Original Article

Chirurgia (2025) 120: 409-415
No. 4, July - August

http://dx.doi.org/10.21614/chirurgia.3152

Functional Outcomes and Patient Satisfaction after Abdominoperineal Resection versus Sphincter-Preserving Techniques for Low Rectal Cancer: A Retrospective Single-Centre Study

Andrei Chitul[1]*, Emilica Ciofic[1,2], Traean Burcoș[1,2], Daniel Cristian[1,2], Florin Grama[1,2]

[1]Department of General Surgery, Coltea Clinical Hospital, Bucharest, Romania
[2]Department of General Surgery, number 10, Carol Davila University of Medicine and Pharmacy, Bucharest, Romania

***Corresponding author:**
Andrei Chitul, MD
E-mail: chitulandrei@gmail.com

Rezumat

Rezultate funcționale și satisfacția pacienților după amputație abdominoperineală versus tehnici de prezervare a aparatului sfincterian în cancerul rectal inferior: un studiu retrospectiv unicentric.

Introducere: În chirurgia cancerului rectal, menținerea unui echilibru între controlul oncologic şi păstrarea unei bune calități a vieții este esențială. Procedurile cu prezervarea sfincterului anal pot oferi beneficii funcționale superioare, dar rezultatele variază în funcție de tehnica utilizată.
Metode: Studiul retrospectiv, observațional şi unicentric a inclus 62 de pacienți diagnosticați cu adenocarcinom rectal localizat ≤ 5 cm de orificiul anal, operați între august 2022 şi august 2024. Toți pacienții au primit tratament neoadjuvant. Aceştia au fost repartizați în trei grupuri chirurgicale: amputație abdomino-perineală, anastomoză coloanală standard, sau anastomoză întârziată (Turnbull-Cutait). Evaluarea funcțională s-a realizat prin scorurile LARS şi St Marks la 1, 6 şi 12 luni postoperator. Satisfacția a fost apreciată prin interviuri telefonice.
Rezultate: 17 pacienți au suferit amputație, 10 au avut anastomoză standard, iar 35 anastomoză întârziată. Anastomoza standard a fost asociată cu scoruri funcționale semnificativ mai bune față de tehnica Turnbull-Cutait. Grupul cu amputație a prezentat incidență crescută a complicațiilor pulmonare şi a inflamației persistente. 80% dintre pacienți s-au declarat mulțumiți la un an postoperator.
Concluzii: Toate tehnicile pot asigura o satisfacție ridicată, dar anastomoza coloanală standard oferă rezultate funcționale superioare. Alegerea intervenției trebuie personalizată şi susținută de un consimțământ informat.

Cuvinte cheie: cancer de rect inferior, prezervare sfincteriană, amputație de rect abdominoperineală, rezultate funcționale, satisfacția pacienților

Received: 28.04.2025
Accepted: 26.06.2025

Abstract

Background: In rectal cancer surgery, maintaining a balance between oncologic control and postoperative quality of life is critical. Sphincter-preserving procedures may offer better functional outcomes, but results vary depending on the technique used.

Methods: This retrospective, observational, single-center study included 62 patients with adenocarcinoma of the rectum ≤5 cm from the anal verge, operated between August 2022 and August 2024. All received standard neo-adjuvant therapy. Patients underwent one of three procedures: abdominoperineal resection, standard coloanal anastomosis, or delayed coloanal anastomosis (Turnbull-Cutait). Functional outcomes were assessed using LARS and St Marks scores at 1, 6, and 12 months postoperatively. Satisfaction was evaluated via telephone interviews.

Results: Seventeen patients underwent abdominoperineal resection, 10 received standard coloanal anastomosis, and 35 underwent the delayed technique. Standard anastomosis yielded significantly better continence scores than the Turnbull-Cutait group. Patients with abdominoperineal resection had higher rates of pulmonary complications and prolonged inflammation. At one year, 80% of patients reported satisfaction with the procedure.

Conclusion: All techniques can provide high satisfaction, but standard coloanal anastomosis appears to offer superior functional outcomes. Surgical decision-making should be individualized and based on thorough informed consent.

Keywords: low rectal cancer, sphincter-preserving surgery, abdominoperineal resection (APR), functional outcomes, patient satisfaction

Background

Rectal cancer has always been a matter of unique surgical challenge, especially when considering tumours located within 5 cm of the anal verge. The challenge lies in balancing sphincter preservation, achieving oncologically safe margins, minimising anastomotic complications, and maintaining post-operative quality of life.

