4 (2–5)	3 (0–5)	0.56
Pain	2 (2–6)	1.5 (0–5)	0.67
Enjoyment	5 (2–7)	8.5 (4–9)	0.10

Table 5: Colostomy questionnaire items answered by the stoma group patients

Variables	Stoma group
Parastomal Bulge or hernia, *n* (%)	7 (31.8)
Parastomal hernia treatment, *n* (%)	3 (13.6)
Functionality of the stoma, median (range)	3 (2–4)
Frequency	3 (2–12)
Inability of Stoma Self-care *n* (%)	8 (36.4)
Leakage or loosening *n* (%)	5 (22.7)
Pain *n* (%)	3 (13.6)
Limitation to diet, median (range) *n* (%)	6 (27.3)
Financial affection, median (range) *n* (%)	5 (22.7)
Stoma Worries and concerns, *n* (%)	18 (31.8)

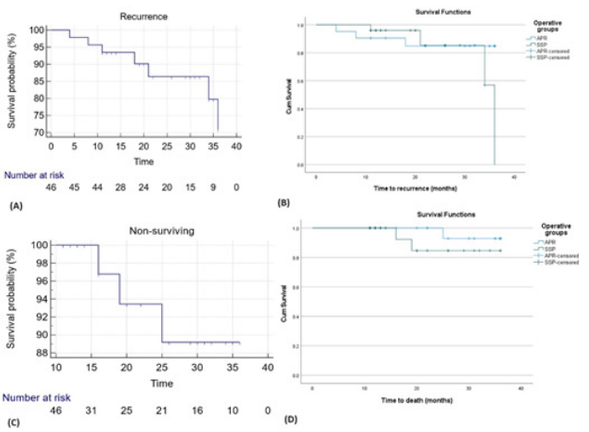

Fig. 3: (a) Time to recurrence in the studied cases (n=46). (b) Disease-free survival comparison between abdominoperineal resection and sphincter-saving procedures groups. (c) Time to death in the studied cases (n=46). (d) Overall survival comparison between abdominoperineal resection and sphincter-saving procedures groups.

DISCUSSION

In this study, perioperative, oncological, and functional results for patients with ultra-low rectal cancer were compared between APR and SSP (including ULAR and ISR). In our study, the APR and SSP groups did not differ significantly in terms of operative time or length of hospital stay; however, the SSP group had a lower amount of blood lost during surgery (*P=0.001*). In the SSP group, the total morbidity was 20% compared with 38.1% in the APR group (*P=0.2*).

According to Peng *et al*., blood loss and operating time did not differ between the APR and APR groups. However, the ISR group had significantly shorter hospital stays and fewer postoperative morbidities (*P<0.001*, *P=0.04*, respectively)[21]. Conversely, He and colleagues observed in their study that there was no discernible difference between the same groups as regards hospital and postoperative morbidity, but they found that the ISR group showed less intraoperative blood loss and shorter surgery period than the APR group[12].

In terms of oncologic safety, the primary oncologic objective in low-lying rectal cancer surgery is local tumor management. It was frequently argued that APR was more oncologically safe than ISR, particularly when it came to controlling local recurrences[13]. In our study, after a median follow-up of 22 months (11–36), there was no statistical difference between APR and SSP groups in both OS and DFS rates (*P=0.343, 0.332*), respectively. Additionally, overall and cumulative recurrence rates were statistically comparable between the two groups.

Schiessel and colleagues examined 121 patients with rectal cancer who had ISR. Following a comprehensive 16 – year follow-up, they concluded that in comparison to LAR and APR, ISR exhibited oncological safety evidenced by a local recurrence rate of 5%[22]. Peng and colleagues in their meta-analysis, demonstrated that the 5-year OS and DFS as well as local recurrence rates were similar between the ISR and APR groups (*P=.48, P=.82, P=.41*), respectively[21].

Martin and colleagues demonstrated favourable oncologic in their systematic review of ISR patients with a mean local recurrence rate of 6.7% (range 0–23%). The 5-year DFS rate after ISR was 78•6% and the OS rate was 86.3%[23]. In addition, both He and colleagues and Tsukamoto and colleagues demonstrated both ISR and APR had comparable oncological outcomes[12,24]. Furthermore, the other two studies highlighted the oncological safety of ISR[25,26].

Although our study and other previous studies have confirmed the oncological safety of ISR, concerns always exist about functional outcomes and defecatory functions after ISR. Of course, partial or complete excision of the internal sphincter in ISR could yield problematic functional outcomes. Nonetheless, high percentages of patients who underwent stapled low colorectal or high coloanal anastomosis suffer from anterior resection syndrome despite the sphincters being preserved[8].

In this study, better functional outcomes were encountered in the ULAR group compared with the ISR group. However, when the used two scores were expressed categorically, no difference was detected between the two groups regarding the incidence of major fecal incontinence or major LARS.