When considering the historical perspective, abdominoperineal resections (APR) was considered the gold standard for these types of tumours, prioritising reliable oncologic clearance - albeit at the cost of a permanent colostomy - was once considered the sole determinant of surgical success (1). However, as an obvious result of the evolution of oncological surgery in general, there has been progressively better understanding of all the aspects surrounding rectal cancer. Ranging from basics, such as the anatomy, the implementation of total mesorectal excision (TME) and the holy planes as described by Professor Heald, and moving on to the most complex data regarding gene therapy, a clear breakthrough has started happening by understanding these notions (2). Therefore, we have now moved on to discussing about sphincter-sparing techniques, like standard coloanal anastomosis or delayed ones like described in the Turnbull-Cutait technique, operations that were unimaginable only a few years ago (3,4).

Although theoretically, there would be no point in considering any alternative technique rather than sphincter-preserving ones, in view of their clear psychological and cosmetic benefits, there are plenty of long-term trade-offs that have become a growing concern. Low Anterior Resection Syndrome (LARS), which is a debilitating constellation of symptoms including urgency, clustering, faecal incontinence and frequent defecation, severely impacts the quality of life. In spite of the technical success and negative resection margins, patients do sometimes report dissatisfaction due to these functional poor outcomes. APR, while eliminating the risk of LARS, introduces lifelong stoma-related issues, body image dissatisfaction and social isolation. Therefore, the choice of surgical technique must balance oncological safety with realistic expectations for bowel function and postoperative quality of life (QoL) (QoL)(5).

When looking at sphincter preserving procedures (SPP), the surgeon is usually facing two main potential alternatives – Turnbull Cutait delayed coloanal anastomosis, and the standard coloanal anastomosis with defunctioning ileostomy (CAA). The Turnbull-Cutait technique, which involves a delayed coloanal pull-through anastomosis, performed in two stages, has gained renewed attention as a means of reducing anastomotic complications and also by being a sphincter preserving procedure. Originally described in the 1950s, this approach had initially fallen out of

favour due to concerns about technical difficulty and longer hospital stay. Nevertheless, in more recent studies there have been clear suggestions that this method may lower the risk of anastomotic leak and improve functional outcomes by allowing the neorectum to adapt gradually, which could potentially lead to a reduction in the severity of LARS (6-8). Looking at the CAA, although widely used globally, it is by far a non-ideal technique, having several disadvantages such as risk of anastomotic leak, stoma-related complications (dehydration, renal failure, peristomal cellulitis, parastomal hernia, etc.) (9,10).

Although SPP have been proven safe from an oncological perspective, the question that still arises is how we appreciate the quality of life of these patients. With that in view, plenty of questionnaires have been designed and validated. Probably some of the most commonly used indexes are the St Marks (Vaizey) and LARS scores[11–13]. These scoring systems represent the basis from which conclusions regarding the functional outcomes of SPP can be drawn. Nevertheless, these scores are not ideal as they focus mainly on the bowel function aspect and the symptoms associated to rectal cancer surgery. Clearly, quality of life is a very complex concept encompassing a wide range of aspects, varying from body image, overall wellbeing, risk of recurrence associated with each procedure, bowel function, sexual function, urinary function, psychological burden and impact, etc. Quite clearly, no single test or set of questions can address all these issues, which is probably one of the most interesting areas for future research. Despite this issue, researchers across the world have imagined separate scores to focus on various relevant topics. As mentioned before, LARS and St Marks focus mainly on bowel function and the subsequent modifications on the quality of life. One questionnaire that is to be potentially considered as complimentary is EORTC QLQ-C30. The purpose of this organization was to issue a standardized approach in describing quality of life for patients with oncological diseases. The QLQ-C30 features a combination of multi-item and single-item scales designed to assess various aspects of a patient's experience. It includes a global scale focused on overall health and quality of life, along with three symptom-focused scales measuring fatigue, pain, and nausea/vomiting. In addition, it incorporates five functional domains - social, emotional, cognitive, role-related, and physical functioning. Several individual symptom items are also included to provide a more detailed symptom profile (14). These are only a few examples of such questionnaires.

This study aims to compare functional outcomes, oncologic characteristics, and patient-reported satisfaction between abdominoperineal resection (APR) and sphincter-preserving procedures (SPP) in patients with low rectal adeno-carcinoma who received standardised neoadjuvant chemoradiotherapy. Specifically, we evaluate and contrast outcomes between:

- APR vs SPP,
- Standard coloanal anastomosis (CAA) vs Turnbull-Cutait delayed anastomosis (TC) within the SPP group,

using validated scoring systems (LARS and St Mark's) and patient feedback at multiple time points (early postoperative, 6 months, and 12 months). The goal is to provide real-world data on functional recovery and patient satisfaction to inform surgical decision-making in cases of low rectal cancer.

Materials and Methods

This was a retrospective, observational study conducted in a single tertiary surgical centre, analysing adult patients who underwent surgery for low rectal adenocarcinoma between August 2022 and August 2024. The primary aim was to compare functional outcomes and patient satisfaction between abdominoperineal resection (APR) and sphincter-preserving procedures (SPP), with additional subgroup analysis of different SPP techniques.

Inclusion Criteria

Patients were eligible for inclusion if they:

- were over 18 years of age,
- tumours identified at maximum 5 cm from the anal verge on digital rectal examination and flexible sigmoidoscopy,
- had a histologically confirmed diagnosis of rectal adenocarcinoma,
- received neoadjuvant chemoradiotherapy with long-course radiotherapy (50.4 Gy) and Capecitabine,
- underwent one of the predefined surgical procedures (APR, standard coloanal anastomosis with defunctioning ileostomy [CAA], or delayed coloanal anastomosis using the Turnbull-Cutait technique [TC]),
- consented to participate in follow-up and

telephone-based questionnaires.

Patients who had died prior to the time of the interview or who could not be contacted were excluded from the functional outcome analysis.

Data Collection

Data were collected from electronic medical records, including demographic information, comorbidities, tumour staging (ypTNM), operative details, postoperative complications, and pathology reports (including perineural invasion [PNI] and lymphovascular invasion [LVI]). Haemoglobin, albumin, C-reactive protein (CRP), and tumour marker values (CEA, CA 19-9) were also recorded preoperatively and postoperatively.

Functional Outcome Assessment

Patients who underwent SPP were contacted via telephone at three timepoints: within the first month postoperatively (or after ileostomy reversal in the CAA subgroup), at 6 months, and at 12 months. Standardised questions were asked to calculate both the Low Anterior Resection Syndrome (LARS) score and the St. Mark's Incontinence Score. Additionally, patients were asked whether they would have preferred a different procedure in retrospect.

A LARS score >30 was considered major, 21–29 moderate, and <20 minor. For the St. Mark's Incontinence Score, higher values reflect more severe impairment, with scores >12 suggesting significant continence issues.

Statistical Analysis

Data were analysed using SPSS (version 20). For normally distributed data, for categorical variables, Chi-square was used, whereas for continuous variables - Independent Sample T-Test were used. For non-normally distributed data, non-parametric tests were applied. Mann-Whitney U tests were used to compare functional outcomes between groups. A p-value < 0.05 was considered statistically significant.

Results

It is challenging to determine which procedure is the most appropriate, effective, and safest. To explore this, we initially divided patients into two main groups: those undergoing abdominoperineal resection (APR) and those receiving a sphincter-preserving procedure (SPP). To further assess functional outcomes, the various SPP techniques were also compared to one another using the continence scores previously described.

In total, 62 adult patients consented to participate in the study. Among them, 22 were female (35.5%) and 40 were male (64.5%). Of the female cohort, 8 underwent APR and 14 SPP. In the male group, 9 had APR and 31 SPP. There was no statistically significant difference between these subgroups (P = 0.242). The mean age across the cohort was 66.52 ± 10.4 years.

The average age was slightly higher in the APR group (68.64 years) than in the SPP group (64.93 years), though this was not statistically significant (P = 0.089).

All patients were diagnosed with rectal adenocarcinoma, confirmed histologically. Each received neoadjuvant chemoradiotherapy (CRT) according to the same protocol: long-course radiotherapy (50.4 Gy) combined with Capecitabine.

Three types of surgical procedures were performed: open or laparoscopic APR; ultralow anterior resection with coloanal anastomosis and defunctioning ileostomy (CAA); and delayed coloanal anastomosis (Turnbull-Cutait, TC). The distribution was as follows: APR in 27.4% (n = 17), CAA in 16.1% (n = 10), and TC in 56.5% (n = 35) (*Table 1*).