In their study assessing the functional outcomes of low rectal cancer patients treated with both LAR and ISR, Kawada and colleagues observed that two years postprocedure, LAR yielded superior mean Wexner continence scores compared with ISR (7.9±4.1 vs. 3.5±3.6, respectively). Moreover, over 93% of individuals in the LAR group achieved a favourable continence score (<10), while only 70% in the ISR group exhibited such scores during the 2-year follow-up. The study also indicated a gradual improvement in anorectal function following ISR over the 2-year observation period. Nonetheless, patients in the LAR group had nearly restored their preoperative level of function one year after surgery[27].

According to Sakr and colleagues the ISR group had a greater rate of significant faecal incontinence than the ULAR group (75.9% vs. 49.3%, *P=.016*). A significant difference was noted between the median Wexner score in the two groups (14 vs. 10 in the same groups, respectively, *P=.043*). They demonstrated that ISR was associated with a major risk for faecal incontinence[28].

Contrarily, several studies have demonstrated that a substantial proportion of patients undergoing ISR exhibited satisfactory anal function postoperatively. He and colleagues confirmed the satisfactory anal function in ISR patients, as evidenced by a mean LARS score of 19 and a mean Wexner score of 5.9 [12]. Similarly, Peng and colleagues meta-analysis highlighted notably improved functional outcomes in ISR patients, concerning stoma avoidance and attainment of acceptable continence levels[21].

These results align consistently with our observations, revealing that a substantial proportion of the SSP group, ~79.2%, achieved a satisfactory level of continence. Diminished bowel functions were observed in 2 (16.7%) cases of the ISR group compared with 3 (25%) cases of the ULAR group, this apparent augmentation in the incidence in the ULAR group was explained by the limited number of the sample size. Despite all of this, the majority of patients with compromised bowel functions in the two groups managed to control their symptoms through diet adjustment, antidiarrheal medications, and biofeedback sessions with no cases requiring permanent stoma.

Furthermore, a significant improvement in continence and bowel functions was noted over time in the SSP group, as evidenced by improvement in their scores and anorectal manometric measurements. However, a longer follow-up duration is necessary to assess changes in bowel function over 6, 12, and 24 months after reversal of ileostomy until full recovery and adaptation of neorectum occur.

Unsurprisingly, our preoperative manometric findings revealed that RP differed significantly between the groups, and that might be attributed to the high proportion of ISR group who were subjected to neoadjuvant CRT signifying the deleterious effect of CRT on the sphincter tone. Moreover, postoperative RP showed also a significant difference between the two groups reflecting the role internal anal sphincter in maintaining the resting anal canal tone and contributing up to 85% of the maximum RP so it fell in the ISR group in which internal sphincter is resected. Nonetheless, the two groups had comparable postoperative SP, and that is possible since the external anal sphincter remains unaffected by ISR, which is in accordance with the literature[29–31].

Reduced MTV was noted in the two groups without significant difference (*P=0.38*) and that was expected due to, the loss of reservoir function in the form of rectal resection occurring in the two groups. Further assessment of the manometric changes over 12 months and 2 years after ileostomy reversal is planned in future studies to assess the adaptation of the neorectum.

In the modern era, maintaining QOL is one of the crucial goals of rectal cancer surgery[29]. In the current study, analysis of Colostomy Questionnaire answers revealed that the stoma group was inferior to the non-stoma group in terms of physical function, social, psychological, and body image affection. Patients of the SSP group even those who were subjected to ISR expressed in their own words that they experienced well-being and acceptance of their situation even with the occurrence of LARS symptoms with altered bowel functions, and that they gradually improved over time, furthermore they emphasized on that their QOL now is better than that they experienced before reversal of ileostomy.

In previous Swedish cohort research that enrolled patients undergoing surgery for rectal cancer, four QOL questionnaires were evaluated, and the results showed that patients with persistent stomas had lower overall QOL than patients without stomas in terms of body image, physical functions, and emotional functions[20].

The main limitations of this study were being a single center experience liable for selection bias and its nonrandomized nature. In addition, the sample size was relatively small that was collected from a single surgical institution. Also, the long-term oncological and functional outcomes are lacking. More studies should be performed to address the previous drawbacks.

CONCLUSION

With meticulous case selection and strict adherence to neoadjuvant protocol we believe that low rectal malignancies may be treated with sphincter preservation, including ULAR and ISR, with comparable oncologic outcomes to APR and improved QOL. SSP demonstrated better short-term surgical outcomes, including reduced operative blood loss and a lower rate of postoperative complications, in addition to the significant benefit of eliminating the permanent faecal diversion.

ISR offers an opportunity to broaden the criteria for sphincter preservation and lower the frequency of APR. However, the patients need to be informed about the potential risks of bowel dysfunction and faecal incontinence following ISR prior to surgery. Nevertheless, further multi-institutional prospective studies with larger sample sizes and longer follow-up periods are necessary to arrive at a definitive conclusion. This represents our future perspectives.

CONFLICT OF INTEREST

There are no conflicts of interest.

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