Postoperative complications were generally similar between groups, with the exception of pulmonary complications, which occurred in 11.8% of APR patients and in none of the SPP group (P = 0.019)(*Table 2*).

Tumour markers CEA and CA 19-9 were measured preoperatively, with no significant differences observed (P = 0.83 for CEA; P = 0.49 for CA 19-9).

An interesting aspect we explored was whether, in retrospect, patients would have preferred a different surgical approach. The question posed was: "*Would you have preferred undergoing a different operation?*" The allowed responses were: "Yes," "No," "Initially yes but not now," and "Initially no but now yes."

The distribution of responses was presented in *Table 3*.

Overall, the vast majority of patients in both groups - 82% of those who underwent APR and 80% of those with SPP - stated they would not opt for a different procedure one year after surgery. This difference was statistically significant (P = 0.010).

There was no statistically significant difference in hospital length of stay between the two main

Table 1. Surgical and Pathological Characteristics of the Study Cohort

Variable	Total (%)	
Surgical Procedure		
- APR	27.4%	
- CAA	16.1%	
- TC (Turnbull-Cutait)	56.5%	
ypT Stage		
- ypT0	16.1%	
- ypT1	9.7%	
- ypT2	30.6%	
- ypT3	32.3%	
- ypT4	6.5%	
- ypTis	4.8%	
ypN Stage		
- ypN0	67.7%	
- ypN1	22.6%	
- ypN2	9.7%	
ypM Stage		
- ypM0	100%	
Early T Stage (Tis–T2)		
- SPP (CAA + TC)	64.5%	Significantly more common (P = 0.015)
- APR	51.9%	
PNI (Perineural Invasion)		
- Absent	75.8%	
- Present	24.2%	More common in APR (35.3%) vs. SPP (20%), P = 0.210
LVI (Lymphovascular Invasion)		
- Absent	82.3%	
- Present	17.7%	APR (29.4%) vs. SPP (13.3%), P = 0.139
Comorbidities		
- Cardiovascular disease	67.7%	APR: 76.5%, SPP: 64.4%, P = 0.366
- Type 2 Diabetes Mellitus (T2DM)	35.5%	APR: 52.2%, SPP: 28.9%, P = 0.077 (trend toward significance)

Table 2. Perioperative Laboratory Parameters by Surgical Group

Parameter	APR Group	SPP Group	P Value	Comment
Pre-op Haemoglobin (g/dL)	12.8	13.01	0.435	No significant difference
Post-op Day 2 Haemoglobin (g/dL)	11.07	10.09	0.651	No significant difference
Pre-op Albumin (g/dL)	4.36	4.90	0.420	No significant difference
Post-op Day 2 Albumin (g/dL)	2.975	2.948	0.104	No significant difference
CRP (mg/L, Post-op Day 3–4)	10.02	6.09	0.017	Significantly higher in APR group

Table 3. Patient-reported preferences regarding their surgical approach, categorized by procedure type (APR vs SPP).

Would you have preferred undergoing a different approach?	Yes	No	Initially yes but not now	Initially no but now yes
APR	0%	18%	82%	0%
SPP	6.7%	44.4%	35.6%	13.3%

groups, either preoperatively (P = 0.117) or postoperatively (P = 0.196).

Functional outcomes were assessed via telephone interviews in the SPP group using validated questionnaires to determine both the LARS and St Mark's scores. These assessments were conducted at three timepoints: within the first postoperative month (after ileostomy reversal in the CAA group or directly post-op in the TC group), at 6 months, and at 1 year (*Tables 4, 5*).

Anastomotic leak rates were comparable between the TC and CAA groups (P = 0.787), with all cases successfully managed conservatively.

Table 4. Mean LARS Scores Over Time by Surgical Subgroup

Timepoint	Turnbull–Cutait (TC)	Coloanal Anastomosis (CAA)	P Value
Postoperative	32.8	26.6	0.026
6 months	29.5	20.01	0.002
1 year	26.2	13.4	0.001

Table 5. Mean St Mark's Incontinence Scores Over Time by Surgical Subgroup

Timepoint	Turnbull–Cutait (TC)	Coloanal Anastomosis (CAA)	P Value
Postoperative	16.1	13.5	0.015
6 months	13.9	9.95	0.005
1 year	11.8	6.41	0.003

No recurrence was identified at 1 year postoperatively. This was assessed through complete colonoscopy, CT of chest and abdomen and MRI of the pelvis. Constant monitoring of tumour markers was also performed.

Discussion

The present study aimed to compare functional outcomes and patient satisfaction following APR versus sphincter-preserving procedures (SPP) in patients with low rectal cancer, all of whom received standardised neoadjuvant chemoradiotherapy. Our analysis showed that, at one year postoperatively, the majority of patients in both groups reported they would not have opted for a different surgical approach, suggesting a generally high degree of satisfaction irrespective of the type of surgery performed. However, probably the most important adjacent conclusion is the fact the quality of life is a variable aspect, time-dependent and this aspect should be clearly underlined during the preoperative period. This outcome can be literature-correlated (15).

Functional outcomes, however, differed significantly between the SPP subtypes. Patients who underwent delayed coloanal anastomosis (Turnbull - Cutait technique) had consistently higher LARS and St Mark's scores at all follow-up points compared to those who had immediate coloanal anastomosis with a defunctioning ileostomy. Although both procedures preserved continence to some degree, the CAA subgroup demonstrated a more favourable trajectory of recovery, with significantly better scores at 1 month, 6 months, and 1 year (Were all the ileostomies reversed within the first postoperative month? At what interval after the surgical intervention do you reverse the ileostomies in your group?). These findings suggest that functional preservation may be optimised by tailoring the reconstructive approach. The majority of studies in the literature come into disagreement with our findings. Delayed coloanal anastomosis seems to be a technique that is much more cost-effective, has decreased leak rates and decreased defecation impairment, and, moreover, a lower chance of chronic pelvic sepsis (16-18). Nevertheless, there is conflicting data in the literature, with some articles finding results similar to ours. One excellent example is the long-term comparison performed by Boullenois et al. who demonstrated that for redo surgeries, immediate coloanal anastomosis is superior to TC (19).

Interestingly, a considerable proportion of APR patients initially expressed a preference for a different procedure but reported satisfaction at one year postoperatively, perhaps reflecting adaptation over time or reduced expectations regarding function.

Postoperative complication rates were largely comparable between groups, with the exception of pulmonary complications, which were more frequent in the APR group. There were no significant differences in haemoglobin, albumin, or tumour marker trends between the groups. Notably, CRP levels were higher in the APR group on postoperative day 3 or 4, which may reflect a more invasive surgical insult or slower systemic recovery.

The use of non-parametric testing was necessary due to non-normal data distribution, and the statistical analysis demonstrated consistent

differences in functional outcomes between the TC and CAA groups, supporting the robustness of these findings.

Our study has plenty of limitations, including its retrospective design, single-centre setting, and reliance on patient recall for some functional assessments. Moreover, although sample size was adequate to demonstrate statistically significant trends, larger multicentre studies would be beneficial to validate these findings and explore quality-of-life metrics in greater depth.

Conclusion

In conclusion, both APR and SPP were associated with high postoperative satisfaction, yet the type of sphincter-preserving technique appears to influence long-term function. Our findings suggest that standard coloanal anastomosis may provide better continence outcomes compared to the Turnbull - Cutait approach. These insights are particularly relevant when counselling patients preoperatively, as perceptions of quality of life may evolve significantly over time.

Conflict of Interests

All author declare that they have no conflict of interest.

Ethical Considerations

All patients provided informed verbal consent prior to inclusion in the follow-up analysis. The study was conducted in accordance with the Declaration of Helsinki. Ethical approval was waived due to the retrospective nature of the data collection and anonymisation of patient identifiers.

References

1. Hawkins AT, Albutt K, Wise PE, Alavi K, Sudan R, Kaiser AM, et al. Abdominoperineal Resection for Rectal Cancer in the Twenty-First Century: Indications, Techniques, and Outcomes. J Gastrointest Surg. 2018;22(8): 1477-1487.
2. Heald RJ, Moran BJ, Ryall RDH, Sexton R, MacFarlane JK. Rectal cancer: the Basingstoke experience of total mesorectal excision, 1978-1997. Arch Surg. 1998;133(8):894-9.
3. Rullier E, Laurent C, Bretagnol F, Rullier A, Vendrely V, Zerbib F. Sphincter-saving resection for all rectal carcinomas: the end of the 2-cm distal rule. Ann Surg. 2005;241(3):465-9.
4. Maguire B, Clancy C, Connelly TM, Mehigan BJ, McCormick P, Altomare DF, et al. Quality of life meta-analysis following coloanal anastomosis versus abdominoperineal resection for low rectal cancer. Colorectal Dis. 2022;24(7):811-820.
5. Baird P, Steinke JD, Minnaar HS, Stewart AJ. Assessment of Quality of Life in Rectal Cancer with Organ-Preservation Treatment: Are We There yet? Clin Oncol (R Coll Radiol). 2023;35(2):e110-e120.
6. Lavryk OA, Bandi B, Shawki SF, Floruta C, Xue J, Valente MA, et al. Turnbull-Cutait abdominoperineal pull-through operation: the Cleveland Clinic experience in the 21st century. Colorectal Dis. 2022;24(10):1184-1191.
7. Hallet J, Milot H, Drolet S, Desrosiers E, Grégoire RC, Bouchard A. The clinical results of the Turnbull–Cutait delayed coloanal anastomosis: a systematic review. Tech Coloproctol. 2014;18(6):579-90.
8. Pompeu BF, Pasqualotto E, Pigossi BD, Marcolin P, de Figueiredo SMP, Bin FC, et al. Turnbull-Cutait pull-through coloanal anastomosis versus standard coloanal anastomosis plus diverting ileostomy for low anterior resection: a meta-analysis and systematic review. Langenbecks Arch Surg. 2024;409(1):187.
9. Kitaguchi D, Seow-En I, Shen M-Y, Ke T-W, Kim J-S, Kim J, et al. Delayed vs Immediate Coloanal Anastomosis after Total Mesorectal Excision for Low Rectal Cancer: An International Multicenter Retrospective Cohort Study. J Am Coll Surg. 2025 Apr 14. Online ahead of print.
10. Melka D, Leiritz E, Labiad C, Blondeau M, Frontali A, Giacca M, et al. Delayed pull-through coloanal anastomosis without temporary stoma: an alternative to the standard manual side-to-end coloanal anastomosis with temporary stoma? A comparative study in 223 patients with low rectal cancer. Colorectal Dis. 2022;24(5):587-593.
11. Emmertsen KJ, Laurberg S. Low anterior resection syndrome score: development and validation of a symptom-based scoring system for bowel dysfunction after low anterior resection for rectal cancer. Ann Surg. 2012; 255(5):922-8.
12. Juul T, Ahlberg M, Biondo S, Emmertsen KJ, Espin E, Jimenez LM, et al. International validation of the low anterior resection syndrome score. Ann Surg. 2014;259(4):728-34.
13. Maeda Y, Vaizey CJ, Norton C. St. Mark's incontinence score. Dis Colon Rectum. 2007;50(12):2252.
14. Aaronson NK, Ahmedzai S, Bergman B, Bullinger M, Cull A, Duez NJ, et al. The European Organization for Research and Treatment of Cancer QLQ-C30: A Quality-of-Life Instrument for Use in International Clinical Trials in Oncology. J Natl Cancer Inst. 1993;85(5):365-76.
15. Dilke SM, Hadjittofi C, Than M, Tozer PJ, Stearns AT. Anterior Resection Syndrome and Quality of Life With Long-term Follow-up After Rectal Cancer Resection. Dis Colon Rectum. 2022;65(10):1251-1263.
16. La Raja C, Foppa C, Maroli A, Kontovounisios C, Ben David N, Carvello M, et al. Surgical outcomes of Turnbull-Cutait delayed coloanal anastomosis with pull-through versus immediate coloanal anastomosis with diverting stoma after total mesorectal excision for low rectal cancer: a systematic review and meta-analysis. Tech Coloproctol. 2022;26(8):603–13.
17. Shannon NB, Seow-En I, Tan EK. Cost-effectiveness comparison of delayed versus immediate coloanal anastomosis following ultralow anterior resection for rectal cancer. ANZ J Surg. 2023;93(4):963-969.
18. Xiong Y, Huang P, Ren Q-G. Transanal Pull-Through Procedure with Delayed versus Immediate Coloanal Anastomosis for Anus-Preserving Curative Resection of Lower Rectal Cancer: A Case-Control Study. Am Surg. 2016; 82(6):533-9.
19. Boullenois H, Lefevre JH, Creavin B, Voron T, Debove C, Chafai N, et al. Long-term functional results and quality of life after redo rectal surgery: delayed versus immediate colo-anal anastomosis. Colorectal Dis. 2020; 22(8):885-893.